Instruction Manual

Tektronix

1710J Series
Waveform Monitors
(S/N B040000 and above)

070-9673-03

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.

www.tektronix.com

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WARRANTY

Tektronix warrants that the products that it manufactures and sells will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If a product proves defective during this warranty period, Tektronix, at its option, either will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under this warranty, Customer must notify Tektronix of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. Customer shall be responsible for packaging and shipping the defective product to the service center designated by Tektronix, with shipping charges prepaid. Tektronix shall pay for the return of the product to Customer if the shipment is to a location within the country in which the Tektronix service center is located. Customer shall be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to any other locations.

This warranty shall not apply to any defect, failure or damage caused by improper use or improper or inadequate maintenance and care. Tektronix shall not be obligated to furnish service under this warranty a) to repair damage resulting from attempts by personnel other than Tektronix representatives to install, repair or service the product; b) to repair damage resulting from improper use or connection to incompatible equipment; c) to repair any damage or malfunction caused by the use of non-Tektronix supplies; or d) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Table of Contents

Theory of Operation

Performance Verification

Adjustment Procedure

Maintenance

List of Figures

List of Tables

General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

While using this product, you may need to access other parts of the system. Read the *General Safety Summary* in other system manuals for warnings and cautions related to operating the system.

Injury Precautions

Use Proper Power Cord. To avoid fire hazard, use only the power cord specified for this product.

Avoid Electric Overload. To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Avoid Overvoltage. To avoid electric shock or fire hazard, do not apply potential to any terminal, including the common terminal, that varies from ground by more than the maximum rating for that terminal.

Avoid Electric Shock. To avoid injury or loss of life, do not connect or disconnect probes or test leads while they are connected to a voltage source.

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.

Do Not Operate Without Covers. To avoid electric shock or fire hazard, do not operate this product with covers or panels removed.

Use Proper Fuse. To avoid fire hazard, use only the fuse type and rating specified for this product.

Do Not Operate in Wet/Damp Conditions. To avoid electric shock, do not operate this product in wet or damp conditions.

Do Not Operate in an Explosive Atmosphere. To avoid injury or fire hazard, do not operate this product in an explosive atmosphere.

Avoid Exposed Circuitry. To avoid injury, remove jewelry such as rings, watches, and other metallic objects. Do not touch exposed connections and components when power is present.

Product Damage Precautions

Use Proper Power Source. Do not operate this product from a power source that applies more than the voltage specified.

Provide Proper Ventilation. To prevent product overheating, provide proper ventilation.

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

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.*

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

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:

DANGER
High Voltage

Protective Ground
(Earth) Terminal

ATTENTION
Refer to Manual

Double
Insulated

Certifications and Compliances

Refer to the specifications section for a listing of certifications and compliances that apply to this 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 main 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.

Preface

This manual documents the Tektronix 1710J-Series Waveform Monitor, serial numbers B040000 and above. Information that applies to all instruments in the series uses 1710J-Series Waveform Monitor as the product name. Information that is specific to one member of the series refers to the instrument by its nomenclature, for example, discussion of the NTSC version of the instrument refers to it as the 1710J Waveform Monitor.

The information in this manual is intended for instrument operators and service technicians. Operators should be familiar with basic television terms and measurements. Qualified service technicians should be familiar with basic television terms and measurements and also have moderate experience with analog and logic circuits.

The information in this manual is divided into two categories:

- Operating instructions that are intended for those who use the instrument to make the measurements for which it was designed.
- Servicing instructions that are intended for those who maintain the instrument.

The information in the book is clearly divided into these two categories by a striped warning page.

The material in this manual is arranged in a logical order, which allows both operating and servicing personnel to retrieve information with equal ease. The major topics in this book are:

- *Getting Started* as follows details how to place the 1710J Waveform Monitor in service and how to use the instrument. This section contains a description of the instrument, typical configurations, a list of accessories, installation instructions, and a functional checkout procedure.
- *Operating Basics* describes the front-panel controls and the rear panel connectors and provides instructions for making elementary television signal amplitude measurements.
- *Reference* discusses how to use the graticules to make measurements and provides more detailed information on how to use the instrument.
- *Specifications* provide tables that list the instruments operating limits.
- *Theory of Operation* provides overview and circuit specific discussions of how the instrument operates.

- *Performance Verification* provides a set if procedure for determining if the instrument is performing within its stated performance requirements or not.
- *Adjustment Procedure* provides the means to return the instrument to operation within its stated requirements.
- *Maintenance* provides the servicing instructions for 1710J-Series Waveform Monitor. These instructions include the service strategy, setting of internal plug jumpers to customize instrument operation, removal and replacement instructions for the various assemblies that comprise this instrument, cleaning and inspection instructions, and troubleshooting information.
- *Replaceable Electrical Parts* includes ordering information and part numbers for all replaceable electrical parts.
- *Diagrams and Illustrations* contain the block diagram, the circuit board illustrations, the schematic diagrams, and the cross reference for locating circuit numbers on the circuit boards and the schematic diagrams.
- *Replaceable Mechanical Parts* includes ordering information and part numbers for all replaceable mechanical parts. This parts list is referenced to an exploded view mechanical drawing.
- *Index* provides a topical listing of the information in this manual that is arranged alphabetically.

Contacting Tektronix

Product support	For questions about using Tektronix measurement products, call toll free in North America: 1-800-833-9200 6:00 a.m. – 5:00 p.m. Pacific time Or contact us by e-mail: tm_app_supp@tek.com For product support outside of North America, contact your local Tektronix distributor or sales office.
Service support	Tektronix offers extended warranty and calibration programs as options on many products. Contact your local Tektronix distributor or sales office. For a listing of worldwide service centers, visit our web site.
For other information	In North America: 1-800-833-9200 An operator can direct your call.
To write us	Tektronix, Inc. P.O. Box 500 Beaverton, OR 97077-0001 USA
Web site	www.Tektronix.com

Getting Started

Getting Started

This section of the manual has the product description, list of accessories, installation instructions, and a functional check of operation.

Product Description

The Tektronix 1710J-Series is a specialized oscilloscope. It is designed to monitor and measure baseband video signals. It offers a choice of three basic sweep rates: two field, two line, and 1 line, each of which can be magnified to provide three additional sweep rates, 1 μs (two line), 0.2 μs (1one line), and X25 (two field). The two-field sweep rate, both magnified and unmagnified displays the complete vertical interval.

The Channel A and B Composite Video Inputs and the External Reference Signal Input are high impedance bridging loop-throughs to protect the integrity of the signal paths. The input switching allows for the display of either Channel A or Channel B Input or both inputs. Synchronization can be either internal or external.

The vertical signal processing provides slow DC restoration that clamps the display while still showing any 50 or 60 Hz hum components. The input signal can be unfiltered (Flat) or either Low Pass or Chrominance filtered. There is also a combination of Flat and Low Pass filtering available when a 2 Line or 2 Field sweep rate is employed; the display consists of one line or field low pass filtered while the second is unfiltered. Vertical amplitudes can be displayed in a calibrated gain mode, which corresponds directly with the graticule vertical scales, magnified five times.

An RGB or YRGB Parade display, for camera setup, is accommodated with a shortened sweep. The input of the camera signal and an enable are through the rear-panel REMOTE connector. The choice of three-step (RGB) or four-step (YRGB) is made by changing the status of a control line through the REMOTE connector.

The CRT is a mesh type, which has better geometry. In addition, it uses an internal graticule to reduce parallax. Variable graticule scale illumination provides even lighting to improve measurement accuracy and the quality of waveform pictures. Option 74 provides a P4 (white) phosphor tube.

Typical Configurations

In addition to the typical master control monitoring applications, you can use this waveform monitor in camera chains. It has a choice of RGB or YRGB parade display that can easily be selected by grounding or ungrounding one pin on the rear-panel REMOTE connector. The parade signal and the display enable are input through the rear-panel REMOTE connector.

A number of operating conditions can be altered by changing internal jumpers. Using these methods most of the 528A operational modes can be accommodated.

Accessories

The accessories listed here are in two categories. Standard accessories are the items that you need to use the instrument as it is designed. Optional accessories are items that enhance the instruments usability or applications in a variety of environments.

Standard Accessories

The following accessories are shipped with the 1710J-Series. Part numbers for these accessories are located at the end of the Replaceable Mechanical Parts list.

1 1710J-Series Instruction Manual

1 Power Cord, with selected power plug option

1 Replacement Cartridge Fuse (correct rating for the power plug option)

3 Replacement Scale Illumination Bulbs

Optional Accessories

There are a number of accessories that can be used with a 1710J-Series Waveform Monitor. The following is a list of the most common accessory items for this series of waveform monitors.

Cabinets are not supplied with the 1710J-Series instruments, order the appropriate cabinet or rack adapter from those listed below. The 1700F items are Field Upgrade Kits that are installed by the customer; instructions are included in all Field Upgrade Kits.

Cameras, C9 (Option 20)

Viewing Hood (016–0475–00)

Front Panel Cover (200–3897–01)

1700F00, Plain Cabinet (painted silver-grey)

1700F02, Portable Cabinet (painted silver-grey)

1700F05, Side-by-Side Rack Adapter

1700F06, Blank Half-Rack Width Panel

Installation

This section provides the information necessary to install the 1710J-Series Waveform Monitor in its operating environment. Information on the settings of the internal jumpers appears in the *Maintenance* section of this manual.

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 *Maintenance* section of this manual.

Electrical Installation

The electrical installation for this instrument, because of its broad operating range power supply, consists of plugging it into any power mains that is within its range.

Power Source

This instrument is intended to operate from a single-phase power source with one current-carrying conductor 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.

Mains Frequency and Voltage Ranges

All 1710J-Series Waveform Monitors operate over a frequency range of 48 to 66 Hz, at any mains voltage between 90 VAC and 250 VAC. They do not require any internal changes to select their operating voltage range.

REMOTE Connector

The rear-panel REMOTE connector is a 15-pin, D-type connector. It is the input for RGB Staircase and Enable signals. See Figure 1–1.

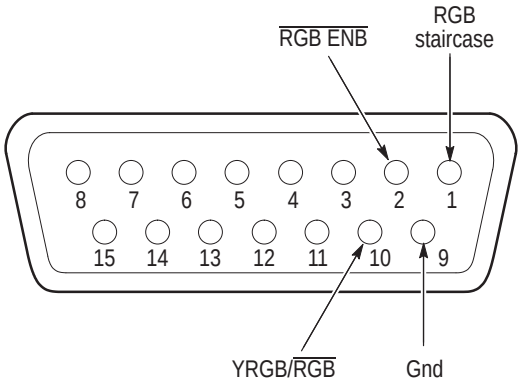


Figure 1–1: REMOTE connector showing the RGB/YRGB functions

RGB/YRGB Parade Display

A TTL low level (ground) on pin 2 of the REMOTE connector enables the shortened RGB/YRGB sweep. A 10-volt square wave input to pin 1 provides approximately nine divisions of sweep. This sweep can be either 1 line or 1 field depending on front-panel switch setting. The displayed signal is the front-panel selected CH A or CH B input.

A TTL low level (ground) on pin 10 of the REMOTE connector shortens the sweep for the three-step RGB display. A high level (open) on pin 10 lengthens the sweep for the four-step YRGB display.

Connecting to the Program Line

The 1710J-Series Waveform Monitor uses high-impedance bridging loop-inputs. These inputs are compensated for 75 Ω impedance systems but require termination to avoid program line distortions. If the instrument is at the end of a line, you can use a standard 75 Ω terminator on the open side of bridging loop-through input; however, be sure that the line is not double terminated, which will introduce 6 dB of loss.

In many cases, because the bridging loop-through connection is passive, you can install the 1710J-Series Waveform Monitor directly in the program line, in which case line termination occurs at another location. Again line termination is critical. If the line is unterminated, signal amplitude will be double (2 V instead of the normal 1 V) and will be easily recognized in the displayed amplitude. If for some reason the program line is double terminated, the displayed amplitude will be only 0.5 V full scale instead of the typical 1 V full scale.

The external reference, normally house sync, is usually routed around on a 75 Ω coaxial line. When connecting to this line it is also important that the line be correctly terminated. Because this input is also a high impedance bridging loop-through, the same considerations that apply to the program line also apply to this line.

Figure 1–2 is a simple diagram of a 1710J-Series Waveform Monitor being used on the program and sync lines. Note that in this application the monitor is not at the end of either line.

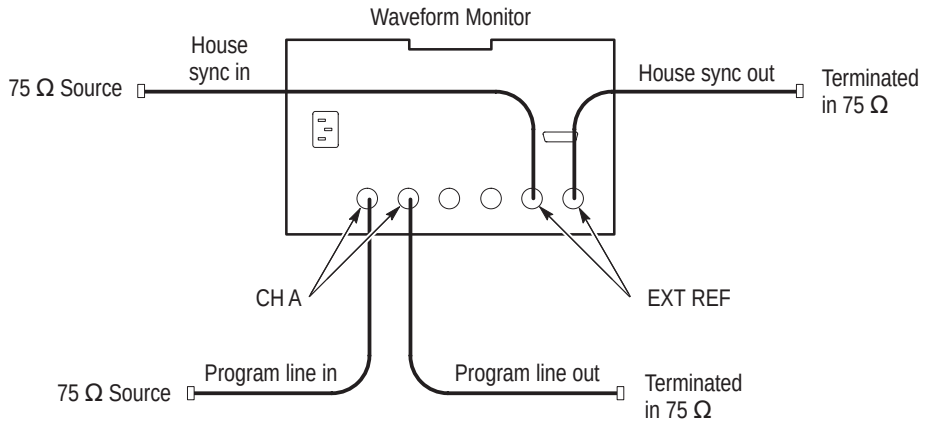


Figure 1–2: A Waveform Monitor installed in program and house sync lines

Mechanical Installation

The mechanical installation for this instrument consists of mounting it in a cabinet. The cabinet may be a portable cabinet with handle, feet, and flip stand, an unadorned cabinet that can be installed in a number of ways, or a side-by-side rack mounted cabinet assembly.

Cabinets

The EMI specifications for the 1710J-Series are only valid if the instrument is mounted in one of the three Tektronix cabinet options. To guarantee compliance with specifications, the instrument must be operated in a 1700F00 or 1700F02 cabinet, or a 1700F05 rackmount adaptor. The plain cabinet, 1700F00, is shown in Figure 1–3.

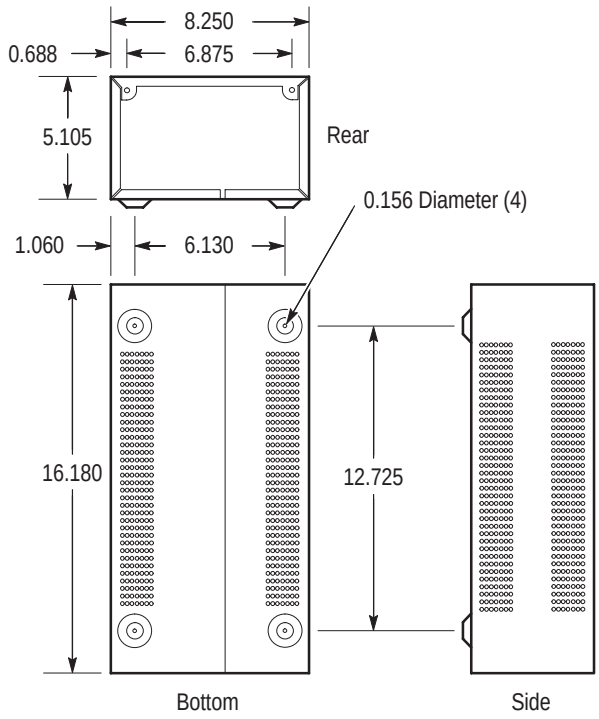


Figure 1–3: Dimensions of the 1700F00 plain cabinet

The portable cabinet 1700F02 has a handle, four feet, a flip-up stand. The hole sizes and spacing are different from those of the 1700F00. See Figure 1–4.

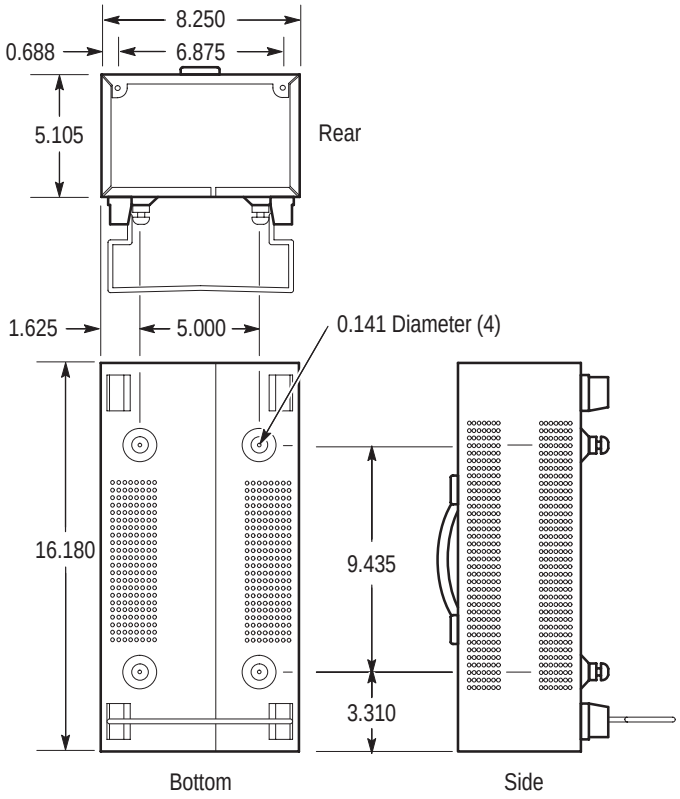


Figure 1–4: 1700F02 portable cabinet

All of the 1700-Series metal cabinets, which are available from Tektronix as Optional Accessories, provide the proper electrical environment for the instrument. They supply adequate shielding, minimize handling damage, and reduce dust accumulation within the instrument.

Cabinet Installation

To install a cabinet on this instrument, slide the instrument into the cabinet and secure it to the cabinet with two 6-32 Pozidrive® screws through the holes in the upper corners of the rear panel. See Figure 1–5.

CAUTION. *Without the mounting screws the instrument can slip out of the cabinet, if it is tipped forward. Do not attempt to carry a cabinetized instrument without installing the mounting screws.*

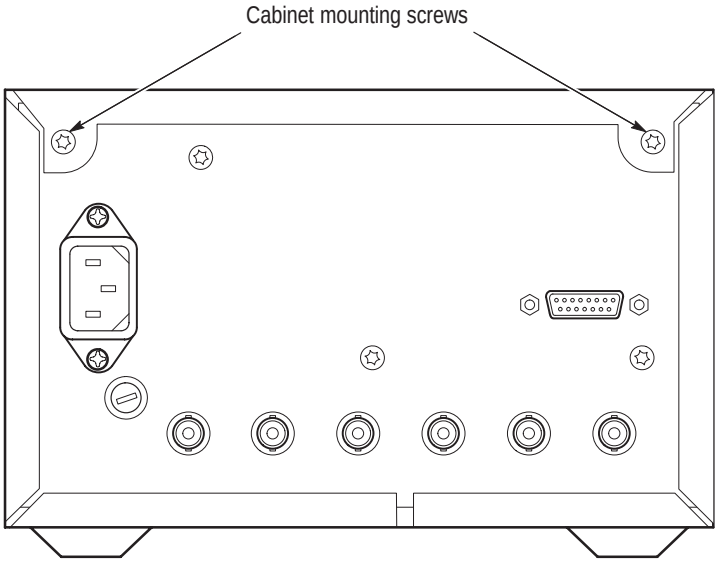


Figure 1–5: Rear view showing the cabinet mounting screws

Rack Adapter

The 1700F05 is a side-by-side rack adapter that is made up of two cabinets. It can be used to mount the 1710J-Series and another half-rack width instrument in a standard 19-inch rack. See Figure 1–6.

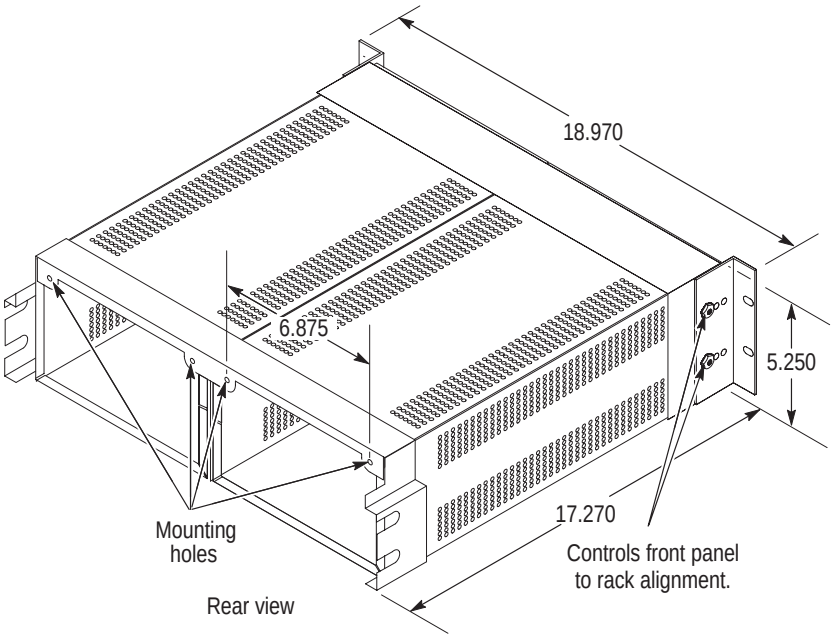


Figure 1–6: The 1700F05 side-by-side rack adapter

The rack adapter is adjustable, so the 1710J-Series Waveform Monitor can be more closely aligned with other equipment in the rack. See Figure 1–6.

If only one section of the rack adapter is used, insert a 1700F06 Blank Panel in the unused section. See Figure 1–7. The rack adapter and panel are available through your local Tektronix field office or representative.

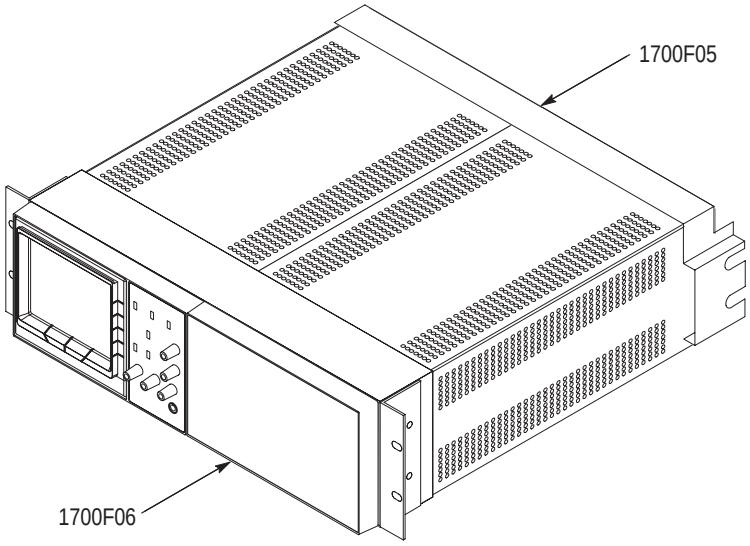


Figure 1–7: An instrument in a 1700F05 cabinet with a blank front panel

In addition to being able to fill the unused side of the side-by-side rack mount cabinet (1700F05) with a blank front panel, you can install an accessory drawer (1700F07) in the blank side of the cabinet. See Figure 1–8.

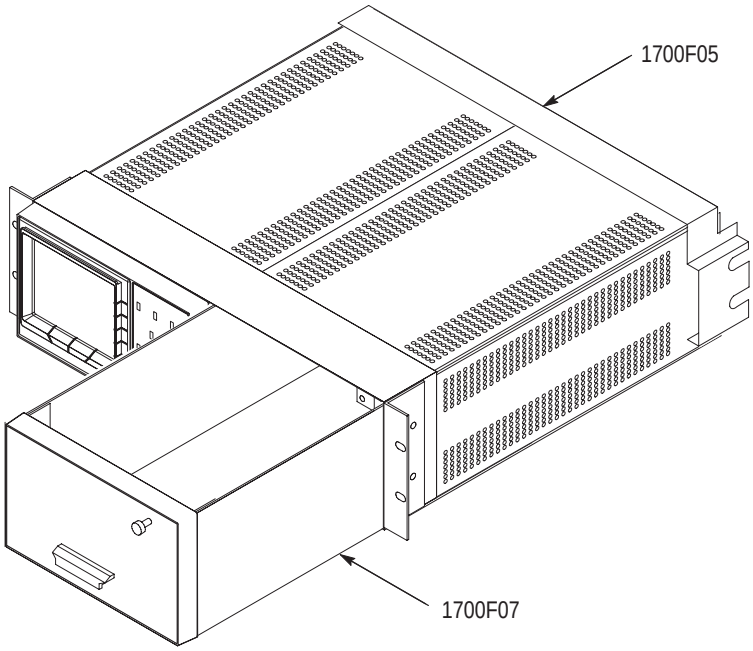


Figure 1–8: A 1700F05 rack mounting cabinet with a 1700F07 utility drawer

Custom Installation

For applications such as consoles 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. See Figure 1–9.

To mount the 1710J-Series safely, attach it to a shelf strong enough to hold its weight. Install the mounting screws through the four 0.156 inch diameter holes in the bottom of the 1700F00 cabinet.

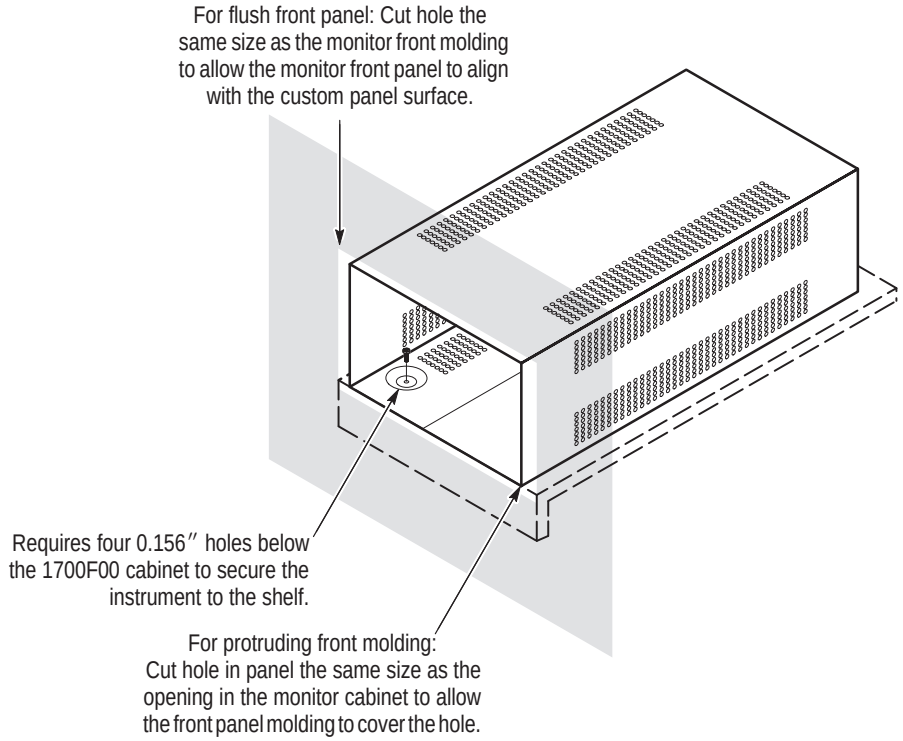


Figure 1–9: Custom installation of an instrument cabinet

Functional Checkout Procedure

The following procedure is provided as an aid in obtaining a display on the 1710J-Series Waveform Monitor (operator familiarization) 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. All checks are made with the cabinet on and all internal jumpers in the factory-set position.

If performing the Functional Checkout Procedure reveals improper operation or instrument malfunction, first check the operation of associated equipment. If associated equipment is performing normally, refer the 1710J-Series Waveform Monitor to qualified service personnel for repair or adjustment.

When a complete check of the instrument performance to its specification is desired, refer to the *Performance Verification Procedure* in this manual.

This procedure requires a source of composite video. The Tektronix 1410-Series Television Test Signal Generator (1410 for NTSC, 1411 for PAL) with Sync, Color Bar, and Linearity modules was used in preparing this procedure.

Procedure

This procedure requires only one hook-up. Figure 1–10 shows the required connections. Once the connections are made, continue on to step 1 of the procedure.

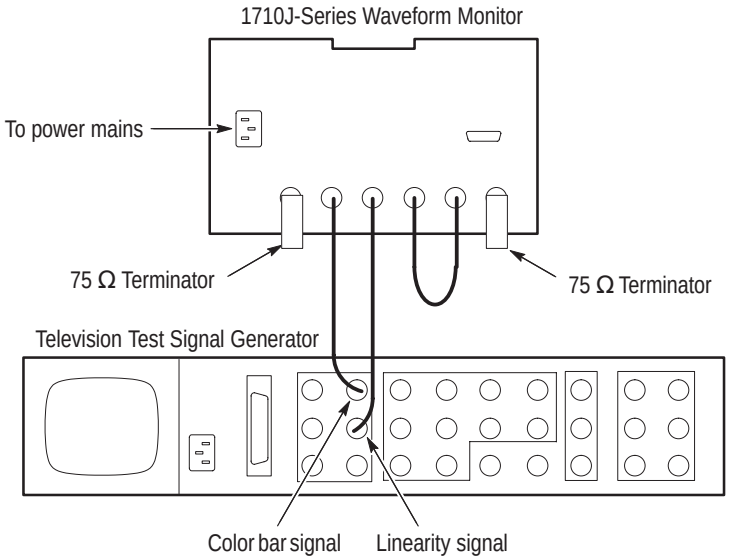


Figure 1–10: Equipment connections for the functional checkout procedure

1. Initial Generator Setup

Video Signal Generator – Test Signals

Full Field Color Bars – 75% Ampl. 7.5% Setup – NTSC
– 75% Ampl. 0% Setup – PAL

Modulated Staircase – Flat Field, 5 Step

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

Set the 1710J-Series Waveform Monitor front-panel controls as shown in Table 1–1.

Table 1–1: Front Panel Controls

Control	Setting
FILTER	FLAT
REF	INT
INPUT	A
GAIN	OFF (no indicators on)
POSITION VERTICAL	as is
POSITION HORIZONTAL	as is
DC REST	OFF
SWEEP	2 LINE
MAG	OFF (no indicators on)
FOCUS, SCALE, & INTENS	as they are
ROTATE & V CAL	as they are
POWER	ON

4. Obtain Display

Adjust the INTENS and FOCUS controls for the desired brightness and a well defined display. Adjust the VERTICAL Position control to place the display blanking level on the graticule 0 IRE (NTSC) or 300 mV (PAL) line. Center the display with the HORIZONTAL Position. See Figure 1–11.

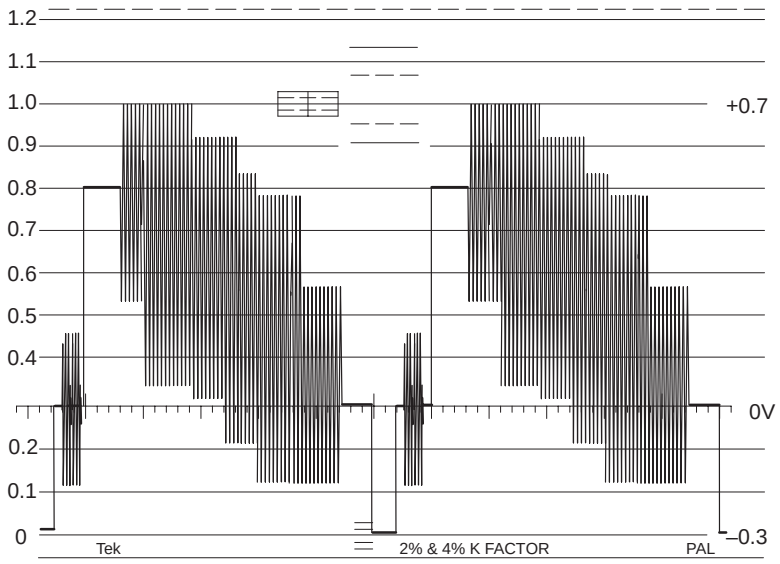


Figure 1–11: Two-line color bar display in flat filter mode

Adjust the SCALE illumination control for the desired graticule scale brightness.

5. Check the Rotation of the Display

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

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

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 1–12.

If necessary, adjust the V CAL screwdriver control for 1 V amplitude (140 IRE). Switch REF to INT mode to restore the color bar display.

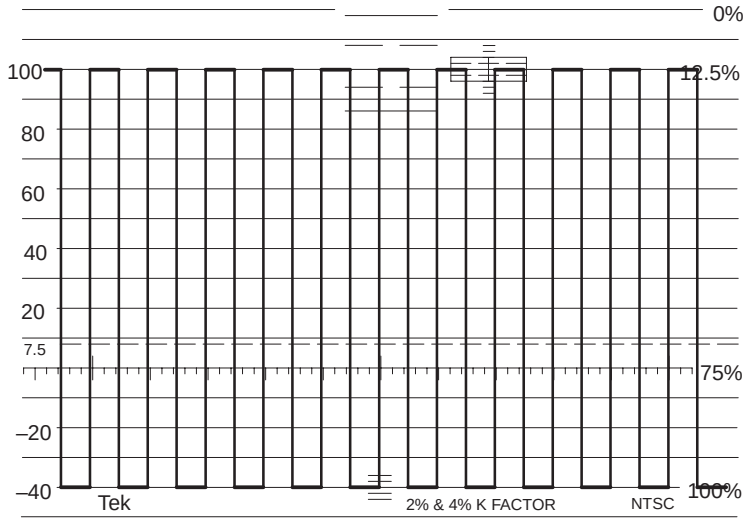


Figure 1–12: Checking vertical gain with internal calibrator

7. Select Input

The AB switch selects the rear-panel Channel A or Channel B inputs. Position the color bar waveform so that the blanking level is at the –40 IRE (0 V) graticule line.

Select the Channel B input. Note that the linearity waveform is displayed.

Push and hold the INPUT button until both the color bar and linearity waveforms are displayed. See Figure 1–13. Check that both the CH-A and CH-B front-panel indicators are on.

Push the switch to return to the Channel A (color bar) display.

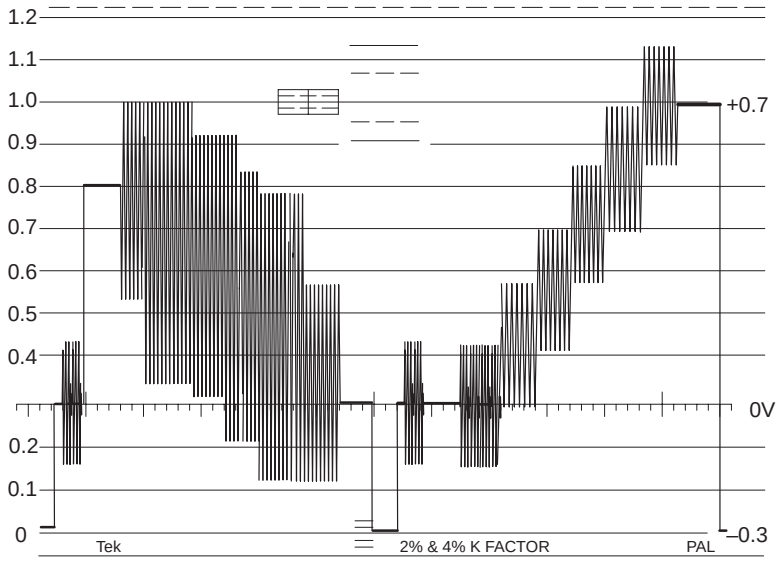


Figure 1–13: Dual channel, 2-line display of color bar and linearity signals

8. Timing Accuracy

Be sure that SWEEP is still 2LINE. Hold the REF button in until the CAL signal appears. Position it so the top of the display is on the 70 IRE (NTSC) or 0.7 V (PAL). 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 1–14a. Check that the falling transition of the 10^{th} 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 1–14b.

Hold the SWEEP button until the 1 LINE front-panel indicator lights. Check for five full cycles over the 10-division timing area. See Figure 1–14c.

Push the waveform monitor REF switch and return to INT.

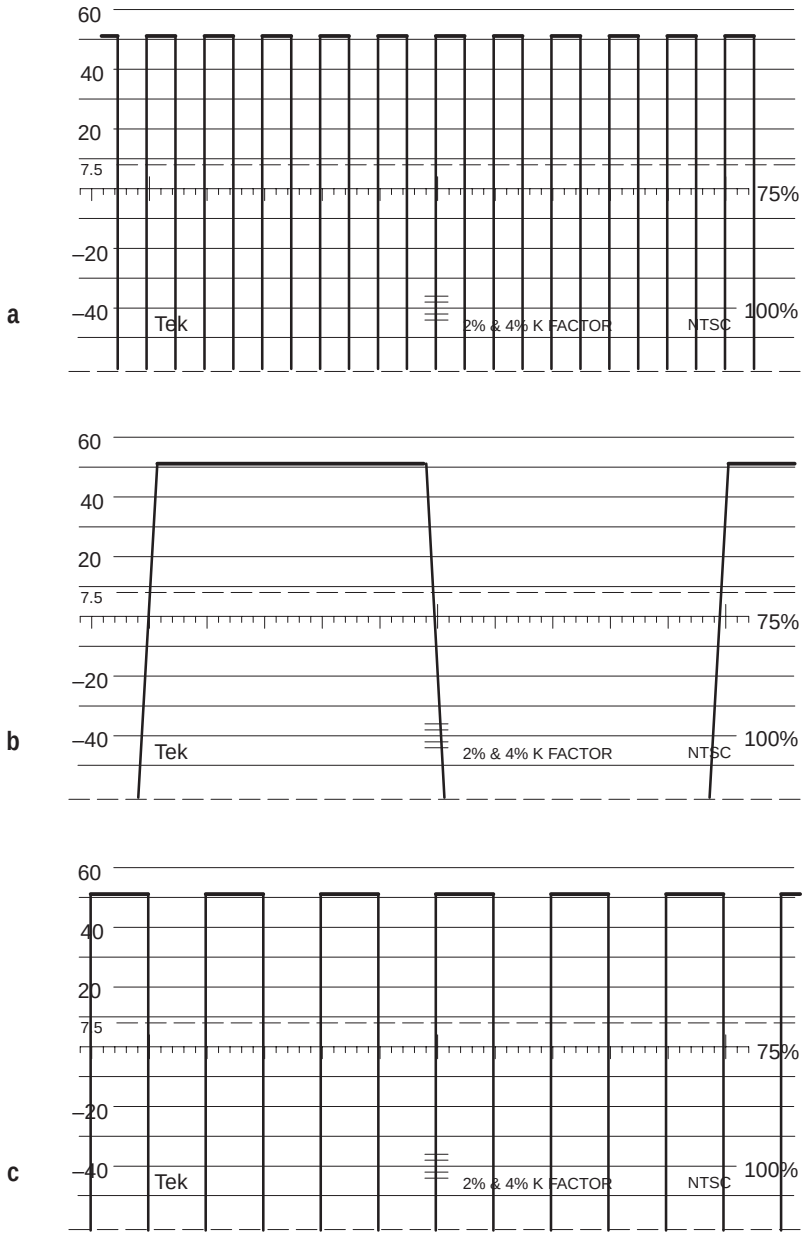


Figure 1–14: Checking timing with the internal calibrator signal: a) 2-line display b) 2-line display magnified c) 1-line display

9. Vertical Gain

The normal GAIN setting (with the GAIN switch off) is 1 V full scale with the X5 indicator off.

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 (NTSC) or 300 mV (PAL) and checking that the maximum excursion of color burst is at approximately the 100 IRE or 1 V graticule line.)

Push the GAIN button once and notice that the display amplitude returns to 1 V Full Scale.

10. Filter Selection

The FILTER button selects the frequency response characteristic for the displayed signal. Use the FLAT response normal applications. Figure 1–11 shows the color bar signal with the FLAT response.

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 1–15.

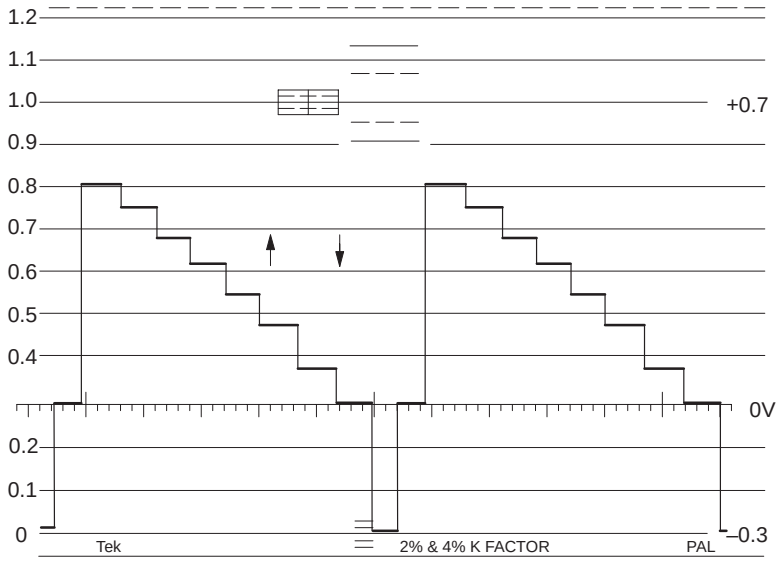


Figure 1–15: Two-line color bar display with the low pass filter on

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 1–16.

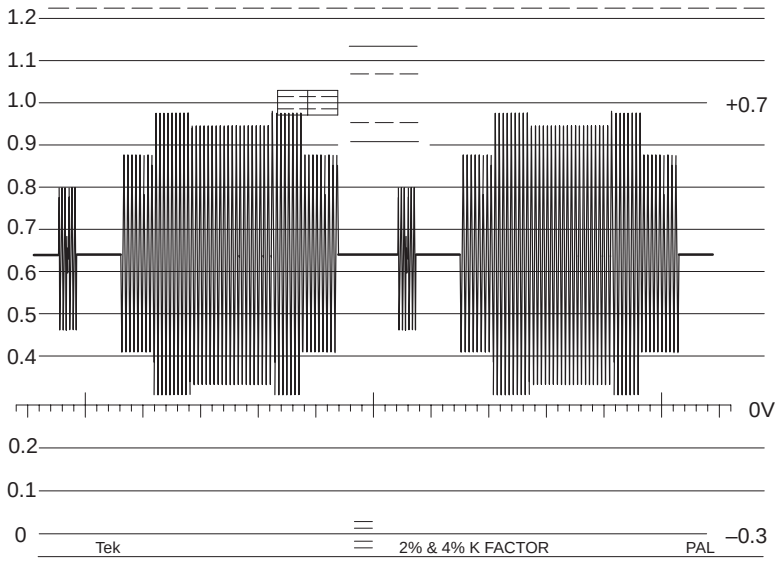


Figure 1–16: Two-line display of color bar signal with chroma filter

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 1–17.

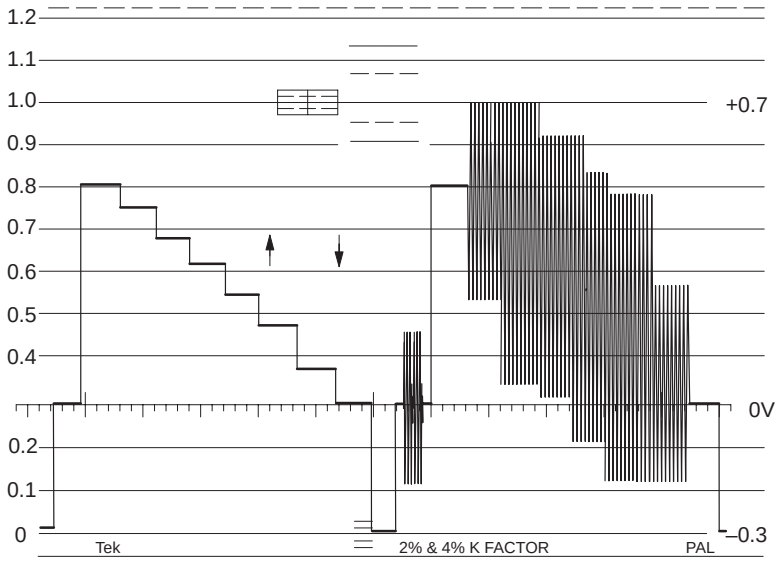


Figure 1–17: Dual filter selected (low pass and flat)

Push the FILTER switch and return to FLAT.

11. Horizontal Magnifier

Select the 2 LINE 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 1–18. Note that the MAG button works with any SWEEP selection. Push the MAG button to turn off the MAG.

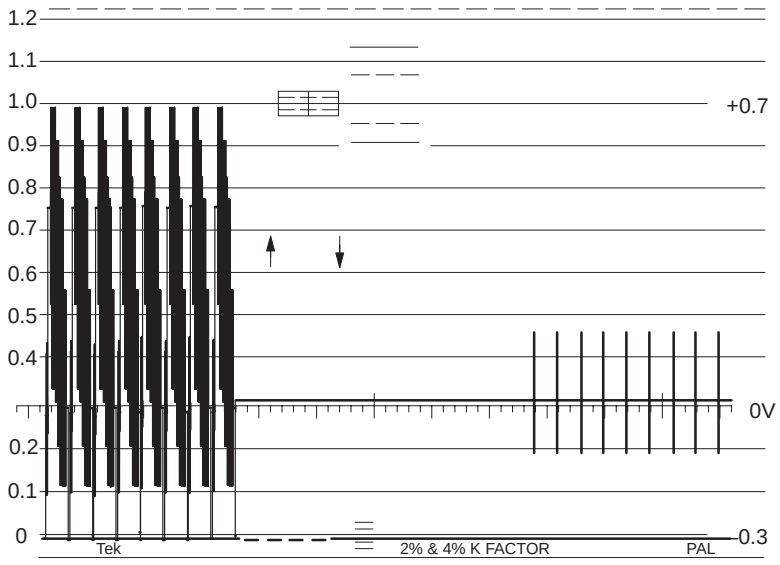


Figure 1–18: Display of vertical interval with magnified 2-field sweep

Operating Basics

Operating Basics

This section of the manual provides information about the front-panel controls and rear-panel connectors.

Front-Panel Controls and Indicators

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.

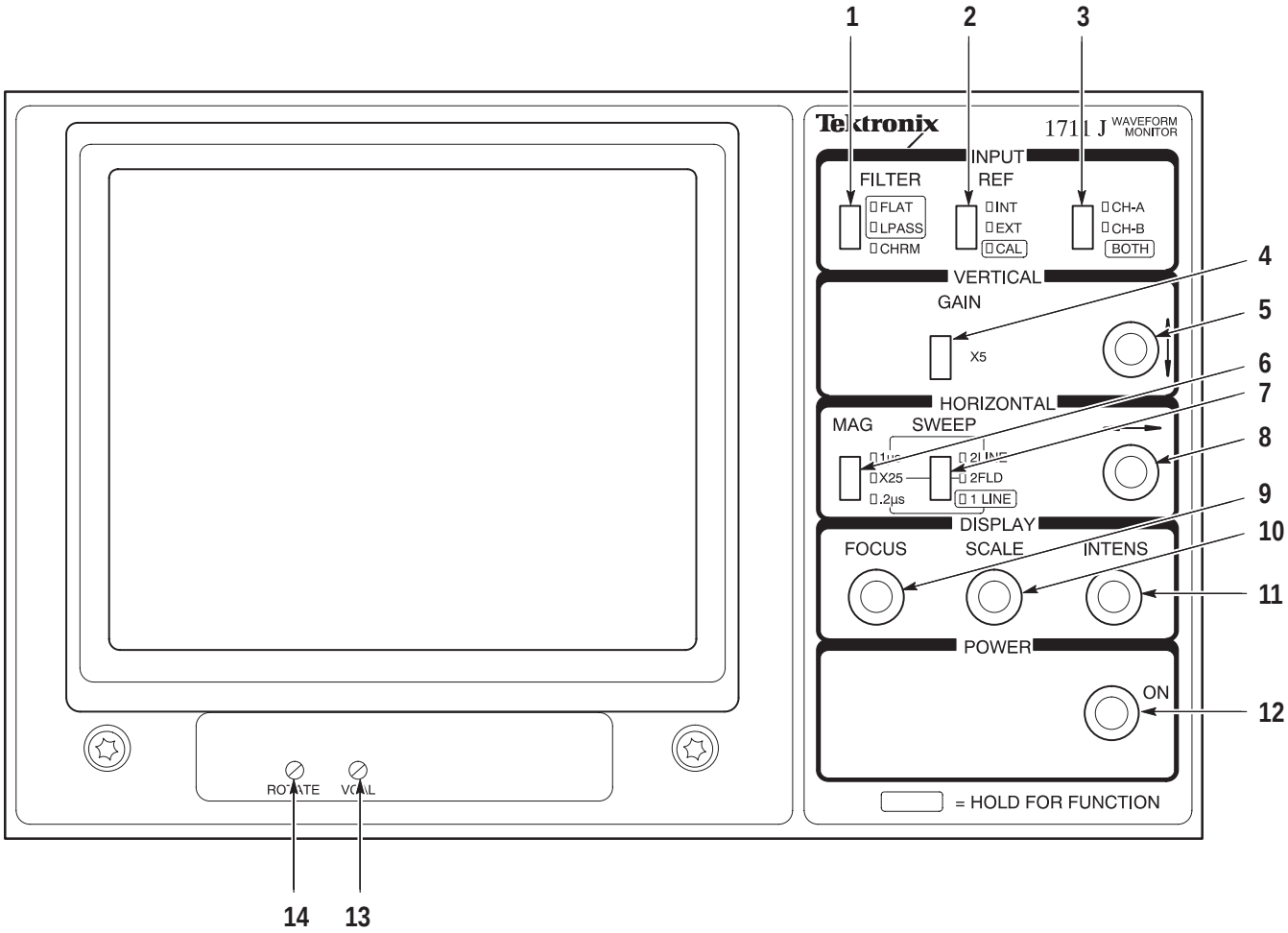


Figure 2–1: 1710J-Series front panel controls

There are four push-button switches that 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. When exiting a held mode the selection reverts to the top of the list at the touch of the push button, with the exception of the REF switch, which returns to its previous setting.

1. **FILTER.** The filter switch toggles through three positions, FLAT, LPASS, and CHROMA. In 2 LINE or 2 FLD SWEEP, a combination filtering routine, consisting of Low Pass and Flat for alternate lines or fields, can be accessed by holding the FILTER switch in. In the dual filter mode, the low pass filtered line or field will always be on the left; lines are overlaid in 1 LINE SWEEP. The dual filter cannot be accessed when the 1710J-Series is in AB switching. If AB switching is selected after the dual filter mode is selected, both lines or fields will be low pass filtered.

   Filtering always returns to FLAT when coming out of the combination filtering routine.

2. **REF.** The reference switch toggles between internal and external reference. The calibrator is accessed by holding in the REF switch. Instrument status is retained in memory when CAL is selected and the original status restored when you push the button again. All front-panel lights, except SWEEP and MAG, go out and GAIN goes to X1 when the calibrator is selected. The X5 is not usable with the calibrator. (Note that MAG and SWEEP are switchable in the calibrator mode, but revert to their previous setting when the mode is exited.)

3. **CH A - CH B.** Toggles between the Channel A and Channel B input. When held, the 1710J-Series goes into an AB (BOTH) alternate mode, with the A input on the left and the B input on the right in 2 Line or 2 Field (lines are overlaid in 1 Line sweep). When in the AB switching mode the REF is forced to EXT, the FILTER is forced to LPASS, if it was in the LPASS-FLAT switching mode; if not the FILTER remains in the previous. Both functions go back to their previous setting when the input is switched out of AB. When leaving BOTH the input always returns to CH A.

4. **GAIN.** The gain switch toggles between X5 and off. An LED indicator lights when X5 is selected.

5. **POSITION.** The vertical position knob controls the up and down movement of the display.

6. **MAG.** The magnifier switch toggles between on and off. It operates in conjunction with the SWEEP mode to provide usable sweep rates as follows:

   2 LINE + MAG = 1 μs/div

   2 FLD + MAG = 1 full vertical interval

7. **SWEEP.** The sweep switch toggles between 2 LINE and 2 FLD Sweep. 1 LINE Sweep is accessed by holding the SWEEP push button in until recognition occurs. The MAG is automatically turned off if SWEEP is changed. Sweep rates are as follows:

   2 LINE unmagnified = 10 μs/div

   1 LINE unmagnified = 5 μs/div

   1 LINE + MAG = 0.2 μs/div

8. **POSITION.** The horizontal position knob controls the left and right movement of the display.

9. **FOCUS.** Focuses the CRT beam for optimum definition.

10. **SCALE.** Adjusts the level of graticule illumination.

11. **INTENSITY.** Adjusts the brightness of the display.

12. **ON – OFF.** Controls the output of the power supply. AC line potential is present in the primary section of the power supply circuit whenever mains power is supplied to the instrument. A mechanical indicator in the center of the switch shows the status of the POWER switch.

WARNING. *Mains power is still applied to the 1710J-Series power supply circuit board, regardless of POWER switch state. To totally remove shock hazard it is necessary to unplug the instrument and wait for the capacitors to discharge.*

13. **V CAL.** The vertical calibration screwdriver adjustment sets the vertical amplifier gain. It is normally used with the calibrator.

14. **ROTATE.** The trace rotation screwdriver adjustment aligns the display with the graticule.

Rear-panel Connectors

Signal inputs, power and RGB are all located on the 1710J-Series Waveform Monitor rear panel. Because of the similarity of the half-rack monitor and half-rack vectorscope rear panels WAVEFORM MONITOR is printed on the 1710J-Series rear panel. See Figure 2–2 for the locations of the rear-panel connectors.

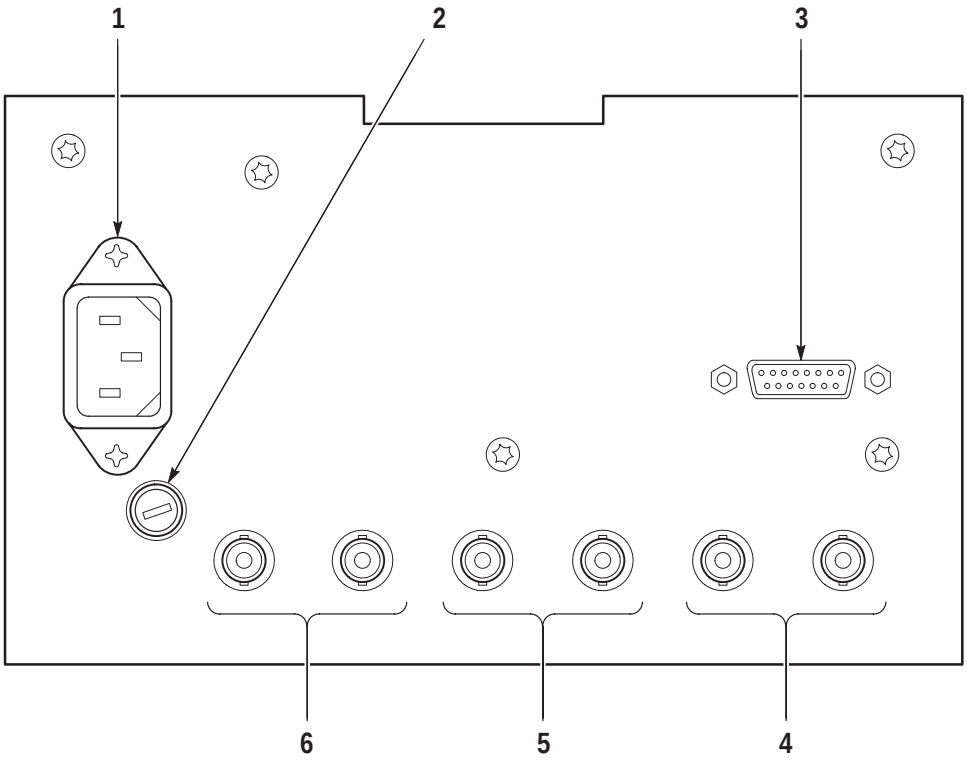


Figure 2–2: 1710J-Series rear-panel connectors

1. **AC Power Plug.** A standard AC plug receptacle for 120 or 240 VAC power mains. Plug is compatible with any of the power cord options available for the 1710J-Series Waveform Monitor.

2. **Fuse Holder.** A holder for the instrument's main fuse. See *Replaceable Electrical Parts List* for the correct fuse value.

3. **REMOTE.** This 15-pin subminiature D-type connector is used for the RGB display. It consists of the RGB input, RGB enable, and the display switching, RGB/YRGB,

4. **EXT REF.** A bridging loop-through synchronization input (compensated for 75 Ω). The signal on this input is selected as the synchronizing source by the

front-panel REF switch. The input signal may be composite sync, black burst, or composite video.

5. **CH-B.** A bridging loop-through composite video input that is compensated for 75 Ω. The signal on this input is selected for display by the front-panel INPUT switch.

6. **CH-A.** A bridging loop-through composite video input that is compensated for 75 Ω. The signal on this input is selected for display by the front-panel INPUT switch.

Making a Signal Amplitude Measurement

The 1710J-Series Waveform Monitor can make both time and amplitude measurements. The short procedure that follows allows you to locate the blanking level, measure the sync amplitude, and measure the peak white level. Timing measurements are more complex, they are discussed in the *Reference* section of this manual.

1. **Signal Input.** Connect a 1 V color bar signal to one of the inputs of the 1710J-Series Waveform Monitor, preferably Ch-A, and terminate the loop-through input with a 75 Ω terminator. For the remainder of this procedure this input signal will be referred to as "the signal." This signal can be from a generator or off of a program line.

2. **Obtain a Display.** Turn on the 1710J-Series Waveform Monitor POWER, select CH A INPUT, FLAT FILTER, and INT REF. Set HORIZONTAL SWEEP to 2 LINE and MAG off. Adjust the DISPLAY controls as necessary for a usable display. Use the VERTICAL and HORIZONTAL position controls to align the display with the graticule.

3. **Check Instrument Vertical Calibration.** Push and hold the REF switch until the CAL indicator lights. Use the VERTICAL position control to align the calibrator waveform with the graticule. See Figure 2–3.

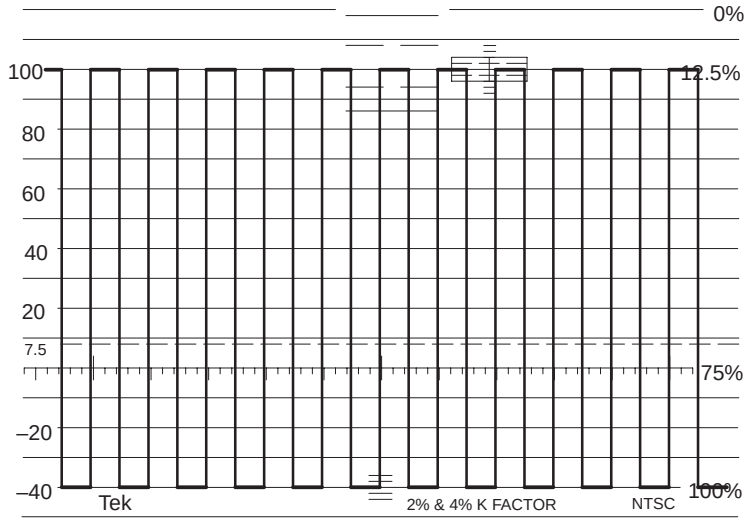


Figure 2–3: Checking vertical gain with internal calibrator

Align the bottom of the waveform with the graticule line for sync tip. This is –40 IRE for 1710J and 0 mV for 1711J.

If necessary adjust the 1710J-Series Waveform Monitor V CAL to set the peak white level to 1.0 V for 1711J or 100 IRE for 1710J. It may be necessary to reposition the display and again adjust the V CAL to match the 1 V signal amplitude to a 1 V display.

4. **Measure Sync Amplitude.** Push the INPUT REF switch to return to INT. This should now display a two line display of the color bar signal. See Figure 2–4.

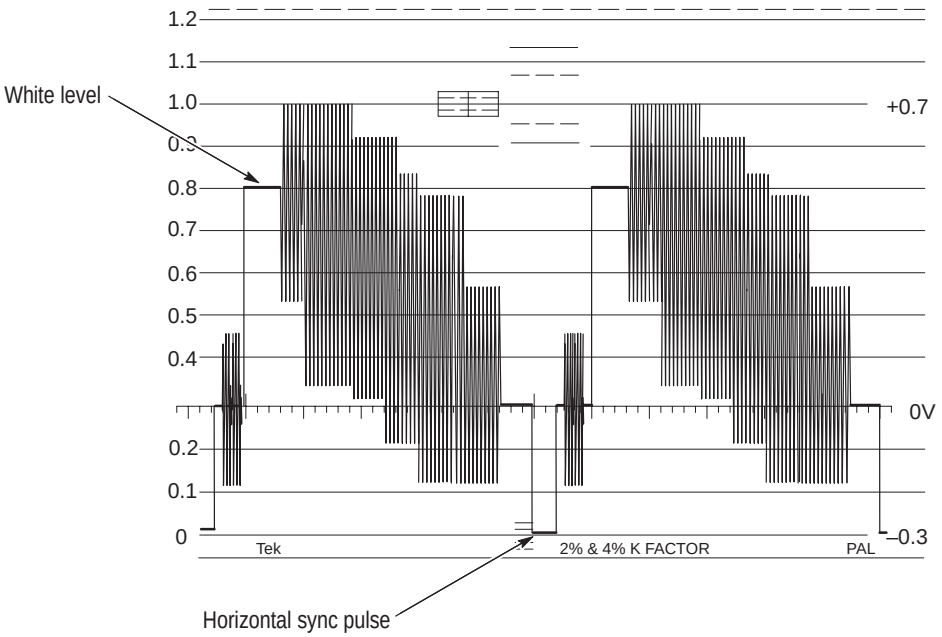


Figure 2–4: Two-line color bar display in flat filter mode

Use the VERTICAL position to move the signal blanking level to the graticule 0.3 V line for the 1711J or 0 IRE line for the 1710J.

Measure the amplitude of the horizontal sync pulse.

5. **Measure White Level.** The white level can vary with the signal source. For example, NTSC color bar signals may be either 75% white or 100% white; therefore, the white level may be at 75 IRE or 100 IRE depending on the source. (In most cases the color bar is at 75% white.)

   With the blanking level on the correct graticule line, measure the white level. See Figure 2–4.

6. **Measure Setup Level.** (NTSC only) This measurement is for 1710J only. Push and hold the HORIZONTAL SWEEP switch until the 1 LINE indicator lights. This changes the display to a single line of color bar signal. See Figure 2–5.

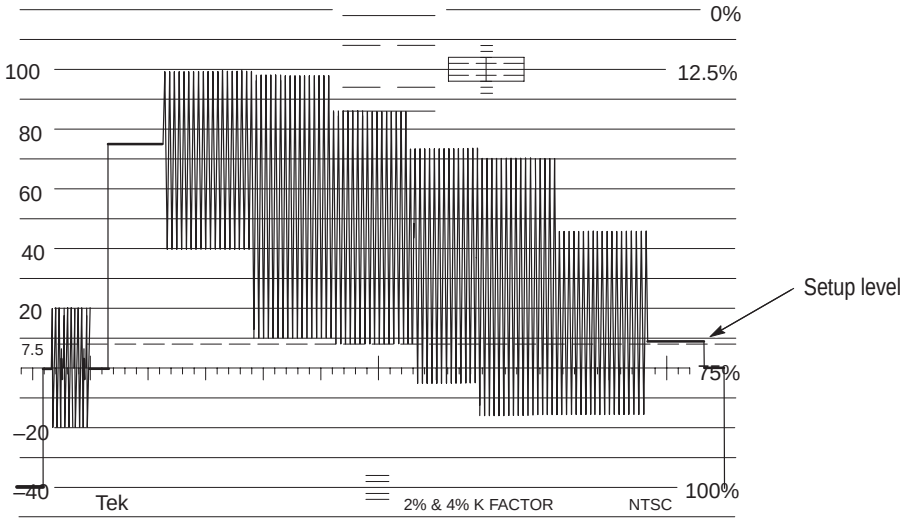


Figure 2–5: One line display for setup measurement on 1710J

Use the VERTICAL position to set the blanking level of the signal to the) IRE graticule line. Measure the amplitude of the level following the last chrominance packet of the color bar. It should be at the dotted line labeled 7.5.

Reference

Reference

This section discusses how to use the graticules to make measurements. Following the graticules there is more information on the measurements that can be made with the 1710J-Series Waveform Monitor.

Graticules

There are two graticule patterns available for the 1710J-Series Waveform Monitors. They are etched into the CRT face and edge illumination. The graticule used by the 1710J is a 525 line/60 Hz NTSC Composite scale. The 1711J has the CCIR 625 line/50 Hz graticule for the PAL color standard.

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 optimum for viewing or photographing needs.

The major differences between the NTSC and PAL graticules are in the vertical scales. In the paragraphs that follow each of the vertical graticule scales will be discussed separately, while the horizontal scales are discussed together.

NTSC Composite Video Graticule Vertical Scales

The NTSC graticule has two main vertical scales to facilitate typical measurements. See Figure 3–1. 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 millivolts. Black level setup is shown as a dashed line at 7.5 IRE.

There are ±2 IRE and ±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 and 2 field 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 μs half-amplitude duration (HAD), 2T bar. Use the set of solid and short dashed lines, to the left of the bar tilt measurement structure, to measure pulse-to-bar ratio; the scale is weighted to include K-Factor ratings of 2% and 4%.

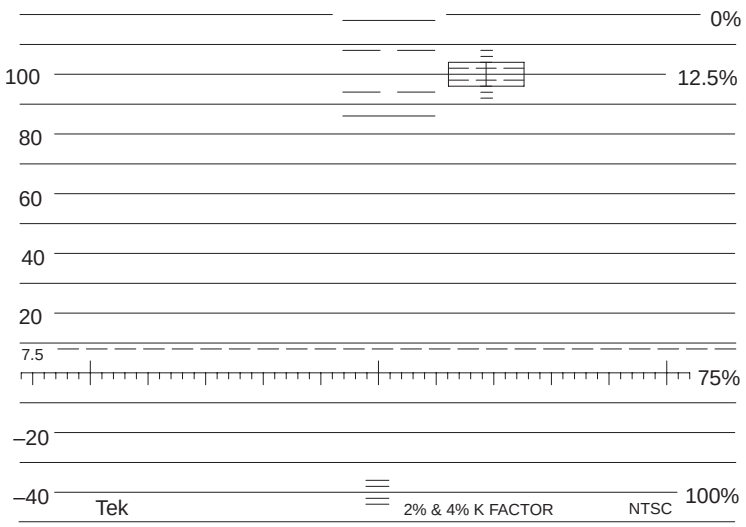


Figure 3–1: NTSC graticule

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. 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 μs 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.

***NOTE**. For signals with a bar HAD that exceeds 18 μs, simply 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 μs is automatically excluded from the measurement.*

Make pulse-to-bar K-Factor measurements 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. 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 and PAL Graticules

The Horizontal reference line is the baseline at 0 IRE (NTSC) or 0.3 V (PAL). This timing line is 12 divisions long on NTSC graticules (12.4 divisions for PAL) and takes on different timing intervals depending on the sweep rate selected. In 2 line sweep each major division is 10 μs, and when magnified (X10), each major division equals 1 μs. In 1 line sweep each major division is equal to 5 μs, and when magnified (X25) each major division equals 0.2 μs. In 2 field sweep the timing scale is of no real value, since this is a monitoring mode; however, when 2 field sweep is magnified (X25), the entire vertical (field) interval can be displayed.

PAL Graticule Vertical Scales

The PAL graticule scales are from 0 to 1.2 V on the left side. See Figure 3–2.

The right side has markings at sync tip (–0.3 V), baseline (0 V), and peak white (+0.7 V). There are 2% and 4% markings at the horizontal center of the graticule on the 0 V line (sync tip level) to assist in measuring sync amplitude. The dashed horizontal line at the top of the graticule is equal to 1.234 V to indicate peak amplitude of 100% color bars.

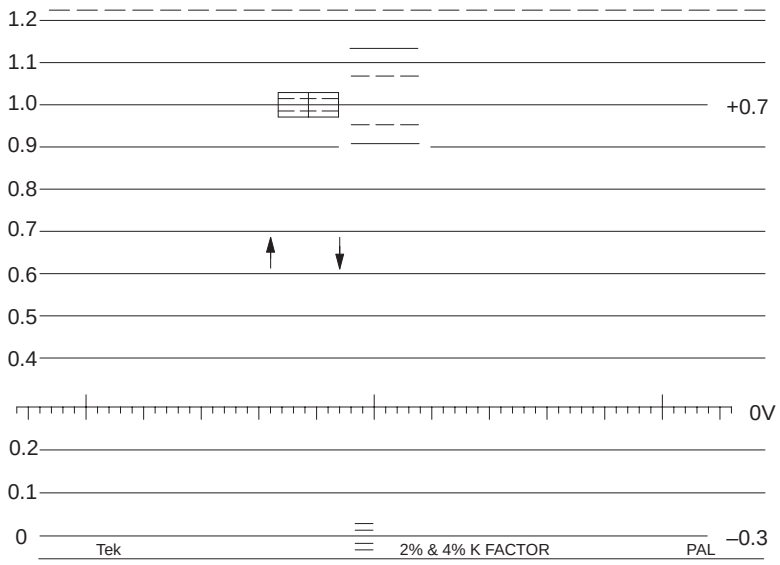


Figure 3–2: PAL graticule

The boxed area slightly to the left of center at the 1.0 V level is scaled for 2% and 4% K-Factor ratings for precise tilt measurements. This structure is designed to work with an 8 μs, half-amplitude duration (HAD) bar. The short dashed lines to the right of the bar tilt measurement structure are used to measure pulse-to-bar ratio; they are weighted for 2% and 4% K-Factor ratings.

There are 2% and 4% markings near the horizontal center of the graticule on the 0 V line (sync tip level) to assist in measuring sync amplitude. The dashed horizontal line at the top of the graticule is equal to 1.234 V to indicate peak amplitude of 100% color bars. Between the 0.9 V and 1.1 V lines, there are markings at 20 mV intervals.

Making Measurements. To use the PAL vertical scale for measuring the K-Factor for line time distortion and pulse-to-bar ratio measurements, set the signal blanking level at the graticule blanking line (0.3 V) and position the leading edge of the bar to the ascending arrow, just right of graticule center. Check to see if insertion gain is unity. Check to see that the negative-going bar transition passes through the descending arrow.

To measure the K-Factor for 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 μs 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 2% line time K-Factor.

***NOTE**. For signals with a bar half-amplitude duration (HAD) that exceeds 8 µs, simply 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 and trailing edge is on the appropriate arrow, the first or last 1 µs is automatically excluded from the measurement.*

Pulse-to-bar K-Factor measurements are made using the solid and short dashed lines to the right of the line time distortion structure. These lines are scaled 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 1.0 when blanking level is at 0.3. 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.

Analyzing a Video Signal

Although television test equipment and test signals have evolved over the years to make video quality monitoring fast and easy, an experienced operator can keep the signal under tight control using just a waveform monitor.

A television system works well over a wide range of conditions because the destination equipment knows what to expect and makes a final presentation on the viewing screen based on how the signal follows the rules. A part of the signal is very specific in controlling the operation of the receiving device and a part of the signal is free-form, where visual effects are created for the screen display.

Because the controlling elements are closely specified, an experienced operator can use this part of the signal to observe distortions in the transmission system and predict the effect on the creative part of the signal.

The Test Signal in the Video Signal

Characteristics of the controlling parts of your video signal can help you read the quality of your system. The specific times set aside for this controlling signal are known as the horizontal and vertical blanking intervals. Both intervals contain valuable clues to system performance.

The horizontal blanking interval is easily observed with a television waveform monitor. The horizontal sync pulse has a specific amplitude and shape, and it starts at a specific time in relation to the left and right edges of the picture. The left, falling edge of the horizontal sync pulse determines the lock and position of the picture on the screen. The color synchronizing burst keeps the receiving picture monitor's color decoder in step so that the intended color values may be reproduced. All of these blanking interval signals are standardized and many transmission systems pass them through unmodified. Since they are known signal elements, they are useful as an indicator of signal path performance.

The shape of the horizontal sync pulse indicates mid-frequency distortions. A rounding or over-peaking of the corners can indicate short trailing smears or ringing upon video signal transitions.

The amplitude (height) of the sync pulse (nominally 274 mV or 40 IRE units for NTSC or 300 mV for PAL) is an indicator of system gain. You want the same sync level (unity gain) through all sections of your signal path. Any notches in the sync edges or sync tip could indicate signal reflections or ghosting caused by improper cable termination or multiple over-the-air signal paths.

The size and shape of the color burst can tell you something about the color and detail performance of your system. The color burst should be the same amplitude as your sync pulse. The matching amplitude between the sync pulse and color burst provides a two point frequency response check of your system, telling you that the gain of your system is the same at a low and a high frequency.

If you have any doubt about how the horizontal blanking interval should look as the composite signal progresses through your system, it does not have to be perfect, but it should look the same as it does at the source at every point down the line.

To determine lower frequency distortions such as AC power hum or poor low frequency response you can look at your video signal at a slower rate. Set 1710J-Series Waveform Monitor to display two fields (2 FLD). With dc restoration off or in the slow position you can see any power line interference moving slowly right-to-left in the display. Poor low frequency response will cause abnormal brightness changes and horizontal banding in the picture and is an indication that maintenance may be required.

The Creative Part of the Video Signal

The active video time is where the picture is carried. Here, too, you can tell quite a lot with just a waveform monitor. The video appears between the horizontal blanking intervals. Change or adjust the video signal and you will see a change in this signal. Select the the 1710J-Series Waveform Monitor LOWPASS filter mode to eliminate the chroma signal and show only the luminance, or brightness signal.

Creativity is allowed here, but the picture signal should use most of the area between the 7.5 IRE (maximum black for NTSC) dotted line (0.3 maximum black for PAL) and the line at 100 IRE or 1.0 V(maximum white). If you do not use all of this range, the picture will have a low-contrast, dark or washed-out look. Most pictures will have some black, some white, and a range of values in between. If the average is more towards black, lighting may be uneven or there may be too many reflections or highlights. Key elements may be too dark. If the average is toward white, the lighting is too flat. A few shadows may add richness to the scene.

Specifications

Specification

This section contains tables that list the specifications for the 1710J-Series Waveform Monitor All specifications are guaranteed unless noted "typical." Specifications that are marked with the ✓ symbol are checked in the *Performance Verification* section.

Values for the 1711J Waveform Monitor, when different from those called out for the 1710J Waveform Monitor are shown in brackets[].

The performance limits in this specification are valid with these conditions:

- The 1710J-Series Waveform Monitor must have been calibrated/adjusted at an ambient temperature between +20° C and +30° C.
- The 1710J-Series Waveform Monitor must be in an environment with temperature, altitude, humidity, and vibration within the operating limits described in these specifications.
- The 1710J-Series Waveform Monitor must have had a warm-up period of at least 20 minutes.

Table 4–1: Input/Output and Vertical Deflection

	Name	Description
	Deflection Factor	
✓	1 V Full Scale	140 IRE [1.0 V] ±1% (1 V input signal displayed with FLAT FILTER)
✓	X5	±5% gain accuracy (1 V input signal displayed with FLAT FILTER)
	Maximum Absolute Input Level	±5 V (DC + peak AC) Inputs over 200 IRE [1.428 V] may cause frequency response errors
	DC Input Impedance	Greater than 15 kΩ, unterminated
	Position Range	1 V signal positioned for peak white and sync tip levels at blanking level (0 IRE [0.3 V]) with the DC Restorer on at X1 or X5 gain
	Frequency Response	
✓	Flat (X1 gain)	250 kHz to 6 MHz within 2% of response at 50 kHz (full screen height video input signal, 1 V Full Scale
✓	Flat (X5 gain)	250 kHz to 6 MHz within 5% of response at 50 kHz
✓	Low Pass Filter	At least 30 dB attenuation at F_{SC} (response at 15 kHz does not vary between FLAT and LPASS by more than 1%)
✓	Chroma Filter NTSC	Nominal bandwidth 1 MHz; attenuation at 87.2 MHz, 20 dB or greater (response at 3.58 MHz does not vary between FLAT and CHROMA by more than 1%) Upper and lower –3 dB points are approximately ±350 kHz from 3.579545 MHz 15 to 35° C operating temperature

Table 4–1: Input/Output and Vertical Deflection (Cont.)

Name	Description
✓ Chroma Filter PAL	Nominal bandwidth 1 MHz; attenuation at 8.9 MHz, 20 dB or greater. (response at 4.43 MHz does not vary between FLAT and CHROMA by more than 1%) Upper and lower –3 dB points are approximately ±350 kHz from 4.433619 MHz 15 to 35° C operating temperature
Transient Response, 1 V Full Scale or X5 Gain Flat using 2T pulse and bar	Specifications apply for full screen height video input signal
✓ Preshoot	1% or less
✓ Pulse-to-bar ratio X1 Gain X5 Gain	 0.99:1 to 1.01:1 0.98:1 to 1.02:1
✓ Overshoot X1 Gain X5 Gain	 2% or less 4% or less
✓ Ringing X1 Gain X5 Gain	 2% or less 4% or less
✓ Field Tilt	1% or less field rate square wave or vertical window
✓ 25 ms Bar Tilt	1% or less
✓ Overscan	Less than 2% variation in baseline of 100 IRE [700 mV] 12.5T [20T] modulated pulse as it is positioned over the middle 80% of the screen
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
Crosstalk between channels	Typically greater than 50 dB of isolation between channels, measured at F_{SC} between CH A, CH B and EXT REF
Loop-Through Isolation	Typically greater than 50 dB of isolation between loop-through inputs, measured at F_{SC} between CH A, CH B and EXT REF
✓ Return Loss (75 Ω) Video Inputs (CH-A, CH-B)	At least 40 dB from 50 kHz to 6 MHz. A and B channels, loop-through terminated in 75 Ω Input in use or not in use, instrument power on or off, all deflection factor settings

Table 4–2: DC Restorer

Name	Description
DC Restorer Clamp Time	Backporch (J500 on/off)
Frequency Response at 60 Hz	Slow — 20% or less Fast — 90% or greater Attenuation of 60 Hz on input signal (J399 Fast/Slow)
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 [7.14 mV] or less
Blanking Level Shift Due to Presence or Absence of Burst	1 IRE unit [7.14 mV] or less shift from no color burst to presence of color burst

Table 4–3: Calibrator

Name	Description
Frequency	100 kHz, ±100 Hz, Synchronizes in 2H and 1H sweeps Crystal controlled; timing accuracy is 10 µs, ±0.01 µs, Can be used as 10 µs and 1 µs timing calibrator
Amplitude	140 IRE [1 V] within 1%
Position	Top of waveform must be between 80 IRE (0.86 V) and 120 IRE [1.14 V] on graticule when backporch is positioned to 0 IRE [0.300 V] line, with DC RESTORER on

Table 4–4: Horizontal Deflection

Name	Description
Sweep	Sweep will occur in all Horizontal mode settings with or without synchronization
2 FLD Sweep Repetition Rate	Equal to frame rate of applied video or external sync
2 FLD Sweep Magnification	Approximately X25
1 LINE Sweep Repetition Rate	Equal to line rate of applied video or external sync
2 LINE Sweep Repetition Rate	Equal to half line rate of applied video or external sync
Sweep Length	2 LINE and 2 FLD sweep length is nominally 12.5 divisions
Timing Accuracy	1 µs/division ±2% 0.2 µs/division ±3% All timing and linearity specifications exclude the first and last major divisions of the unmagnified display
Linearity 1 µs/division and 0.2 µs/division	Within 2%
Differential Linearity 1 µs/division and 0.2 µs/division	Within 2%

Table 4–4: Horizontal Deflection (Cont.)

Name	Description
Sweep Magnifier Registration	Typically magnification occurs about the center of the screen
HORIZONTAL Position	Any portion of a synchronized video sweep can be positioned on screen in all sweep modes

Table 4–5: Synchronization

Name	Description
Input Requirements	
✓ Internal Reference	
NTSC	Composite video or black burst with sync amplitudes 40 IRE ±6 dB
PAL	Composite video or black burst with sync amplitudes 300 mV ±6 dB
✓ External Reference	Sync amplitude between 143 mV and 4 V will synchronize sweeps
External Reference Dc Input Impedance (Unterminated)	Greater than 15 kΩ
✓ Return Loss (75 Ω)	At least 40 dB from 50 kHz to 6 MHz Loop-through terminated in 75 Ω, instrument power on or off
Absolute Maximum Input Voltage	±12 VDC plus peak AC

Table 4–6: RGB/YRGB

Name	Description
✓ RGB/YRGB	Will display either a three-step or four-step RGB / YRGB parade or overlay display Pin 10 of the REMOTE connector controls selection of RGB/YRGB sweep length YRGB is high RGB is low
✓ Staircase Amplitude	A 10 V input will result in a horizontal display of nine divisions ±1.4 major divisions 12 V_{p-p} AC component, signal voltage not to exceed ±12 VDC plus peak AC
✓ 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
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.

Table 4–6: RGB/YRGB (Cont.)

Name	Description
Magnifier	Typically X25 for 2 FLD, and X10 in 1 or 2 LINE
Sweep Length	three-step: 3.4 — 4.1 divs. four-step: 2.5 — 3.1 divs. Field or line rate sweeps

Table 4–7: CRT

Name	Description
CRT Viewing Area	Typically 80 × 100 mm Horizontal = 12.5 division Vertical = 170 IRE units [1.19 V]
Accelerating Potential	Typically 13.75 kV
Trace Rotation Range	Greater than +1 degree from horizontal Total adjustment range is typically 8 degrees
Graticule	Internal, variable illumination

Table 4–8: Power Source

Name	Description
Mains Voltage Range	90 - 250 V (Continuous range from 90 to 250 VAC)
Mains Frequency	50 or 60 Hz
Power Consumption	56 VA (35 watts)
Peak Inrush Current	9.1 A @ 90 V_{AC}/50 Hz, 25.2 A @ 250V_{AC}/50 Hz

Table 4–9: Physical Characteristics

Name	Description
Dimensions	Height: 5 1/4 in (133.4 mm) Width: 8 1/2 in (215.9 mm) Depth: 18 1/8 in (460.4 mm)
Weight	Net: 8.5 lbs (3.8 kg)

Table 4–10: Environmental Characteristics

Name	Description
Operating Temperature	0° to 50° C (+32° to 122° F)
Storage Temperature	–40° to 75° C (-40° to 158° F).
Operating Altitude	To 15,000 feet (4572 meters)
Storage Altitude	To 50,000 feet (15,240 meters)
Vibration	5 minutes at 5 - 15 Hz with 0.060 in. displacement 5 minutes at 15 - 25 Hz with 0.040 in. displacement 5 minutes at 25 - 55 Hz with 0.020 in. displacement Military Specification: Mil-T-28800D, Paragraph 1.2.2, Class 3
Mechanical Shock	Non-operating: 50 g 1/2 sine, 11 ms duration three shocks per surface (18 total)
Transportation	Qualified under NSTA Test Procedure 1A, Category II (24 inch drop)
Humidity	Will operate at 95% relative humidity for up to five days Do not operate with visible moisture on the circuit boards

Table 4–11: Certifications and Compliances

EC Declaration of Conformity[1]	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 Communities: EN 50081-1 Emissions: EN 55022 Class B Radiated and Conducted Emissions 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 Low Voltage Directive 73/23/EEC: EN 61010-1 Safety requirements for electrical equipment for measurement, control, and laboratory use EN 61010-2-031:1994 Particular requirements for hand-held probe assemblies for electrical measurement and test
EMI[1]	FCC 47 CFR Part 15, Sub-part B, Class A
Installation (Overvoltage) Category	Terminals on this product may have different installation (overvoltage) category designations. The installation categories are: CAT III Distribution-level mains (usually permanently connected). Equipment at this level is typically in a fixed industrial location. CAT II Local-level mains (wall sockets). Equipment at this level includes appliances, portable tools, and similar products. Equipment is usually cord-connected. CAT I Secondary (signal level) or battery operated circuits of electronic equipment.

Table 4–11: Certifications and Compliances (cont.)

Pollution Degree	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.	
	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.
	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.
	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.
	Pollution Degree 4	Pollution that generates persistent conductivity through conductive dust, rain, or snow. Typical outdoor locations.
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 and	CSA safety requirements for electrical and electronic measuring 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.	

1 **Conditions:**
High-Quality shielded cables must be used to ensure compliance to the above listed standards.
This product complies when installed into any of the following Tektronix instrument enclosures:
1700F00 Standard Cabinet
1700F02 Portable Cabinet
1700F05 Rack Adaptor

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 material in this section is subdivided into a general description, which is supported by the simplified and main block diagrams, and the detailed circuit descriptions that use the schematic diagrams as illustrations. A thorough understanding of the instrument starts with knowing how the major circuit blocks fit together, which is then followed by an understanding of the individual circuit's functions. These discussions of the 1710J-Series Waveform Monitor begin with a brief, fundamental overview, then proceed on to the block diagram, and then go on to the individual circuit descriptions.

Overview

The 1710J-Series Waveform Monitor is a specialized oscilloscope. It is designed to monitor and measure television baseband signals. See Figure 5–1. Signals input through either of the rear-panel 75 Ω bridging loop-through inputs are synchronously displayed on a CRT.

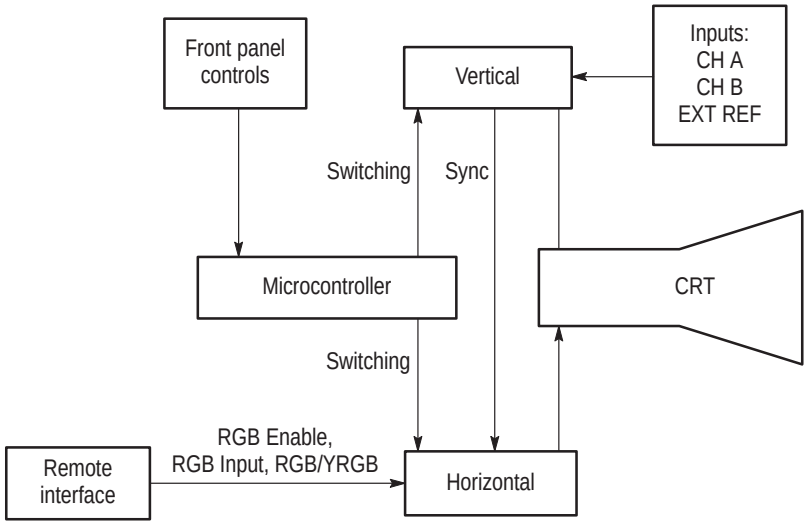


Figure 5–1: Simplified representation of a 1710J-Series Waveform Monitor

Front-panel mode switching is accomplished by a series of push-button switches whose status is being constantly polled by a microprocessor. In turn, the microprocessor 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.

Block Diagram

The Block Diagram for the 1710J-Series Waveform Monitor is located on a foldout in *Diagrams/Circuit Board Illustration* section of this manual. The following functional description uses the diagram as its illustration. The numbers on the circuit blocks correspond to the schematic diagram where that circuit block is detailed.

Vertical

Color-encoded video signals are input through the bridging channel A and channel B inputs. The input amplifiers are shunted by sample-and-hold-type clamps, that are timed by a back porch sample from the back porch generator. Switching at the output of the amplifiers provides for display of either input signal or a combination of both in all sweep modes. In the combination mode, the channel A signal is displayed on the left of the CRT with the channel B following.

Front-panel switching can select a flat (unfiltered), a low pass, or a chroma filtered signal for display. Low pass filtering can be used with flat as part of the dual filter mode. In dual filter mode, the low pass filtered signal is displayed to the left with the unfiltered (flat) signal following. When the calibrator signal is selected (from the front-panel switching), 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 to check horizontal accuracy from a common, self-contained source.

Signal amplitude can be adjusted at the gain cell using the front-panel V GAIN control. The output signal from the gain cell drives another clamped amplifier. This second clamped amplifier has a loop-compensated sample-and-hold circuit to provide the fast clamping required for the fast dc restorer.

The vertical positioning voltage, along with the conditioned video signal, is input to a switchable gain amplifier. Both amplifier gain and positioning range can be increased by a factor of 5 when X5 Gain is selected at the front panel. The limiter stage that follows prevents overdriving of the output amplifier.

The conditioned video signal and the Y component of the readout (from the microcontroller) are input to the vertical output amplifier to match impedances and normalize gain (approximately 40 V for 8 cm of vertical deflection) in order to voltage drive the CRT vertical deflection plates.

Horizontal

Composite video from either internal (Channel A or B) or external reference has all active video stripped away by the sync stripper to leave only sync to output a sweep trigger.

The composite sync output of the sync stripper times a programmed logic array (PLA) that controls the horizontal and vertical sync generators. The sync generator H and V trigger outputs synchronize the sweep generator. If calibrator is selected, the cal drive signal from the microprocessor provides the sweep generator triggering signal.

The ramp signal, output by the sweep generator, drives the mag amplifier, which provides three gain ranges: X1 (un-magnified sweep), X10 (1 μs/div. in two line sweep), and X25 (to display the full vertical interval in two field sweep, while providing 0.2 μs/div. sweep rate in 1 line sweep). The horizontal positioning offset voltage is input to the mag amplifier to ensure sufficient range to position any part of the display onto the graticule.

When the RGB Parade display is enabled, the sweep is shortened. The RGB staircase produces three short ramps per sweep that are displayed in sequence.

The output of the mag amplifier drives 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 Z-Axis control uses the blanking signal (unblanking) and the intensity voltage to unblank the CRT during sweep time. When the sweep is magnified its off-screen portion is blanked to increase the on-off contrast ratio. The focus amplifier, which is controlled by the front-panel FOCUS control, provides a voltage to the CRT focus ring.

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

Vertical Input, Diagram 1

The 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, drive the picture monitor output, serve as the internal sync source, and eventually be displayed on the CRT.

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 A and B inputs are high-impedance bridging loop-through inputs compensated for use in 75 Ω systems. Each amplifier has its own DC restorer that is turned on or off by repositioning a plug jumper (See *Diagram 5*). Restorers are either both on or off.

Because the Channel A and Channel B input amplifiers are identical, circuit numbers for the Channel A amplifier are used to simplify the remainder of this discussion.

The input amplifiers are inverting feedback operational amplifiers with a gain of –1. The input resistor (R_i) is R196 and the feedback resistor (R_f) is R198. A plug and jumper is provided to select input coupling. J197 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 C197, the ac-coupling capacitor.

The DC restorer is a feedback sample-and-hold circuit. Sampling occurs when U395A closes at back porch time to charge the hold cap (C398) When the restorer is selected U395D closes and the loop-compensated buffer amplifier (U495A) drives the input amplifier input summing junction through R197. The time constant of the restorer does not attenuate 50/60 Hz hum by more that 10%.

Channel Switch

The input amplifier output signals drive the channel switch, U492. The signal selection is determined by the level of the $\overline{\text{CH-B}}$ signal at U492 (pin 10). When $\overline{\text{CH-B}}$ is low, channel B is selected; when it is high, channel A is selected. The channel switch output (pin 6) drives a current mirror with three current sources.

Q792 is the current source for the internal sync signal and Q791 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 R392 (or R393) into the channel switch. This signal current is available to drive the vertical through Q791.

Only 0.5 mA of signal current is available to drive the sync stripper through Q792. Its emitter resistor, R694, is twice the resistance of R792 and R693, the emitter resistance for Q790.

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 U795A and B. It has a gain of –1, which is determined by the combination of input resistor (R_i) R997 and feedback resistor (R_f) R898. The operational amplifier output drives Q798, which is one current source for the source switch (U795D).

The internal sync current source, for the other side of the common emitter Source Switch (U795D), is Q792. It provides signal current through pin 5 of U795D which also forward biases CR696 when the switching signal ($\overline{EXT}$) is high. CR698 keeps CR696 from conducting when external sync input is selected.

When external sync is selected, $\overline{EXT}$ (from *Diagram 5*) goes low, turning on U795 (pins 1, 2, & 3) so that signal current from Q798 (the external sync current source) forward biases CR697. The 0.5 mA of signal current from Q798 (external) or Q792 (internal) drives into a common base stage, Q799, which develops a 1 V video signal across R797.

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 consist 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.

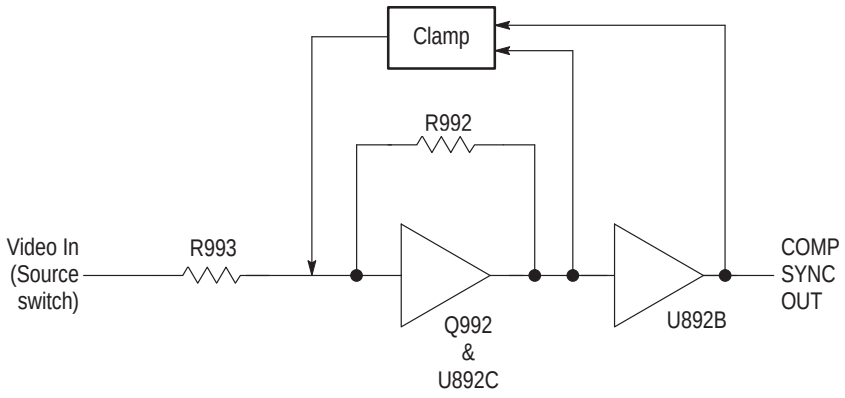


Figure 5–2: Simplified block diagram of the sync stripper

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 Q992 and U892C. The gain setting resistors R993 (R_i) and R992 (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 CR990, to maintain the proper level.

During non-sync times (active video), CR988 and CR989 are both on to shunt U892C and greatly reduce the gain. Shunting the active video limits the saturation of U892C, which allows it to respond quickly to the next sync transition.

An inverting amplifier, U892B, 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 U892E and U892A. U892E and CR990 form a current switch. When the first stage output level is at sync tip, current flows through U892E, which charges C887. At the same time U892B pulls down on CR887 to provide a discharge path for C887. The result of these opposing actions is to establish an equilibrium voltage on C887. At the end of sync time U892C saturates and pulls down on CR990 to shut off U892E.

Filter Selection

The three filters are driven from current source Q791 through one of the analog switch sections of U786. Only one switch section will be closed at a time, as dictated by its enable, from the microprocessor (Diagram 5) going low. chrominance filters are clamped to ground when low pass filtering or flat is selected. In this condition Q777 and Q776 are turned on clamping the chrominance filter outputs to ground.

When the chrominance filter is turned on an additional bias current for the ac-coupled filters (3.58 and 4.43 MHz) is required. It is supplied by pulling the emitters of either CR671 or CR670 low with the microprocessor-generated enable signal, which turns on Q775 to saturate Q774. When Q774 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 VDC level 2 mA of bias current is added to 1 mA of signal current that drives the input of the Gain Cell.

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 B or FLAT goes active an RC circuit consisting of C94 (CH B) or C871 (FLAT) and R878 and R885 generates a pulse through Q764. Q765 inverts the blanking pulse, which is input to the blanking circuitry on *Diagram 4*.

Calibrator

The calibrator is a common base amplifier, Q587, 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 R689, the Cal Amp. The emitter current drives the low pass filter (which is at least 30 dB down at 3.58 to 4.43 MHz) through an analog switch, U585C, which is activated by the microprocessor-generated CAL.

Vertical Output, Diagram 2

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

Gain Cell

Q684 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 (U578) is driven differentially; pin 1 is the signal input with a –3.0 VDC level plus the signal voltage. R675 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 V CAL control, R700, sets an input dc level on pin 10 of the gain cell.

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, R480.

Gain Cell Amplifier

The gain cell amplifier is a clamped inverting operational amplifier driving both the switchable gain amplifier and the second DC restorer. It consists of Q673, Q674, and Q669, with Q669, an emitter follower, operating as the output stage. Amplifier gain is approximately 4.

Second 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 R474 into an analog switch (U277B) that is activated by the $\overline{\text{BACKPORCH}}$ signal**.** U277B closes during back porch time to charge the hold cap, C484. The error amplifier (U488) drives a current summing point at the input of the gain cell amplifier through U585D. For slow restorer, R484 is in the loop compensation. However; for fast dc restorer, R484 is shorted to ground through U277C to speed up the loop time constant. The position of J99 controls the action of U277C.

Switchable Gain Amplifier

The switchable gain amplifier consists of Q476, Q477, and Q478, with Q469 as the switching element. When the base of Q469 is pulled low through R472, amplifier gain is –1. R_i is R475 and R_f is the sum of R367 and R368. When its base is high, Q469 saturates and grounds the collector end of R470 to put an attenuator in the feedback path and increase gain by a factor of five. The output, at the collector of Q476, drives a bridge limiter circuit comprised of CR280 and CR380. 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 CR280 and CR380, 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.

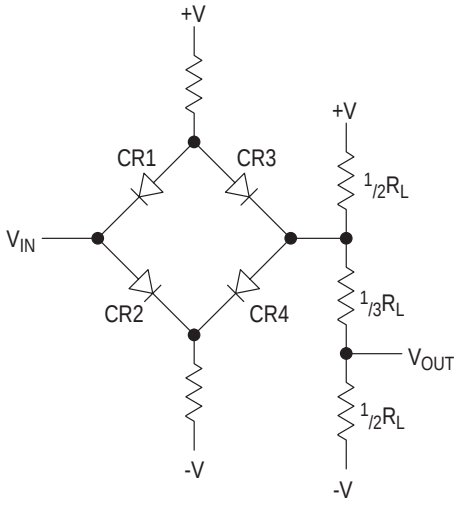


Figure 5–3: Simplified illustration of the bridge limiter circuit

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.

The bridge load, R378, R377, and R374, is also a voltage divider that sets the input dc level for the vertical output amplifier at approximately –2 V.

Vertical Output Amplifier

The combination of Q382 and Q383 forms a shunt-feedback amplifier. Q382 amplifies and inverts the collector current flowing in Q383 to provide most of the signal current through R485. Because the current across Q382 is nearly constant the input-signal voltage is applied directly across its emitter resistor, R485, with very little distortion. Negative feedback is employed to improve linearity and reduce the thermal distortions introduced by Q383. In addition, negative feedback increases the input impedance. A series compensation network consisting of R384 and C384 provides improved bandwidth and stability.

The combination of Q385 and Q387 form a shunt-feedback amplifier, identical to Q383 and Q382. The signal current for this amplifier is input through R485. Signal current through Q387 is equal in value and opposite in phase to the current change in Q382. The Limit Center, R489, balances the bias current flowing in Q382 and Q387. R387 and C387 form another series compensation to improve bandwidth and stability. R486 and C389 provide high-frequency peaking to improve the flat response; R385 and C385 improve low-frequency transient response.

Q280 and Q289 are common-base stages that couple the complementary signal currents to the non-inductive CRT load resistors, R184 and R186. The resulting signal voltages drive the CRT vertical deflection plates. R183 and R187 shunt the load resistors to provide the proper load resistance for the high-bandwidth output signal. L180 and L190 are adjustable shunt-peaking coils to increase the vertical bandwidth and allow precise adjustment of flat response.

Timing, Diagram 3

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 ($\overline{\text{RGB ENABLE}}$) by a TTL low.

Timing State Machine

The timing state machine is U735. It, in conjunction with the microcontroller outputs control signals for input switching, calibrator drive, and the filter switching on *Diagram 1*. In addition, it provides the clamp control pulses, sweep triggers, and miscellaneous signals used by the microcontroller.

U735 is a quad 20-input logic array. It outputs a sync signal from pin 21 that triggers the horizontal sync generator, which in turn outputs a regenerated

horizontal sync. With the exception of composite sync, from the sync stripper on *Diagram 1*, all inputs the U735 are from the microcontroller on *Diagram 5*. Table 5–1 describes the signals output by the timing state machine.

Table 5–1: Timing State Machine Outputs

Signal Name	Function
H TRIG	Triggers signal that synchronizes the line sweep generator when composite sync signal is available. (To Diagram 4)
V TRIG	Trigger signal that synchronizes the field sweep generator when composite sync is available. (To Diagram 4)
FLAT	Closes a switch in the filter selection matrix when pulled low. (To Diagram 1)
LPASS	Closes a switch in the filter selection matrix when pulled low. (To Diagram 1)
CH B	Input switch control: CH A when high and CH B when low. (To Diagram 1)
SYNC SIG	A sync signal that is phased to composite sync that is used as the sync generator synchronizing signal. (To Diagram 4)

Horizontal Sync Generator

Composite sync (SYNSIG) from U735 drives a non-retriggerable one shot, U844B, that triggers on the leading edges of horizontal sync pulses. The pulse width is wide enough to lock out half lines from the vertical interval. The output of U844B are regenerate sync pulses, HSYNC and $\overline{\text{HSYNC}}$. HSYNC is a clock source for the PAL and drives the back porch one shot, U844A. The pulse width is set to end at the start of the burst on the back porch of the composite sync signal.

The back porch pulse for the DC restorer is generated by U844A and Q737. C843 and R837 set the position of the pulse. C848 and R849 determine the pulse width. The RC network, formed by R963, C964, C97, and R964 turns the output of U844A into a pulse that drives Q99. The voltage follower formed by Q99 and R98 outputs the $\overline{\text{BACKPORCH}}$ pulse used by the clamp circuits to sample the composite signal during the backporch. During the vertical interval broad pulses there is no burst or backporch and therefore no pulse is desired. During the vertical broad pulses the SYNCSIG from U735 asynchronously clears U844A.

When the dual filter operating mode is selected (lowpass and flat) the filter inputs (*Diagram 1*) are switched, which generates a switching glitch during sync time. HSYNC, from U844B, and the GLITBLKEN are anded to form the GLITCH BLK signal for the Z-axis circuit to turn off the CRT beam during this switching transient. When the Q output of U844B goes low, during horizontal sync, U234D inverts it and inputs it to one input of U234B. If the dual filter mode is operating, GLITBLKEN (from the microcontroller on *Diagram 5*) is high and U234B outputs $\overline{\text{GLITCH BLK}}$. R003 sets the pulse output amplitude.

Vertical Sync Generator

The composite sync signal also drives the vertical sync generator. The SYNC SIG is integrated by R947, C950, and U947A. During normal video lines and vertical serrated lines, the signal is mostly positive and charges the capacitor, C950, holding the output of U947A negative. During the vertical broad pulses the signal is mostly zero and the capacitor discharges making the output of U947A go positive. The output then swings negative again after the broad pulses.

R850 and R751 offset the output of U947, which drives a comparator, U753B, through C853. U753B shapes the FIELD signal to the TTL level required to drive the microcontroller (*Diagram 5*) Interrupt 0 input. The voltage divider formed by R850 and R751 also provides a 2.5 V source for the end of sweep comparators in the sweep generator on *Diagram 4.*

Z-Axis Control

U252 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 control using Q243 (in the focus control) as a current source. The blanking signal is input to the transistor switching array through U252B (pin 9). When it goes high, the current output, collector of U252A (pin 8), is shut off and the Z-axis amplifier (*Diagram 8*) blanks the CRT.

Trace Rotation

Trace rotation compensates for changes in the magnetic field surrounding the 1710J-Series Waveform Monitor. Q142 and Q143 are emitter followers to provide trace rotation current to the CRT surrounding coil located inside the CRT shield. Amplitude and polarity are controlled by the front-panel ROTATE screwdriver adjustment.

Graticule Illumination

U263A is a triangle generator whose output is compared to the front-panel SCALE control output level, by U263B (a comparator). Whenever the output of U263A is higher than the level from the front-panel SCALE control, Q158 is turned on and current is drawn through the bulbs (DS100, DS200, and DS300) to ground. The duty cycle of Q158 is determined by the level set by the front-panel SCALE control.

Regulators

The + and –15 V supplies generated by the main low voltage power supply are further regulated to meet the power requirements of the Main (A3) circuit board. U164 is the regulator; its reference level is set by R167, the –11.8 V adjust. U172 is the +11.8 V supply regulator and its reference level is set by R168, the +11.8 V adjust.

Sweep Generators and Horiz Output, Diagram 4

Sweep Generator

U552B (line rate sweep generator) and U552A (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 (U541A or B) clear is high and preset is low, to set Q high and turn on Q451 or Q450, which discharges the integrating capacitor (C448 or C453). See Figure 5–4. The Q output of U541A or B going high also starts a one-shot (U741A or B) which pulls the flip-flop preset low which assures at least 2 μs (line-sweep one-shot time constant) of discharge (retrace) time. Field sweep one-shot time constant is 2 ms. 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 Q451 or Q450 to start charging the integrating capacitor.

Current source for the integrators is through R654. When a one line or field sweep (including RGB parade) is selected, pin 3 of U735A is pulled low and effectively shorts out R654 to provide more current for a faster sweep. Q750 provides a compensation for 50 Hz sweep by taking away a small amount of current when operating with 625/50 Hz sweep rates.

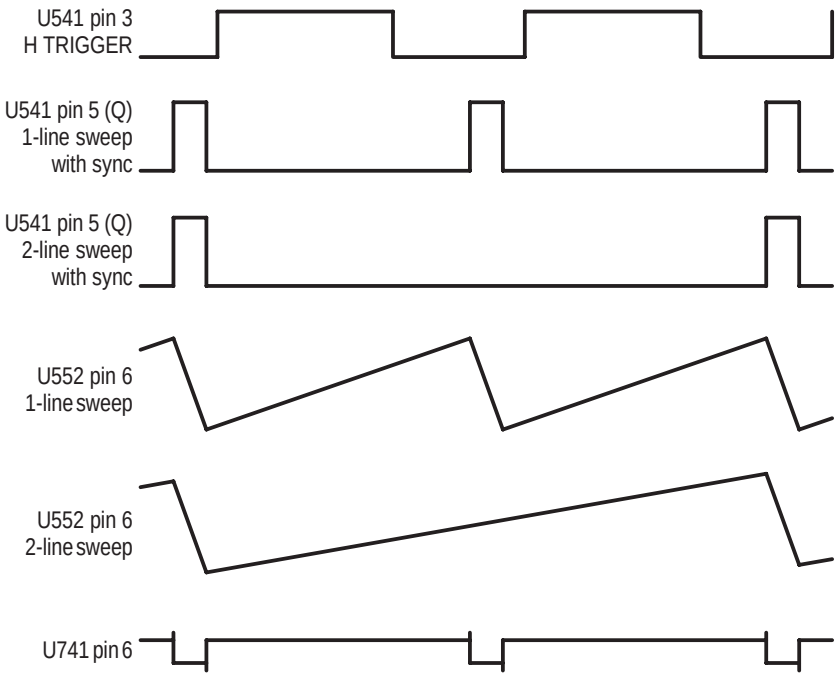


Figure 5–4: Timing signals for 1-line and 2-line sweep

If there is no H or V trigger, the output of the running sweep generator is self retriggered. When the ramp amplitude reaches about 3/4 of its maximum amplitude U445B trips and sets the flip-flop preset high to turn on Q451 or Q450 to start retrace. Just before retrace begins U445A also trips and pulls the flip-flop clear high to lock out the trigger signal and generate the HOLDOFF signal used by the timing generator (*Diagram 3*) to phase up the horizontal timing of the input or filter switching.

Magnifier Amplifier

An operational amplifier consisting of U564C and D and Q566 positions and magnifies the sweep signal. R557 and R558 are the central elements of the feedback resistor network. The value of the network is altered by R552 (1 μs cal) and R553 (0.2 μs cal) when magnified sweep rates are selected. The junction of input resistance (R559) and the feedback resistance network (R557 and R558) is the amplifier input summing junction.

Horizontal positioning voltage is input to an operational amplifier, U655B, which drives the mag 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 J456 to accommodate either three- or four-step sweeps (for RGB and YRGB modes).

U465A and U465B 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 U234C is pulled low to generate the BLANK enabling level for the Z-axis amplifier (*Diagram 3*).

Horizontal Output Amplifier

The horizontal output amplifier is composed of Q858, Q860, Q862, and Q864, with Q868 and Q865 serving as current source. R960 provides the differential mode feedback; R958 and R959 provide the common mode feedback that biases the outputs to approximately 50 volts. The gain of the amplifier is determined by a voltage divider with two adjustments, R660 (sweep length adj.), and magnified sweep registration R661 (mag registration adj.).

Microcontroller, Diagram 5

The microcontroller is the brain of the 1710J-Series Waveform Monitor. It monitors the front panel, and reacts to changes to any switch setting and generates appropriate control levels for circuits in the rest of the monitor.

Processor

The microcontroller interfaces the front-panel switching to the 1710J-Series Waveform Monitor control functions. The programmability and integration of RAM, ROM, and counters provides flexible control over the complex switching required for this waveform monitor. The microprocessor is equipped with

4 kbytes of one-time programmable EPROM, 128 kbytes of RAM, and two 16-bit timer/counters. Its operating frequency, 12 MHz, is crystal controlled by Y709. External instructions are imported and exported through a multi-function serial port, and seven 8-bit bidirectional input/output ports. Port 0 and port 2 send data to U407, the LED display controller. Port 1 monitors the front-panel push-button switches and the 50/60 Hz input line. Port 4 is a static latch that controls various instrument functions, such as magnifiers and sweep selections. Port 5 is a static and dynamic latch that extends the control functions of Port 4.

The FIELD and HSYNC are inputs from the timing (on *Diagram 3*). FRCLOCK is a freerun output clock used by the timing PAL on *Diagram 3,* when horizontal sync is not present.

The front-panel LED indicators are controlled by U407, which outputs 8 bits of data on bits SA – SD to provide the enables for the indicators. At the same time one of the four bit lines, D1 – D4, turns on a transistor in a switching matrix consisting of U305A – D. When one of the transistors is turned on it saturates and provides the ground to close the circuit for one of the front-panel LEDs. For example, if bits SA and D1 are set high, U305A saturates and drives its collector to ground, which turns on the FLAT indicator.

U331 divides the ALE (address latch enable) signal from the microprocessor (U522) by 20. When the calibrator is enabled U331 divides ALE down to output the 100 kHz CALDR (calibrator drive signal).

At power-up time, or after a power failure, the microcontroller presets the 1710J-Series Waveform Monitor for a 2-line sweep, flat filtering, X1 gain and internal sync.

There are a number of control lines, originating from the microcontroller. Table 5–2 lists these lines, the condition of the line and the expected results.

Table 5–2: Control Line Functions

Signal Line	State	Result
60/$\overline{50}$	High	Identifies NTSC or PAL standard. Needed for 2-field sweep
FIELD	High	Field rate output of the vertical sync generator. Used with HSYNC and 60/$\overline{50}$ to identify fields and synchronize 2-field sweep, or synchronize dual filter or dual input switching
FRCLOCK	High	Has a frequency of approximately 3.91 kHz and is output when HSYNC is absent
AD0 – AD7	——	Address/data lines used to transfer data to U407
$\overline{WR}$	Low	Latches data into U407
$\overline{DCR\ EN}$	Low	Enables DC restorer
ALE	——	2 MHz signal that is divided down to a 100 kHz pulse for the calibrator drive

Table 5–2: Control Line Functions (Cont.)

Signal Line	State	Result
$\overline{\text{CAL}}$	Low	Enables calibrator
LIN/$\overline{\text{FLD}}$	High	1 or 2 line display
	Low	2 field display
TWO/$\overline{\text{ONE}}$	High	2 field or 2 line display
	Low	1 line (no single field display possible)
X5	High	Enables 5X vertical magnifier
$\overline{\text{EXT}}$	High	Enables internal sync reference
	Low	Enables external sync reference
CH A	High	Enables CH-A input
CH B	High	Enables CH-B input
$\overline{\text{HMAG1}}$	Low	Enables magnifier in 2-line sweep
$\overline{\text{HMAG2}}$	Low	Enables magnifier in 1-line and 2-field sweep modes
$\overline{3.58}$	Low	Enables NTSC chrominance filter
$\overline{4.43}$	Low	Enables PAL chrominance filter
LPASS	High	Enables low pass filter
FLAT	High	Enables flat (no filter)
FIELDSWP	High	Enables field-rate sweep
$\overline{\text{ON DCR}}$	Low	Enables DC restorer
$\overline{\text{GLITBLKEN}}$	Low	Generates blanking pulse during H sync time in 2-line sweep

RGB Amplifier

Under normal operation the base of Q856 is pulled down by CR955, which causes Q855 to saturate and ground the amplifier output. When exerted the $\overline{\text{RGB ENABLE}}$, from the REMOTE connector, is inverted to provide a discharge path for the emitter of CR955, which enables the RGB staircase amplifier.

The staircase signal from the REMOTE connector drives an operational amplifier composed of Q856 and Q855, whose gain is approximately 0.5. The amplifier is compensated, for optimum step definition (transient response), by C953. R856, the RGB offset adjustment, compensates for input dc level variation.

Cal Drive

U331 divides down the microprocessor ALE output to generate cal drive. U331 is enabled by the CAL from the I/O data latch, U532.

LED Drive

The front-panel LEDs are driven in six common banks by U407. U305 provides a common current drain that is enabled by U407. Data registers in U407 are written into by the microprocessor over the eight-bit address bus and read out to front-panel LEDs when $\overline{WR}$ goes low.

Front Panel, Diagram 6

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 six 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 (*Diagram 5*) through the LED and back to the light driver.

Switches complete a simple matrix that is read by Port 1 of the microprocessor. A completed circuit through the processor (switch closure) dictates an output through the data I/O that changes one or more operating conditions. Some of the switches are read in two different ways by the microprocessor. When touched and released they cause the microprocessor to toggle to the next item on that switch's menu. When held in, the microprocessor selects a specific operation. Hold for function switching options are outlined in blue on the front panel.

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 3*. 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.

Low Voltage Power Supply, Diagram 7

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

The low voltage power supply is called a flyback switcher. When switcher MOSFET, Q9, is turned on, its drain voltage drops to approximately 0 V. The current through the 350 μH primary winding of T3 begins ramping up. The voltages present at all secondaries is such that the rectifier diodes are reverse biased. Energy is being stored in the magnetic field of T3. When Q9 turns off, the drain voltage "flies back" in a positive direction. Current now flows in all of the secondary windings and supplies power.

Line Rectifier and Filter

The input line voltage is filtered by the rear-panel connector to reduce the electrical noise conducted into or out of the instrument. R89 limits the initial charging current through the rectifier diodes and C54.

CR21, CR22, CR23, and CR24 form a bridge rectifier. C54 filters the 110 to 350 VDC rectifier output. L4 filters the switching noise produced by the switcher. R102 reduces the circulating current in the parallel circuit consisting of L4 and C44. DS4, R93, and R94 form a line voltage indicator. R91 and R92 charge C42. C42 provides power to U5 until the primary housekeeping winding provides power through CR17.

Pulse Width Modulator

U5 is a current-mode pulse width modulator (PWM). A current-mode PWM uses two feedback loops. See Figure 5–5. The inner current-feedback loop directly controls the switcher MOSFET peak current. The outer voltage-feedback loop programs the inner loop peak current trip point.

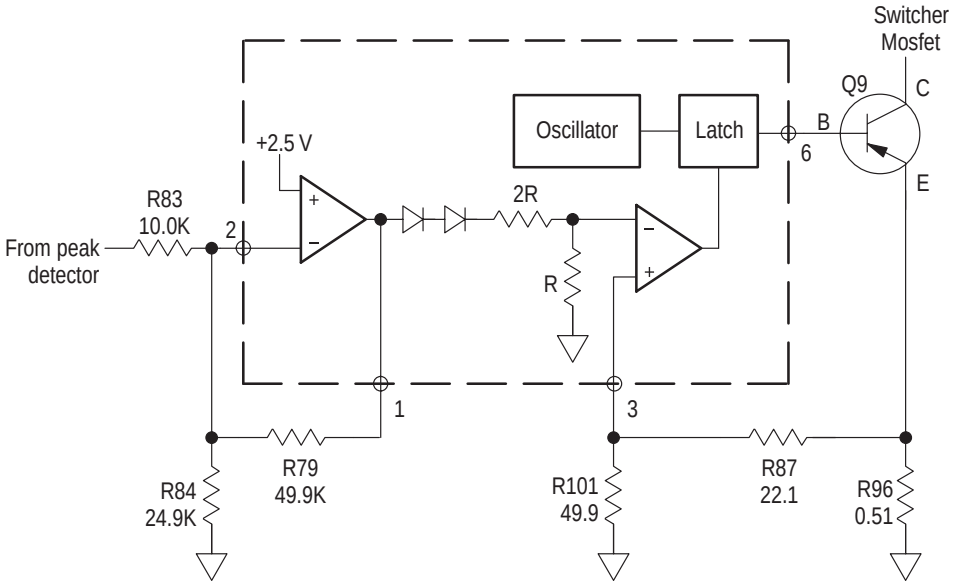


Figure 5–5: Simplified representation of the pulse-width modulator circuit

U5 pin 2 is the inverting input of an internal operational amplifier. The non-inverting input is set to 2.5 V by an internal voltage reference. Current from the peak detector flows through R83 and R79. R84 provides a 100 μA offset. The voltage at U5 pin 1 will vary in order to maintain U5 pin 2 at 2.5 V.

The voltage at U5 pin 1 is modified by an internal circuit and sets the trip point of the internal comparator. U5 pin 3 is the external input to the comparator. R88 and C52, connected to U5 pin 4, set the internal oscillator to 80 kHz.

The circuit works as follows: The oscillator resets the latch and U5 pin 6 goes high, turning the switcher MOSFET on. The current through the switcher MOSFET increases, causing the voltage across R96 to increase. This voltage is divided by R87 and R101, and is applied to the comparator (pin 3). When the voltage at U5 pin 3 reaches the comparator trip point, the latch toggles and the switcher MOSFET is turned off. This process is repeated at an 80 kHz rate.

C58 increases the PWM noise immunity by rolling off the internal operational amplifier frequency response. R82 holds the switcher MOSFET off as the circuit is powering up. R81 slows the turn-on of the switcher MOSFET while CR27 speeds up the turn off.

Output Filters

The three output windings supply four output voltages. Each output is rectified by a single diode and filtered by an LC pi filter.

Error Amplifier

The error amplifier regulates the +5 V output by feeding an error signal to the pulse width modulator. VR1 is a 2.5 V shunt regulator containing an operational amplifier and a voltage reference. The +5 V is divided by R69 and R70 to provide 2.5 V to VR1, with fine adjustment provided by R99. C40 and R71 determine the gain and frequency response of VR1. VR4 controls overshoot of the +5 V at power up. R98 and CR26 provide a minimum operating current for VR1. R68 decouples C39 from VR1. Over-voltage protection for the +5V supply is provided by a crowbar circuit formed by Q11, VR3, R13, and R14.

Feedback Transformer Driver and Peak Detector

The 80 kHz sawtooth waveform at U3 pin 3 trips comparator U3. U3 pin 1 then feeds a trigger pulse to one shot U4. U4 pin 13 outputs a 300 ns pulse to the 130 mA current source consisting of Q7 and Q8. When Q8 turns on, T2 pin 2 is pulled down until CR15 (error amplifier) is forward biased. The negative-going pulse at T2 pin 2 is peak detected by CR16 and C46. The dc voltage present at the anode of CR16 feeds the pulse width modulator and the output under-voltage shutdown circuit. CR29 resets T2 between pulses.

Output Under-Voltage Shutdown

If the +5 V is below 4.9 V, the error amplifier will cause the peak detector output to go below 2.9 V. The output of comparator U3B will pull low and shut down pulse width modulator U5. C47 and R96 delay the operation of U3B long enough for the power supply to power up. If the +5 V does not reach 4.9 V within 50 ms of power up, U3B will shut down the switcher. The power supply will then cycle on and off every couple of seconds.

High Voltage Power Supply, Diagram 8

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. Q6 and T1 are the principal elements of an Armstrong oscillator running at about 22 kHz. 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 Q6. The +100 V output is regulated directly, while the high voltage power supply is indirectly regulated through a current feedback circuit.

R48, C16, R60, and R64 form the high voltage power supply current 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 increases the base drive to Q6, the HV Osc. This current feedback compromises the regulation of the +100 V supply to keep the high voltage constant with varying intensities.

C66 and Q10 are a start delay circuit that holds the error amplifier output low, through CR30, until C66 is charged. Delaying the start of the high voltage oscillator allows the low voltage power supply to start, unencumbered by the load from the high voltage oscillator.

Power Supply Outputs

CR4 is the high voltage rectifier. Filter capacitors C3, C4, and C8 work with CR4 to provide –2530 V to the CRT cathode. U1 is a four-times multiplier providing +11 kV to the CRT anode.

Focus Amplifier

Q1 and Q2 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, R11, 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 cathode of the CRT is at a –2750 V potential with the grid coupled to the Z-axis amplifier by the grid drive circuit. The grid is approximately 75 V negative with respect to the cathode. The 200 V_{p-p} sine wave present at the cathode of CR8 is input to the grid drive circuit where it is clipped for use as CRT control grid bias.

The sine wave from the cathode of CR8 is coupled through R47 to a clipping circuit consisting of CR5 and CR6. Clipping level for the positive excursion of the sine wave is set by the CRT bias adjustment, R58. The negative clipping level is set by the front-panel INTENSITY control through the Z-axis amplifier. The clipped sine wave is coupled through C11 to a rectifier made up of CR1 and CR3. The rectified, clipped sine wave is the CRT control grid bias voltage. C9 couples the blanking signal from the Z-Axis Amplifier to the CRT control grid. DS1 and DS2 limit the CRT grid to cathode voltage at instrument turn on or off. DS3 limits the CRT heater to cathode voltage.

Z-Axis Amplifier

This is an inverting amplifier with negative feedback. See Figure 5–6. R22 is the feedback resistor while R7, R20, and R33 act to maintain the summing junction at +5 V. Without any Z-axis input current, the amplifier output is approximately +10 V. Negative Z-axis input current will cause the output to go positive.

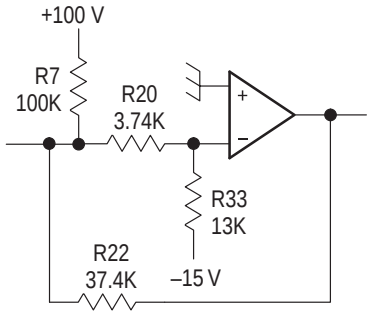


Figure 5–6: Z-Axis amplifier

Q5 is a current amplifier feeding the output stage. Q3 and Q4 form a push-pull output stage. Q3 acts as a 2.7 mA constant current pull-up, while Q4 is the pull-down transistor. C6 speeds up the amplifier by coupling ac signals to the base of Q3. CR2 and R41 protect the amplifier during CRT arcing.

Performance Verification

Performance Verification

This section contains procedures for verifying that the instrument performs according to the characteristics stated in the *Specifications* section of this manual.

Limits, tolerances, and waveforms given in this section are guides for the checks and are not instrument specifications, except when listed in the the *Specification* section of this manual.

If failure is found, it is recommended that only those circuits that do not meet performance criteria be adjusted. If adjustment fails to return the circuit to the specified performance, refer to the *Maintenance* section of this manual.

Performance verification should be performed at regular intervals to ensure that instrument performance is within tolerance. The recommended interval for performance verification is 2000 hours of operation or every 12 months, whichever is sooner.

Required Equipment List

Table 6–1 lists the test equipment required for this Performance Verification. The characteristics specified are the minimum.

Table 6–1: Required Equipment

Test Equipment	Characteristic	Example
Test Oscilloscope	Vertical amplifier bandwidth 30 MHz, sensitivity 1 mV, and accuracy of 0.25% Horizontal deflection system 5 ms/div to 1 s/div that can accept an external trigger.	Tektronix TAS465
Oscilloscope 10X Probe		Tektronix P6137 probe
Oscilloscope 1X Probe		Tektronix P6101 probe
Television Test Signal Generator (NTSC)	Provide 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 Variable color burst amplitude required	Tektronix 1410 with Option AA and Option AB (modified SPG2 and TSG7), TSG3, TSG5, and TSG6
Television Test Signal Generator (PAL)		Tektronix 1411 with Option AA and Option AB (modified SPG12 and TSG11), TSG13, TSG15, and TSG16.
Leveled Sine Wave Generator	Frequency range, 250 kHz to 10 MHz	Tegam SG503 Leveled Sine Wave Generator
Function Generator	Sine Wave frequencies 90 Hz to 2 kHz, amplitude 0.1 V to 10 V_{p-p} into 75 Ω.	Tegam FG501A Function Generator

Table 6–1: Required Equipment (Cont.)

Test Equipment	Characteristic	Example
Voltmeter	Range, 0 to greater than 100 VDC; accuracy, ±0.1%	
Frequency Counter	Range, 100 kHz to 5 MHz; accuracy, ±0.001%	Tegam DC503A Universal Counter/Timer
Video Amplitude Calibrator	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.	Tektronix 067–0916–00
Power Module	For powering and housing Tegam SG503, DC503A, FG503, and Tektronix 067–0916–00	Tegam TM506A
Variable Autotransformer	Variable range of 90 –120 V (If 220 volt operation must be checked, a conversion transformer or appropriate 220 volt autotransformer is needed)	General Radio Metered Auto Transformer W10MT3W.
Spectrum Analyzer with Tracking Generator	Bandwidth ≥10 MHz and sensitivity to 50 dB	Tektronix 2712 Opt 04
Step Attenuator	75 Ω constant impedance attenuator variable from 0 to 40 dB in 1 dB steps	Wavetek 75803 Step Attenuator
75 Ω Terminators	Three required, one should be a feed-through type	End-line, 75 Ω terminator (Tektronix P/N 011–0102–00) and a feed-through 75 Ω terminator (Tektronix P/N 011–0103–02)
75 Ω Coaxial Cable	42-inch RG59U, Three required	Tektronix P/N 012–0159–00
10X, 75 Ω Attenuator		Tektronix P/N 011–0061–00
Alligator Clip to BNC Adapter		Tektronix P/N 013–0076–00
Dual Input Coupler	Matched bnc cable-T for making phase comparisons between two inputs. Matched length of the two arms within ±0.1 inch	Tektronix P/N 067–0525–02
Precision 50 Ω Coaxial Cable	Used with the Sine Wave Generator	Tektronix P/N 012–0482–00
50 Ω-to-75 Ω Minimum Loss Attenuator		Tektronix P/N 011–0057–00
Parade Display Test Connector	A 15-pin sub-miniature D-type connector modified for RGB Parade input. See Figure 6–1	Tektronix P/N 131–0459–00

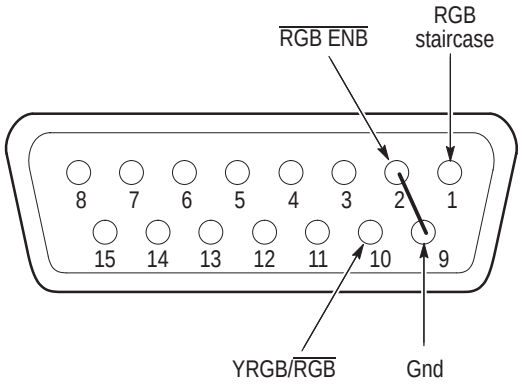


Figure 6–1: RGB/YRGB parade display test connector

Verification Procedure

This is a step-by-step procedure that begins with the powering up of the instrument. There is a 20 minute warm-up time required after the 1710J-Series Waveform Monitor power is turned on.

Preliminary Setup

This preliminary setup is the starting point for all parts of this procedure.

1. Set up the 1710J-Series Waveform Monitor front-panel controls as shown in Table 6–2.

Table 6–2: Preliminary Control Settings

Control	Setting
POWER	ON
INTENSITY	Set to preference
FOCUS	Set to preference
SCALE	Set to preference
VERTICAL Position	Set later
HORIZONTAL Position	Set later
FILTER	FLAT
REF	INT
INPUT	B
GAIN (switch)	off
MAG	off
SWEEP	2 LINE

2. Connect the AC power cord to the variable autotransformer. Turn power on 1710J-Series Waveform Monitor and set the autotransformer for either 110 or 220 Volts.
3. Use a 75 Ω coaxial cable to connect a composite color bar signal from the television test signal generator to the CH B input. Terminate the remaining side of the loop-through with a 75 Ω end-line terminator.

Check Power Supply Operation

The requirement is AC input range 90–132 V or 180–250 V.

1. Vary the autotransformer from 90–132 V or 180–250 V.
2. Check for stable operation over the voltage range.
3. Return the autotransformer to 110 or 220 Volts.

Check Calibrator Frequency

The frequency requirements are

- Frequency 100 kHz ±100 Hz
- Synchronizes 1 Line and 2 LINE Sweep (free runs in 2 FLD)

1. Connect a X10 probe from the frequency counter to the blue CRT lead on the main circuit board.
2. Display the CAL signal at the 2 LINE sweep rate.
3. Check that the frequency of the Calibrator is 99.9 to 100.1 kHz.
4. Check that the Calibrator is synchronized in both 1 LINE and 2 LINE sweep.
5. Check that sweep free runs in 2 FLD sweep.

Check Sync Separation

The requirements are stable sweep synchronization are

- Internally 40 IRE (300 mV) ±6 dB
- Externally 143 mV to 4 V

1. Check that the 1710J-Series Waveform Monitor can be synchronized to the amplitudes shown in Table 6–3, using the television test signal generator. Check both 2 LINE and 2 FLD sweep for stable triggering.

Table 6–3: Sync Amplitude

Reference Source	Signal	Sync Amplitude
Internal	Composite Video	143 mV to 572 mV (NTSC) 150 mV to 600 mV (PAL)
External Reference	Composite Sync or Video	143 mV to 4 V (NTSC) 150 mV to 4 V (PAL)

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 0 dB and 12 dB attenuation are 0.5 and 2X sync amplitude.*

Check Sweep Operation

The operation requirements are

- The correct sweep rate can be selected
- Some part of the blanking interval is displayed when magnifying the centered 2 LINE and 2 FLD sweeps

1. Display CH A input with nothing connected.

2. Check that a sweep occurs at each sweep rate (2 LINE, 2 FLD, and 1 LINE).

3. Select CH B input.

4. Check that the 1 LINE and 2 LINE sweep modes display one line and two lines of the color bar, respectively.

5. Check for a 2 FLD sweep display of the color bar signal.

6. Select and center the 2 FLD sweep and then push the MAG button.

7. Check that some portion of the vertical (field) blanking interval is displayed.

8. Select and center the 2 LINE sweep and then push the MAG button.

9. Check that some portion of the horizontal (line) blanking interval is displayed.

10. Check that both lines of the 2 LINE MAG sweep can be positioned onto the display with the HORIZONTAL position control.

Check Sweep Calibration

The requirements are shown in Table 6–4.

Table 6–4: Timing Accuracy

Sweep Range	Timing Accuracy	Timing Linearity	Differential Linearity
1 Line	±2%	±2%	———
1 Line, Magnified	±3%	±2%	±2%
2 Line	±2%	±2%	———
2 Line, Magnified	±3%	±2%	±2%

1. Hold the 1710J-Series Waveform Monitor REF button in until the calibrator signal is displayed.
2. Turn off the HORIZONTAL MAG and select 2 LINE sweep.
3. Use the HORIZONTAL position control to place the first falling calibrator transition on the 10 µs graticule mark (the timing mark on the left side of the graticule that goes completely through the blanking line). See Figure 6–2.

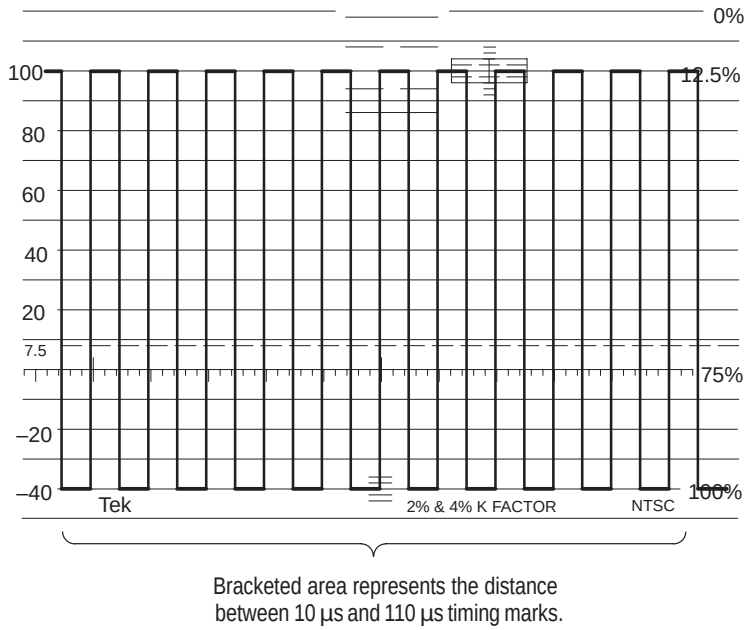


Figure 6–2: Ten full cycles of calibrator signal between timing marks

4. Check for ten full cycles of calibrator signal in the ten center major graticule divisions, ±2% (one minor division).

5. Check that no falling transition between the 10 µs and the 110 µs graticule marks is more than 1% (0.5 minor division) from a major graticule mark.
6. Select 1 LINE sweep (push and hold).
7. Use the HORIZONTAL position control to place the first calibrator transition on the 5 µs graticule mark (left side graticule timing mark).
8. Check for five full cycles of calibrator signal in the center ten major graticule divisions, ±2% (one minor division).
9. Select 2 LINE sweep and turn on the HORIZONTAL MAG.
10. Check for one full cycle of calibrator signal in the center ten divisions of the graticule, ±2% (one minor division).
11. Use a 75 Ω coaxial cable to connect the television signal generator multiburst output to the 1710J-Series Waveform Monitor CH A input.
12. Use a 75 Ω coaxial cable to connect the other side of the loop-through to the digital counter input.
13. Adjust the multiburst Frequency for a 5 MHz sine wave as measured on the digital counter.
14. Select the 1710J-Series Waveform Monitor INT REF and 1 LINE sweep. Turn on the MAG
15. Set the multiburst generator to Composite.
16. Use the 1710J-Series Waveform Monitor HORIZONTAL position control to display all but the first and last 10% of the sweep.
17. Check for ten cycles over ten graticule divisions, ±1.5 minor divisions.
18. Switch the multiburst generator to Continuous and check that its frequency, as measured on the digital counter, remains set at 5 MHz. Return to Composite.

Check RGB/YRGB Parade Display

The requirements are shown in Table 6–5.

Table 6–5: RGB/YRGB Parade Display

Requirement	Tolerance
Sweep Length	
Three Step, RGB	3.4 to 4.1 divisions
Four Step, YRGB	2.5 to 3.1 divisions
Staircase input gain	10 V = 9 horizontal divisions ±1.4 division
Attenuated sweep responds to sweep rate and magnification controls	

1. Use a 75 Ω coaxial cable to connect the television test signal generator color bar signal to the 1710J-Series Waveform Monitor CH A input. Terminate the remaining side of the loop-through with a 75 Ω end-line terminator.
2. Display the color bar in 1 LINE sweep. Center the display. Note the position of the plug on J456 on Assembly A3. The 2–3 position selects attenuation for a three-step display (1–2 position selects attenuation for four-step display).
3. Install the parade display test connector on the 1710J-Series Waveform Monitor REMOTE connector. See Figure 6–1.
4. Check that the sweep has shortened to 3.4 to 4.1 divisions if P456 is set for a three-step display, or 2.5 to 3.1 divisions if the plug on J456 (1–2) is set for a four-step display.
5. Check that the shortened sweep is 1 LINE or 2 FLD, according to the sweep controls, and that the sweep can be magnified.
6. Check that the display can be moved to the sides of the screen with the HORIZONTAL position control. It may be necessary to adjust R856.
7. Position the display to the right side of the screen.
8. Use a 75 Ω coaxial cable with the BNC connector-to-alligator clip adaptor to connect a 0 to +10 V, 2 kHz square wave to pins 1 and 9 of the parade display test connector.
9. Check that 7.6 to 10.4 divisions of deflection have been added by the square wave.

Check Vertical Gain

The requirements are

- Gain within 1% for both CH A and CH B inputs
- X5 gain within 5%
- Less than 1 major division shift from baseline between unmagnified and magnified signal

1. Use a 75 Ω coaxial cable to connect the Video Amplitude Calibrator (VAC) output to the 1710J-Series Waveform Monitor CH A input.

2. Use a 75 Ω coaxial cable to connect the television test signal generator linearity output to the CH B input. Do not terminate either loop-through. See Figure 6–3.

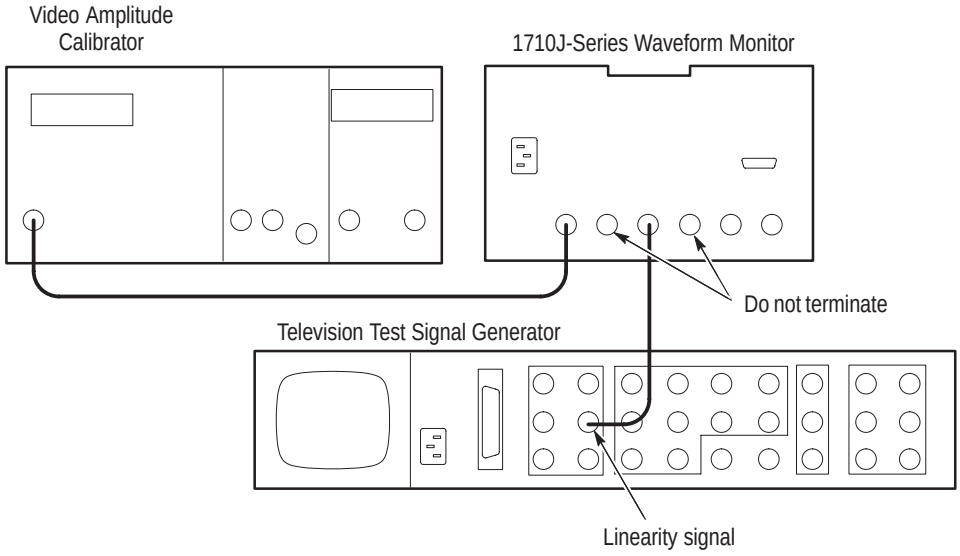


Figure 6–3: Equipment hook-up for checking vertical gain

3. Set the VAC to 999.9 mV.

4. Move A3J500 to the (1–2) OFF position.

5. Adjust VCAL for exactly 140 IRE (1.00 V).

6. Set the VAC to 0.200 V and change the 1710J-Series Waveform Monitor GAIN to X5.

7. Check that the display is 133 to 147 IRE (0.950 V to 1.05 V).

8. Select CH B input.

9. Terminate the CH B loop-through with a 75 Ω end-line terminator.

10. Use the VERTICAL position control to place the signal blanking level on the baseline.
11. Select X5 GAIN.
12. Check for less than 1 major division of baseline shift when switching between X1 (Gain off) and X5 GAIN.
13. Turn off X5 GAIN.
14. Remove the connections from the 1710J-Series Waveform Monitor CH B input.
15. Change the 75 Ω coaxial cable with the VAC signal to the CH B input. Do not terminate the loop-through.
16. Set the VAC for a 999.9 mV square wave.
17. Check that the vertical amplitude of the display is 138.6 to 141.4 IRE (0.990 V to 1.010 V).
18. Disconnect the VAC from the 1710J-Series Waveform Monitor.

Check Calibrator Amplitude

The requirement is 1 V ±1%

1. Push the REF button and hold it in until the calibrator signal is displayed.
2. Check the 1710J-Series Waveform Monitor for a displayed amplitude of 138.6 to 141.4 IRE PAL (0.990 V to 1.010 V).

Check DC Restorer Operation

The requirements are

- 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)

1. Use a 75 Ω coaxial cable to connect the television test signal generator modulated five-step linearity signal (with AC Bounce on) to the 1710J-Series Waveform Monitor CH B input. Terminate the remaining side of the loop-through input with a 75 Ω end-line terminator.
2. Use a 75 Ω coaxial cable to connect the television test signal generator black burst signal to the 1710J-Series Waveform Monitor EXT REF input. Terminate the remaining side of the loop-through input with a 75 Ω end-line terminator.
3. Move A3J99 to the 2-3 position, Fast DC Restorer.

4. Move A3J500 to the (2–3) ON position.
5. Display the signal with the 2 LINE sweep.
6. Select CH B input.
7. Position the signal blanking level to the graticule baseline (0 IRE or 0.3 mV).
8. Switch television test signal generator linearity signal APL (Average Picture Level) between 50% and 10% and 50% and 90%.
9. Check that the signal blanking level moves less that 1 IRE (NTSC) or 7 mV (PAL).
10. Use a 75 Ω coaxial cable to connect the television test signal generator multiburst signal to the CH A input. Terminate the remaining side of the loop-through input with a 75 Ω end-line terminator.
11. Select CH A and EXT REF.
12. Switch multiburst generator Burst off and on.
13. Check that the blanking level changes less than 1 IRE (NTSC) or 7 mV(PAL).
14. Remove the multiburst input from the CH A input.
15. Use a 75 Ω coaxial cable to connect the function generator output through a X10 (75 Ω) Attenuator to the CH A input.
16. Move A3J500 to the 1–2 (off) position.
17. Set the function generator frequency to a 60 Hz (50 Hz PAL) sine wave. Set the amplitude for a 100 IRE (700 mV PAL) 1710J-Series Waveform Monitor display.
18. Move A3J500 to the 2–3 (on) position.
19. Check that the display amplitude is 10 IRE (70 mV PAL) or less.
20. Move A3J99 to the 1–2 (slow) position.
21. Check that the display amplitude is 80 IRE (560 mV PAL) or greater.
22. Remove the signal cable and 75 Ω terminator from the CHA input.
23. Move A3J500 to the (1–2) OFF position.

Check Flat Response

Using 50 kHz as the reference the requirements are

- X1 gain 250 kHz to 6 MHz within 2%
- X5 gain 250 kHz to 6 MHz within 5%

1. Connect a 50 Ω precision cable and 50 to 75 Ω minimum loss pad from the leveled sine wave generator to the CH A input. Terminate the remaining side of the loop-through input with a 75 Ω end-line terminator. See Figure 6–4.

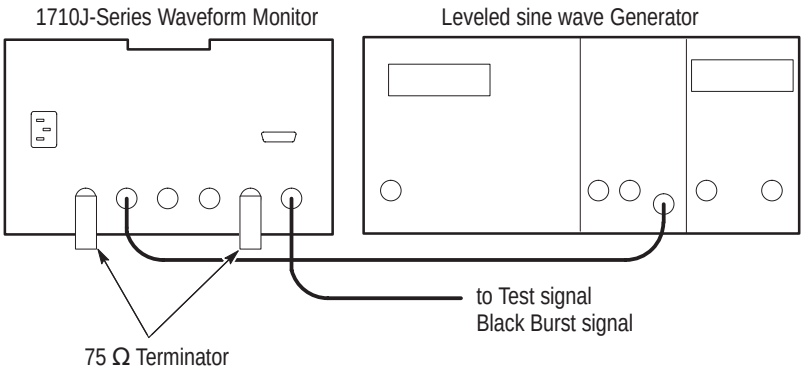


Figure 6–4: Initial equipment setup to check Flat Response

2. Select EXT REF.

3. Set the leveled sine wave generator frequency range to 50 kHz and set the output amplitude for a 100 IRE (0.7 V) display amplitude.

4. Check the flat response using the 50 kHz response as a reference. While changing the frequency of the sine wave generator, check that the response is within ±2% from 250 kHz to 6 MHz.

5. Change the VERTICAL GAIN to X5.

6. Set the leveled sine wave generator to 50 kHz and set the output amplitude for a 100 IRE (0.7 V) display amplitude.

7. Check flat response using the 50 kHz response as a reference. Check that the amplitude is 100 IRE (0.7 V) ±5% from 250 kHz to 6 MHz.

8. Move the 75 Ω coaxial cable that comes from the leveled sine wave generator output to CH B. Terminate the remaining side of the loop-through input with a 75 Ω end-line terminator.

9. Select CH B input.

10. Check flat response using the 50 kHz response as a reference. Check that the amplitude is 100 IRE (0.7 V) ±5% from 250 kHz to 6 MHz.

11. Turn off X5 VERTICAL GAIN.

12. Check the flat response using the 50 kHz response as a reference. Check that the response is within ±2% from 250 kHz to 6 MHz.

Check Transient Response

The requirements are shown in Table 6–6.

Table 6–6: Transient Response

Requirement	Tolerance
2T Pulse and Bar	
Preshoot	1% or less
Pulse-to-bar ratio	1:1 within 1%
Overshoot	2% or less
Ringing	2% or less
Tilt,field-rate square wave or 25 µs bar	1% or less
12.5T modulated pulse (20T for PAL) baseline overscan	Less than 2% over the middle 80% of the display

1. Use a 75 Ω coaxial cable to connect the television test signal generator pulse and bar signal to the CH B input. Terminate the remaining side of the loop-through input with a 75 Ω end-line terminator.

2. Select INT REF.

3. Select the full amplitude 2T pulse and bar signal from the television test signal generator. Display the signal with the 1 LINE sweep.

4. Check for less than 1% preshoot and less than 2% overshoot and ringing for the pulse and bar transitions.

5. Check for a pulse-to-bar ratio within 1% of unity.

6. Check for less than 1% tilt across the bar.

7. Select the field square wave signal. Display the signal with the 2 FLD sweep.

8. Check for less than 1% tilt across the high APL portion of the display.

9. Set the 1710J-Series Waveform Monitor VERTICAL to X5 gain.

10. Select 2 LINE sweep and MAG ON.

11. Display the 12.5T modulated pulse for NTSC or 20T for PAL. Position the baseline over the center 140 IRE (NTSC) or 1 V (PAL).

12. Check that the baseline of the modulated pulse varies less than 2%.

Check X5 Transient Response

The requirements are shown in Table 6–7.

Table 6–7: X5 Gain Transient Response

Requirement	Tolerance
2T Pulse and Bar	
Preshoot	1% or less
Pulse-to-bar ratio	1:1 within 2%
Overshoot	4% or less
Ringing	4% or less

1. Connect the black burst signal to the 1710J-Series Waveform Monitor EXT REF and terminate the remaining side of the loop-through input with a 75 Ω terminator.

2. Turn MAG OFF. Select X5 VERTICAL GAIN and EXT REF.

3. Install the Step Attenuator and insert 14 dB of attenuation in the input signal path.

4. Check for 1% or less preshoot and 4% or less overshoot and ringing for the pulse and bar transitions.

5. Check for a pulse-to-bar ratio within 2% of unity.

6. Disconnect signal from the CH B input.

Check Low Pass Filter Response

The requirement is that response at 15 kHz does not vary between FLAT and LPASS by more than 1%.

1. Connect the modulated, five-step linearity signal to the CH B input.

2. Select the 100-IRE (100%) FLAT FIELD/ALT LINEARITY setting of the generator.

3. Select the LPASS FILTER and turn off X5 GAIN (X1).

4. Switch between LPASS and FLAT.

5. Check that the amplitude of the linearity signal, in LPASS, is within ±1% of the amplitude of the display in the FLAT mode.

Check Chrominance Filter Response

The requirements are

- Response at 3.58 MHz (4.43 MHz for PAL) does not vary between FLAT and CHROMA by more than 1%
- Attenuation at 7.2 MHz (8.9 MHz for PAL) is greater than 20 dB

1. Use a 75 Ω coaxial cable to connect the leveled sine wave generator output to the 1710J-Series Waveform Monitor CH B input. Terminate the remaining side of the loop-through input with a 75 Ω end-line terminator.
2. Display the signal in FLAT with the 2 LINE sweep and EXT REF.
3. Set the leveled sine wave generator frequency to 3.58 MHz (NTSC) or 4.43 MHz (PAL) and adjust the amplitude for 100 IRE (NTSC) or 700 mV (PAL).
4. Switch the FILTER to CHROMA
5. Check that the amplitude of the largest chrominance bar is 99 to 101% of the amplitude in step 3.
6. Select FLAT filter.
7. Set the leveled sine wave generator frequency to 50 kHz. Adjust the amplitude so that the display is 100 IRE (NTSC) or 700 mV (PAL).
8. Set the frequency of the leveled sine wave generator to 7.2 MHz (NTSC) or 8.9 MHz (PAL).
9. Select CHROMA filter.
10. Check that less than 10% of the reference amplitude remains.
11. Move A3J500 to the (2–3) ON position.

Check Return Loss

The requirement is return loss of at least 40 dB from 50 kHz to 6 MHz (instrument on or off, any deflection factor setting).

NOTE. *The Return Loss Check needs to be done only if repairs have been made on the Input circuitry.*

1. Connect a precision 50 Ω cable from the spectrum analyzer RF Input to the RF Output on the RF bridge. See Figure 6–5.
2. Connect a precision 50 Ω cable from the spectrum analyzer TG Output to the RF Input on the RF bridge.

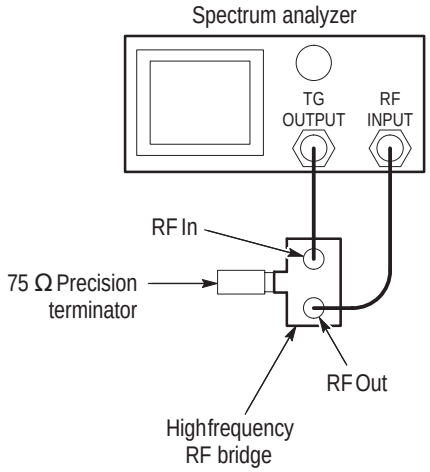


Figure 6–5: Connecting the RF bridge to the spectrum analyzer and tracking generator

3. Select Demod/TG on the spectrum analyzer. Turn on the tracking generator and set the tracking generator fixed level to 0.00 dBm.
4. Set the spectrum analyzer Span/Div to 1 MHz and the Resolution Bandwidth to 300 kHz.
5. Set the spectrum analyzer Vertical Scale to 10 dB.
6. Set the spectrum analyzer Reference Level to the first major division down from the top on the analyzer display.
7. Remove one of the cables from the RF bridge.
8. Set the spectrum analyzer Frequency to 5 MHz and turn the Marker on. Set the Marker to 6 MHz.
9. Reconnect the cable to the RF bridge.
10. Observe the Reference Level Readout.
11. Adjust the spectrum analyzer External Attenuation Amplitude (on the spectrum analyzer Input menu) by the amount noted in step 10. The Reference Level Readout should now be 0.00 dBm.
12. Connect the precision high-frequency terminator to the Device Under Test connector on the RF bridge.
13. Check that the frequency response from 0 MHz to 6 MHz is ≥40 dBm.
14. Return the spectrum analyzer frequency marker to 6 MHz if it was moved.
15. Remove the precision high-frequency terminator from the RF bridge.

16. Connect the male-to-male bnc adapter to the Device Under Test connector on the RF bridge.

17. Connect the Device Under Test connector on the RF bridge to the 1710J-Series Waveform Monitor CH A input. Terminate the CH A loop-through with the same precision high-frequency terminator used in step 15.

18. Select the 1710J-Series Waveform Monitor CH A input.

19. Check that the Reference Level Readout on the spectrum analyzer is ≥40 dBm with the instrument power on and off.

20. Repeat steps 17 through 19 for CH B and EXT REF inputs.

21. Remove all cables and terminators from the 1710J-Series Waveform Monitor.

Adjustment Procedure

Adjustment Procedure

If the instrument performance is not within tolerance for a particular characteristic, determine the cause, repair if necessary, and then use the appropriate adjustment procedure to return the instrument operation to performance specification. After any adjustment, verify performance by repeating at least the applicable part of the *Performance Verification* Procedure.

Allow the instrument to warm up for at least 20 minutes, in an ambient temperature of 20° C to 30° C before making any adjustments. Waveform illustrations in the procedure are typical and may differ from one instrument to another. These waveforms should not be construed as being representative of specific tolerances.

Static Discharge Precautions

Many semiconductor components, especially MOS types, can be damaged by static discharge. Damage may not be catastrophic and, therefore, not immediately apparent. It usually appears as a degradation of the semiconductor characteristics. Devices that are particularly susceptible are MOS, CMOS, JFETs, and high impedance operational amplifiers (FET input stages.) The damaged parts may operate within acceptable limits over a short period, but their reliability may have been severely impaired. Damage can be significantly reduced by observing the following precautions during performance of the adjustment procedure.

- Handle equipment containing static sensitive components or circuit assemblies at or on a static free work surface. Work stations should contain a static free bench cover or work plane such as conductive polyethylene sheeting and a grounding wrist strap. The work plane should be connected to earth ground.
- All test equipment and accessories should be connected to earth ground.

More information about handling static sensitive assemblies and components can be found in the *Maintenance* section of this manual.

Required Test Equipment

Table 7–1 lists test equipment and fixtures recommended for the adjustment procedure. The characteristics specified ar the minimum required for the checks. Substitute equipment must meet or exceed these characteristics.

Table 7–1: Equipment Required

Test Equipment	Characteristic	Example
Test Oscilloscope	Vertical amplifier bandwidth 30 MHz, sensitivity 1 mV, and accuracy of 0.25% Horizontal deflection system 5 ms/div to 1 s/div that can accept an external trigger.	Tektronix TAS465
Oscilloscope 10X Probe		Tektronix P6137 probe
Oscilloscope 1X Probe		Tektronix P6101 probe
Television Test Signal Generator (NTSC)	Provide 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 Variable color burst amplitude required	Tektronix 1410 with Option AA and Option AB (modified SPG2 and TSG7), TSG3, TSG5, and TSG6
Television Test Signal Generator (PAL)		Tektronix 1411 with Option AA and Option AB (modified SPG12 and TSG11), TSG13, TSG15, and TSG16.
Leveled Sine Wave Generator	Frequency range, 250 kHz to 10 MHz	Tegam SG503 Leveled Sine Wave Generator
Function Generator	Sine Wave frequencies 90 Hz to 2 kHz, amplitude 0.1 V to 10 V_{p-p} into 75 Ω.	Tegam FG501A Function Generator
Voltmeter	Range, 0 to greater than 100 VDC; accuracy, ±0.1%	
Frequency Counter	Range, 100 kHz to 5 MHz; accuracy, ±0.001%	Tegam DC503A Universal Counter/Timer
Video Amplitude Calibrator	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.	Tektronix 067-0916-00
Power Module	For powering and housing Tegam SG503, DC503A, FG503, and Tektronix 067–0916–00	Tegam TM506A
Variable Autotransformer	Variable range of 90 -120 V (If 220 volt operation must be checked, a conversion transformer or appropriate 220 volt autotransformer is needed)	General Radio Metered Auto Transformer W10MT3W.
75 Ω Terminators	Three required, one should be a feed-through type	End-line, 75 Ω terminator (Tektronix P/N 011–0102–00) and a feed-through 75 Ω terminator (Tektronix P/N 011–0103–02)
75 Ω Coaxial Cable	42-inch RG59U, Three required	Tektronix P/N 012–0159–00
10X, 75 Ω Attenuator		Tektronix P/N 011–0061–00
Alligator Clip to BNC Adapter		Tektronix P/N 013–0076–00
Dual Input Coupler	Matched bnc cable-T for making phase comparisons between two inputs. Matched length of the two arms within ±0.1 inch	Tektronix P/N 067–0525–02
Precision 50 Ω Coaxial Cable	Used with the Sine Wave Generator	Tektronix P/N 012–0482–00

Table 7–1: Equipment Required (Cont.)

Test Equipment	Characteristic	Example
50 Ω-to-75 Ω Minimum Loss Attenuator		Tektronix P/N 011–0057–00
Parade Display Test Connector	A 15-pin sub-miniature D-type connector modified for RGB Parade input. See Figure 7–1.	Tektronix P/N 131–0459–00

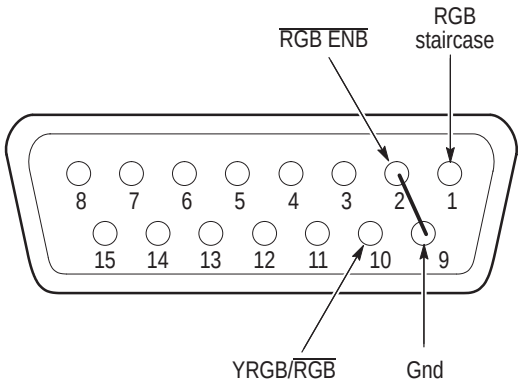


Figure 7–1: RGB/YRGB parade display test connector

Procedure

This procedure covers only the adjustments. Checks other than those that must be made to ensure that a step is completed are in the *Verification Procedure.*

Allow 20 minutes of warm-up time, at normal room temperature (approximately 25° C) before making any adjustments to the instrument. All test equipment warm-up times, as specified by the manufacturer, must also be observed to ensure that all tolerances are within specification.

Preliminary Setup

1. Set up the 1710J-Series Waveform Monitor front-panel controls as shown in Table 7–2.

Table 7–2: Preliminary Control Settings

Control	Setting
POWER	ON
INTENSITY	Set to preference
FOCUS	Set to preference
SCALE	Set to preference

Table 7–2: Preliminary Control Settings (Cont.)

Control	Setting
VERTICAL Position	Set later
HORIZONTAL Position	Set later
FILTER	FLAT
REF	INT
INPUT	B
GAIN (switch)	off
MAG	off
SWEEP	2 LINE

2. Connect the AC power cord to the variable autotransformer. Turn power on 1710J-Series Waveform Monitor and set the autotransformer for either 110 or 220 Volts.

3. Connect a composite multiburst signal to the CH B input and terminate the opposite side of the loop-through with a 75 Ω termination.

+5 Adjust

The component to adjust is A1R99.

1. Connect the DMM negative lead to TP1 (GND) and the positive lead to W1 (+5 V).

2. Adjust A1R99 (+5 V ADJ) for +5.0 V ±0.5 V. See Figure 7–2.

***NOTE**. The 5 V supply is the reference for all supplies in the 1710J-Series Waveform Monitor. Do not readjust this supply if it is within tolerance, unless you intend to perform a complete readjustment of the instrument.*

CRT Bias

The component to adjust is A1R58.

1. Turn the INTENSity control fully counterclockwise.
2. Adjust A1R58 (CRT BIAS) so that the display is just extinguished.
3. Set the INTENSity control to desired level.

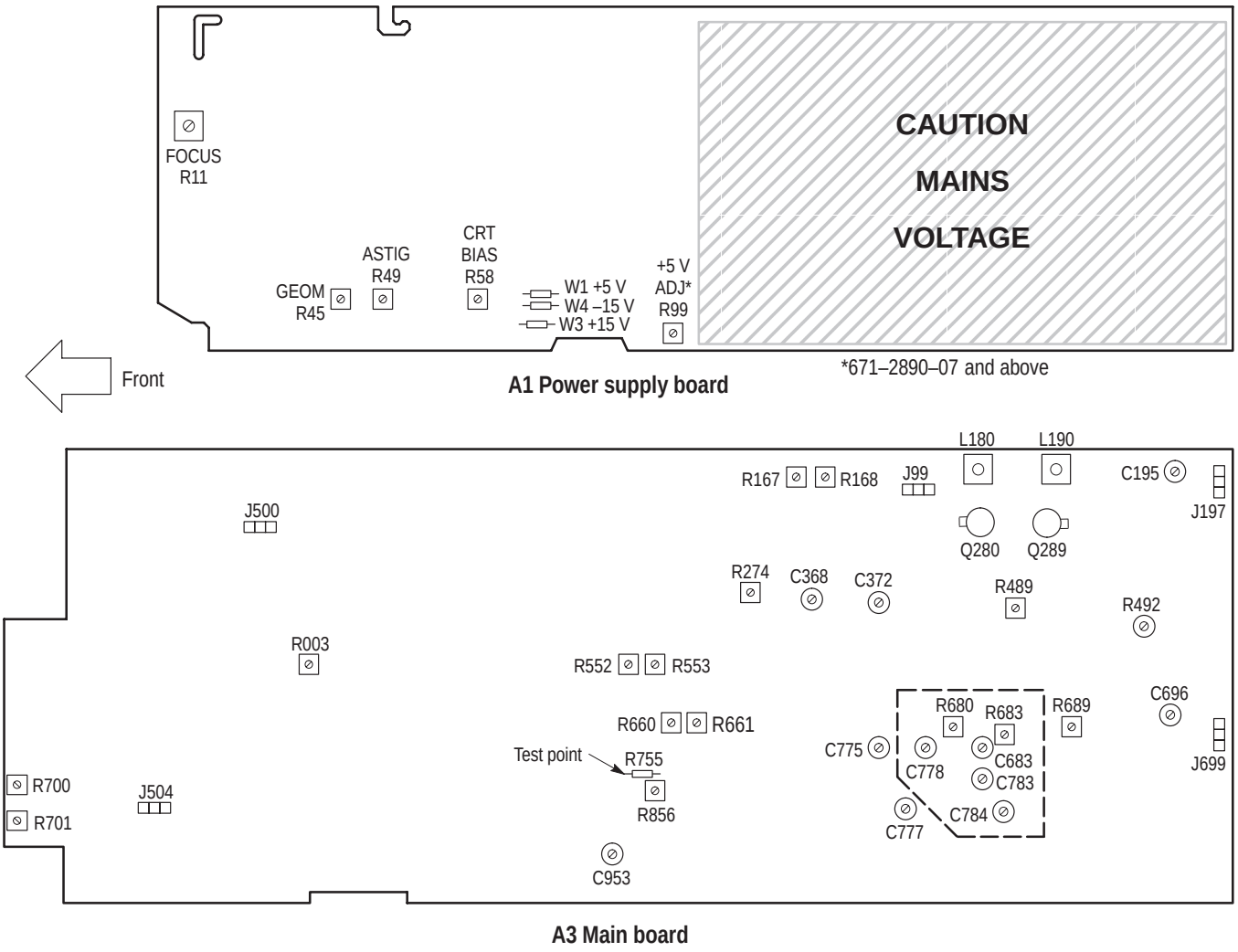


Figure 7–2: Adjustment locations for the Main and Power Supply boards

Geometry, Focus and Astigmatism

The components to adjust are A1R45, A1R11, and A1R49.

1. Connect the DMM between pin1 of A1J3 and ground.
2. Adjust R45 (GEOM) for 35V ±1 V at pin 1 of J3.

3. Select CH B input.
4. Set the front-panel FOCUS control to approximately the center of its rotation.
5. Adjust R11 (CENTER FOCUS) and R49 (ASTIG) for the most clearly-defined multiburst display.

Trace Rotation

The component to adjust is the front-panel ROTATE.

1. Select CH A input.
2. Adjust the front-panel ROTATE for a level trace across the CRT's 0 IRE line (NTSC) or 0.3 V line (PAL).

Main Circuit Board Regulated Power Supplies

The components to adjust are A1R167 and A1R168.

NOTE. *The power supply adjustments should not be made unless the entire procedure is going to be performed. If supplies are within tolerances listed below, any individual adjustment should be possible without having to perform a complete readjustment.*

1. Connect the voltmeter ground lead to one of the rear-panel ground lugs and the active lead to the –11.8 V test point. See Figure 7–3.
2. Adjust R167 (–11.8 V ADJ) for –11.78 to –11.82 V.

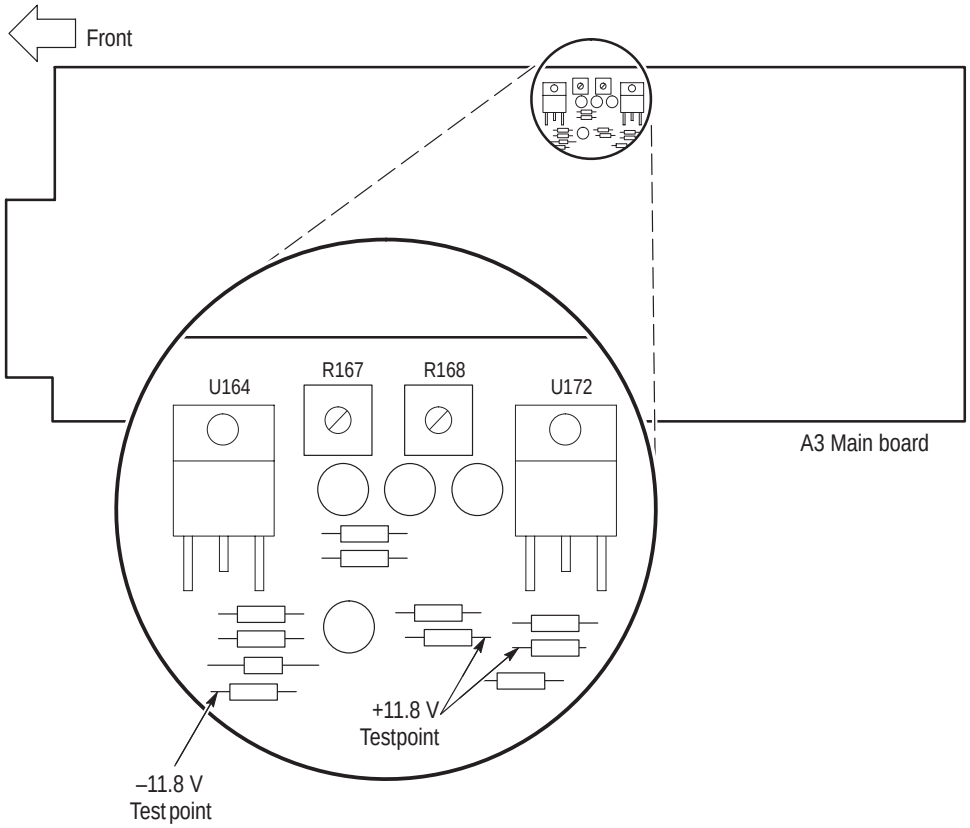


Figure 7–3: Segment of the Main board, showing the test points and adjustment locations for the ±11.8 V supplies

3. Connect the voltmeter active lead to the +11.8 V test point. See Figure 7–3.
4. Adjust R168 (+11.8 V ADJ) for +11.78 to +11.82 volts.

2 Line and 1 µs Sweep Calibration

The components to adjust are A3R660 and A3R552

1. Display the CAL signal in the 2 LINE sweep.
2. Adjust R660 (Sweep Length) for one cycle of the calibrator signal per major division over the center ten divisions.
3. Turn on the MAG.
4. Adjust R552 (1 µ*s* Cal) for one full cycle over the ten major divisions.

0.2 µs Sweep Calibration

The component to adjust is A1R553.

1. Set REF to INT and select CH A input.

2. Use a 75 Ω coaxial cable to connect the multiburst output from the television test signal generator to one side of the CH A input loop-through. See Figure 7–4.

3. Use a 75 Ω coaxial cable to connect the digital counter to the remaining side of the input loop through connector.

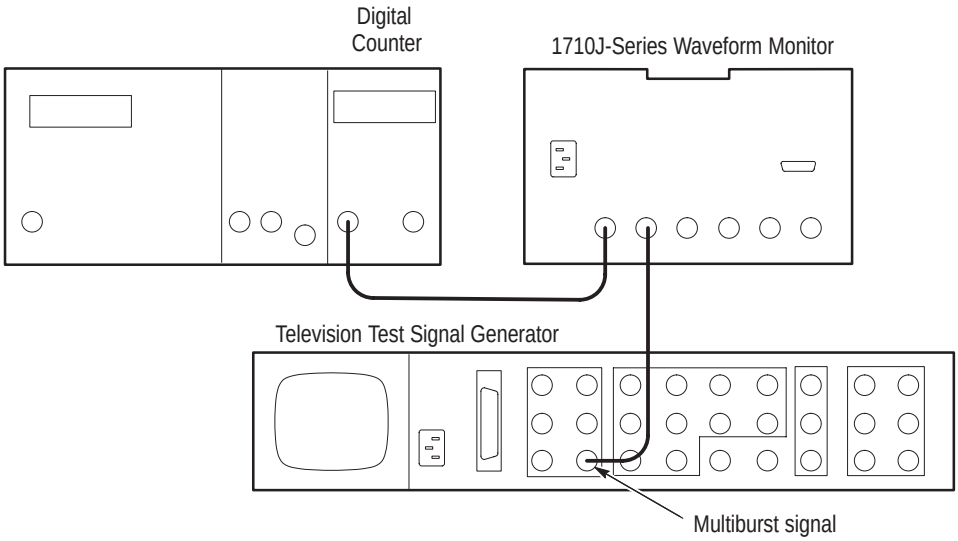


Figure 7–4: Equipment setup to adjust 0.2 µs timing

4. Set the multiburst generator to low, continuous, and manual. Turn markers off.

5. Adjust the multiburst Frequency for a 5 MHz sine wave as measured on the digital counter.

6. Change the multiburst generator to Composite.

7. Select 1 LINE sweep and turn on the MAG.

8. Adjust R553 for 10 cycles of subcarrier over 10 divisions ±1 minor division. Recheck multiburst generator frequency by switching it back to Continuous.

9. Disconnect the cable that goes to the digital counter and terminate the open side of the CH A input with a 75 Ω end-line terminator.

Dual Filter Switching

The component to adjust is A1R003.

1. Select 2 LINE sweep and turn the MAG off.

2. Hold the waveform monitor FILTER button in until both the FLAT and LPASS indicators light.

3. Position the tip of the sync pulse that occurs between the two lines so that the switching transition is visible.
4. Adjust R636 (Switching Phase) to placed the switching transition at the center of the sync tip.

Magnifier Registration

The component to adjust is A1R661.

1. Set the multiburst generator for High Range Multiburst.
2. Turn on the 1710J-Series Waveform Monitor MAG.
3. Use the HORIZONTAL Position control to position the leading edge of the sync pulse to the center major graticule division.
4. Turn the MAG off.
5. Adjust R661 (MAG Reg) so that the leading edge of sync is at the center major graticule division. It may be necessary to repeat this step several times to achieve magnifier registration.
6. With the MAG off, check that both ends of the trace can be positioned to at least the center of the screen.

RGB Offset

The component to adjust is A3R856.

1. Change from the multiburst signal to the color bar signal.
2. Set the 1710J-Series Waveform Monitor sweep to 1 LINE.
3. Set the HORIZONTAL Position control to mid range.
4. Connect pin 2 of the rear-panel REMOTE socket to ground.
5. Note that the color bar display compresses to 1/4 to 1/3 of its previous length.
6. Adjust R856 (RGB Offset) to center the display at mid screen.

RGB Compensation

The component to adjust is A3C953.

1. Remove the color bar signal from the CH A input.
2. Use a 75 Ω coaxial cable with the alligator clip to BNC adaptor to connect the output of function generator to the REMOTE connector pin 1 (cable center conductor) and 1710J-Series Waveform Monitor chassis ground. Pin 2 of the REMOTE connector should still be grounded
3. Set the function generator for a 10 V, 2 kHz square wave signal.

4. Connect a probe from the test oscilloscope to the junction of R854 and R755. See Figure 7–2 for locations.
5. Adjust C953 (RGB Comp) for best transient response.
6. Remove the connections from the REMOTE connector.

Vertical Amplifier Output Bias

The component to adjust is A3R489.

1. Set the VERTICAL Position control fully clockwise.
2. Connect the voltmeter lead to the collector (transistor case) of Q280. See Figure 7–2.
3. Adjust R489 (Limit Cent) for +0.8 V.
4. Set the VERTICAL Position control fully counterclockwise.
5. Connect the voltmeter lead to the collector (transistor case) of Q289. See Figure 7–2.
6. Check that the voltage is +0.8 V. If it is not, repeat steps 1 through 5 until the collector voltages are balanced at the same DC level.

Calibrator Signal Amplitude

The component to adjust is A3R689.

1. Use a 75 Ω coaxial cable to connect the VAC signal to the 1710J-Series Waveform Monitor CH A input; do not terminate the remaining side of the loop-through input. See Figure 7–5.
2. Set the VAC for an output of 999.9 mV.
3. Move A3J500 (DC Restore) to the 1-2 (Off) position.

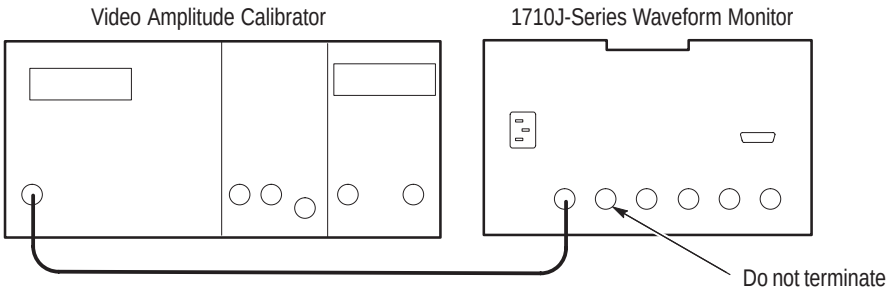


Figure 7–5: Equipment setup for adjusting the calibrator amplitude

4. Adjust the 1710J-Series Waveform Monitor front-panel V CAL so that the VAC signal is displayed as exactly 1 V_{p-p} (140 IRE on the NTSC graticule) on the CRT graticule.
5. Hold the 1710J-Series Waveform Monitor REF button until the CAL signal replaces the function generator signal on the display.
6. Adjust R689 (Cal Ampl) so that the Calibrator amplitude is 1 V_{p-p} (140 IRE NTSC) as displayed on the CRT graticule.

Dual Input DC Level

The component to adjust is A3R492.

1. Use a 75 Ω coaxial cable to connect the color bar signal through a 75 Ω in-line terminator and a Dual Input Coupler to the 1710J-Series Waveform Monitor CH A and CH B inputs. Do not terminate the loop-through inputs.
2. Use a 75 Ω coaxial cable to connect the black burst signal to the 1710J-Series Waveform Monitor EXT REF. Terminate the remaining side of the loop-through input with a 75 Ω terminator.
3. Set the input to BOTH (CH A and CH B).
4. Adjust R492 (DC Bal) to overlay the CH A and CH B displays.

X5 Magnifier Registration

The component to adjust is A3R274.

1. Select CH A input.
2. Use the VERTICAL Position control to position the signal blanking level on the graticule baseline.
3. Select X5 GAIN.
4. Adjust R274 (X5 Mag) to reposition blanking level to the baseline.
5. Select GAIN off and repeat steps 2, 3, and 4 until there is no baseline shift when switching between off and X5 GAIN.

Input A Compensation and Flat Response

The components to adjust are A3C195, A3L180, A3L190, and A3C368.

1. Use a 75 Ω coaxial cable to connect the television test signal generator multiburst signal through an in-line 75 Ω termination to the CH A input. See Figure 7–6.
2. Use a 75 Ω cable to connect the television test signal generator black burst signal to the 1710J-Series Waveform Monitor EXT REF and terminate the remaining side of the loop-through input with a 75 Ω terminator.

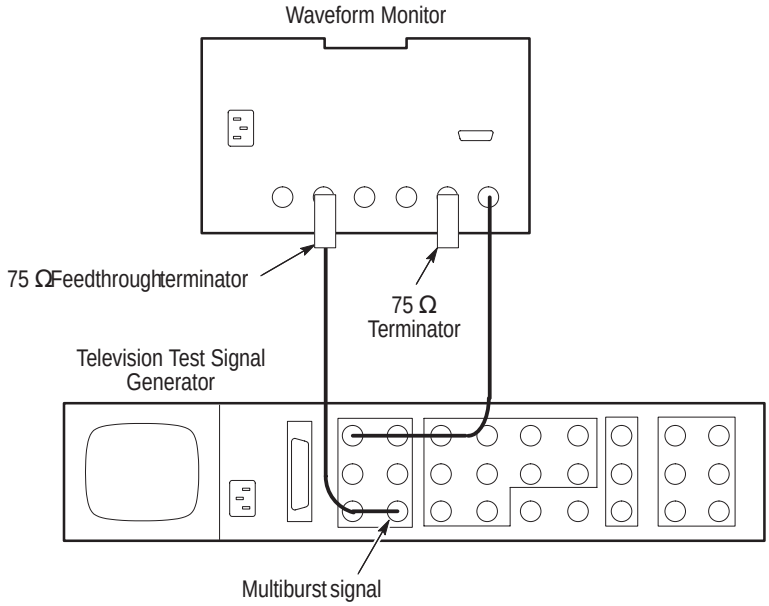


Figure 7–6: Equipment setup for adjusting Channel A input compensation

3. Set multiburst generator to Sweep, High Range, Composite, Markers, and Full Amplitude.

4. Set the 1710J-Series Waveform Monitor sweep to 2 FLD and EXT REF.

5. Adjust C195 (CH A Comp.) for flat response at 6 MHz. See Figure 7–7.

6. Check the response in the 2-4 MHz region. If it is bumped up; adjust both L180 and L190 in a small amount (both cores should be adjusted together). If it is dipped; adjust both L180 and L190 out a small amount (both cores should be adjusted together).

7. Repeat steps 5 and 6 until the best response to 6 MHz is achieved. You may need to adjust C368 (HF Comp) slightly (it affects response in the 6-8 MHz region).

8. Disconnect the multiburst signal from the CH A input and remove the 75 Ω termination from the remaining side of the loop-through connector.

9. Use a precision 50 Ω cable, a 50–75 Ω minimum loss attenuator, a 75 Ω feed through attenuator, and the Dual Input Coupler to connect the output of the leveled sine wave generator to the CH A and CH B inputs.

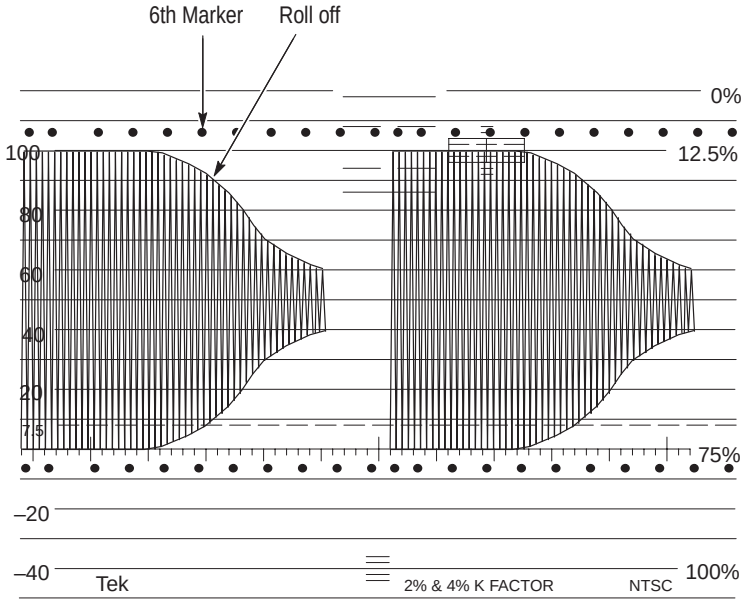


Figure 7–7: Adjusting for best flat response

10. Set the leveled sine wave generator frequency to 50 kHz and adjust its amplitude for a 100 IRE (NTSC) or 700 mV (PAL) output as displayed on the 1710J-Series Waveform Monitor.
11. Set the leveled sine wave generator frequency to 6 MHz.
12. Adjust C195 (CH A Comp) for 100 IRE (NTSC) or for 700 mV (PAL).
13. Set the leveled sine wave generator frequency to 3.58 MHz (NTSC) or 4.43 (PAL) and check for 100 IRE or 700 mV ±2% (2 IRE or 14 mV).
14. If not in specification at 3.58 or 4.43 MHz, repeat steps 5 through 7 (as set up by steps 1 and 2).

Input B Compensation

The component to be adjusted is A3C696.

1. Select CH B input.
2. Select 2 LINE sweep.
3. Set the leveled sine wave generator frequency to 6 MHz.
4. Adjust C696 (CH B Comp) to overlay the CH A display with the CH B display.
5. Set the leveled sine wave generator frequency to 3.58 MHz (NTSC) or 4.43 (PAL) and check for 100 IRE or 700 mV ±2% (2 IRE or 14 mV).

X5 Gain HF Response

The component to be adjusted is A3C372.

1. Select the CH A input.
2. Select X5 VERTICAL GAIN.
3. Set the sine wave generator for 50 kHz.
4. Select CH A input, EXT REF, and 1 LINE sweep.
5. Adjust the sine wave generator for a displayed amplitude of 100 IRE (or 700 mV).
6. Set the sine wave generator Frequency to 3.58 MHz (NTSC) or 4.43 MHz (PAL)
7. Adjust C372 (X5 Comp) for an amplitude of 100 IRE (NTSC) or 700 mV (PAL).
8. Set the sine wave generator frequency to 6 MHz and check that displayed amplitude is still 100 IRE, ±5 IRE (NTSC) or 700 mV, ±35 mV (PAL).

Low Pass Filter

Components to adjust are A3C777 and A3C3775.

1. Set the 1710J-Series Waveform Monitor sweep to 2 LINE.
2. Use a 75 Ω coaxial cable to connect the television test signal generator color bar signal to the CH A input. Terminate the remaining side of the loop-through input with a 75 Ω terminator.
3. Select input A and LPASS FILTER.
4. Turn on HORIZONTAL MAG and X5 VERTICAL GAIN.
5. Adjust C777 (LPASS Filter) for minimum chrominance (minimum trace width on the back porch, following color burst).
6. Position the sync pulse to the baseline at center screen.
7. Adjust C775 (LPASS Filter) for the best corner on the leading edge of the sync pulse.
8. Remove the coaxial cable from the 1710J-Series Waveform Monitor CH A input. Leave the 75 Ω terminator in place.
9. Use a 75 Ω coaxial cable to connect the output of the sine wave generator to the 1710J-Series Waveform Monitor CH A input.
10. Set the sine wave generator for 50 kHz.
11. Adjust the sine wave generator for a display amplitude of 100 IRE (NTSC) or 700 mV (PAL).

12. Set the sine wave generator Frequency to 4.00 MHz.

13. Re-adjust C777 for minimum chrominance.

Chroma Filter

The components to adjust are A3R683 and A3C683 for NTSC instruments, or A3R680 and A3C778 for PAL instruments.

1. Use a 75 Ω coaxial cable to connect the television test signal generator color bar signal to the 1710J-Series Waveform Monitor CH A input.

2. Set the television test signal generator for Full Field and turn off Luminance (Y) and Setup (NTSC). Set color bar amplitude to 75%.

3. Set the 1710J-Series Waveform Monitor to CH A, CHRM FILTER, 1 LINE sweep, and sweep MAG off.

4. Adjust R683 (NTSC Chroma Filter Gain) or R680 (PAL Chroma Filter Gain) so that the amplitude of the largest color packet is 100 IRE or 700 mV, depending on the color standard employed.

5. Adjust C683 (3.58 NTSC) or C778 (PAL) for the squarest envelope (minimum burst envelope decay time). It may be necessary to readjust C783 (NTSC) or C784 (PAL) for maximum amplitude.

6. It may be necessary to perform steps 4 and 5 several times before reaching the optimum setting for both Gain and Chroma Filter Compensation.

7. Move A3J500 (DC Restore) jumper to the 2-3 (On) position.

Maintenance

Maintenance

This section of the manual provides the servicing instructions for the 1710J–Series Waveform Monitor. Following the Service Strategy and the precautionary information there is discussion of the internal (cover off) plug jumper settings, and other installation information. The next portion of the section provides instructions for inspection and cleaning and the step–by–step removal and replacement procedures. The sections ends with the troubleshooting procedures.

Service Strategy

This manual contains all of the information needed for periodic maintenance of the 1710J–Series Waveform Monitor. All components listed in the *Replaceable Electrical* and *Mechanical Parts Lists* can be obtained from Tektronix.

There are two Replaceable Parts Lists (electrical and mechanical) for this manual they have a complete a list of all the components of this instrument. To isolate a failure to a component, use the troubleshooting procedures, schematic diagrams and circuit board drawings. To remove and replace any failed module, follow the *Removal and Replacement Instructions* that are further back in this section.

Tektronix provides service to cover repair under warranty. Other services are available that may provide a cost–effective answer to your service needs.

Whether providing warranty repair service or any of the other services listed below, Tektronix service technicians, trained on Tektronix products, are best equipped to service your 1710J–Series Waveform Monitor. Tektronix technicians are appraised of the latest information on improvements to the product as well as the latest product options.

Tektronix warrants this product for one year from the date of purchase. (The warranty appears after the title page and copyright page in this manual.) Tektronix technicians provide warranty service at most Tektronix service locations worldwide. Your Tektronix product catalog lists all service locations worldwide.

Tektronix offers single per–incident and annual maintenance agreements that provide Depot Service repair of this instrument.

Of these services, the annual maintenance agreement offers a particularly cost–effective approach to service for many owners of the 1710J–Series Waveform Monitor. Such agreements can be purchased to span several years.

For More Information. Contact your local Tektronix service center or sales engineer for more information on any of the repair or adjustment services previously described.

Preparation

The servicing instructions that are in this manual are intended for qualified service personnel.

Before initiating any maintenance activity be sure to read the Safety Summery at the front of the manual and the Servicing Safety Summery located on the page that separates the operating information from the servicing information.

Operating instructions are contained in the *Operating Basics* section, be sure to read this section if you need more information on how the 1710J–Series Waveform Monitor is used.

Handling 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
2	ECL	200 V – 500 V
3	Schottky Signal Diodes	250 V
4	Schottky TTL	500 V
5	HF Bipolar Transistors	400 V – 600 V
6	JFET's	600 V – 800 V
7	Linear Microcircuits	400 V – 1000 V
8	Low Power Schottky TTL	900 V
9	TTL	1200 V

Handling Precautions

Observe the following precautions to avoid damaging static–sensitive devices:

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 wrist grounding strap when handling static–sensitive components. [Service assemblies containing static–sensitive components at static–free work stations.]

4. Remove any device capable of generating or holding a static charge from the work station surface.
5. Whenever possible keep the component leads shorted together.
6. Pick up components by the body, never by the leads.
7. Do not slide components over any surface.
8. Avoid handling components in areas where the floor or work surface covering is capable of generating a static charge.
9. Use a soldering iron that is connected to earth ground.
10. Use only special antistatic suction or wick–type desoldering tools.

Operating Options

Not all installations are identical. In order to make operation of the 1710J–Series Waveform Monitor as flexible as possible there are internal jumpers that can be changed to provide operating flexibility. For example, it is possible to select either the three–step or four–step parade to accommodate RGB or YRGB displays. With the exception of the 50–60 Hz jumper, the factory preset position is indicated by a box printed on the etched circuit board. Table 8–2 details these internal jumper selections. If any of these jumpers are placed in the optional position, be sure that all operators are aware of changes to prevent unnecessary trouble reports. See Figure 8–1 for location of the internal plug jumpers.

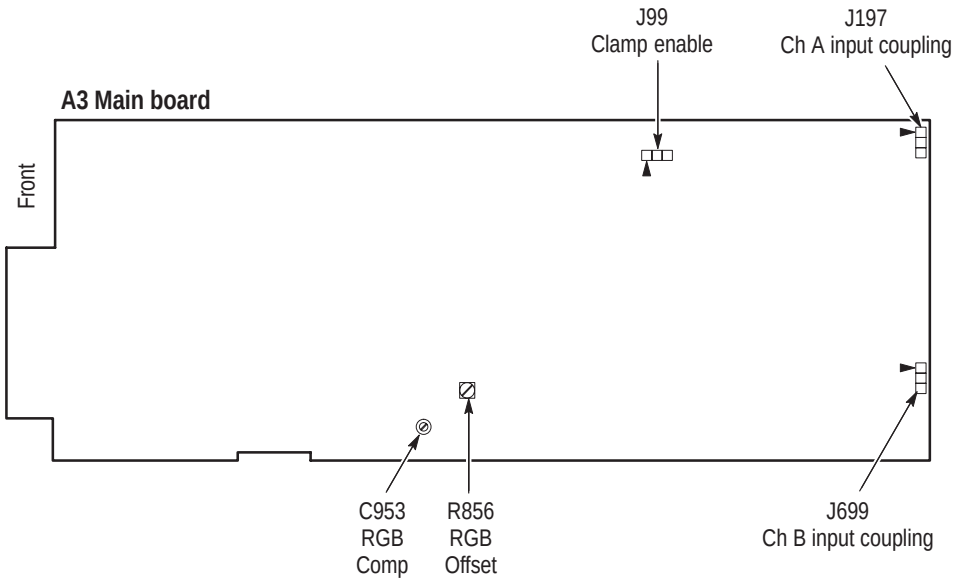


Figure 8–1: Plug jumper locations and RGB compensation adjustments

Table 8–2: Internal Jumper Selections

Jumper Number	Name	Position	Purpose
A3J500	DC Restorer Enable	1–2	Restorer Disabled
		2–3	Restorer Enabled
A3J99	Clamp Speed	1–2	Slow DC Restorer (Factory Set)
		2–3	Fast DC Restorer
A3J197	CH A Input Coupling	1–2	AC Coupled (Factory Set)
		2–3	DC Coupled
A3J699	CH B Input Coupling	1–2	AC Coupled (Factory Set)
		2–3	DC Coupled
A3J504	50/60 Hz	1–2	50 Hz Line Rate (Factory Set for 1711)
		2–3	60 Hz Line Rate (Factory Set for 1710)

REMOTE Connector

The rear–panel REMOTE connector is a 15–pin, D–type connector. It is the input for RGB signals.

Pin assignments for the REMOTE connector are shown in Figure 8–2 and discussed in Table 8–3.

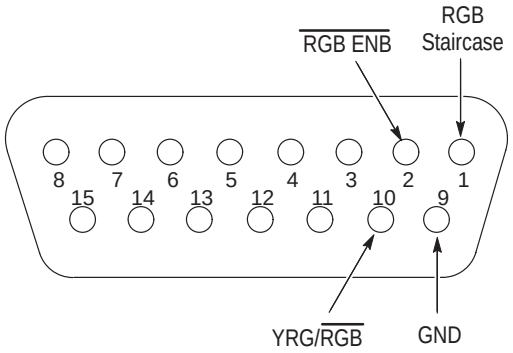


Figure 8–2: REMOTE connector pin functions

Table 8–3: Remote Connector Pin Assignments and Functions

Pin	Name	Function/Description
1	RGB Staircase	The RGB Staircase input signal controls the internal sweep ramp to offset the Horizontal in time with the RGB PARADE signal.
2	$\overline{\text{RGB Enable}}$	Low = RGB Enable. Level sensitive, allows the instrument to process the RGB staircase input.
9	Ground	Instrument ground for Remote Control

RGB/YRGB Parade Display

A TTL low level (ground) on pin 2 of the REMOTE connector enables the shortened RGB/YRGB sweep. A 10 V square wave input to pin 1 provides approximately nine divisions of sweep. This sweep can be either one line or one field depending on front–panel switch setting. The displayed signal is the front–panel selected CH A or CH B input.

When the 1710J–Series Waveform Monitor is substituted for a Tektronix 528 or 528A Waveform Monitor, in some applications the +28 V enable signal used by the 528 must be converted to ground closure (0 VDC). This conversion requires only a few common parts, as shown in Figure 8–3.

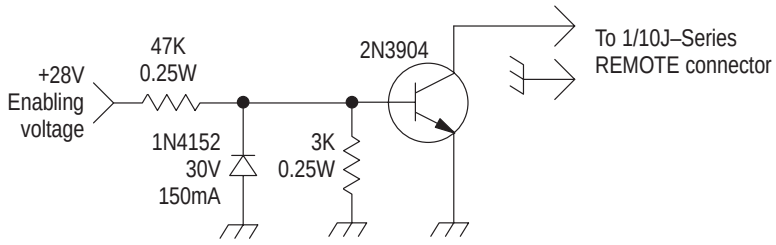


Figure 8–3: Common parts used to convert from +28 Vdc enable to ground closure

RGB Offset and Compensation. Television cameras vary in output dc level; R856 is provided to compensate for this variation in dc level. See Figure 8–1.

C953 is the input compensation that matches the Staircase Amplifier input time constant to the camera output time constant. See Figure 8–1.

Each time the camera input to the 1710J–Series Waveform Monitor is changed, the RGB offset and input time constant will probably need to be reset. The following procedure provides a simple means to make these adjustments.

Setting RGB Offset

The RGB offset adjustment sets the display in the useable part of the 1710J–Series Waveform Monitor graticule. The following procedure is easy to perform and requires no special test equipment.

1. Display any standard television waveform. Do not enable the rear–panel REMOTE connector RGB enable.
2. Use the 1710J–Series Waveform Monitor HORIZONTAL position control to align the display with the graticule.
3. Ground the REMOTE connector RGB Enable (pin 2) and apply the camera staircase output to the RGB Staircase input (pin 1).
4. Apply the camera video output to the 1710J–Series Waveform Monitor INPUT (CH A or CH B) and select that input with the front–panel INPUT switch.
5. Adjust R856 (see Figure 8–1 for location) to center the RGB signal on the graticule.
6. Adjust C953 for the best looking display.

Preventive Maintenance

Preventive maintenance consists of cleaning, visual inspection, performance checking, and, if needed, readjustment. The preventive maintenance schedule established for the instrument should be based on the environment in which it is operated and the amount of use. Under average conditions, scheduled preventive maintenance should be performed every 2000 hours of operation.

Cleaning and Inspection

Preventive maintenance consists of cleaning and visual inspection. The schedule depends on the severity of the operating environment. Under average conditions, perform preventive maintenance after 2000 hours of operation.

Cleaning

Clean the entire instrument often enough to prevent dust and dirt from accumulating. Dirt can act as a thermal insulating blanket that prevents effective heat dissipation. In addition, dust buildup can provide high–resistance electrical leakage paths between conductors or components in a humid environment.

Exterior. Cleaning the exterior consists of an occasional wiping of the outside surfaces with a damp soft cloth. Do not use commercial cleaners because they could discolor or damage the finish.

Check all air vents on a regular schedule to ensure that there is not a dust buildup that could impede the flow of cooling air.

WARNING. *To avoid any potential of electrical shock, disconnect power before removing the instruments cabinet.*

CRT. Clean the CRT protective shield, light filter, and CRT face with a soft, lint-free cloth dampened in denatured alcohol.

Interior. Interior cleaning is not recommended, but if it is necessary, use low-velocity, dry air to blow away dust or lint. If air alone does not remove all of the dust and lint, use a soft brush to complete the task. Exercise extreme care to not disturb components on the plug-in circuit boards during cleaning.

CAUTION. *This instrument contains static sensitive devices that can be damaged by static discharge. Wear a wrist grounding strap when working on this instrument's circuitry.*

CAUTION. *Do not allow water to get inside any enclosed assembly or component. Do not clean any plastic materials with organic cleaning solvents, such as benzene, toluene, xylene, acetone, or similar compounds, because they may damage the plastic.*

Visual Inspection

After cleaning, carefully check the instrument for defective connections, damaged parts, and improperly seated transistors or integrated circuits. The remedy for most visible defects is obvious; however, if heat–damaged parts are discovered, determine the cause of overheating before replacing the damaged part, to prevent additional damage.

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.

Performance Verification and Readjustment

Instrument performance should be checked after each 2000 hours of operation or every 12 months, if used intermittently. This will help to ensure maximum performance and assist in locating defects that may not be apparent during regular operation.

Removal and Replacement Instructions

The instructions contained here are for disassembly. Reassembly is performed by reversing the order of the steps used to disassemble the instrument.

WARNING. *To avoid possible electrical shock, disconnect the power cord before replacing components.*

CAUTION. *To avoid potential short circuiting do not reinsert screws in the rear panel when the instrument is removed from the cabinet.*

CAUTION. *To avoid short circuiting potential, do not install cabinet mounting screws when the instrument is out of the cabinet.*

NOTE. *All screws, unless otherwise noted, are TORX _ screws and can be removed with a T15 screwdriver tip (Tektronix part number 003–0966–00). The exception is #2 Pozidrive _ screws which can be removed with a #1 Pozidrive tip (Tektronix part number 003–0443–00).*

Bezel Removal

In order to replace the graticule light bulbs, clean or replace the CRT, or remove the instruments front panel it is necessary to remove the CRT bezel. Removal requires a screwdriver with a T15 Torx tip.

1. Remove the two bezel screws. See Figure 8–4.
2. Grasp the bottom of the bezel and 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.

To replace the graticule bezel perform the following steps:

1. Engage the bezel top tabs with the hinge slots.
2. Allow the bezel to hinge down till it sits flat with the front panel.
3. Reinstall the two bezel screws. See Figure 8–4.

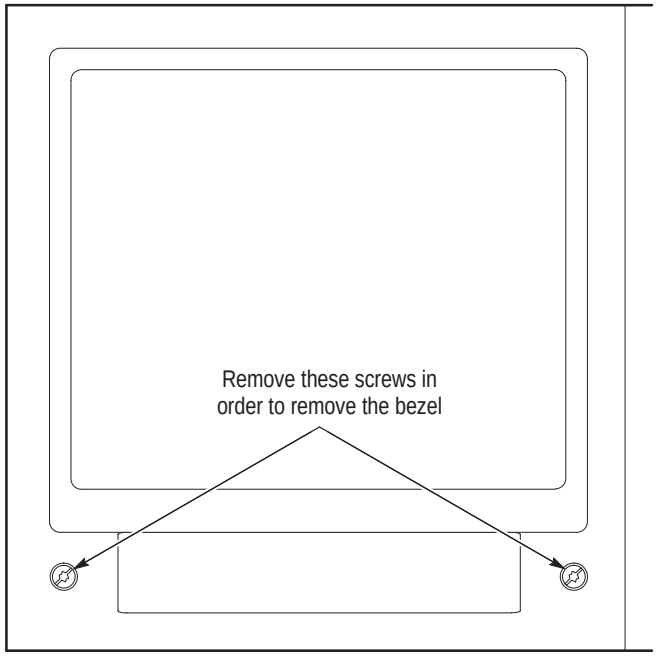


Figure 8–4: Bezel removal

Graticule Light Removal and Replacement

For graticule light removal and replacement, tweezers with curved, serrated tips are recommended. For example, Miltex PL312, 6–100 (equivalent to PL312) or PL317 (longer than PL312).

CAUTION. *The graticule light bulbs can easily be damaged if the wrong tools are used to remove or install them. Do not use needle nose pliers.*

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 instructions. (See *Bezel Removal*.)
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.

To replace graticule lights perform the following procedure:

1. To install a bulb, hold it with the tweezer tips on the thin, flat portion of the bulb (close to the plastic socket). Position the bulb in front of the socket, and push the bulb with your finger until it snaps into place.
2. Replace the bezel. (See *Bezel Replacement*.)

CRT Removal and Replacement

The CRT is a high–vacuum device and you need to be cautious about how it is removed and handled. When handling a CRT always wear safety glasses and if possible, wear gauntlet type leather gloves for its transportation. Always store CRTs in protective packaging; do not leave a CRT sitting on a bench top or desk.

1. Remove the bezel. (See *Bezel Removal*.)
2. Remove the CRT protective filter.

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. Slide a screwdriver with an insulated handle under the anode cap on the side of the CRT, and ground the anode to the chassis, to discharge the CRT. DO NOT touch the metal shaft of the screwdriver while doing this. Disconnect the anode cap by prying it gently away from the CRT.
4. Disconnect J225 (trace rotation) on the Main board and push the connector through the hole in the board.
5. The CRT can now be pulled straight out (some pressure may be needed). The CRT shield, along with the grommet around its front and the rubber manchet around its back, should come out with the CRT.

To replace the CRT perform the following procedure:

1. If the CRT is to be replaced, remove the metal shield from the neck of the old CRT and place it around the neck of the new CRT, with the WARNING sticker towards the top of the instrument. This should place the opening in the grommet on the front edge of the shield towards the bottom of the instrument. Ensure that the rubber manchet is on the back edge of the shield.
2. Slip the CRT part way back into position and feed the trace rotation wires (and plug) back through the hole in the Main board.

WARNING. *The CRT may retain a dangerous charge. Ground the the anode connector to discharge the CRT. Do not allow the conductor to touch your body or any circuitry.*

3. Use a screwdriver to ground the anode connector on the CRT to the chassis.
4. Slide the CRT into the instrument, guiding the rubber manchet on the end of the shield into the rear CRT support.
5. Align the socket on the A10 CRT Socket board with the pins and key on the CRT. Gently push the CRT and the socket board together until the CRT pins are fully seated in the socket.

6. Replace the trace rotation connector (J255, Main board), and snap the anode lead onto the anode connector on the side of the CRT.

7. Wipe the faceplate of the CRT to remove fingerprints, then replace the bezel. If the fit is too tight to allow the bezel to go into position, or if the CRT has a loose fit after the bezel is completely tightened down, then the rear CRT support must be repositioned.

   To reposition the rear CRT support, loosen the two nuts that hold the support in place. With the CRT and bezel in place, push the support towards the front of the instrument until it is snug against the rubber manchet on the rear of the CRT shield. Tighten the two support nuts.

Removing the Rear Panel

The rear panel is mounted directly to the main chassis. It is held in place with three Torx head screws. In addition, the instruments power plug is mounted on the rear panel with two additional Torx head screws. Use a screwdriver with a T15 Torx tip to remove and replace the rear panel.

1. Remove the five rear screws. See Figure 8–5.

2. Unsolder the lead to the six BNC connectors and one the one ground connection.

3. Pull the rear panel free from the chassis; be careful not to pull the unsoldered wires.

To replace the rear panel perform the following procedure:

1. Hold the rear panel in place and replace the three screws holding it to the main chassis.

2. Resolder the connections to the six BNC connectors and the ground wire.

3. Reinstall the screws holding the instruments power connector to the rear panel.

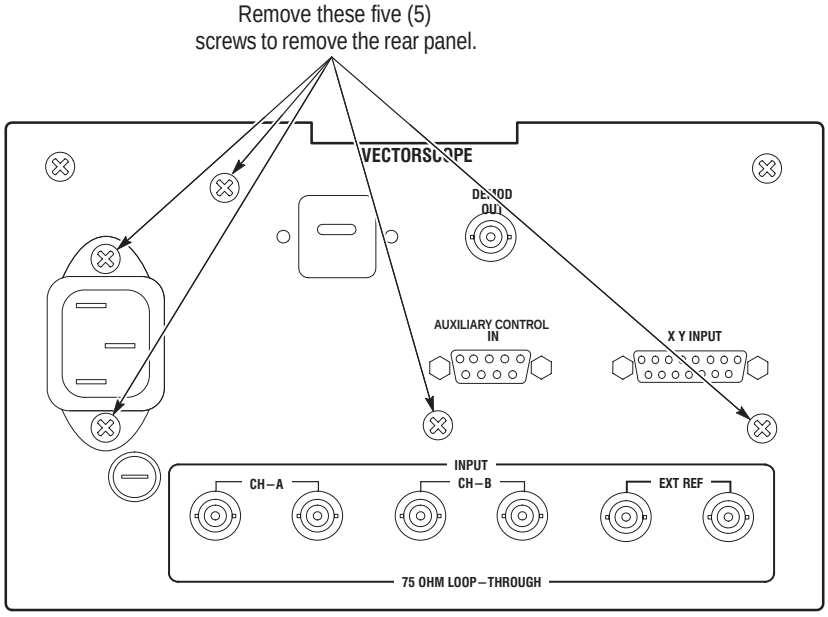


Figure 8–5: Rear panel securing screws

Front Panel and Front Panel Circuit Board Removal

The instrument's front–panel circuit board is mounted on the back of the front panel. It is necessary to remove this assembly in order to access the front panel switches and controls. There are two Torx head screws that fasten the front panel to front casting. The circuit board is mounted to front panel with four Torx head screws. Use a screwdriver with a T15 Torx tip to remove and replace these items.

1. Remove the blue multi–wire connector from J154.
2. Remove the two screws holding the board in place. See Figure 8–6.
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 for component access.

To replace the front panel and front panel circuit board perform the following procedure:

1. Push the circuit board switch buttons and control knobs through their respective holes in the front panel.
2. Replace the four screws that fasten the circuit board to the front panel.

3. Replace the front–panel knobs.
4. Carefully slide the circuit board through the front–panel opening.
5. Replace the two screws holding the front panel to the front casting.
6. Replace the multi–wire connector on J154.

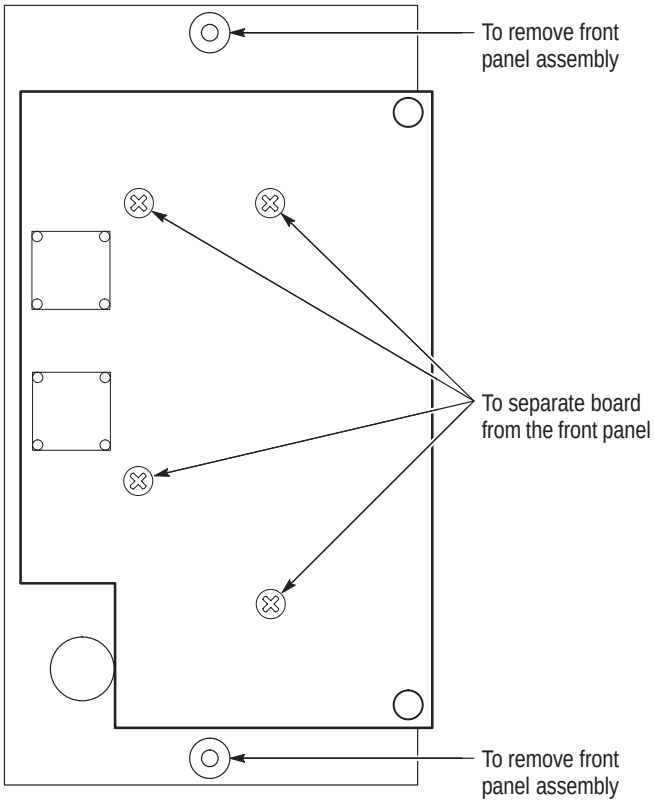


Figure 8–6: Screws that hold the front panel circuit board (A2) in place

Removing the Main Board

The main circuit board is held in place by eight Torx head screws. Use a screwdriver with a T15 Torx tip to remove and replace these screws. In addition a soldering iron is required to remove this circuit board.

1. Remove the plugs from the following connectors: J107 to the Front Panel board, J4 on the Power Supply board, and J225 on the Main board (the trace rotation leads to the CRT).
2. Unsolder the leads to the six BNC connectors and three ground from the rear panel, the two horizontal CRT leads (red and green), and the two vertical CRT leads (blue and brown).

3. Slip the CRT and trace rotation leads through the appropriate holes in the Main board.

4. Remove the eight screws that are holding the board in place. See Figure 8–7 for their locations.

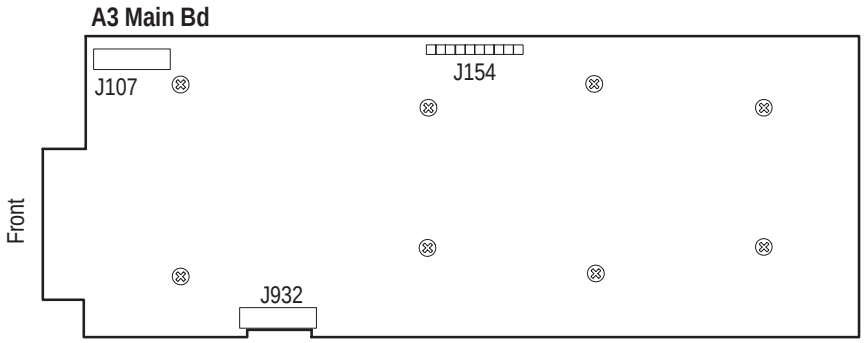


Figure 8–7: Screws holding the Main circuit board (A3) in place

5. Remove the board by sliding it toward the rear panel until the toe of the board clears the front, then lift out.

To replace the main circuit board perform the following procedure:

1. To replace the Main board, lay the board flat and slide it forward into place.

2. Reinstall the eight screws that hold the circuit board in place.

3. Slip the CRT and trace rotation leads through the appropriate holes in the Main board and reconnect them.

4. Solder the leads to the six BNC connectors and three grounds from the rear panel, the two horizontal CRT leads (red and green), and the two vertical CRT leads (blue and brown).

5. Reinstall the plugs on the following connectors: J107 to the Front Panel board, J4 on the Power Supply board, and J225 on the Main board (the trace rotation leads to the CRT).

Removing the Power Supply Board

The front–panel power switch is held in place with two Pozidrive[screws. Use a screwdriver with a #1 Pozidrive tip to remove and replace these screws

The circuit board is held in place with seven Torx head screws. In addition, the power line filter is held in place on the rear panel with two Torx head screws. Use a screwdriver with a T15 Torx tip to remove and replace them.

There are a number of solder connections that must be unsoldered to remove the circuit board and soldered back to replace the circuit board. A soldering iron is required for this procedure.

1. Remove the plug from J4 on the Power Supply board. This is the connection to the Main board.
2. Remove the anode connection from the CRT and discharge it 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. Unsolder the following connections: J1 pins 1 through 4, J3 pins 1 through 4, and the focus lead at J11.
4. Disconnect the ac line filter from the rear panel by unscrewing its two mounting screws.
5. Use a screwdriver with #1 Pozidrive tip to disconnect the power on/off switch from the front casting.
6. Remove the seven screws that are holding the Power Supply board down. See Figure 8–8.
7. Remove the board by sliding it forward and lifting it up.

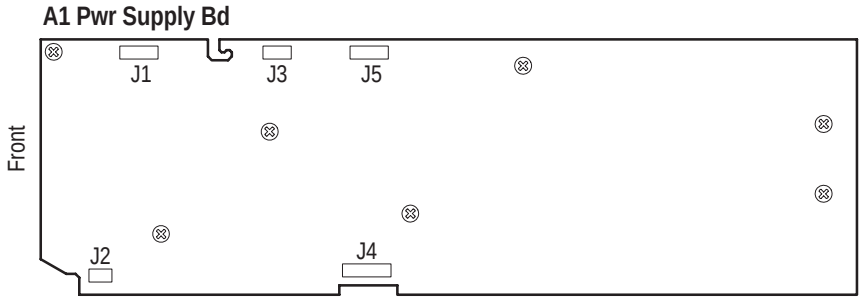


Figure 8–8: Screws holding the power supply circuit board (A1) in place

To replace the power supply circuit board perform the following procedure:

1. Replace the board by sliding it back into place.
2. Reinstall the seven screws that hold the Power Supply board down. See Figure 8–8.

3. Use a screwdriver with #1 Pozidrive tip to reinstall the power on/off switch to the front casting.
4. Reconnect the AC line filter from the rear panel by reinstalling the two mounting screws.
5. Solder the following connections: J1 pins 1 through 4, J3 pins 1 through 4, and the focus lead at J11.
6. Reconnect the anode connection to the CRT.
7. Reconnect the plug on J4.

Troubleshooting

The material at the start of this discussion is general and is not intended to cover specific cases. Note that the manual itself is considered a troubleshooting aid, and as such a brief discussion of its content is in order.

The procedural information that appears as "General Troubleshooting Techniques" should be familiar to most technicians; however, a quick review may save some time and reduce "wheel spinning."

The instructions for troubleshooting the low voltage power supply are detailed. These instructions should be followed to the letter in order to accomplish the task.

Foldout Pages

The foldout pages at the back of the manual contain information that is useful in troubleshooting the instrument. Block and schematic diagrams, circuit board illustrations, and parts locating charts are found there.

Diagrams. Schematic diagrams are the most often used troubleshooting aids. The circuit number and electrical value of each component is shown on the diagram. The first page has definitions of the symbology used on the schematic diagrams. Refer to the Replaceable Electrical Parts list for a complete description of each component. Circuits that are mounted on circuit boards or assemblies are enclosed in a border, with the name and assembly number shown on the border.

Circuit Board Illustrations. Electrical components, connectors, and test points are identified on circuit board illustrations, which are located on the page facing the first schematic diagram for that board. Circuit board illustrations are assigned location grids along the left side and top, which are used with the parts locating charts to rapidly locate the components.

Parts Locating Charts. The parts locating charts are used in conjunction with the location grids on the board illustrations and on the schematics. There is one locator chart that shows all of the parts on the board. This locator chart shows which schematic the part is shown on, in addition to the board and schematic grid locations for that part. In addition, there are locator charts facing each schematic page that gives the board and schematic grid locations lists for only the parts depicted on that schematic page.

Assembly and Circuit Numbering. The circuit board assemblies are assigned assembly numbers. Figure 8–9 shows the circuit board assembly locations for this instrument.

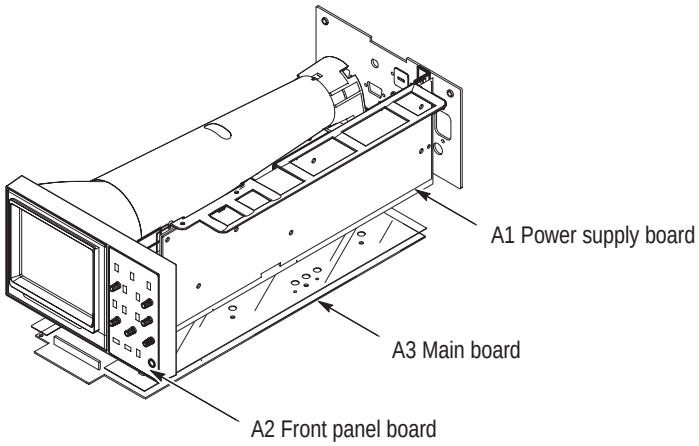


Figure 8–9: Circuit board assembly locations

Adjustment Locations. The *Adjustment Procedure* has illustrations that have the adjustments and test points called out as calibration and troubleshooting aids.

Parts Lists

There are two separate parts lists in this manual. The *Replaceable Electrical Parts* list precedes the schematic diagrams and circuit board illustrations. The *Replaceable Mechanical Parts* list is accompanied by exploded view drawings.

Replaceable Electrical Parts. This list is arranged by assembly as designated in ANSI Standard Y32.16–1975. The list begins with the part numbers for the major assemblies (etched circuit boards). Each circuit board is identified by an A# (Assembly Number).

The circuit numbers of the individual components in the parts list are made up by combining the assembly number with the individual circuit number.

Example: R117 on Assembly (circuit board) A3 would be listed in the Replace–able Electrical Parts list as A3R117.

NOTE. *Always consult the parts list for part numbers and descriptions when ordering replacement parts. Some parts may have been replaced or have a different part number in an individual instrument.*

Replaceable Mechanical Parts. This list is arranged so that it corresponds to the exploded view drawing for major instrument components. The list and exploded view drawing follow the schematic diagrams in this manual. Standard Accessories, which are also included in the parts list, are also in the exploded view drawing.

Major Assembly Interconnection

Signals and power supply voltages are passed through the instrument with a system of interconnecting cables. The connector holders, on these cables, have numbers that identify terminal connectors; numerals are used from pin 2 up. A triangular key symbol is used to identify pin 1 on the circuit board to assist in aligning connector with correct square pins. Figure 8–10 shows the numbering scheme (and the triangular marking) on the etched circuit board.

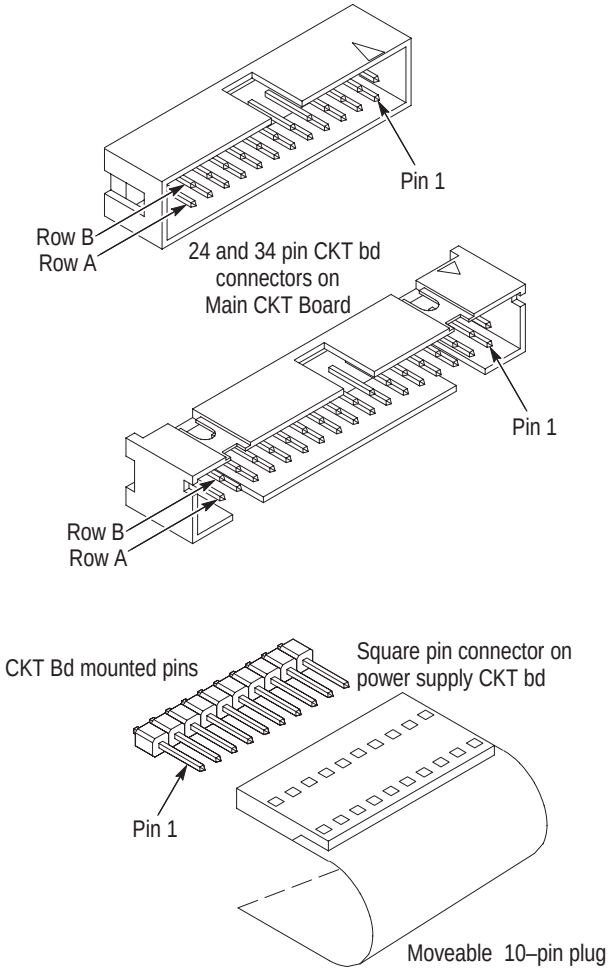


Figure 8–10: Multiple pin connectors

General Troubleshooting Techniques

The following procedure is designed to assist in isolating problems, which in turn expedites repairs and minimizes down time.

1. Ensure that the malfunction exists in the instrument. This is done by making sure that the instrument is operating as intended by Tektronix (see *Operating Basics*), and by checking that a malfunction has not occurred up stream from the waveform monitor.

2. Determine and evaluate all trouble symptoms. This is accomplished by isolating the problem to a general area such as an assembly. The block diagram is a valuable aid in signal tracing and circuit isolation.

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.*

3. Determine the nature of the problem. Attempt to make the determination of whether the instrument is out of calibration or if there has been a component failure. Once the type of failure has been determined, proceed on to identify the functional area most likely at fault.

4. Visually inspect the suspect assembly for obvious defects. Most commonly these will be broken or loose components, improperly seated components, overheated or burned components, chafed insulation, etc. Repair or replace all obvious defects. In the case of overheated components, determine the cause of overheating and correct the cause 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 to determine if a circuit is operating within specifications. At times it may be necessary to change a calibration adjustment to determine if a circuit is operational, but since this can destroy instrument calibration, care should be exercised. Before changing an adjustment, note its position so that it can be returned to its original setting.

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.

CAUTION. *Always remove the assembly from the instrument prior to attempting to replace a soldered in component. See Corrective Maintenance for the correct procedure.*

Specific Troubleshooting Techniques

The 1710J–Series Waveform Monitor has one area, the low voltage power supply, where ordinary troubleshooting techniques do not apply.

Power Supply Troubleshooting

The power supply is of the high–efficiency type and requires a specific trouble–shooting procedure and an isolation transformer to avoid personal danger or instrument damage.

The power supply presents special troubleshooting problems, if a fault occurs. Besides having a sizeable area where dangerous potentials can be contacted, the type of circuitry employed can not be troubleshot by conventional means.

WARNING. *Dangerous voltages exist in this power supply. Do not attempt to troubleshoot the 1710J–Series Waveform Monitor power supply without reading these instructions.*

Power Supply Troubleshooting Procedure

It is important that you follow these instructions when troubleshooting this power supply, because it can not be evaluated using traditional power supply troubleshooting techniques.

NOTE. *A review of the power supply Theory of Operation is recommended before attempting repairs.*

The equipment needed to troubleshoot the power supply:

- A Digital Multimeter (DMM), with a diode check function
- A general purpose oscilloscope
- A 0 to 20 VDC Variable Power Supply
- A clip lead to short across a component
- A high voltage probe, ≥ 1 G Ω input resistance

Introduction

The Troubleshooting Procedure for the power supply (Assembly A1) is split into two sections, the low volts and high volts supplies. Start the procedure by determining which section of the power supply has malfunctioned. Apply AC power and turn on the power supply. From Table 8–4, determine which symptom the power supply exhibits and refer to the corresponding procedure.

Table 8–4: Power Supply Fault Symptoms

Symptom	Procedure
Line fuse open	Rectifier/Switcher Check (Low Volts)
Power Supply cycles OFF/ON	Output Check (Low Volts) or High Voltage Oscillator Check (High Volts)
Does not power up	Control Circuit Check (Low Volts)
+5 V not regulating	Error Amplifier Check (Low Volts)
Improper CRT display	High Volts Supply

Low Voltage Power Supply

Faults in the low voltage supply can only be isolated using the following procedure.

Preliminary Checks

This procedure is used to eliminate some of the more obvious faults.

1. A properly functioning and loaded low volts supply will output the voltages listed in Table 8–5. Use the DMM to measure the voltages between TP1 and the voltage test points. If the supply is not regulating properly, continue with the procedure.

Table 8–5: Low Volts Supply Voltages

Test Point	Voltage Range
W1 (+5 V)	+4.88 to +5.12 V
W4 (+15 V)	+14.0 to +16.0 V
W3 (–15 V)	–14.0 to –16.0 V
W2 – (+40 V)	+39.0 to +41.0 V

***NOTE**. The Low Volts power supply troubleshooting is performed without applying AC power.*

2. Disconnect AC power from the instrument. Disconnect the instrument from the Power Supply by removing the jumper from J4.
3. Use the DMM to measure the voltage between TP2 and the tab (drain) of Q9. Check that the voltage is near 0 V.

***WARNING.** Do not proceed until the the drain of Q9 is near 0 V. Dangerous voltage potentials are present in the circuit until the capacitors discharge.*

Rectifier/Switcher Check

This is a resistance check for the switcher FET and the rectifier diodes.

1. Use the DMM to measure the voltage between TP2 and the tab (drain) of Q9. Be sure the voltage is near 0 V before proceeding.
2. Unsolder and lift one end of R102.
3. With the negative lead of the DMM connected to TP2 and the positive lead connected to the tab of Q9, measure the circuit resistance. A resistance of

less than 20 kΩ indicates a shorted MOSFET (Q9). If the MOSFET is shorted, replace it and perform the Control Circuit Check.

4. Using the DMM diode test function, test CR21, CR22, CR23, and CR24 for shorts. Diode replacements must be fast reverse recovery (300 ns) types to reduce conducted noise.

5. Reconnect the lifted end of R102.

Output Check

This procedure uses the variable power supply to check output voltages.

1. Connect the negative output from the 20 VDC power supply to TP1. Connect the positive output to W4 (+15 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR11 or U2 (High Volts power supply).

2. Connect the negative output from the 20 VDC power supply to TP1. Connect the positive output to W2 (+40 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR14 or Q6 (high volts power supply).

3. Connect the positive output from the 20 VDC Power Supply to TP1. Connect the negative output to W3 (–15 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR12.

4. Connect the negative output from the 5 VDC power supply to TP1. Connect the positive output to W1 (+5 V). The circuit should draw less than 20 mA. Excessive current draw can be caused by CR13 or Q1 and Q2 (high volts power supply).

Control Circuit Check

This procedure uses the variable power supply and an oscilloscope to determine if the control circuit is functioning properly.

1. Connect the negative output from the 20 VDC Power Supply to TP2. Connect the positive output to the cathode of CR17. Short C47 with a clip lead. Connect the oscilloscope probe ground to TP2.

2. Table 8–6 lists the signal present in a properly functioning control circuit.

Table 8–6: Control Circuit Test Points

Circuit Location	Signal
U5, pin 1	Approximately 5 VDC
U5, pin 2	Approximately 2 VDC
U5, pin 3	0 V
U5, pin 4	80 kHz triangle wave, 2 V p–p

Table 8–6: Control Circuit Test Points (Cont.)

Circuit Location	Signal
U5, pin 6	80 kHz square wave, 18 V p–p
U3, pin 1	80 kHz square wave, 5 V p–p
U3, pin 2	2.1 VDC
U3, pin 6	2.9 VDC
U3, pin 7	Approximately 5 VDC
U4, pin 13	80 kHz repetition rate, 300 ns width, approximately 3 V p–p
Q8, collector	80 kHz repetition rate, 400 ns width, switching from 5 V to approximately 2 V

3. Remove the clip lead from across C47.

Error Amplifier Check

This procedure is used to determine if the +5 V supply is regulating.

1. Connect the negative output from the variable DC power supply to TP1. Connect the positive output to W1 (+5 V).
2. Connect the negative output of another variable DC power supply to TP1. Connect the positive output to W4 (+15 V). Set the variable power supply to 20 VDC.
3. Connect the DMM between TP1 and the cathode of CR15.
4. Set the variable DC power supply connected to W1 (+5 V) to 4.8 V. The cathode of CR15 should be approximately 20 V.
5. Set the variable DC power supply connected to W1 (+5 V) to 5.2 V. The cathode of CR15 should be approximately 2 V.
6. If this check does not reveal the cause for the +5 V supply not regulating, refer to the Output Check and the Control Circuit Check.

High Voltage Power Supply

The design of the 1710J–Series Waveform Monitor requires special test methods to locate high voltage power supply faults.

Preliminary Checks

These procedures start by accessing the more obvious symptoms and then performing one or more the high voltage supply check procedures.

Table 8–7 lists the high volts supply fault symptoms and procedures.

Table 8–7: High Volts Supply Fault Symptoms

Symptom	Procedure
Unable to focus CRT using the front–panel control	Focus Amplifier Check
Unable to adjust CRT intensity using the front–panel control	Z–Axis Amplifier Check, Grid Drive Check
No CRT display	High Voltage Oscillator Check, CRT Voltage Check

Before proceeding with the remainder of these procedures load the low volts supply with the instrument or with the 20 Ω 2 W resistor from W1 to TP1.

Focus Amplifier Check

This is the procedure to use if you cannot adjust CRT focus with the front panel focus control.

1. Unsolder and lift one end of R24.
2. Power up the power supply.
3. Using the digital multimeter, measure the voltage between TP1 and the collector of Q1. It should be approximately –140 V.
4. Power down the power supply.
5. Reconnect the lifted end of R24.

Z–Axis Amplifier Check

This is one of the two procedures to use if you cannot adjust CRT intensity with the front panel intensity control.

1. Unsolder and lift one end of R8.
2. Power up the power supply.
3. Using the digital multimeter, measure the voltage between TP1 and the collector of Q4. It should be approximately +10 V.
4. Short together the base and emitter of Q5. The collector of Q4 should be approximately +100 V.
5. Power down the power supply.
6. Reconnect the lifted end of R8.

Grid Drive Check

This is the other procedure to use if the front panel intensity control is not working correctly.

1. Turn off the power supply. Use the diode check on the DMM to test CR1, CR2, CR3, CR5, and CR6 for shorts.
2. Power up the power supply.
3. Using the DMM, measure the voltage between TP1 and the cathode of CR5. It should vary between approximately +75 and +200 V as R58 (CRT Bias) is adjusted.
4. Connect the oscilloscope probe to the anode of CR5 and the probe ground to TP1. The signal should be a clipped sinewave of +75 to +200 V_{p-p} .

High Voltage Oscillator Check

This is one of two procedures to perform if there is no CRT display.

1. Connect the oscilloscope probe to T1 pin 3 (Q6 collector) and the probe ground to TP1. Power up the supply. The signal should be a +60 V_{p-p} , 22 kHz sine wave.
2. Check the voltages listed in Table 8–8 using the DMM:

Table 8–8: High Voltage Oscillator Test Points

Circuit Location	Voltage
T1, pin 4	Approximately +40 V
T1, pin 13	Less than +2 V
U2, pin 2	Approximately +4.8 V
U2, pin 6	+4 to +11 V
CR9, cathode	Approximately +100 V

CRT Voltage Check

This is the second procedure to perform if there is no CRT Display.

NOTE. *This check requires a high voltage probe having an input resistance of 1G Ω or more.*

1. Connect the high voltage probe ground to TP1.
2. Load the low volts supply with the instrument, or with a 20 Ω, 2 W resistor loading the 5 V supply.
3. Power up the power supply.
4. Use the high voltage probe to measure the voltage at the anode of CR4. It should be approximately –2350 V.

5. Measure the voltage at the anode end of CR3. It should be 50–150 V more negative than the reading from the anode of CR4.

Repackaging

Identification Tag

If the instrument is to be shipped to a Tektronix Service Center for service or repair, attach a tag to the instrument showing:

1. Owner (with complete address) and the name of the person at your firm that 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 8–11). 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 to allow room 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. Allow three inches on all sides for cushioning.
4. Seal the carton with shipping tape or an industrial stapler.

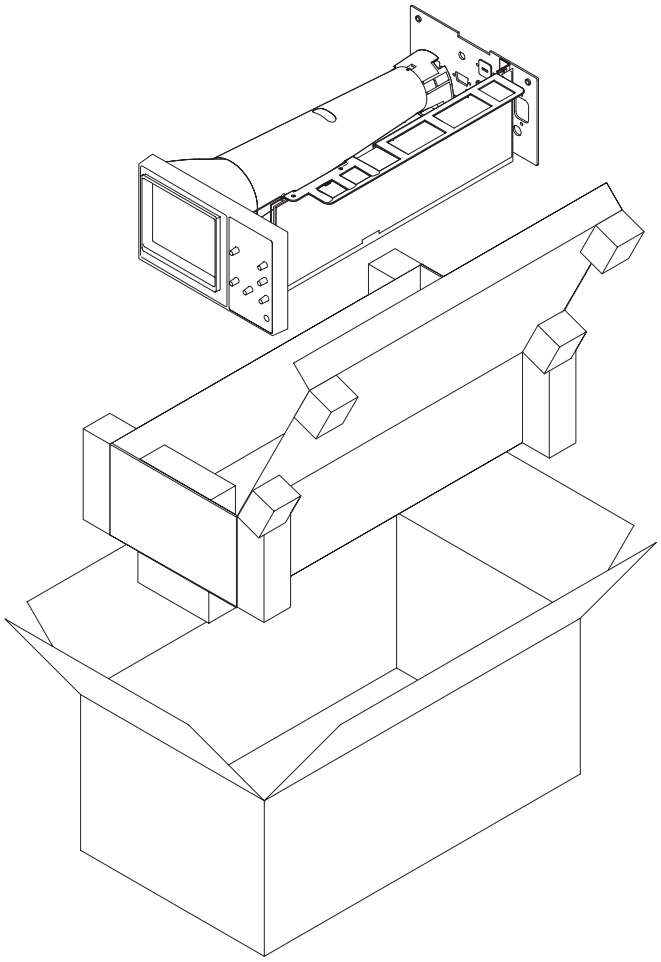


Figure 8–11: Repackaging a 1710J–Series Waveform Monitor

Replaceable Electrical Parts

Replaceable Electrical Parts

This section contains a list of the electrical components for the 1710J-Series Waveform Monitors. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest 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 you order a part that has been replaced with a different or improved part, your local Tektronix 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 replacement parts. The following table describes each column of the electrical parts list.

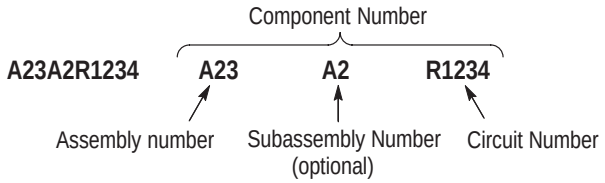
Parts List Column Descriptions

Column	Column Name	Description
1	Component Number	The component number appears on diagrams and circuit board illustrations, located in the diagrams section. Assembly numbers are clearly marked on each diagram and circuit board illustration in the *Diagrams* section, and on the mechanical exploded views in the *Replaceable Mechanical Parts* list section. The component number is obtained by adding the assembly number prefix to the circuit number (see Component Number illustration following this table). The electrical parts list is arranged by assemblies in numerical sequence (A1, with its subassemblies and parts, precedes A2, with its subassemblies and parts). Chassis-mounted parts have no assembly number prefix, and they are located at the end of the electrical parts list.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entry indicates the part is good for all serial numbers.
5	Name & Description	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.
6	Mfr. Code	This indicates the code number of the actual manufacturer of the part.
7	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations

Abbreviations conform to American National Standard ANSI Y1.1–1972.

Component Number



Read: Resistor 1234 (of Subassembly 2) of Assembly 23

List of Assemblies

A list of assemblies is located at the beginning of the electrical parts list. The assemblies are listed in numerical order. When a part's complete component number is known, this list will identify the assembly in which the part is located.

Chassis Parts

Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts List.

Mfr. Code to Manufacturer Cross Index

The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
00779	AMP INC.	CUSTOMER SERVICE DEPT PO BOX 3608	HARRISBURG, PA 17105–3608
01295	TEXAS INSTRUMENTS INC	SEMICONDUCTOR GROUP 13500 N CENTRAL EXPRESSWAY PO BOX 655303	DALLAS, TX 75272–5303
02113	COILCRAFT, INC.	1102 SILVER LAKE RD.	CARY, IL 60013
04222	AVX/KYOCERA	PO BOX 867	MYRTLE BEACH, SC 29577
04713	MOTOROLA INC	SEMICONDUCTOR PRODUCTS SECTOR 5005 E MCDOWELL ROAD	PHOENIX, AZ 85008–4229
05347	ULTRONIX INC	461 N 22ND P O BOX 1090	GRAND JUNCTION, CO 81502
05820	EG & G WAKEFIELD	60 AUDUBON ROAD	WAKEFIELD, MA 01880
07716	IRC, INC	2850 MT PLEASANT AVE	BURLINGTON, IA 52601
09023	CORNELL–DUBILIER CORPORATION	C/O EARL & BROWN CO INC 7185 SW SANDBURG RD	TIGARD, OR 97223
09969	DALE ELECTRONIC COMPONENTS	EAST HWY 50 P.O. BOX 180	YANKTON, SD 57078
0CVK3	ALLEGRO MICROSYSTEMS INC	115 NE CUTOFF PO BOX 2036	WORCHESTER, MA 01613–2036
0J260	COMTEK MANUFACTURING OF OREGON	P O BOX 4200 M/S 16–207	BEAVERTON, OR 970764200
0JR03	ZMAN MAGNETICS INC	7633 S 180TH	KENT, WA 98032
0LUA3	PHILIPS COMPONENTS	100 PROVIDENCE PIKE	SLATERSVILLE, RI 02876
12697	CLAROSTAT SENSORS & CONTROLS INC	12055 ROJAS DR SUITE K	EL PASO, TX 79936
12954	ICROSEMI CORP – SCOTTSDALE	8700 E THOMAS ROAD PO BOX 1390	SCOTTSDALE, AZ 85252–5252
13103	THERMALLOY INC	2021 W. VALLEY VIEW LN PO BOX 810839	DALLAS, TX 75381–5381
17856	TEMIC NORTH AMERICA	(SILICONIX & MATRA MHS) 2201 LAURELWOOD RD	SANTA CLARA, CA 95954–1516
19701	PHILIPS COMPONENTS	AIRPORT RD P.O.BOX 760	MINERAL WELLS, TX 76067
21847	FEI MICROWAVE	825 STEWART DRIVE	SUNNYVALE, CA 94086
24226	GOWANDA ELECTRONICS CORP	1 INDUSTRIAL PLACE	GOWANDA, NY 14070–1409
24546	DALE ELECTRONICS INC	550 HIGH ST	BRADFORD, PA 16701
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR PO BOX 58090 MS 30–115	SANTA CLARA, CA 95051–0606
30983	PHILIPS COMPONENTS	1440 W INDIANTOWN ROAD	JUPITER, FL 33458
32997	BOURNS INC	TRIMPOT DIVISION 1200 COLUMBIA AVE	RIVERSIDE, CA 92507–2114
33095	SPECTRUM CONTROL INC	8061 AVONIA RD	FAIRVIEW, PA 16415
34361	OMRON ELECTRONICS	2105 HAMILTON AVE SUITE 160	SAN JOSE, CA 95125

Manufacturers Cross Index (Cont.)

Mfr. Code	Manufacturer	Address	City, State, Zip Code
34371	HARRIS SEMICONDUCTORS	SEMICONDUCTOR SECTOR MS 58–71 PO BOX 883	MELBOURNE, FL 32902–0883
50139	ALLEN–BRADLEY COMPANY INC	ELECTRONIC COMPONENTS DIVISION 1414 ALLEN BRADLEY DRIVE	EL PASO, TX 79936
50558	ELECTRONIC CONCEPTS INC	PO BOX 1278	EATONTOWN, NJ 07724
52769	SPRAGUE–GOODMAN ELECT INC	1700 SHAMES DRIVE	WESTBURY, NY 11590
54294	SHALLCROSS INC	US 70 EAST	SMITHFIELD, NC 27577
55680	NICHICON (AMERICA) CORP	927 E STATE PARKWAY	SCHAUMBURG, IL 60195–4526
56501	THOMAS & BETTS CORPORATION	1555 LINFIELD RD	MEMPHIS, TN 38119
56845	DALE ELECTRONIC COMPONENTS	2300 RIVERSIDE BLVD PO BOX 74	NORFOLK, NE 68701
57668	ROHM CORPORATION	15375 BARRANCA PARKWAY SUITE B207	IRVINE, CA 92718
58050	TEKA INTERCONNECTION SYSTEMS	45 SALEM ST	PROVIDENCE, RI 02907
59660	TUSONIX INC	7741 N BUSINESS PARK DR PO BOX 37144	TUCSON, AZ 85740–7144
61429	FOX ELECTRONICS	DIV OF FOX ENTERPRIXED INC 5842 CORPORATION CIRCLE	FORT MEYERS, FL 33905
62643	UNITED CHEMI–CON INC	9801 W HIGGINS RD	ROSEMONT, IL 60018–4771
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD PO BOX 76500	COLD SPRINGS, KY 41076
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001
8X345	NORTHWEST SPRING MFG CO	5858 WILLOW LANE	LAKE OSWEGO, OR 97035
86928	SEASTROM MFG CO INC	456 SEASTROM STREET	TWIN FALLS, ID 83301
91637	DALE ELECTRONIC COMPONENTS	1122 23RD ST	COLUMBUS, NE 68601
98291	ITT CANNON RF PRODUCTS	585 EAST MAIN STREET	NEW BRITAIN, CT 06051
TK0196	ALMAC/ARROW ELECTRONICS	9500 SW NIMBUS AVE BUILDING E	BEAVERTON, OR 97005
TK0891	MICONICS	1 FAIRCHILD AVE	PLAINVIEW, NY 11803
TK1155	QUALITY PLASTIC INJECTION MOLD	3910 INDUSTRIAL AVE	COEUR D'ALENE, ID 83814
TK2058	TDK CORPORATION OF AMERICA	1600 FEEHANVILLE DRIVE	MOUNT PROSPECT, IL 60056
TK2073	TOKYO COSMOS AMERICA INC	1177 E TOWER ROAD	SCHAUMBURG, IL 60173

Replaceable Electrical Parts List

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A1	671–2890–11		B041233	CIRCUIT BD ASSY:POWER SUPPLY	80009	671289011
A1	671–2890–12	B041234		CIRCUIT BD ASSY:POWER SUPPLY	80009	671289012
A2	671–1362–01			CIRCUIT BD ASSY:FRONT PANEL	80009	671–1362–01
A3	672–1333–10	B030669	B040787	CIRCUIT BD ASSY:MAIN (1710J)	80009	672–1333–10
A3	672–1333–11	B040788	B040906	CIRCUIT BD ASSY:MAIN BD,1710J	80009	672–1333–11
A3	672–1333–12	B040907	B041145	CIRCUIT BD ASSY:MAIN BD,1710J	80009	672–1333–12
A3	672–1333–13	B041146	B041684	CIRCUIT BD ASSY:MAIN BD,1710J	80009	672–1333–13
A3	672–1333–14	B041685		CIRCUIT BD ASSY:MAIN BD,1710J	80009	672–1333–14
A3	672–1465–00	B040153	B040180	CIRCUIT BD ASSY:MAIN,1711J	80009	672–1465–00
A3	672–1465–01	B040181	B040229	CIRCUIT BD ASSY:MAIN,1711J	80009	672–1465–01
A3	672–1465–02	B040230	B040332	CIRCUIT BD ASSY:MAIN,1711J	80009	672–1465–02
A3	672–1465–03	B040333	B040539	CIRCUIT BD ASSY:MAIN,1711J	80009	672–1465–03
A3	672–1465–04	B040540		CIRCUIT BD ASSY:MAIN,1711J	80009	672–1465–04
A3A1	671–1796–01			CIRCUIT BD ASSY:GRATICULE LIGHT	80009	671–1796–01
A10	671–3637–00			CIRCUIT BD ASSY:CRT SOCKET BD	80009	671363700
A1	671–2890–11			CIRCUIT BD ASSY:POWER SUPPLY	80009	671289011
A1C1	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C2	283–0021–00			CAP,FXD,CER DI:0.001UF,20%,5000V	TK2058	TCK45YS3H102M–A
A1C3	283–0261–00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C4	283–0261–00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C5	285–1341–01			CAP,FXD,PLSTC:MTLZD FILM;0.1UF,20%,100V,POLYESTER	TK1913	MKS 2 0.1UF 20%
A1C6	281–0771–00			CAP,FXD,CER DI:2200PF,20%,200V	04222	SA102C222MAA
A1C7	285–1470–00			CAP,FXD,PLSTC:MTLZD FILM;330PF,1600VDC/500VAC	TK1913	FKP1 330/1600/5
A1C8	283–0261–00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C9	283–0261–00			CAP,FXD,CER DI:0.01UF,20%,4000V	18796	DHR28Z5U103M4KV
A1C10	281–0563–00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C11	283–0021–00			CAP,FXD,CER DI:0.001UF,20%,5000V	TK2058	TCK45YS3H102M–A
A1C12	281–0707–00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C13	281–0707–00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C14	281–0707–00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C15	285–1341–01			CAP,FXD,PLSTC:MTLZD FILM;0.1UF,20%,100V,POLYESTER	TK1913	MKS 2 0.1UF 20%
A1C16	290–1311–00			CAP,FXD,ALUM:10UF,20%,50V,ESR=1.4 OHM	55680	UPL1H100MDH1TD
A1C17	285–1341–01			CAP,FXD,PLSTC:MTLZD FILM;0.1UF,20%,100V,POLYESTER	TK1913	MKS 2 0.1UF 20%

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A1C18	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C19	290–1310–00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM	0H1N5	CEJSM2C100M
A1C20	281–0707–00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C21	281–0707–00			CAP,FXD,CER DI:15000PF,10%,200V	04222	MA302C153KAA
A1C22	281–0563–00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C23	285–1328–00			CAP,FXD,PLSTC:MTLZD FILM;0.01UF,5%,2000V	TK1913	FKP1 .01/2000/5
A1C24	290–1310–00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM(120HZ,20C)	0H1N5	CEJSM2C100M
A1C25	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C27	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C28	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C29	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C30	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C31	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C32	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C33	290–1310–00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM	0H1N5	CEJSM2C100M
A1C34	290–1310–00			CAP,FXD,ALUM:10UF,20%,160V,ESR=24.9 OHM	0H1N5	CEJSM2C100M
A1C35	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C36	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C37	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C38	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C39	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C40	281–0772–00			CAP,FXD,CERAMIC:MLC;4700PF,10%,100V	04222	SA101C472KAA
A1C41	281–0563–00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C42	290–1267–00			CAP,FXD,ALUM:560UF,20%,50V,ESR=0.40 OHM (100KHZ,20C)	0H1N5	CEEFM1H561M7
A1C43	281–0563–00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C44	285–1331–00			CAP,FXD,MTLZD:0.47UF,5%,400V	TK1913	MKS4 .47/400/5
A1C45	281–0563–00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C46	283–0005–03			CAP,FXD,CER DI:0.01 UF,+80–20%,250V	04222	SR30VE103ZAATR2
A1C47	281–0563–00		671–2890–11	CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C47	283–0059–00	671–2890–12		CAP,FXD,CER DI:1UF,+80–20%,50V SQUARE	04222	SR305C105MAA
A1C48	281–0809–00			CAP,FXD,CERAMIC:MLC;200 PF,5%,100V,0.100 X 0.170	04222	SA101A201JAA
A1C49	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C50	281–0563–00			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V,0.150 X 0.290	04222	SA305E474MAA
A1C51	281–0773–00			CAP,FXD,CERAMIC:MLC;0.01UF,10%,100V	TK1743	CGB103KEX
A1C52	281–0773–00			CAP,FXD,CERAMIC:MLC;0.01UF,10%,100V	TK1743	CGB103KEX
A1C53	285–1437–00			CAP,FXD,PLSTC:100PF,5%,1600VDC/500VACSAF CONT	TK1913	FKP1/100/1600/5
A1C54	290–1275–00			CAP,FXD,ALUM:330UF,20%,400V,35X35MM,105C	55680	LGQ2G331MHSC
A1C56	285–1246–00			CAP,FXD,PPR DI:0.022UF,20%,250VAC	TK0515	PME 289 MB 5220

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A1C57	285–1222–00			CAP,FXD,PLSTC:0.068UF,20%,250V	TK0515	PME 271 M 568
A1C58	281–0809–00			CAP,FXD,CERAMIC:MLC;200 PF,5%,100V,0.100 X 0.170	04222	SA101A201JAA
A1C59	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C60	281–0775–01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V,Z5U,0.170	04222	SA105E104MAA
A1C61	281–0768–00			CAP,FXD,CER DI:470PF,20%,100V	04222	SA101A471KAA
A1C65	285–1301–01			CAP,FXD,MTLZD:0.47UF,10%,50V	TK1913	MKS 2 .47/50 OR
A1C66	290–1311–00			CAP,FXD,ALUM:10UF,20%,50V,ESR=1.4 OHM	55680	UPL1H100MDH1TD
A1CR1	152–0061–00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR2	152–0061–00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR3	152–0061–00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR4	152–0409–00			DIODE,RECT:FAST RCVRY;12KV,10MA,250NS	83701	CRVT150
A1CR5	152–0061–00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR6	152–0061–00			DIODE,SIG:200V,0.1A,700NS,4.0PF	12969	PV122
A1CR7	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR8	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR9	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR10	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR11	152–0814–00		671–2890–11	DIODE,RECT:ULTRA FAST;150V,3A,1.1VF,30NS,SOFT RCVY	0LUA3	BYV28–150
A1CR11	152–0808–00	671–2890–12		DIODE,RECT:ULTRA FAST,400V,1.5A,50NS,BYD73G,AXIAL LEAD,TR	04713	PR 1273
A1CR12	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR13	152–1191–00			DIODE,RECT:SCHTKY;100V,10A,150A IFSM,800MVF AT 10A	04713	MBR10100
A1CR14	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR15	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR16	152–0141–02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR17	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR19	152–0141–02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR20	152–0897–00			DIODE,RECT:FAST RCVRY;1000V,1.5A,300NS,SOFT RCVRY	0LUA3	BYV96E
A1CR21	152–1165–00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR22	152–1165–00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR23	152–1165–00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR24	152–1165–00			DIODE,RECT:ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A1CR25	152–0141–02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR26	152–0141–02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR27	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR29	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936
A1CR30	152–0141–02			DIODE,SIG:ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1CR31	152–0400–00			DIODE,RECT:FAST RCVRY;400V,1A,200NS	0LUA3	1N4936

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A1DS1	150–0050–00			LAMP,GLOW:135V MAX,1.9MA,C2A–T,WIRE LEAD	0J9R2	NE–2Q–11R–T
A1DS2	150–0050–00			LAMP,GLOW:135V MAX,1.9MA,C2A–T,WIRE LEAD	0J9R2	NE–2Q–11R–T
A1DS3	150–0050–00			LAMP,GLOW:135V MAX,1.9MA,C2A–T,WIRE LEAD	0J9R2	NE–2Q–11R–T
A1DS4	150–0050–00			LAMP,GLOW:135V MAX,1.9MA,C2A–T,WIRE LEAD	0J9R2	NE–2Q–11R–T
A1F1	159–0021–00			FUSE,CARTRIDGE:3AG,2A,250V,FAST BLOW	71400	AGC–2
				MOUNTING PARTS		
	200–2264–00			CAP,FUSEHOLDER:3AG FUSES,	61935	FEK 031 1666
	204–0906–00			BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES	61935	TYPE FAU 031.35
				END MOUNTING PARTS		
A1J1	131–5338–00			CONN,HDR:PCB/WIREWRAP;MALE,STR,1 X 7,0.15CTR	22526	65561–107
A1J2	131–4794–00			CONN,HDR:PCB;MALE,STR,1 X 2,0.1 CTR	53387	2402–6112 UB
A1J3	131–5337–00			CONN,HDR:PCB/WIREWRAP;MALE,STR,1 X 4,0.150	22526	65561–104
A1J4	131–3392–00			CONN,HDR:PCB;MALE,STR,1 X 10,0.1 CTR,0.230	00779	1–102844–1
A1J6	119–1946–00			FILTER,RFI:1A,250V,400HZ W/PC TERMINAL	0GV52	FX326–1/02–K–D–
A1L1	108–1412–00			INDUCTOR,FXD:POWER;4.7UH,20%,I<3.7A,RDC<0.017 OHM	TK2058	TSL0807–4R7M3R0
A1L2	108–1412–00			INDUCTOR,FXD:POWER;4.7UH,20%,I<3.7A,RDC<0.017 OHM	TK2058	TSL0807–4R7M3R0
A1L3	108–1412–00			INDUCTOR,FXD:POWER;4.7UH,20%,I<3.7A,RDC<0.017 OHM	TK2058	TSL0807–4R7M3R0
A1L4	108–0205–00			INDUCTOR,FXD:POWER;1MH,5%,IDC<400 MA,RDC<2.12 OHM	76493	8209
A1Q1	151–0749–00			TRANSISTOR,SIG:BIPOLAR,PNP;400V,500MA,50MHZ,AMPL	04713	MPSA94
A1Q2	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A1Q3	151–0350–03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA,100MH,AMPL	04713	2N5401RLRP
A1Q4	151–0347–02			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA,100MH,AMPL	04713	2N5551RLRP
A1Q5	151–0350–03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA,100MH,AMPL	04713	2N5401RLRP
A1Q6	151–0476–00			TRANSISTOR,PWR:BIPOLAR,NPN;100V,3.0A,3.0MHZ,AMPL	04713	TIP31C
				ATTACHED PARTS		
	214–3848–00			HEAT SINK,SEMIC:TRANSISTOR,TO–220;ALUMINUM,CLIP–ON	13103	6043PB
				END ATTACHED PARTS		
A1Q7	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A1Q8	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA,300MHZ,AMPL	0JR04	2N3904
A1Q9	151–1286–00			TRANSISTOR,PWR:MOS,N–CH;800V,4.0A,3.0 OHM	0LUA3	BUK456–800A
				ATTACHED PARTS		
	210–0406–00			NUT,PLAIN,HEX:4–40 X 0.188,BRS CD PL	73743	12161–50
	211–0008–00			SCREW,MACHINE:4–40 X 0.25,PNH,STL	TK0435	ORDER BY DESC
	214–3841–00			HEAT SINK,SEMIC:XSTR,TO–220;VERTICALMOUNT	13103	6021PB
				END ATTACHED PARTS		
A1Q10	151–0350–03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA,100MH,AMPL	04713	2N5401RLRP
A1Q11	151–0528–00			THYRISTOR,PWR:BIPOLAR,SCR;50V,16A RMS,PHASE	04713	2N6400
A1R1	303–0155–00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A1R2	301–0225–02			RES,FXD,CMPSN:2.2M OHM,5%,0.5W	50139	EB2255
A1R3	303–0155–00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555
A1R4	303–0155–00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555
A1R5	303–0155–00			RES,FXD,CMPSN:1.5M OHM,5%,1W	50139	GB1555
A1R7	322–3385–00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R8	322–3097–00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R11	311–1256–00			RES,VAR,TRMR:CERMET;2.5M OHM,10%,0.5W,0.375	32997	3386F–1–255
A1R12	315–0471–03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R13	322–3097–00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R14	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R20	322–3248–00			RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0	91637	CCF50G37400F
A1R22	322–3329–00			RES,FXD,FILM:26.1K OHM.1%,0.2W,TC=T0MI,SM BODY	91637	CCF501G26101F
A1R24	322–3097–00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R25	322–3097–00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R26	322–3452–00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50–2–G4993FT
A1R27	322–3300–02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A1R28	322–3344–00			RES,FXD,FILM:37.4K OHM,1%,0.2W,TC=T0MI,SM BODY	91637	CCF501G37401F
A1R29	315–0470–03			RES,FXD,CMPSN:47 OHM,5%,0.25W	50139	CB4705
A1R30	315–0103–03			RES,FXD,CMPSN:10K OHM,5%,0.25W	50139	CB1035
A1R31	322–3385–00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R32	322–3452–00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50–2–G4993FT
A1R33	322–3300–02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A1R34	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R35	322–3162–00			RES,FXD:METAL FILM;475 OHM,1%,0.2W,TC=100 PPM	91637	CCF50G475R0F
A1R36	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R37	322–3034–00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50–2–G22R10F
A1R38	315–0226–01			RES,FXD,CMPSN:22 M OHM,5%,0.25,WALLEN BRADLEY	50139	CB2265
A1R39	315–0471–03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R40	315–0103–03			RES,FXD,CMPSN:10K OHM,5%,0.25W	50139	CB1035
A1R41	322–3121–00			RES,FXD:METAL FILM;178 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G178R0F
A1R42	322–3402–00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A1R43	315–0471–03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R44	315–0471–03			RES,FXD,CMPSN:470 OHM,5%,0.25W	50139	CB4715
A1R45	311–2239–00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197	TK2073	GF06UT2 104 M L
A1R46	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R47	322–3385–00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R48	322–3239–00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SM BODY	91637	CCF501G30100F

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A1R49	311–2236–00			RES,VAR,TRMR:CERMET,20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L20
A1R50	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R51	322–3260–00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	91637	CCF501G49900F
A1R52	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R53	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R54	322–3260–00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	91637	CCF501G49900F
A1R55	322–3322–00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W,TC=100	91637	CCF501G22101F
A1R56	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R57	322–3034–00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50–2–G22R10F
A1R58	311–2239–00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197	TK2073	GF06UT2 104 M L
A1R59	322–3485–07			RES,FXD,FILM:5K OHM,0.1%,0.2W,TC=T9,SMALL BODY	91637	CCF501C50000B
A1R60	322–3268–00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0MI,SM BODY	91637	CCF501G60400F
A1R61	322–3034–00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50–2–G22R10F
A1R62	322–3097–00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R63	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R64	322–3385–00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R65	322–3385–00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F
A1R66	322–3452–00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50–2–G4993FT
A1R67	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R68	322–3121–00			RES,FXD:METAL FILM;178 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G178R0F
A1R69	322–3289–07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R,SM BODY	91637	CCF501C10001B
A1R70	322–3289–07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R,SM BODY	91637	CCF501C10001B
A1R71	322–3418–00			RES,FXD:METAL FILM;221K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G22102F
A1R72	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R73	322–3001–00			RES,FXD:METAL FILM;10 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10R00F
A1R74	322–3260–00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	91637	CCF501G49900F
A1R75	322–3260–00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	91637	CCF501G49900F
A1R76	322–3248–00			RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0	91637	CCF50G37400F
A1R77	322–3097–00			RES,FXD:METAL FILM;100 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G100R0F
A1R78	322–3248–00			RES,FXD,FILM:3.74K OHM,1%,0.2W,TC=T0	91637	CCF50G37400F
A1R79	322–3356–00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0MI,SM BODY	91637	CCF501G49901F
A1R80	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R81	322–3121–00			RES,FXD:METAL FILM;178 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G178R0F
A1R82	322–3260–00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	91637	CCF501G49900F
A1R83	322–3289–07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R,SM BODY	91637	CCF501C10001B
A1R84	322–3315–00			RES,FXD,FILM:18.7K OHM,1%,0.2W,TC=T0MI,SM BODY	91637	CCF501G18701F
A1R85	322–3385–00			RES,FXD:METAL FILM;100K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G10002F

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A1R86	308–0793–00			RES,FXD:0.51 OHM,5%,1WTC=150PPM/DEG C,MI	75042	BW20 .51OHM 5PE
A1R87	322–3034–00			RES,FXD:METAL FILM;22.1 OHM,1%,0.2W,TC=100 PPM	91637	CCF50–2–G22R10F
A1R88	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R89	307–0746–00			RES,THERMAL:5 OHM,10%,7A/DEG C	15454	SG200–S STRAI
A1R90	305–0242–00			RES,FXD,CMPSN:2.4K OHM,5%,2W	11502	GF–3 OR GS–3 24
A1R91	306–0104–00			RES,FXD,CMPSN:100K OHM,10%,2W	24546	FP42 OR FP2 100
A1R92	306–0104–00			RES,FXD,CMPSN:100K OHM,10%,2W	24546	FP42 OR FP2 100
A1R93	322–3402–00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A1R94	322–3402–00			RES,FXD:METAL FILM;150K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G15002F
A1R95	322–3256–00			RES,FXD,FILM:4.53K OHM,1%,0.2W,TC=T0MI,SM BODY	91637	CCF50–2–G4531FT
A1R96	322–3356–00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0MI,SM BODY	91637	CCF501G49901F
A1R97	322–3222–00			RES,FXD:METAL FILM;2K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20000F
A1R98	322–3289–07			RES,FXD,FILM:10K OHM,0.1%,0.2W,TC=T9,T&R,SM BODY	91637	CCF501C10001B
A1R99	311–2239–00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W,0.197	TK2073	GF06UT2 104 M L
A1R101	322–3068–00			RES,FXD:METAL FILM;49.9 OHM,1%,0.2W,TC=100 PPM	91637	CCF501G49R90F
A1R102	308–0290–00			RES,FXD,WW:8 OHM,5%,5W	91637	CW52–8R000J T/R
A1R103	322–3452–00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL	91637	CCF50–2–G4993FT
A1T1	120–1695–00			TRANSFORMER,PWR:HIGH VOLTAGE,FEEDBACK 3V	75498	120–1695–00
A1T2	120–1945–00			TRANSFORMER,RF:PRI 8UH,2:7,ON–OFF,VERT MT,PC MT	0JR03	120–1945–00
A1T3	120–1944–00			TRANSFORMER,RF:PRI 88V,PRI 15V,SEC 40V AT0.385A	75498	129–2074–EC
A1TP1	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIAPCB	26364	104–01–02
A1TP2	214–4085–00			TERM,TEST POINT:0.070 ID,0.220 H,0.063 DIAPCB	26364	104–01–02
A1U1	152–0900–00			MODULE,HV:7.5KVAC IN,15KVDC OUT,POTTED MODULE	51406	MSL2556
A1U2	156–0067–00			IC,LINEAR:BIPOLAR,OP–AMP	01295	UA741CP
A1U3	156–1225–00			IC,LINEAR:BIPOLAR,COMPTR;DUAL,OPEN COLL,300NS	01295	LM393P
A1U4	156–2761–01			IC,DIGITAL:HCMOS,MULTIVIBRATOR	0JR04	TC74HC221AP
A1U5	156–2524–00			IC,LINEAR:BIPOLAR,SW–REGULATOR CONTROLLER;PWM	48726	UC3842N
A1VR1	156–1631–01			IC,LINEAR:BIPOLAR,VR;ADJUSTABLE,SHUNT,100MA,2.2%	01295	TL431CLPM
A1VR2	152–0195–00			DIODE,ZENER:5.1V,5%,0.4W	14552	CD332125
A1VR3	152–0195–00			DIODE,ZENER:5.1V,5%,0.4W	14552	CD332125
A1VR4	152–0149–00			DIODE,ZENER:10V,5%,0.4W	04713	1N961BRL
A1VR5	152–0287–00			DIODE,ZENER:110V,5%,0.4W	04713	1N986BRL
A1VR6	152–0287–00			DIODE,ZENER:110V,5%,0.4W	04713	1N986BRL
A1W1	131–0566–00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207
A1W2	131–0566–00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207
A1W3	131–0566–00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207
A1W4	131–0566–00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A2	671–1362–01			CIRCUIT BD ASSY:FRONT PANEL	80009	671–1362–01
A2DS117	150–1290–00			DIODE,OPTO:LED,ASSEMBLY,GRN,A THREE PLACE HOLDER	TK1155	150–1290–00
A2DS118	————————			(PART OF DS117)		
A2DS119	————————			(PART OF DS117)		
A2DS136	150–1290–00			DIODE,OPTO:LED,ASSEMBLY,GRN,A THREE PLACE HOLDER	TK1155	150–1290–00
A2DS137	————————			(PART OF DS136)		
A2DS138	————————			(PART OF DS136)		
A2DS144	150–1286–00			DIODE,OPTO:LED,ASSEMBLY,GRN,A TWO PLACE HOLDER	TK1155	150–1286–00
A2DS145	————————			(PART OF DS144)		
A2DS228	150–1282–00			DIODE,OPTO:LED,ASSEMBLY,GRN,A SINGLEPLACE HOLDER	TK1155	150–1282–00
A2DS314	150–1290–00			DIODE,OPTO:LED,ASSEMBLY,GRN,A THREE PLACE HOLDER	TK1155	150–1290–00
A2DS315	————————			(PART OF DS314)		
A2DS316	————————			(PART OF DS314)		
A2DS327	150–1290–00			DIODE,OPTO:LED,ASSEMBLY,GRN,A THREE PLACE HOLDER	TK1155	150–1290–00
A2DS328	————————			(PART OF DS327)		
A2DS329	————————			(PART OF DS327)		
A2P107	175–9773–01			CA ASSY,SP:RIBBON,IDC,34,28AWG,4.64L,2X17,O.1,RCPT	TK0196	ORDER BY DESCR
A2R245	311–2321–00			RES,VAR,WW:CLAROSTAT,3 TURN POT	12697	CM45221
				MOUNTING PARTS		
	210–0583–00			NUT,PLAIN,HEX:0.25–32 X 0.312,BRS CD PL	73743	2X–20319–402
	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	12697	CM45221
				MOUNTING PARTS		
	210–0583–00			NUT,PLAIN,HEX:0.25–32 X 0.312,BRS CD PL	73743	2X–20319–402
	210–1435–00			WASHER,FLAT:0.254 X 0.311 X 0.016,SST	86928	5710–56–15P
				END MOUNTING PARTS		
A2R412	311–2540–00			RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUND LUG	12697	311–2540–00
				ATTACHED PARTS		
	214–4725–00	B040153		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/–,0.0A0		
				END ATTACHED PARTS		
A2R429	311–2540–00			RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUND LUG	12697	311–2540–00
				ATTACHED PARTS		
	214–4725–00	B040153		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/–,0.0A0		
				END ATTACHED PARTS		
A2R443	311–2540–00			RES,VAR,PNL:CP,20K OHM,20%,0.5W,LINEAR,W/ GROUND LUG	12697	311–2540–00

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
				ATTACHED PARTS		
	214–4725–00	B040153		SPRING:COMPRESSION SPRING,0.026,302 STAINLESS STEEL,0.313,+/–,0.0A0		
				END ATTACHED PARTS		
A2S112	260–2300–00			SWITCH,SIG:SPST,PUSH,MOM,NO,W/GROUND TERM	34361	B3F1152
A2S130	260–2300–00			SWITCH,SIG:SPST,PUSH,MOM,NO,W/GROUND TERM	34361	B3F1152
A2S145	260–2300–00			SWITCH,SIG:SPST,PUSH,MOM,NO,W/GROUND TERM	34361	B3F1152
A2S222	260–2300–00			SWITCH,SIG:SPST,PUSH,MOM,NO,W/GROUND TERM	34361	B3F1152
A2S309	260–2300–00			SWITCH,SIG:SPST,PUSH,MOM,NO,W/GROUND TERM	34361	B3F1152
A2S322	260–2300–00			SWITCH,SIG:SPST,PUSH,MOM,NO,W/GROUND TERM	34361	B3F1152
A3	672–1333–10			CIRCUIT BD ASSY:MAIN	80009	672–1333–10
				ATTACHED PARTS		
	174–0334–00			CABLE ASSY,RF:50 OHM COAX,5.25 L,9–N	80009	174–0334–00
	337–0607–00			PLATE,ELEC SHLD:CIRCUIT BOARD 661	0J260	337–0607–00
				END ATTACHED PARTS		
A3C87	281–0776–00			CAP,FXD,CERAMIC:MLC,120PF,5%,100V ,0.100 X0.170,AXIAL,MI	04222	SA102A121JAA
A3C88	281–0823–00			CAP,FXD,CER DI:470PF,10%,50V TUBULAR,MI	04222	SA101A471KAA
A3C89	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C90	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C91	281–0537–00			CAP,FXD,CERAMIC:MLC,0.68PF,20%,500V,0.170 X 0.187,AXIAL	04222	TBA
A3C96	281–0788–00			CAP,FXD,CERAMIC:MLC,470PF,10%,100V,0.100 X 0.170,AXIAL	04222	SA102C471KAA
A3C97	281–0799–00			CAP,FXD,CER DI:62PF,2%,100V TUBULAR,MI	04222	SA102A620GAA
A3C98	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C99	290–0943–00			CAP,FXD,ALUM:47UF,+50–20%,25V,6 X 11MM,RADIAL	62643	CEUSM1E470–Q
A3C001	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C002	281–0814–00			CAP,FXD,CERAMIC:MLC,100 PF,10%,100V,0.100 X 0.170,AXIAL	04222	SA102A101KAA
A3C003	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C004	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C005	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C020	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C021	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C129	290–0839–00			CAP,FXD,ELCTLT:330UF,+50–20%,35V ALUMINUM	62643	CEUST1V331
A3C135	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C146	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C156	290–0973–01			CAP,FXD,ALUM:100UF,20%,25VDC,8X11.5MM,0.2 LS,RADIAL	62643	SME35VB101M8X11 FT
A3C165	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3C167	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C168	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C169	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C185	283–0167–02			CAP,FXD,CER DI:0.1UF,10%,100V,T&R,0.2 SPACING	04222	SR591C104KAAAP1
A3C195	281–0302–00			CAP,VAR,PLASTIC:1.2–4PF,100V	52769	GXL4R000
A3C196	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA
A3C197	290–0848–00			CAP,FXD,ALUM:47UF,20%,16V,ESR=7.05 OHM(120HZ,25C)	62643	CEBPM1E470M
A3C198	281–0756–00			CAP,FXD,CERAMIC:MLC,2.2PF,+/–0.5PF,200V,NPO,0.100 X 0.170	04222	SA102A2R2DAA
A3C199	281–0903–00			CAP,FXD,CER DI:3.9PF,100V TUBULAR,MI	04222	SA102A3R9DAA
A3C248	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C249	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C254	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C263	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C264	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C267	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C272	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C294	281–0819–00			CAP,FXD,CERAMIC:MLC,33 PF,5%,50V,0.100 X 0.170,AXIAL,MI	04222	SA102A330JAA
A3C297	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C298	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C324	290–0748–00			CAP,FXD,ELCTLT:10UF,+50–20%,25WVDC AL	62643	CEUST1E100
A3C331	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA
A3C332	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C363	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C367	281–0810–00			CAP,FXD,CERAMIC:MLC,5.6PF,+/–0.5PF,100V,0.100 X 0.170	04222	SA102A5R6DAA
A3C368	281–0302–00			CAP,VAR,PLASTIC:1.2–4PF,100V	52769	GXL4R000
A3C372	281–0158–00			CAP,VAR,CER DI:7–45PF,100WVDC	59660	518–006 G 7–45
A3C374	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C375	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C376	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C377	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C384	283–0625–01			CAP,FXD,MICA DI:220PF,1%,500V TAPE & AMMO PACK	09023	CDA10FD221F03
A3C385	281–0814–00			CAP,FXD,CERAMIC:MLC,100 PF,10%,100V,0.100 X 0.170,AXIAL	04222	SA102A101KAA
A3C387	283–0625–01			CAP,FXD,MICA DI:220PF,1%,500V TAPE & AMMO PACK	09023	CDA10FD221F03
A3C388	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C389	283–0639–01			CAP,FXD,MICA DI:56PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED560F03
A3C394	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA
A3C395	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C396	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3C398	281–0815–00			CAP,FXD,CERAMIC:MLC,0.027UF,20%,50V,0.100 X 0.260,AXIAL	04222	SA205C273MAA
A3C409	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C428	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C431	281–0763–00			CAP,FXD,CERAMIC:MLC,47PF,10%,100V,0.100 X 0.170,AXIAL,MI	04222	SA102A470KAA
A3C448	285–1133–00			CAP,FXD,PLASTIC:0.33MF,1%,100V MTLZD MYPRO	50558	MH12D334F
A3C453	283–0655–00			CAP,FXD,MICA DI:3300PF,1%,500V	09023	CD19FD332F03
A3C468	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C473	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA
A3C476	283–0642–00			CAP,FXD,MICA DI:33PF,2%,500V,0.370 X 0.340,RADIAL	09023	CD10ED330G03
A3C481	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C484	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C487	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C488	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C493	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C495	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C496	281–0815–00			CAP,FXD,CERAMIC:MLC,0.027UF,20%,50V,0.100 X 0.260,AXIAL	04222	SA205C273MAA
A3C497	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA
A3C498	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C522	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C547	281–0767–00			CAP,FXD,CERAMIC:MLC,330PF,20%,100V,0.100 X0.170,AXIAL,MI	04222	SA102C331MAA
A3C548	281–0763–00			CAP,FXD,CERAMIC:MLC,47PF,10%,100V,0.100 X 0.170,AXIAL,MI	04222	SA102A470KAA
A3C549	281–0814–00			CAP,FXD,CERAMIC:MLC,100 PF,10%,100V,0.100 X 0.170,AXIAL	04222	SA102A101KAA
A3C555	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C557	281–0811–00			CAP,FXD,CERAMIC:MLC,10PF,10%,200V,0.100 X 0.170,AXIAL,MI	04222	SA102A100KAA
A3C561	290–0943–00			CAP,FXD,ALUM:47UF,+50–20%,25V,6 X 11MM,RADIAL	62643	CEUSM1E470–Q
A3C567	290–0943–00			CAP,FXD,ALUM:47UF,+50–20%,25V,6 X 11MM,RADIAL	62643	CEUSM1E470–Q
A3C569	281–0816–00			CAP,FXD,CERAMIC:MLC,82 PF,5%,100V,0.100 X 0.170,AXIAL,MI	04222	SA102A820JAA
A3C570	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C571	290–0943–00			CAP,FXD,ALUM:47UF,+50–20%,25V,6 X 11MM,RADIAL	62643	CEUSM1E470–Q
A3C574	290–0943–00			CAP,FXD,ALUM:47UF,+50–20%,25V,6 X 11MM,RADIAL	62643	CEUSM1E470–Q
A3C579	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C595	281–0819–00			CAP,FXD,CERAMIC:MLC,33 PF,5%,50V,0.100 X 0.170,AXIAL,MI	04222	SA102A330JAA
A3C596	281–0756–00			CAP,FXD,CERAMIC:MLC,2.2PF,+/–0.5PF,200V,NPO,0.100 X 0.170	04222	SA102A2R2DAA
A3C597	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA
A3C606	281–0819–00			CAP,FXD,CERAMIC:MLC,33 PF,5%,50V,0.100 X 0.170,AXIAL,MI	04222	SA102A330JAA
A3C607	281–0819–00			CAP,FXD,CERAMIC:MLC,33 PF,5%,50V,0.100 X 0.170,AXIAL,MI	04222	SA102A330JAA
A3C629	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C641	283–0634–01			CAP,FXD,MICA DI:65PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED650F03

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3C658	290–0943–00			CAP,FXD,ALUM:47UF,+50–20%,25V,6 X 11MM,RADIAL	62643	CEUSM1E470–Q
A3C663	281–0903–00			CAP,FXD,CER DI:3.9PF,100V TUBULAR,MI	04222	SA102A3R9DAA
A3C676	281–0770–00			CAP,FXD,CER DI:1000PF,20%,100V TUBULAR,MI	04222	SA101C102MAA
A3C681	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C683	281–0158–00			CAP,VAR,CER DI:7–45PF,100WVDC	59660	518–006 G 7–45
A3C696	281–0302–00			CAP,VAR,PLASTIC:1.2–4PF,100V	52769	GXL4R000
A3C697	290–0848–00			CAP,FXD,ALUM:47UF,20%,16V,ESR=7.05 OHM(120HZ,25C)	62643	CEBPM1E470M
A3C699	281–0903–00		672–1333–11	CAP,FXD,CER DI:3.9PF,100V TUBULAR,MI	04222	SA102A3R9DAA
A3C699	281–0810–00	672–1333–12		CAP,FXD,CERAMIC:MLC,5.6PF,+/–0.5PF,100V,0.100 X 0.170,AXIAL,MI	04222	SA102A5R6DAA
A3C699	281–0903–00		672–1465–01	CAP,FXD,CER DI:3.9PF,100V TUBULAR,MI	04222	SA102A3R9DAA
A3C699	281–0810–00	672–1465–02		CAP,FXD,CERAMIC:MLC,5.6PF,+/–0.5PF,100V,0.100 X 0.170,AXIAL,MI	04222	SA102A5R6DAA
A3C740	281–0773–00			CAP,FXD,CERAMIC:MLC,0.01UF,10%,100V,SAFETY,0.100 X 0.170	04222	SA101C103KAA
A3C752	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C775	281–0158–00			CAP,VAR,CER DI:7–45PF,100WVDC	59660	518–006 G 7–45
A3C776	281–0786–00			CAP,FXD,CERAMIC:MLC,150PF,10%,100V,0.100 X 0.170,AXIAL	04222	SA101A151KAA
A3C777	281–0158–00			CAP,VAR,CER DI:7–45PF,100WVDC	59660	518–006 G 7–45
A3C778	281–0158–00			CAP,VAR,CER DI:7–45PF,100WVDC	59660	518–006 G 7–45
A3C779	283–0629–00			CAP,FXD,MICA DI:62PF,1%,500V	09023	CD10ED620F03
A3C780	283–0677–00			CAP,FXD,MICA DI:82PF,1%,500V	09023	CD15ED820F03
A3C781	283–0629–00			CAP,FXD,MICA DI:62PF,1%,500V	09023	CD10ED620F03
A3C782	283–0639–01			CAP,FXD,MICA DI:56PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED560F03
A3C783	281–0123–00			CAP,VAR,CER DI:5–25PF,100V SUBMIN CERDISC,TOP ADJ	33095	53–709–001 A5–25
A3C784	281–0123–00			CAP,VAR,CER DI:5–25PF,100V SUBMIN CERDISC,TOP ADJ	33095	53–709–001 A5–25
A3C843	283–0667–01			CAP,FXD,MICA DI:420PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD421F03
A3C844	283–0111–04		672–1333–13	CAP,FXD,CER DI:0.1UF,20%,50V SQUARE,TAPE&AMMO PACK	04222	SR595C104MAAAP 1
A3C844	283–0111–04		672–1465–03	CAP,FXD,CER DI:0.1UF,20%,50V SQUARE,TAPE&AMMO PACK	04222	SR595C104MAAAP 1
A3C848	283–0634–01			CAP,FXD,MICA DI:65PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED650F03
A3C853	281–0773–00			CAP,FXD,CERAMIC:MLC,0.01UF,10%,100V,SAFETY,0.100 X 0.170	04222	SA101C103KAA
A3C854	281–0810–00			CAP,FXD,CERAMIC:MLC,5.6PF,+/–0.5PF,100V,0.100 X 0.170	04222	SA102A5R6DAA
A3C859	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C861	281–0811–00			CAP,FXD,CERAMIC:MLC,10PF,10%,200V,0.100 X 0.170,AXIAL,MI	04222	SA102A100KAA
A3C865	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C872	290–0782–02			CAP,FXD,ELCTLT:4.7UF,+75–10%,35VDC ALTAPE & REEL	55680	UVX1V4R7MAA1TD
A3C887	281–0815–00			CAP,FXD,CERAMIC:MLC,0.027UF,20%,50V,0.100 X 0.260,AXIAL	04222	SA205C273MAA
A3C889	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3C893	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C898	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C900	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C944	283–0772–01			CAP,FXD,MICA DI:497PF,1%,500V,TAPE & AMMO PACK	09023	CDA15FD(497)F03
A3C945	290–0974–03			CAP,FXD,ELCTLT:10UF,20%,60VDC AL TAPE & REEL	55680	UVX1H100MAA1TD
A3C950	283–0634–01			CAP,FXD,MICA DI:65PF,1%,500V,TAPE & AMMO PACK	09023	CDA15ED650F03
A3C952	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C953	281–0302–00			CAP,VAR,PLASTIC:1.2–4PF,100V	52769	GXL4R000
A3C964	281–0775–01			CAP,FXD,CER:MCL,0.1UF,20%,50V,Z5U,0.170 X 0.100,AXIAL	04222	SA105E104MAA
A3C989	281–0762–00			CAP,FXD,CERAMIC:MLC,27PF,10%,100V,NPO,0.100 X 0.170	04222	SA102A270KAA
A3C997	290–0778–00			CAP,FXD,ALUM:1UF,20%,50V,5 X 11 MM,NONPOLAR,RADIAL	62643	CEBPM1H010M(Q)
A3C998	290–0183–00			CAP,FXD,TANT:DRY,1UF,10%,35V,TANT OXIDE,0.151 X 0.317	12954	AT513A105K035N
A3CR001	152–0322–00			DIODE,SIG:SCHTKY,15V,410MVF AT 1MA,1.2PF,5082–2811,T&R	21847	A2X600
A3CR002	152–0322–00			DIODE,SIG:SCHTKY,15V,410MVF AT 1MA,1.2PF,5082–2811,T&R	21847	A2X600
A3CR003	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR004	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR005	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR246	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR254	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR255	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR256	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR257	152–0400–00			DIODE,RECT:FAST RCVRY,400V,1A,200NS,1N4936,DO–41,T&R	04713	1N4936RL
A3CR264	152–0066–00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US,GP10G/1N5060,T&R,	0LUA3	1N5060
A3CR268	152–0066–00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US,GP10G/1N5060,T&R,	0LUA3	1N5060
A3CR272	152–0066–00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US,GP10G/1N5060,T&R,	0LUA3	1N5060
A3CR280	152–0307–00			DIO,SIG:ULTRA FAST,100V,4.0NS,1.5PF,DUAL COM–CATHODE	04713	MSD6100
A3CR326	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR334	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR364	152–0066–00			DIODE,RECT:400V,1A,IFSM=30A,1.2VF,2US,GP10G/1N5060,T&R	0LUA3	1N5060
A3CR380	152–0501–01			DIODE,SIG:FAST RCVRY,70V,200MA,100NS,COM–ANODE	04713	MSD6150RLRP
A3CR459	152–0322–00			DIODE,SIG:SCHTKY,15V,410MVF AT 1MA,1.2PF,5082–2811,T&R	21847	A2X600
A3CR463	152–0322–00			DIODE,SIG:SCHTKY,15V,410MVF AT 1MA,1.2PF,5082–2811,T&R	21847	A2X600
A3CR476	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR566	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR582	152–0307–00			DIO,SIG:ULTRA FAST,100V,4.0NS,1.5PF,DUAL COM–CATHODE	04713	MSD6100
A3CR588	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR589	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR636	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3CR664	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR670	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR671	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR682	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR696	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR697	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR698	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR699	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR778	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR779	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR850	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR865	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR887	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR900	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR901	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR955	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR988	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR989	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3CR990	152–0141–02			DIODE,SIG:ULTRA FAST,40V,150MA,4NS,2PF,1N4152,DO–35	01295	1N4152R
A3J99	131–4530–00			CONN,HDR:PCB,MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120	00779	104344–1
A3J107	131–3571–00			CONN,HDR::PCB,MALE,RTANG,2 X 17,0.1CTR,0.350 H X 0.120	00779	103311–7
A3J154	175–9797–00			CA ASSY,SP:FLAT FLEX,FLX,10,27 AWG,2.5 L,1X10,BOX X STR	00779	487729–1
A3J197	131–4530–00			CONN,HDR:PCB,MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120	00779	104344–1
A3J225	131–4752–00			CONN,HDR::PCB,MALE,45 DEG,1 X 2,0.1CTR,0.240 MLG X 0.110	58050	082–0243–AS10
A3J500	131–4187–00			CONN,HDR:PCB,MALE,1 X 3,0.1 CTR,0.240 MLG X 0.110 TAIL	58050	082–0343–AS10
A3J504	131–4187–00			CONN,HDR:PCB,MALE,1 X 3,0.1 CTR,0.240 MLG X 0.110 TAIL	58050	082–0343–AS10
A3J699	131–4530–00			CONN,HDR:PCB,MALE,STR,1 X 3,0.1 CTR,0.230 MLG X 0.120	00779	104344–1
A3J932	131–3528–00			CONN,HDR::PCB,MALE,RTANG,2 X 12,0.1CTR,0.350 H X 0.112	56501	609–2407
A3L157	108–1262–00			INDUCTOR,FXD:POWER,100UH,10%,I<0.75A,RDC<0.23 OHM	TK2058	TSL0807–101KR75
A3L180	114–0500–00			INDUCTOR,VAR:SIGNAL,UNSHIELDED,3.5–7.8UH	02113	SLOT TEN–2–05
A3L190	114–0500–00			INDUCTOR,VAR:SIGNAL,UNSHIELDED,3.5–7.8UH	02113	SLOT TEN–2–05
A3L548	108–1268–00			INDUCTOR,FXD:SIGNAL,56UH,10%,IDC<100 MA,RDC<5.7 OHM	24226	10M562K
A3L643	108–1268–00			INDUCTOR,FXD:SIGNAL,56UH,10%,IDC<100 MA,RDC<5.7 OHM	24226	10M562K
A3L777	108–1351–00			INDUCTOR,FXD:SIGNAL,82UH,10%,IDC<175 MA,RDC<3.2 OHM	TK2058	SPT0305–820K–2
A3L778	108–1268–00			INDUCTOR,FXD:SIGNAL,56UH,10%,IDC<100 MA,RDC<5.7 OHM	24226	10M562K
A3L779	108–0317–01			INDUCTOR,FXD:CUSTOM,POWER,15UH,10%,IDC<460 MA	0JR03	108–0317–01
A3L781	108–1352–00			INDUCTOR,FXD:SIGNAL,22UH,10%,IDC<285 MA,RDC<1.2 OHM	TK2058	SPT0305–220K–2
A3L782	108–1351–00			INDUCTOR,FXD:SIGNAL,82UH,10%,IDC<175 MA,RDC<3.2 OHM	TK2058	SPT0305–820K–2

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3P99	131–0993–00			CONN,BOX:SHUNT,FEMALE,STR,1 X 2,0.1 CTR,0.385 H	00779	530153–2
A3P197	131–0993–00			CONN,BOX:SHUNT,FEMALE,STR,1 X 2,0.1 CTR,0.385 H	00779	530153–2
A3P500	131–0993–00			CONN,BOX:SHUNT,FEMALE,STR,1 X 2,0.1 CTR,0.385 H	00779	530153–2
A3P504	131–0993–00			CONN,BOX:SHUNT,FEMALE,STR,1 X 2,0.1 CTR,0.385 H	00779	530153–2
A3P699	131–0993–00			CONN,BOX:SHUNT,FEMALE,STR,1 X 2,0.1 CTR,0.385 H	00779	530153–2
A3Q99	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q142	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q143	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q158	151–0710–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,1.0A,50MHZ,AMPLIFIER	04713	MPS6715
A3Q198	151–0198–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,50MA,600 MHZ,AMPLIFIER	04713	MPS918
A3Q272	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q280	151–0211–00			XSTR,SIG:BIPOLAR,NPN,30V VCEO,55V VCBO,400MA,500MHZ	04713	2N3866
				ATTACHED PARTS		
	214–1291–00			HEAT SINK,SEMIC:TRANSISTOR/IC,TO–5/TO–39,RADIAL	05820	207SB
	342–0324–00			INSULATOR,DISK:TRANSISTOR,NYLON	13103	7717–5N
				END ATTACHED PARTS		
A3Q289	151–0211–00			XSTR,SIG:BIPOLAR,NPN,30V VCEO,55V VCBO,400MA,500MHZ	04713	2N3866
				ATTACHED PARTS		
	214–1291–00			HEAT SINK,SEMIC:TRANSISTOR/IC,TO–5/TO–39,RADIAL	05820	207SB
	342–0324–00			INSULATOR,DISK:TRANSISTOR,NYLON	13103	7717–5N
				END ATTACHED PARTS		
A3Q297	151–0188–05			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906RLRA
A3Q298	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q299	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q382	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,400MHZ,AMPL	01295	SKA5122
A3Q383	151–0198–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,50MA,600 MHZ,AMPL	04713	MPS918
A3Q385	151–0198–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,50MA,600 MHZ,AMPL	04713	MPS918
A3Q387	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,400MHZ,AMPL	01295	SKA5122
A3Q450	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q451	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q457	151–0207–01			TRANSISTOR,SIG:BIPOLAR,NPN,45V,300MA,250MHZ,AMPL	27014	PN100A/D26Z
A3Q458	151–0207–01			TRANSISTOR,SIG:BIPOLAR,NPN,45V,300MA,250MHZ,AMPL	27014	PN100A/D26Z
A3Q460	151–1059–01			TRANSISTOR,SIG:JFET,N–CH,10V,30MA(MIN),30OHM	04713	MPF4391RLRP
A3Q461	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q469	151–0198–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,50MA,600 MHZ,AMPL	04713	MPS918
A3Q476	151–0220–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,400MHZ,AMPL	01295	SKA5122
A3Q477	151–0198–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,50MA,600 MHZ,AMPL	04713	MPS918
A3Q478	151–0198–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,50MA,600 MHZ,AMPL	04713	MPS918

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3Q497	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q498	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q499	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q558	151–0207–01			TRANSISTOR,SIG:BIPOLAR,NPN,45V,300MA,250MHZ,AMPL	27014	PN100A/D26Z
A3Q566	151–0216–04			TRANSISTOR,SIG:BIPOLAR,PNP,25V,100MA,170MHZ,AMPL	04713	MPS6523RLRA
A3Q587	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q590	151–0190–00			TRANSISTOR,SIG:BIPOLAR,NPN,40V,200MA,300MHZ,AMPL	04713	2N3904
A3Q673	151–0221–08			TRANSISTOR,SIG:BIPOLAR,PNP,12V,80MA,SWITCHING	04713	MPS4258RLRA (EL8345)
A3Q674	151–0221–08			TRANSISTOR,SIG:BIPOLAR,PNP,12V,80MA,SWITCHING	04713	MPS4258RLRA (EL8345)
A3Q684	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q737	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q750	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q774	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q775	151–0195–02			TRANSISTOR,SIG:BIPOLAR,NPN,20V,100MA,150MHZ,AMPL	04713	2N5223RLRP
A3Q776	151–0223–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,500MA,SWITCHING	04713	MPS2369A
A3Q777	151–0223–00			TRANSISTOR,SIG:BIPOLAR,NPN,15V,500MA,SWITCHING	04713	MPS2369A
A3Q788	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q790	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q791	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q792	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q798	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q799	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q855	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3Q856	151–0195–02			TRANSISTOR,SIG:BIPOLAR,NPN,20V,100MA,150MHZ,AMPL	04713	2N5223RLRP
A3Q858	151–0216–04			TRANSISTOR,SIG:BIPOLAR,PNP,25V,100MA,170MHZ,AMPL	04713	MPS6523RLRA
A3Q860	151–0216–04			TRANSISTOR,SIG:BIPOLAR,PNP,25V,100MA,170MHZ,AMPL	04713	MPS6523RLRA
A3Q862	151–0347–00			TRANSISTOR,SIG:BIPOLAR,NPN,160V,600MA,100MHZ,AMPL	04713	2N5551
A3Q864	151–0347–00			TRANSISTOR,SIG:BIPOLAR,NPN,160V,600MA,100MHZ,AMPL	04713	2N5551
A3Q865	151–0350–00			TRANSISTOR,SIG:BIPOLAR,PNP,150V,600MA,100MHZ,AMPL	01295	SKA8001
A3Q868	151–0350–00			TRANSISTOR,SIG:BIPOLAR,PNP,150V,600MA,100MHZ,AMPL	01295	SKA8001
A3Q900	151–0188–05			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906RLRA
A3Q905	151–0188–05			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906RLRA
A3Q992	151–0188–00			TRANSISTOR,SIG:BIPOLAR,PNP,40V,200MA,250MHZ,AMPL	04713	2N3906
A3R81	322–3481–00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 1M00
A3R82	322–3285–00			RES,FXD,FILM:9.09K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 9K09
A3R83	322–3262–00			RES,FXD,FILM:5.23K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 5K23

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R84	322–3105–00			RES,FXD:METAL FILM,121 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 121E
A3R85	322–3414–00			RES,FXD:METAL FILM,200K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB 20 FXE 200 K OHM
A3R86	322–3105–00			RES,FXD:METAL FILM,121 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 121E
A3R98	322–3269–02			RES,FXD,FILM:6.19K OHM,0.2W,5%,TAPED & REELED	57668	CRB DYE 6K19
A3R99	322–3175–00			RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 649E
A3R001	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R002	322–3269–02			RES,FXD,FILM:6.19K OHM,0.2W,5%,TAPED & REELED	57668	CRB DYE 6K19
A3R003	311–2238–00			RES,VAR,TRMR:CERMET,50K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 503 M L20
A3R004	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R005	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R006	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R007	322–3205–00			RES,FXD,FILM:1.33K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K33
A3R008	322–3126–00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0 MI,SMALL BODY	91637	CCF501G200ROF
A3R009	322–3205–00			RES,FXD,FILM:1.33K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K33
A3R010	322–3126–00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0 MI,SMALL BODY	91637	CCF501G200ROF
A3R011	322–3205–00			RES,FXD,FILM:1.33K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 1K33
A3R012	322–3402–00			RES,FXD:METAL FILM,150K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G15002F
A3R013	322–3126–00			RES,FXD,FILM:200 OHM,1%,0.2W,TC=T0 MI,SMALL BODY	91637	CCF501G200ROF
A3R014	322–3402–00			RES,FXD:METAL FILM,150K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G15002F
A3R015	322–3402–00			RES,FXD:METAL FILM,150K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G15002F
A3R020	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R021	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R136	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R137	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R138	322–3369–00			RES,FXD:METAL FILM,68.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 68R1
A3R140	308–0297–00			RES,FXD,WW:24.7 OHM,1%,3W AXIAL LEADS,MI	05347	MS3–24R0F
A3R141	308–0297–00			RES,FXD,WW:24.7 OHM,1%,3W AXIAL LEADS,MI	05347	MS3–24R0F
A3R143	301–0101–00			RES,FXD,FILM:100 OHM,5%,0.5W MI	19701	5053CX100RDJ
A3R157	307–0023–00			RES,FXD,CMPSN:4.7 OHM,10%,0.5W MI	50139	EB47G1
A3R161	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R162	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R163	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R164	322–3322–00			RES,FXD:METAL FILM,22.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 22K1
A3R166	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R167	311–2230–00			RES,VAR,TRMR:CERMET,500 OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 501 M L20

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R168	311–2230–00			RES,VAR,TRMR:CERMET,500 OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 501 M L20
A3R180	322–3034–00			RES,FXD:METAL FILM,22.1 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G22R10F T
A3R183	301–0472–00			RES,FXD,FILM:4.7K OHM,5%,0.5W MI	19701	5053CX4K700J
A3R184	308–0783–00			RES,FXD,WW:1K OHM,1%,3W,TC=30PPM	54294	LA461ND9–1000OH M +–1PERCENT
A3R186	308–0783–00			RES,FXD,WW:1K OHM,1%,3W,TC=30PPM	54294	LA461ND9–1000OH M +–1PERCENT
A3R187	301–0472–00			RES,FXD,FILM:4.7K OHM,5%,0.5W MI	19701	5053CX4K700J
A3R189	322–3034–00			RES,FXD:METAL FILM,22.1 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G22R10F T
A3R192	322–3066–00			RES,FXD:METAL FILM,47.5 OHM,1%,0.2W,TC=100 PPM,AXIAL	09969	CCF502G47R50F
A3R196	321–0603–07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE15001B
A3R197	322–3410–00			RES,FXD:METAL FILM,182K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G1823FT
A3R198	321–0603–07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE15001B
A3R199	322–3185–00			RES,FXD:METAL FILM,825 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 825E
A3R221	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R241	322–3381–00			RES,FXD,FILM:90.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G9092FT
A3R242	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R243	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R246	322–3066–00			RES,FXD:METAL FILM,47.5 OHM,1%,0.2W,TC=100 PPM,AXIAL	09969	CCF502G47R50F
A3R249	322–3218–00			RES,FXD:METAL FILM,1.82K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 1K82
A3R254	322–3254–00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF502G4321FT
A3R255	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R256	322–3226–00			RES,FXD:METAL FILM,2.21K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G22100F
A3R258	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R263	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R264	322–3172–00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 604E
A3R266	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R267	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R268	322–3172–00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 604E
A3R272	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R273	322–3363–00			RES,FXD,FILM:59K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 59K0
A3R274	311–2240–00			RES,VAR,NONWW:TRMR,200K OHM,20%,0.5W LINEAR	TK2073	GF06UT2 204 M L20
A3R276	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R294	322–3210–00			RES,FXD:METAL FILM,1.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 1K50
A3R295	315–0220–00			RES,FXD,FILM:22 OHM,5%,0.25W MI	50139	CB2205
A3R296	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R297	322–3239–00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R298	322–3243–00			RES,FXD:METAL FILM,3.32K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–1–G33200F
A3R299	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R304	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R305	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R306	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R307	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R327	322–3330–00			RES,FXD,FILM:26.7K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 26K7
A3R331	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R363	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R367	322–3203–00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	57668	CRB20 FXE 1K27
A3R368	322–3203–00			RES,FXD,FILM:1.27K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	57668	CRB20 FXE 1K27
A3R370	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R371	322–3300–02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A3R372	322–3185–00			RES,FXD:METAL FILM,825 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 825E
A3R373	322–3165–00			RES,FXD,FILM:511 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 511E
A3R374	322–3190–00			RES,FXD,FILM:931 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 931E
A3R376	322–3114–00			RES,FXD:METAL FILM,150 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20–FX–150E–AXIAL
A3R377	322–3141–00			RES,FXD,FILM:287 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 287E
A3R378	322–3201–00			RES,FXD:METAL FILM,1.21K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G12100F
A3R379	322–3066–00			RES,FXD:METAL FILM,47.5 OHM,1%,0.2W,TC=100 PPM,AXIAL	09969	CCF502G47R50F
A3R380	322–3256–00			RES,FXD,FILM:4.53K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G4531FT
A3R381	322–3256–00			RES,FXD,FILM:4.53K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G4531FT
A3R382	322–3155–00			RES,FXD,FILM:402 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 402E
A3R383	322–3271–00			RES,FXD,FILM:6.49K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G–64900 FT
A3R384	322–3034–00			RES,FXD:METAL FILM,22.1 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G22R10FT
A3R385	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R386	322–3271–00			RES,FXD,FILM:6.49K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G–64900 FT
A3R387	322–3034–00			RES,FXD:METAL FILM,22.1 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G22R10FT
A3R388	322–3244–00			RES,FXD,FILM:3.4K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 3K40
A3R389	322–3274–00			RES,FXD,FILM:6.98K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G–69800 FT
A3R390	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R392	321–0754–07			RES,FXD,FILM:900 OHM,0.1%,0.125W,TC=T9MI	50139	ADVISE
A3R393	321–0754–07			RES,FXD,FILM:900 OHM,0.1%,0.125W,TC=T9MI	50139	ADVISE

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R394	322–3147–00			RES,FXD:METAL FILM,332 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 332E
A3R395	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM	91637	CCF50G10001F
A3R409	322–3001–00		672–1333–13	RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R409	131–4566–00	672–1333–14		BUS,CONDUCTOR:0 OHM,300 SPACING,SM BODY MI,DUMMY	91637	FRJ–50
A3R409	322–3001–00		672–1465–03	RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R409	322–3001–00	672–1465–04		BUS,CONDUCTOR:0 OHM,300 SPACING,SM BODY MI,DUMMY	91637	FRJ–50
A3R441	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R442	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R444	322–3356–00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 49K9
A3R445	322–3356–00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 49K9
A3R446	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R447	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R448	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R449	322–3410–00			RES,FXD:METAL FILM,182K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G1823FT
A3R454	322–3231–00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 2K49
A3R455	322–3231–00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 2K49
A3R456	322–3117–00			RES,FXD,FILM:162 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB 20 FXE 162E
A3R457	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R459	322–3295–00			RES,FXD:METAL FILM,11.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 11K5
A3R460	322–3481–00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 1M00
A3R463	322–3295–00			RES,FXD:METAL FILM,11.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 11K5
A3R465	322–3243–00			RES,FXD:METAL FILM,3.32K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–1–G33200F
A3R466	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R470	322–3114–00			RES,FXD:METAL FILM,150 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20–FX–150E–AXIAL
A3R471	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R472	322–3210–00			RES,FXD:METAL FILM,1.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 1K50
A3R473	322–3226–00			RES,FXD:METAL FILM,2.21K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G22100F
A3R474	322–3147–00			RES,FXD:METAL FILM,332 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 332E
A3R475	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R477	322–3311–00			RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	56845	CCF–50–2–1692F
A3R478	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R479	322–3243–00			RES,FXD:METAL FILM,3.32K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–1–G33200F
A3R480	322–3235–00			RES,FXD:METAL FILM,2.74K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 2K74
A3R481	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R482	322–3156–00			RES,FXD,FILM:412 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 412E
A3R483	322–3156–00			RES,FXD,FILM:412 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 412E
A3R484	322–3322–00			RES,FXD:METAL FILM,22.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 22K1

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R485	322–3062–00			RES,FXD,FILM:43.2 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	RB20FXE43E2
A3R486	322–3083–00			RES,FXD,FILM:71.5 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 71E5
A3R487	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R489	311–2230–00			RES,VAR,TRMR:CERMET,500 OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 501 M L20
A3R491	322–3410–00			RES,FXD:METAL FILM,182K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G1823FT
A3R492	311–0614–00			RES,VAR,NONWW:TRMR,30K OHM,0.5W CERMET	32997	3329H–L58–303
A3R493	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R495	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R497	322–3147–00			RES,FXD:METAL FILM,332 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 332E
A3R498	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R499	322–3243–00			RES,FXD:METAL FILM,3.32K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–1–G33200F
A3R504	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R505	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R506	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R507	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R526	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R538	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R544	322–3246–00			RES,FXD,FILM:3.57K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 3K57
A3R545	322–3277–00			RES,FXD,FILM:7.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 7K50
A3R546	322–3162–00			RES,FXD:METAL FILM,475 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G475R0F
A3R547	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R548	322–3339–00			RES,FXD:METAL FILM,33.2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G3322FT
A3R549	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R550	322–3034–00			RES,FXD:METAL FILM,22.1 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G22R10FT
A3R551	322–3329–00			RES,FXD,FILM:26.1K OHM.1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 26K1
A3R552	311–2227–00			RES,VAR,TRMR:CERMET,100 OHM,20%,0.5W,0.197 SQ	30983	ORDER BY DESCR
A3R553	311–2227–00			RES,VAR,TRMR:CERMET,100 OHM,20%,0.5W,0.197 SQ	30983	ORDER BY DESCR
A3R554	322–3089–00			RES,FXD:METAL FILM,82.5 OHM,1%.0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 82E5
A3R555	322–3030–00			RES,FXD:METAL FILM,20 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB 20 FXE 20E0
A3R556	322–3295–00			RES,FXD:METAL FILM,11.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 11K5
A3R557	322–3232–00			RES,FXD,FILM:2.55K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	57668	CRB20 FXE 2K55
A3R558	322–3232–00			RES,FXD,FILM:2.55K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	57668	CRB20 FXE 2K55
A3R559	322–3200–00			RES,FXD,FILM:1.18K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	91637	CCF501G11800F
A3R563	322–3226–00			RES,FXD:METAL FILM,2.21K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G22100F
A3R564	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R565	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R566	322–3379–00			RES,FXD,FILM:86.6K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	91637	CCF502G8662FT
A3R567	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R569	322–3418–00			RES,FXD:METAL FILM,221K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 221K
A3R570	322–3210–00			RES,FXD:METAL FILM,1.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 1K50
A3R571	322–3306–00			RES,FXD:METAL FILM,15K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G1502F
A3R572	322–3066–00			RES,FXD:METAL FILM,47.5 OHM,1%,0.2W,TC=100 PPM,AXIAL	09969	CCF502G47R50F
A3R573	322–3204–00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G13000F
A3R574	322–3204–00			RES,FXD,FILM:1.3K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G13000F
A3R575	322–3216–00			RES,FXD,FILM:1.74K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 1K74
A3R576	322–3175–00			RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 649E
A3R577	322–3066–00			RES,FXD:METAL FILM,47.5 OHM,1%,0.2W,TC=100 PPM,AXIAL	09969	CCF502G47R50F
A3R578	322–3242–00			RES,FXD,FILM:3.24K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 3K24
A3R579	322–3235–00			RES,FXD:METAL FILM,2.74K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 2K74
A3R580	322–3206–00			RES,FXD,FILM:1.37K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 1K37
A3R581	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R582	322–3333–02			RES,FXD,FILM:28.7K OHM,0.2W,.5%,TAPED&REELED	57668	CRB20 DYE 28K7
A3R583	322–3367–00			RES,FXD,FILM:64.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G64901FT
A3R584	322–3367–00			RES,FXD,FILM:64.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G64901FT
A3R588	322–3242–00			RES,FXD,FILM:3.24K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 3K24
A3R589	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R590	322–3260–00			RES,FXD,FILM:4.99K OHM,1%,0.2W,TC=T0	91637	CCF501G49900F
A3R591	322–3297–00			RES,FXD:METAL FILM,12.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 12K1
A3R592	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R593	322–3235–00			RES,FXD:METAL FILM,2.74K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 2K74
A3R594	322–3250–00			RES,FXD:METAL FILM,3.92K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2F39200F
A3R595	322–3210–00			RES,FXD:METAL FILM,1.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 1K50
A3R596	321–0603–07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE15001B
A3R597	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R598	322–3239–00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R599	322–3185–00			RES,FXD:METAL FILM,825 OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 825E
A3R603	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R608	322–3339–00			RES,FXD:METAL FILM,33.2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G3322FT
A3R627	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R641	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R642	322–3162–00			RES,FXD:METAL FILM,475 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G475R0F
A3R644	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R649	322–3356–00			RES,FXD,FILM:49.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 49K9
A3R650	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R651	322–3322–00			RES,FXD:METAL FILM,22.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 22K1
A3R652	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R653	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R654	322–3220–00			RES,FXD,FILM:1.91K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 1K91
A3R655	322–3310–00			RES,FXD,FILM:16.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 16K5
A3R656	321–0380–00			RES,FXD,FILM:88.7K OHM,1%,0.125W,TC=T0 MI	50139	NOT AVAILABLE
A3R657	322–3251–00			RES,FXD,FILM:4.02K OHM,1%,0.2W,TC=T0	91637	CCF501G40200F
A3R658	322–3200–00			RES,FXD,FILM:1.18K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	91637	CCF501G11800F
A3R659	322–3066–00			RES,FXD:METAL FILM,47.5 OHM,1%,0.2W,TC=100 PPM,AXIAL	09969	CCF502G47R50F
A3R660	311–2234–00			RES,VAR,TRMR:CERMET,5K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 502 M L20
A3R661	311–2234–00			RES,VAR,TRMR:CERMET,5K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 502 M L20
A3R664	322–3165–00			RES,FXD,FILM:511 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 511E
A3R667	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R668	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R669	322–3377–00			RES,FXD:METAL FILM,82.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2F82501F
A3R670	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R671	322–3239–00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R672	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R673	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R674	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R675	322–3172–00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 604E
A3R676	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R677	322–3297–00			RES,FXD:METAL FILM,12.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 12K1
A3R678	322–3335–00			RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 30K1
A3R679	322–3335–00			RES,FXD,FILM:30.1K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 30K1
A3R680	311–2232–00			RES,VAR,TRMR:CERMET,2K OHM,20%,0.5W,0.197 SQ	30983	ORDER BY DESCR
A3R681	322–3346–00			RES,FXD:METAL FILM,39.2K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20FXE39K2
A3R682	322–3179–00			RES,FXD,FILM:715 OHM,1%,0.2W,TC=T0 MI,SMALL BODY	57668	CRB20 FXE 715E
A3R683	311–2233–00			RES,VAR,TRMR:CERMET,3K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 302 M L20
A3R687	322–3275–00			RES,FXD,FILM:7.15K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 7K15
A3R688	322–3268–00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 6K04
A3R689	311–2234–00			RES,VAR,TRMR:CERMET,5K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 502 M L20
A3R690	322–3297–00			RES,FXD:METAL FILM,12.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 12K1

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R691	322–3297–00			RES,FXD:METAL FILM,12.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 12K1
A3R692	322–3239–00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R694	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R695	322–3164–00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G499ROF
A3R696	321–0603–07			RES,FXD,FILM:15K OHM,0.1%,0.125W,TC=T9MI	07716	CEAE15001B
A3R697	322–3410–00			RES,FXD:METAL FILM,182K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G1823FT
A3R698	315–0220–00			RES,FXD,FILM:22 OHM,5%,0.25W MI	50139	CB2205
A3R700	311–2269–00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5W LINEAR,MI	30983	ADVISE
A3R701	311–2269–00			RES,VAR,NONWW:TRMR,20K OHM,20%,0.5W LINEAR,MI	30983	ADVISE
A3R736	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R740	322–3322–00		672–1333–12	RES,FXD:METAL FILM,22.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 22K1
A3R740	322–3326–00	672–1333–13		RES,FXD,FILM:24.3K OHM,1%,0.2W,TC–T0 MI,SMALL BODY	91637	CCF50–2432F–R36
A3R740	322–3322–00		672–1465–02	RES,FXD:METAL FILM,22.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 22K1
A3R740	322–3326–00	672–1465–03		RES,FXD,FILM:24.3K OHM,1%,0.2W,TC–T0 MI,SMALL BODY	91637	CCF50–2432F–R36
A3R746	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R750	322–3412–00			RES,FXD,FILM:191K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 191K
A3R751	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R752	322–3336–00			RES,FXD,FILM:30.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2F30901F
A3R753	322–3437–00			RES,FXD,FILM:348K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	57668	CRB20 FXE 348K
A3R754	322–3402–00			RES,FXD:METAL FILM,150K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G15002F
A3R755	322–3189–00			RES,FXD,FILM:909 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB 20 FXE 909E
A3R756	322–3300–02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A3R757	322–3311–00			RES,FXD,FILM:16.9K OHM,1%,0.2W,TC=T0MI,SMALL BODY	56845	CCF–50–2–1692F
A3R759	322–3179–00			RES,FXD,FILM:715 OHM,1%,0.2W,TC=T0 MI,SMALL BODY	57668	CRB20 FXE 715E
A3R761	322–3172–00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 604E
A3R762	322–3172–00			RES,FXD,FILM:604 OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 604E
A3R771	322–3239–00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F
A3R772	322–3297–00			RES,FXD:METAL FILM,12.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 12K1
A3R773	322–3268–00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 6K04
A3R774	322–3339–00			RES,FXD:METAL FILM,33.2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G3322FT
A3R775	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R776	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R777	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R783	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R784	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R791	322–3268–00			RES,FXD,FILM:6.04K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 6K04
A3R792	322–3164–00			RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G499ROF
A3R793	322–3330–00			RES,FXD,FILM:26.7K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 26K7

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R794	322–3235–00			RES,FXD:METAL FILM,2.74K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 2K74
A3R795	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R796	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R797	322–3254–00			RES,FXD,FILM:4.32K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF502G4321FT
A3R837	322–3310–00			RES,FXD,FILM:16.5K OHM,1%,0.2W,TC=T0	57668	CRB20 FXE 16K5
A3R838	322–3001–00			RES,FXD:METAL FILM,10 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10R00F
A3R840	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R845	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R846	322–3293–00			RES,FXD:METAL FILM,11K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 11K0
A3R849	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R850	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R851	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R852	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R853	322–3293–00			RES,FXD:METAL FILM,11K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 11K0
A3R854	322–3452–00			RES,FXD,FILM:499K OHM,1%,0.2W,TC=TOMI,SMALL BODY	91637	CCF50–2–G4993FT
A3R855	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R856	311–2236–00			RES,VAR,TRMR:CERMET,20K OHM,20%,0.5W,0.197 SQ	TK2073	GF06UT2 203 M L20
A3R857	322–3308–00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G15801F
A3R858	322–3308–00			RES,FXD,FILM:15.8K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G15801F
A3R859	322–3300–02			RES,FXD,FILM:13K OHM,0.5%,0.2W,TC=T2	91637	CCF501D13001D
A3R860	322–3293–00			RES,FXD:METAL FILM,11K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 11K0
A3R861	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R865	322–3233–00			RES,FXD,FILM:2.61K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G2611FT
A3R866	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R867	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R868	322–3233–00			RES,FXD,FILM:2.61K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G2611FT
A3R878	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R885	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R887	322–3281–00			RES,FXD:METAL FILM,8.25K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 8K25
A3R888	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R889	322–3201–00			RES,FXD:METAL FILM,1.21K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G12100F
A3R890	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R891	322–3306–00			RES,FXD:METAL FILM,15K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G1502F
A3R892	322–3097–00			RES,FXD:METAL FILM,100 OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G100R0F
A3R893	322–3226–00			RES,FXD:METAL FILM,2.21K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G22100F
A3R894	322–3243–00			RES,FXD:METAL FILM,3.32K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–1–G33200F
A3R895	322–3239–00			RES,FXD,FILM:3.01K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G30100F

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R896	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R897	322–3226–00			RES,FXD:METAL FILM,2.21K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G22100F
A3R898	322–3306–00			RES,FXD:METAL FILM,15K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G1502F
A3R899	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R900	322–3193–00			RES,FXD:METAL FILM,1K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10000F
A3R901	322–3164–00		672–1333–10	RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G499ROF
A3R901	322–3175–00	672–1333–11		RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0,SMALL BODY	57668	CRB20 FXE 649E
A3R901	322–3164–00		672–1465–00	RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G499ROF
A3R901	322–3175–00	672–1465–01		RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0,SMALL BODY	57668	CRB20 FXE 649E
A3R902	322–3164–00		672–1333–10	RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G499ROF
A3R902	322–3175–00	672–1333–11		RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0,SMALL BODY	57668	CRB20 FXE 649E
A3R902	322–3164–00		672–1465–00	RES,FXD,FILM:499 OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF501G499ROF
A3R902	322–3175–00	672–1465–01		RES,FXD,FILM:649 OHM,1%,0.2W,TC=T0,SMALL BODY	57668	CRB20 FXE 649E
A3R903	322–3222–00			RES,FXD:METAL FILM,2K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G20000F
A3R904	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R905	322–3231–00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 2K49
A3R906	322–3231–00			RES,FXD,FILM:2.49K OHM,1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 2K49
A3R938	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R940	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R944	322–3391–00		B040332	RES,FXD,FILM:115K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G11502F T
A3R944	322–3385–00	B040333		RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL,T&R,SMALL BODY	57668	CRB20T29EFX1003
A3R944	322–3391–00		B040332	RES,FXD,FILM:115K OHM,1%,0.2W,TC=T0MI,SMALL BODY	91637	CCF50–2–G11502F T
A3R944	322–3385–00	B040333		RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL,T&R,SMALL BODY	57668	CRB20T29EFX1003
A3R947	322–3421–00			RES,FXD,FILM:237K OHM,1%,0.2W,TC=T0 MI,SMALL BODY	91637	CCF50–2F23702F
A3R951	322–3066–00			RES,FXD:METAL FILM,47.5 OHM,1%,0.2W,TC=100 PPM,AXIAL	09969	CCF502G47R50F
A3R953	322–3481–00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 1M00
A3R954	322–3435–00			RES,FXD:METAL FILM,332K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–33202FT
A3R956	322–3258–00			RES,FXD:METAL FILM,4.75K OHM,1%,0.2W,TC=100 PPM,AXIAL	56845	CCF50–2–G4751FT
A3R957	322–3318–00			RES,FXD,FILM:METAL FILM,20K OHM,1%,0.2W,TC=100 PPM	91637	CCF501G20001F
A3R958	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R959	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R960	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R963	322–3243–00			RES,FXD:METAL FILM,3.32K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–1–G33200F
A3R964	322–3481–00			RES,FXD,FILM:1M OHM.1%,0.2W,TC=T0MI,SMALL BODY	57668	CRB20 FXE 1M00
A3R965	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
A3R966	322–3354–00			RES,FXD:METAL FILM,47.5K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G47501F
A3R987	322–3273–00			RES,FXD:METAL FILM,6.81K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G68100F
A3R988	322–3322–00			RES,FXD:METAL FILM,22.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 22K1
A3R989	322–3250–00			RES,FXD:METAL FILM,3.92K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2F39200F
A3R990	322–3250–00			RES,FXD:METAL FILM,3.92K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2F39200F
A3R991	322–3385–00			RES,FXD:METAL FILM,100K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF501G10002F
A3R992	322–3418–00			RES,FXD:METAL FILM,221K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 221K
A3R993	322–3289–00			RES,FXD:METAL FILM,10K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50G10001F
A3R994	322–3322–00			RES,FXD:METAL FILM,22.1K OHM,1%,0.2W,TC=100 PPM,AXIAL	57668	CRB20 FXE 22K1
A3R997	322–3306–00			RES,FXD:METAL FILM,15K OHM,1%,0.2W,TC=100 PPM,AXIAL	91637	CCF50–2–G1502F
A3U164	156–1451–00			IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR,NEGATIVE,ADJUST	01295	LM337KC
A3U172	156–1161–00			IC,LINEAR:BIPOLAR,VOLTAGE REGULATOR,POSITIVE,ADJUST	04713	LM317T
A3U234	156–0941–00			IC,DIGITAL:CMOS,GATE,QUAD 2–INPUT NAND,74C00,DIP14.3	27014	MM74C00N
A3U252	156–0048–00			IC,LINEAR:BIPOLAR,XSTR ARRAY,(5),NPN,(1)DIFF PAIR,(3)IND	04713	MC3346P
A3U263	156–1225–00			IC,LINEAR:BIPOLAR,COMPARATOR,DUAL,OPEN COLLECTOR	01295	LM393P
A3U277	156–1850–00			IC,MISC:CMOS,ANALOG SWITCH,QUAD,DG211,DIP16.3	17856	DG211CJ
A3U305	156–0259–00			IC,LINEAR:BIPOLAR,TRANSISTOR ARRAY,(5)NPN	0CVK3	ULN2083A
A3U331	156–0910–00			IC,DIGITAL:LSTTL,COUNTER,DUAL 4–BIT DECADE	01295	SN74LS390N
A3U334	156–0575–00			IC,DIGITAL:CMOS,GATE,TRIPLE 3–INPUT NOR	04713	MC14025BCP
A3U395	156–1850–00			IC,MISC:CMOS,ANALOG SWITCH,QUAD,DG211,DIP16.3	17856	DG211CJ
A3U407	156–1430–00			IC,DIGITAL:CMOS,MISC,4–DIGIT LED DISPLAY CONTROLLER	27014	MM74C911N
A3U445	156–1225–00			IC,LINEAR:BIPOLAR,COMPARATOR,DUAL,OPEN COLLECTOR	01295	LM393P
A3U465	156–1225–00			IC,LINEAR:BIPOLAR,COMPARATOR,DUAL,OPEN COLLECTOR	01295	LM393P
A3U488	156–1149–00			IC,LINEAR:BIFET,OP–AMP,LF351N,DIP08.3	04713	MC34001P/LF351N
A3U492	156–2460–00			IC,MISC:BIPOLAR,MODULATOR/DEMODULATOR,BALANCED	04713	MC1496P
A3U495	156–1191–00			IC,LINEAR:BIFET,OP–AMP,DUAL,TL072CN/LF353N,DIP08.3	01295	TL072CP
A3U522	160–7318–00			MICROCKT,DGTL:CMOS,MICROCOMPUTER,8 BIT,PRGM	80009	160–7318–00
				MOUNTING PARTS		
	136–0871–00			SOCKET,PLCC::PCB,68 POS,0.05 CTR,0.360H X 0.125 TAIL	00779	3–821574–1
				END MOUNTING PARTS		
A3U541	156–2009–00			IC,DIGITAL:HCMOS,FLIP FLOP,DUAL D–TYPE,SET,CLEAR	01295	SN74HC74N
A3U552	156–1191–00			IC,LINEAR:BIFET,OP–AMP,DUAL,TL072CN/LF353N,DIP08.3	01295	TL072CP
A3U564	156–0048–00			IC,LINEAR:BIPOLAR,TRANSISTOR ARRAY,(5),NPN,(1)DIFF PAIR	04713	MC3346P
A3U578	156–2460–00			IC,MISC:BIPOLAR,MODULATOR/DEMODULATOR,BALANCED	04713	MC1496P
A3U585	156–1850–00			IC,MISC:CMOS,ANALOG SWITCH,QUAD,DG211,DIP16.3	17856	DG211CJ
A3U655	156–1191–00			IC,LINEAR:BIFET,OP–AMP,DUAL,TL072CN/LF353N,DIP08.3	01295	TL072CP
A3U735	160–7332–01			IC,DIGITAL:STTL,PLD,PAL,20R4,28.5MHZ,210MA,PRGM	80009	160–7332–01
				MOUNTING PARTS		

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
	136–0727–00			SKT,PL–IN ELEK:MICROCKT,8 CONTACT MI	98291	DIPS08PIT
				END MOUNTING PARTS		
A3U741	156–0750–03		672–1333–12	IC,DIGITAL:CMOS,MULTIVIBRATOR,DUAL MONOSTABLE	27014	MM74C221N
A3U741	156–2761–01	672–1333–13		IC,DIGITAL:HCMOS,MULTIVIBRATOR,DUPLICATE OF 156–2761–00,74HC221A,DIP16.3,TUBE	0JR04	TC74HC221AP
A3U741	156–0750–03		672–1465–02	IC,DIGITAL:CMOS,MULTIVIBRATOR,DUAL MONOSTABLE	27014	MM74C221N
A3U741	156–2761–01	672–1465–03		IC,DIGITAL:HCMOS,MULTIVIBRATOR,DUPLICATE OF 156–2761–00,74HC221A,DIP16.3,TUBE	0JR04	TC74HC221AP
A3U753	156–1225–00			IC,LINEAR:BIPOLAR,COMPARATOR,DUAL,OPEN COLLECTOR	01295	LM393P
A3U786	156–3972–00			IC,MISC:CMOS,ANALOG SWITCH,QUAD SPST,100 OHM,400NS	17856	DG444DJ
A3U795	156–0048–00			IC,LINEAR:BIPOLAR,TRANSISTOR ARRAY,(5),NPN,(1)DIFF PAIR	04713	MC3346P
A3U809	156–3142–00			IC,DIGITAL:HCTCMOS,GATE,QUAD 2–INPUT NAND	01295	SN74HCT00N
A3U844	156–0750–03		672–1333–12	IC,DIGITAL:CMOS,MULTIVIBRATOR,DUAL MONOSTABLE	27014	MM74C221N
A3U844	156–2761–01	672–1333–13		IC,DIGITAL:HCMOS,MULTIVIBRATOR,DUPLICATE OF 156–2761–00,74HC221A,DIP16.3,TUBE	0JR04	TC74HC221AP
A3U844	156–0750–03		672–1465–02	IC,DIGITAL:CMOS,MULTIVIBRATOR,DUAL MONOSTABLE	27014	MM74C221N
A3U844	156–2761–01	672–1465–03		IC,DIGITAL:HCMOS,MULTIVIBRATOR,DUPLICATE OF 156–2761–00,74HC221A,DIP16.3,TUBE	0JR04	TC74HC221AP
A3U892	156–1381–00			IC,LINEAR:BIPOLAR,TRANSISTOR ARRAY,THREE NPN	34371	CA3096AE
A3U947	156–1191–00			IC,LINEAR:BIFET,OP–AMP,DUAL,TL072CN/LF353N,DIP08.3	01295	TL072CP
A3VR273	152–0273–00			SEMICOND DVC,DI:TAB,LEAD SPIDER	80009	152–0273–00
A3VR297	152–0175–00			DIODE,ZENER:5.6V,5%,0.4W,1N752A,DO–7OR 35,TR	04713	SZG35008 (1N752ARL)
A3VR460	152–0217–00			DIODE,ZENER:8.2V,5%,0.4W,1N959B FMLY,DO–35 OR 7,T&R	04713	SZG20RL
A3VR497	152–0175–00			DIODE,ZENER:5.6V,5%,0.4W,1N752A,DO–7OR 35,TR	04713	SZG35008 (1N752ARL)
A3VR769	152–0359–00			DIODE,ZENER:9V,500MW,5%,TEMP COMPENSATED	04713	SZ50850
A3W786	131–0566–00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225 L	24546	OMA0207
A3Y709	158–0300–00			XTAL UNIT,QTZ:12.0 MHZ,50 PPM	61429	FOX120X
A3A1	671–1796–01			CIRCUIT BD ASSY:GRATICULE LIGHT	80009	671–1796–01
A3A1DS100	150–0168–00			LAMP,INCAND:14V,0.08A,WG BASE,T1.75 FOR SKT MT	80009	150–0168–00
				MOUNTING PARTS		
	136–1119–01			SOCKET,LPHLDR:PCB,LAMPHOLDER,FEMALE,STR	80009	136–1119–01
				END MOUNTING PARTS		
A3A1DS200	150–0168–00			LAMP,INCAND:14V,0.08A,WG BASE,T1.75 FOR SKT MT	80009	150–0168–00
				MOUNTING PARTS		
	136–1119–01			SOCKET,LPHLDR:PCB,LAMPHOLDER,FEMALE,STR	80009	136–1119–01
				END MOUNTING PARTS		
A3A1DS300	150–0168–00			LAMP,INCAND:14V,0.08A,WG BASE,T1.75 FOR SKT MT	80009	150–0168–00

Replaceable Electrical Parts List (Cont.)

Component Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Name & Description	Mfr. Code	Mfr. Part Number
				MOUNTING PARTS		
	136–1119–01			SOCKET,LPHLDR:PCB,LAMPHOLDER,FEMALE,STR	80009	136–1119–01
				END MOUNTING PARTS		
A3A1J100	131–4530–00			CONN,HDR:	80009	131–4530–00
A3A1P100	131–3199–00			CONN,SHUNT:FEM,STR,1 X 2,0.1 CTR,0.2 H,LOW PF,JUMPER	22526	76264–101
A3A1P200	131–2790–00			CONN,HDR:PCB;RTANG,1 X 2,0.15 CTR	80009	131–2790–00
A3A1P800	131–2790–00			CONN,HDR:PCB;RTANG,1 X 2,0.15 CTR	80009	131–2790–00
A10	671–3637–00			CIRCUIT BD ASSY:CRT SOCKET BD	80009	671363700
V1	154–0985–00			ELECTRON TUBE:CRT,FINISHED,D14–375GH/985 (1710J ONLY)	80009	154–0985–00
V1	154–0985–16			ELECTRON,TUBE:CRT,FINISHED,D14–375WA/985 (1710J OPTION 74 ONLY)	80009	154–0985–16
V1	154–0986–00			ELECTRON TUBE:CRT,FINISHED,D14–375GH/986 (1711J ONLY)	80009	154–0986–00
V1	154–0986–16			ELECTRON,TUBE:CRT,FINISHED,D14–375WA/986 (1711J OPTION 74 ONLY)	80009	154–0986–16
W3	196–3146–00			CA ASSY,SP:FLAT FLEX,FLX,27 AWG,1.0 L,PCB,TERM (CONNECTED AT A3J3 AND "CH-A" BNC)	TK0196	FSN–1A,P OR K
W6	196–3146–00			CA ASSY,SP:FLAT FLEX,FLX,27 AWG,1.0 L,PCB,TERM (CONNECTED AT A3J6 AND "CH-B" BNC)	TK0196	FSN–1A,P OR K
W9	196–3146–00			CA ASSY,SP:FLAT FLEX,FLX,27 AWG,1.0 L,PCB,TERM (CONNECTED AT A3J9 AND "EXT REF" BNC)	TK0196	FSN–1A,P OR K
W100	196–3146–00			CA ASSY,SP:FLAT FLEX,FLX,27 AWG,1.0 L,PCB,TERM (CONNECTED AT A3J100 AND "CH-B" BNC GROUND LUG)	TK0196	FSN–1A,P OR K

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: $\overline{\text{ID CONTROL}}$, (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:

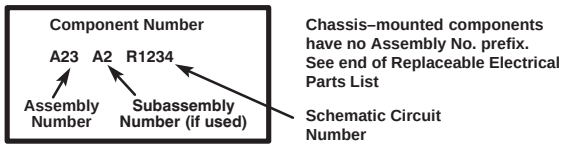
Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μF).
Resistors = Ohms (Ω).

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.

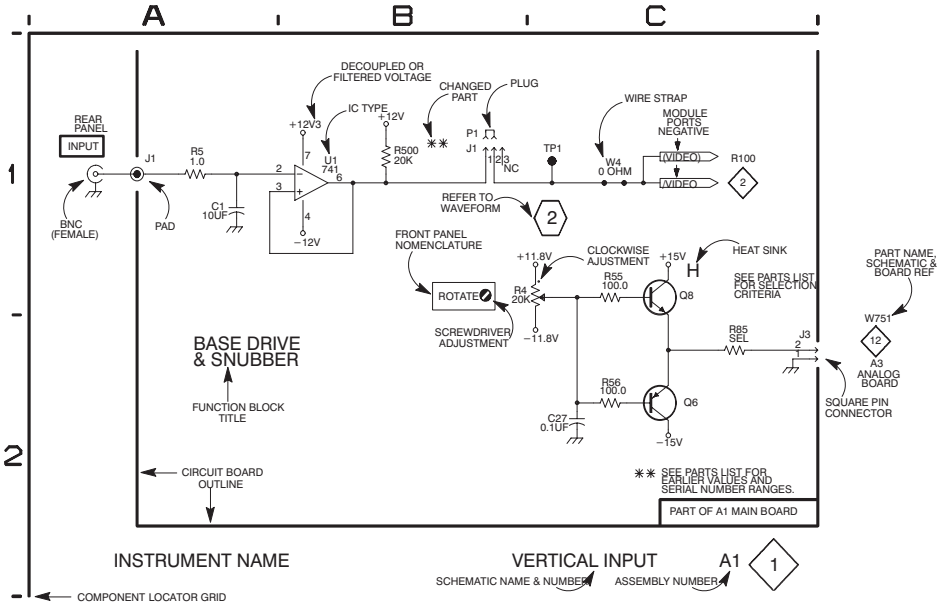
The Replaceable Electrical Parts List is arranged by assembly number in numerical sequence; the components are listed by component number. Example:



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.



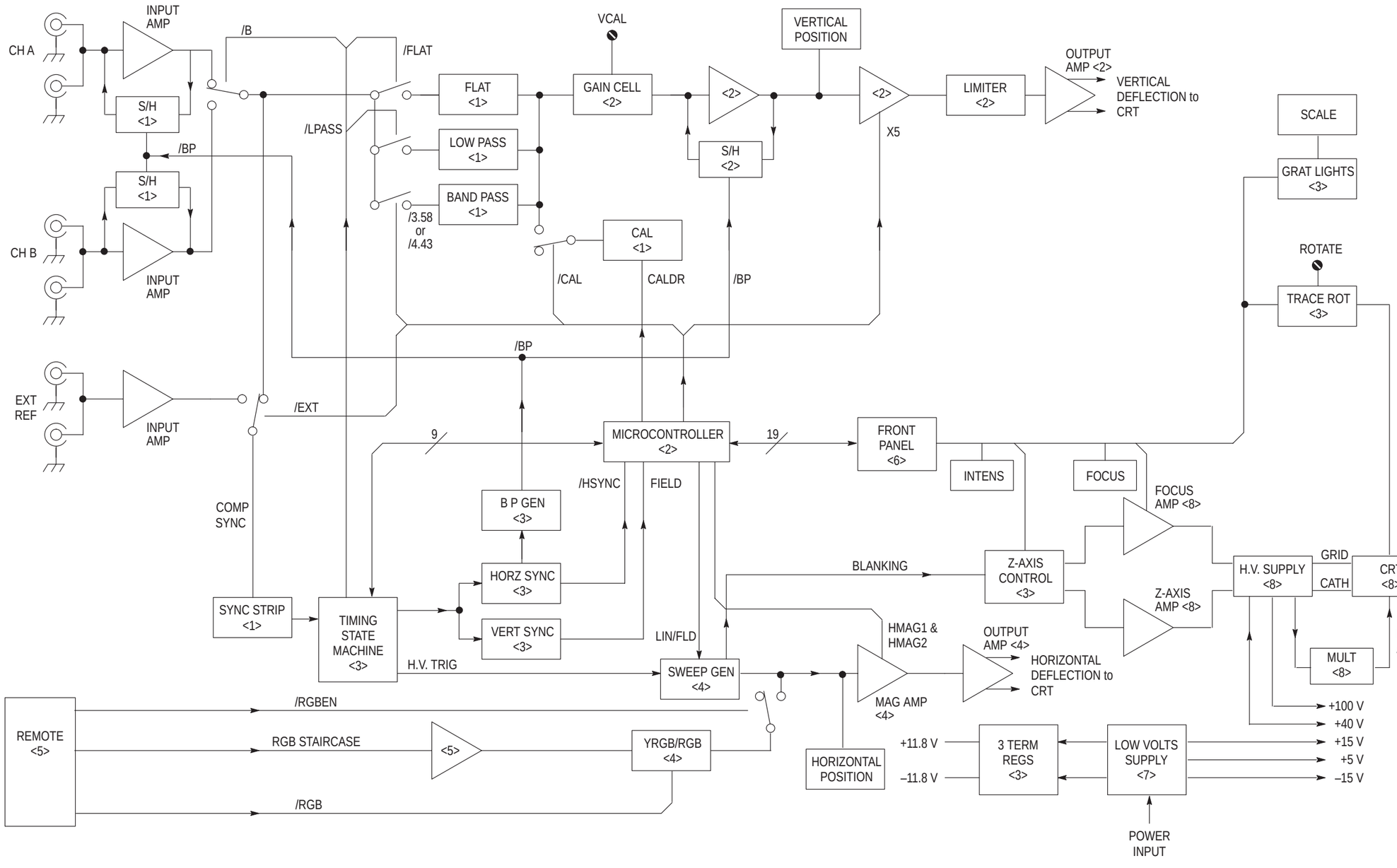
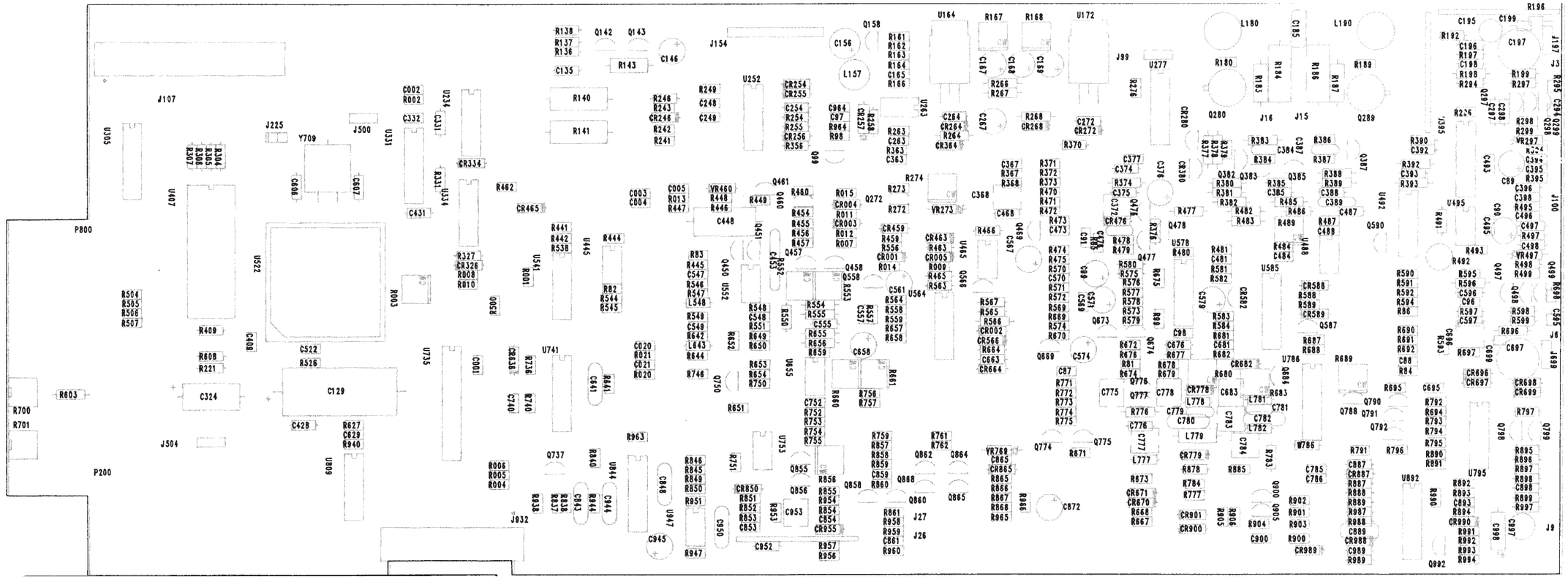
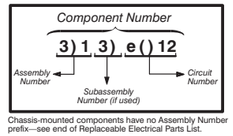


Figure 10–1: 1710J–Series Block diagram



A3 Main Board

Ab baNaf ai 4Ne NI 3 N



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

STATIC SENSITIVE DEVICES

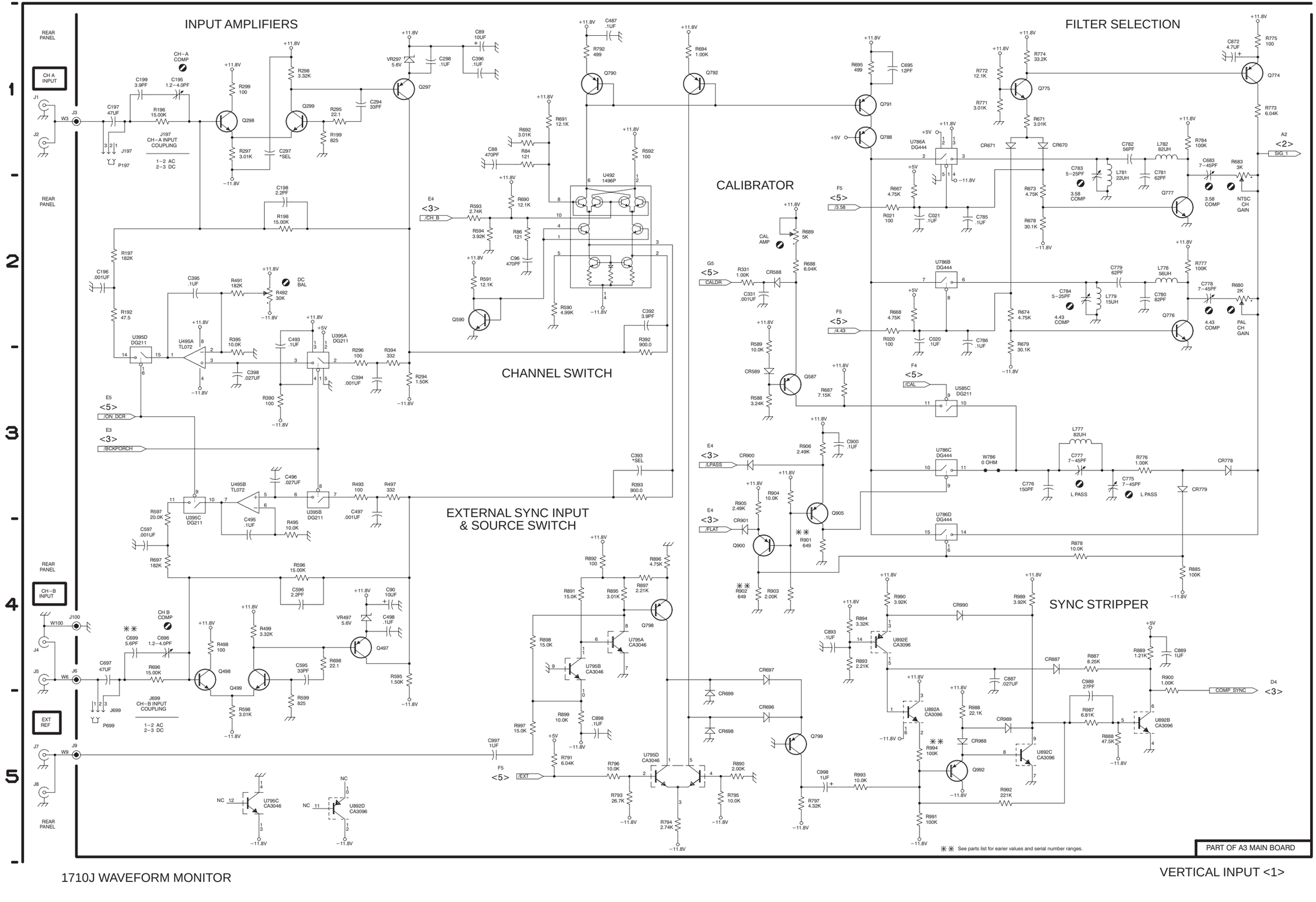
A3 Main Board Schematic <1> Component Locator

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram. The etched circuit boards follow a numbering sequence starting with the lowest number at the upper left corner, as pictured in this manual.

Assembly A3 *Partial Assembly A3 also shown on Schematics 2, 3, 4, and 5.*

Circuit Number	Schematic Diagram Location
C020	F2
C021	F2
C88	C1
C89	C1
C90	C4
C96	D2
C195	A1
C196	A2
C197	A1
C198	B2
C199	A1
C294	C1
C297	B1
C298	C1
C331	E2
C392	D2
C393	D3
C394	C3
C395	B2
C396	C1
C398	B3
C487	D1
C493	B2
C495	B4
C496	B3
C497	C3
C498	C4
C595	B4
C596	B4
C597	A4
C683	H1
C695	F1
C696	A4
C697	A4
C699	A4
C775	G3
C776	G3
C777	G3
C778	H2
C779	G2
C780	G2
C781	G1
C782	G1
C783	G1
C784	G2
C785	F2
C786	F2
C872	H1
C887	G4
C889	H4
C893	F4
C898	D5
C900	F3
C989	G5
C997	C5
C998	F5
CR588	E2
CR589	E3
CR670	G1
CR671	G1
CR696	E5
CR697	E4
CR698	E5
CR699	E5
CR778	H3
CR779	H3
CR887	G4
CR900	E3
CR901	E4
CR988	F5
CR989	G5
CR990	F4
J1	A1
J2	A1
J3	A1
J4	A4
J5	A4
J6	A4
J7	A5
J8	A5
J9	A5
J100	A4
J197	A1
J699	A5
L777	G3
L778	H2
L779	G2
L781	G1
L782	H1
P197	A1
P699	A5
Q297	C1
Q298	B1
Q299	B1
Q497	C4
Q498	B4
Q499	B4
Q587	E3
Q590	C2
Q774	H1
Q775	G1
Q776	H2
Q777	H2
Q788	F1
Q790	D1
Q791	F1
Q792	E1
Q798	D4
Q799	E5
Q900	E4
Q905	E3
Q992	F5
R020	F2
R021	F2
R84	D1
R86	D2
R192	A2
R196	A1
R197	A2
R198	B2
R199	B1
R294	C3
R295	B1
R296	C3
R297	B1
R298	B1
R299	B1
R390	B3
R392	D3
R393	D3
R394	C3
R395	B3
R491	B2
R492	B2
R493	C3
R495	B4
R497	C3
R498	B4
R499	B4
R588	E3
R589	E2
R590	D2
R591	C2
R592	D1
R593	C2
R594	C2
R595	C4
R596	B4
R597	A3
R598	B5
R599	B5
R667	F2
R668	F2
R671	G1
R673	G2
R674	G2
R678	G2
R679	G2
R680	H2
R683	H1
R687	F3
R688	E2
U395A	B3
U395B	B3
U395C	B3
U395D	A3
U492	D2
U492	D2
U495A	B3
U495B	B3
U585C	F3
U786A	F1
U786B	F2
U786C	F3
U786D	F4
U795A	D4
U795B	D4
U795C	B5
U795D	D5
U892A	F5
U892B	G5
U892C	G5
U892D	B5
U892E	F4
VR297	C1
VR497	C4
W786	G3

Figure 10–2: A3 Main Board Schematic <1> component locator



1710J WAVEFORM MONITOR

VERTICAL INPUT <1>

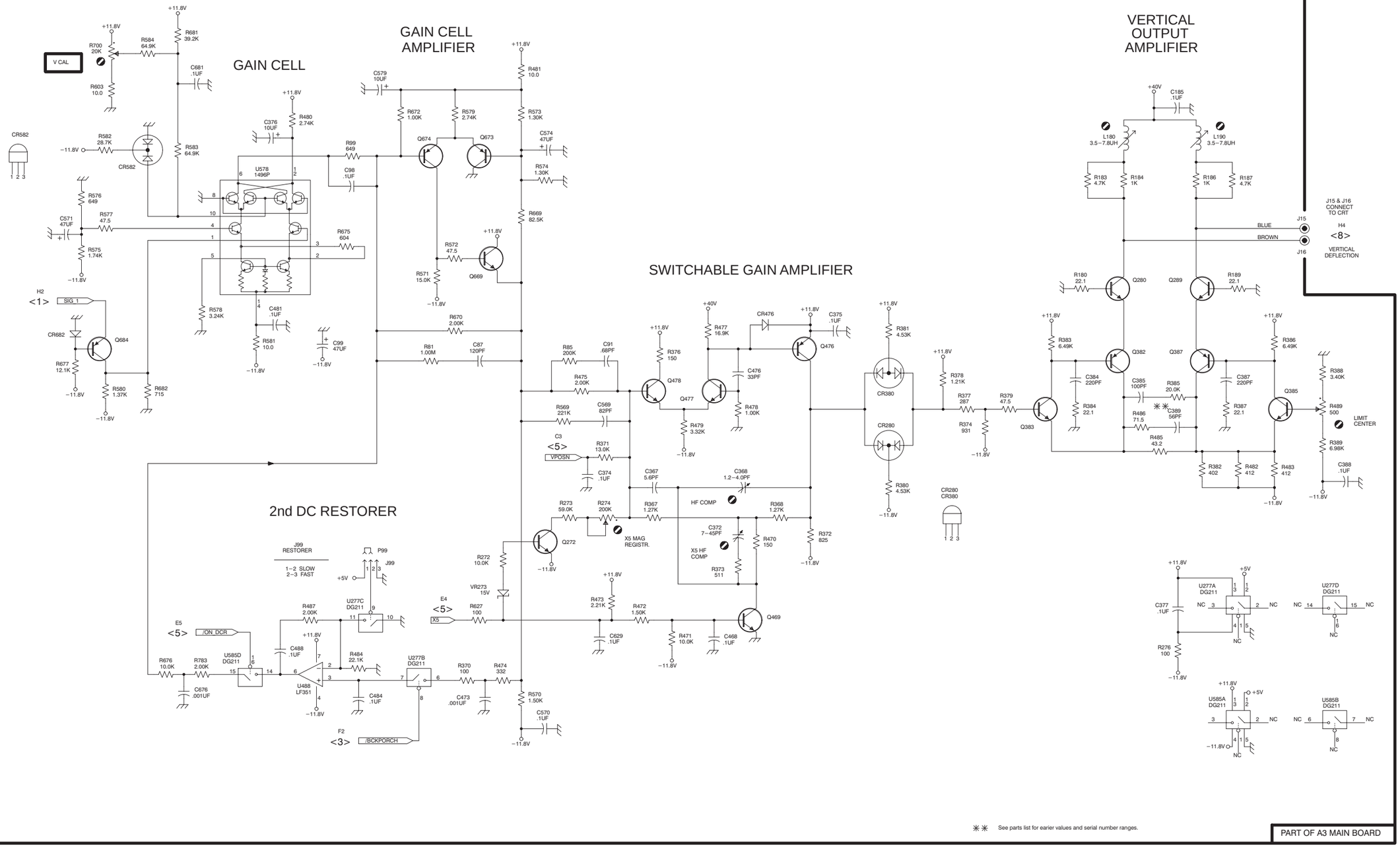
A3 Main Board Schematic <2> Component Locator

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram. The etched circuit boards follow a numbering sequence starting with the lowest number at the upper left corner, as pictured in this manual.

Assembly A3 *Partial Assembly A3 also shown on Schematics 1, 3, 4, and 5.*

Circuit Number	Schematic Diagram Location	Circuit Number	Schematic Diagram Location	Circuit Number	Schematic Diagram Location
C87	C3	R81	C3	R580	A3
C91	D3	R85	D3	R581	B3
C98	C2	R99	C2	R582	A2
C99	C3	R180	G3	R583	B2
C185	G2	R183	G2	R584	B1
C367	D4	R184	G2	R603	A2
C368	E4	R186	G2	R627	C4
C372	E4	R187	H2	R669	D2
C374	D4	R189	H3	R670	C3
C375	E3	R272	D4	R672	C2
C376	B2	R273	D4	R675	C2
C377	G4	R274	D4	R676	B5
C384	G3	R276	G4	R677	A3
C385	G3	R367	D4	R681	B1
C387	H3	R368	E4	R682	B3
C388	H4	R370	C5	R700	A1
C389	G3	R371	D3	R783	B5
C468	E4	R372	E4		
C473	C5	R373	E4	U277A	H4
C476	E3	R374	F3	U277B	C5
C481	B3	R376	D3	U277C	C4
C484	C5	R377	F3	U277D	H4
C488	B4	R378	F3	U488	B5
C569	D3	R379	F3	U578	B2
C570	D5	R380	F4	U578	B2
C571	A2	R381	F3	U585A	H5
C574	D2	R382	G3	U585B	H5
C579	C2	R383	G3	U585D	B5
C629	D4	R384	G3		
C676	B5	R385	G3	VR273	D4
C681	B2	R386	H3		
		R387	H3		
CR280	F3	R388	H3		
CR380	F3	R389	H3		
CR476	E3	R470	E4		
CR582	B2	R471	D4		
CR682	A3	R472	D4		
		R473	D4		
J15	H2	R474	D5		
J16	H2	R475	D3		
J99	C4	R477	E3		
		R478	E3		
L180	G2	R479	E3		
L190	G2	R480	B2		
		R481	D1		
P99	C4	R482	H3		
		R483	H3		
Q272	D4	R484	C5		
Q280	G3	R485	G3		
Q289	G3	R486	G3		
Q382	G3	R487	B4		
Q383	G3	R489	H3		
Q385	H3	R569	D3		
Q387	G3	R570	D5		
Q469	E4	R571	C2		
Q476	E3	R572	C2		
Q477	E3	R573	D2		
Q478	D3	R574	D2		
Q669	C2	R575	A2		
Q673	C2	R576	A2		
Q674	C2	R577	A2		
Q684	A3	R578	B3		
		R579	C2		

Figure 10–3: A3 Main Board Schematic <2> component locator


GAIN CELL
GAIN CELL AMPLIFIER
SWITCHABLE GAIN AMPLIFIER
2nd DC RESTORER
VERTICAL OUTPUT AMPLIFIER
V CAL
+11.8V
−11.8V
+40V
+5V
R700 20K
R584 64.9K
R681 39.2K
C681 .1UF
R603 10.0
CR582
R582 28.7K
R583 64.9K
C376 10UF
R480 2.74K
U578 1496P
R99 649
C98 .1UF
C579 10UF
R672 1.00K
R579 2.74K
R481 10.0
Q674
Q673
R573 1.30K
C574 47UF
R574 1.30K
R669 82.5K
R576 649
C571 47UF
R577 47.5
R575 1.74K
R675 604
R572 47.5
R571 15.0K
Q669
R578 3.24K
C481 .1UF
R581 10.0
C99 47UF
R670 2.00K
R81 1.00M
C87 120PF
H2
<1>
SIG 1
CR682
Q684
R677 12.1K
R580 1.37K
R682 715
R85 200K
C91 .68PF
R475 2.00K
R569 221K
C569 82PF
R376 150
Q478
Q477
R479 3.32K
R477 16.9K
CR476
C476 33PF
R478 1.00K
C375 .1UF
Q476
R381 4.53K
CR380
R380 4.53K
CR280
C3
<5>
VPOSN
R371 13.0K
C374 .1UF
C367 5.6PF
C368 1.2−4.0PF
HF COMP
R273 59.0K
R274 200K
R367 1.27K
R368 1.27K
X5 MAG REGISTR.
X5 HF COMP
C372 7−45PF
R470 150
R373 511
R372 825
Q272
R272 10.0K
VR273 15V
E4
<5>
X5
R627 100
R473 2.21K
R472 1.50K
R471 10.0K
C629 .1UF
C468 .1UF
Q469
J99 RESTORER
1−2 SLOW
2−3 FAST
P99
J99
U277C DG211
R487 2.00K
C488 .1UF
E5
<5>
/ON_DCR
U585D DG211
R676 10.0K
R783 2.00K
C676 .001UF
U488 LF351
R484 22.1K
C484 .1UF
U277B DG211
R370 100
R474 332
C473 .001UF
R570 1.50K
C570 .1UF
F2
<3>
/BCKPORCH
R378 1.21K
R377 287
R374 931
R379 47.5
Q383
C384 220PF
R384 22.1
Q382
C385 100PF
R385 20.0K
R486 71.5
C389 56PF
R485 43.2
Q387
C387 220PF
R387 22.1
Q385
R383 6.49K
R386 6.49K
R388 3.40K
R489 500
LIMIT CENTER
R389 6.98K
C388 .1UF
R382 402
R482 412
R483 412
C185 .1UF
L180 3.5−7.8UH
L190 3.5−7.8UH
R183 4.7K
R184 1K
R186 1K
R187 4.7K
J15 & J16 CONNECT TO CRT
H4
<8>
VERTICAL DEFLECTION
J15
J16
BLUE
BROWN
R180 22.1
Q280
Q289
R189 22.1
CR280 CR380
U277A DG211
C377 .1UF
R276 100
U277D DG211
U585A DG211
U585B DG211
NC
** See parts list for earlier values and serial number ranges.
PART OF A3 MAIN BOARD

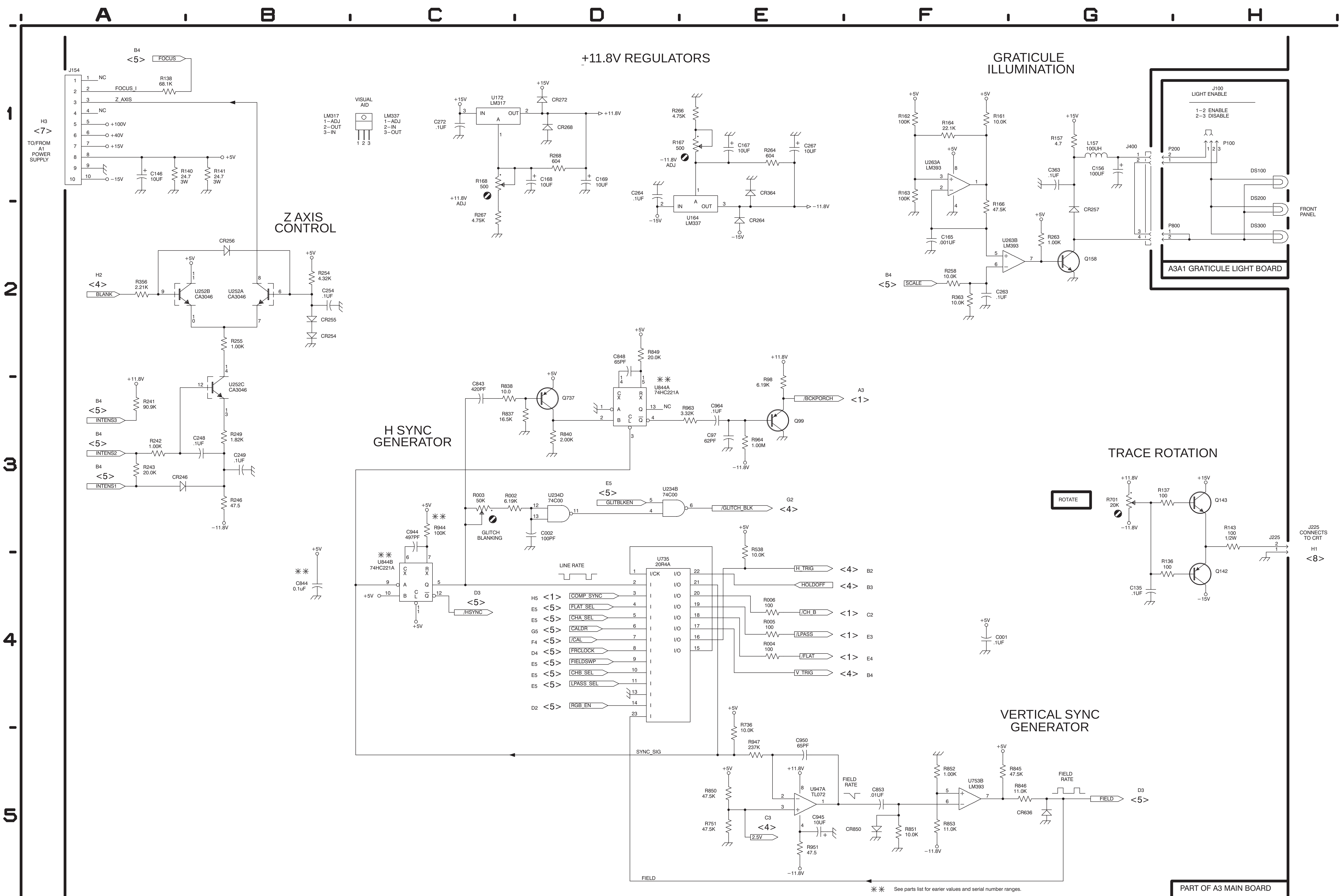
A3 Main Board Schematic <3> Component Locator

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram. The etched circuit boards follow a numbering sequence starting with the lowest number at the upper left corner, as pictured in this manual.

Assembly A3 *Partial Assembly A3 also shown on Schematics 1, 2, 4, and 5.*

Circuit Number	Schematic Diagram Location
Grat Light Board	
DS100	H1
DS200	H2
DS300	H2
J100	H1
P100	H1
P200	G1
P800	G2
A3	
C001	F4
C002	D3
C97	E3
C135	G4
C146	A1
C156	G1
C165	F2
C167	E1
C168	D1
C169	D1
C248	B3
C249	B3
C254	B2
C263	F2
C264	D1
C267	E1
C272	C1
C363	G1
C843	C3
C848	D2
C853	F5
C944	C3
C945	E5
C950	E5
C964	E3
CR246	A3
CR254	B2
CR255	B2
CR256	B2
CR257	G2
CR264	E2
CR268	D1
CR272	D1
CR364	E1
CR636	G5
CR850	F5
J154	A1
J225	H3
L157	G1
P200	G1
P800	G2
Q99	E3
Q142	H4
Q143	H3
Q158	G2
Q737	D3
R002	C3
R003	C3
R004	E4
R005	E4
R006	E4
R98	E2
R136	G4
R137	G3
R138	A1
R140	A1
R141	B1
R143	H3
R161	F1
R162	F1
R163	F1
R164	F1
R166	F1
R167	E1
R168	C1
R241	A3
R242	A3
R243	A3
R246	B3
R249	B3
R254	B2
R255	B2
R258	F2
R263	G2
R264	E1
R266	E1
R267	C2
R268	D1
R356	A2
R363	F2
R538	E4
R701	G3
R736	E4
R751	E5
R837	D3
R838	C3
R840	D3
R845	F5
R846	G5
R849	D2
R850	E5
R851	F5
R852	F5
R853	F5
R944	C3
R947	E5
R951	E5
R963	E3
R964	E3
U164	D1
U172	C1
U234B	D3
U234D	D3
U252A	B2
U252B	A2
U252C	B3
U263A	F1
U263B	F2
U735	D4
U753B	F5
U844A	D3
U844B	C4
U947A	E5

Figure 10–4: A3 Main Board Schematic <3> component locator



+11.8V REGULATORS
GRATICULE ILLUMINATION
Z AXIS CONTROL
H SYNC GENERATOR
TRACE ROTATION
VERTICAL SYNC GENERATOR
A3A1 GRATICULE LIGHT BOARD
PART OF A3 MAIN BOARD
See parts list for earier values and serial number ranges.

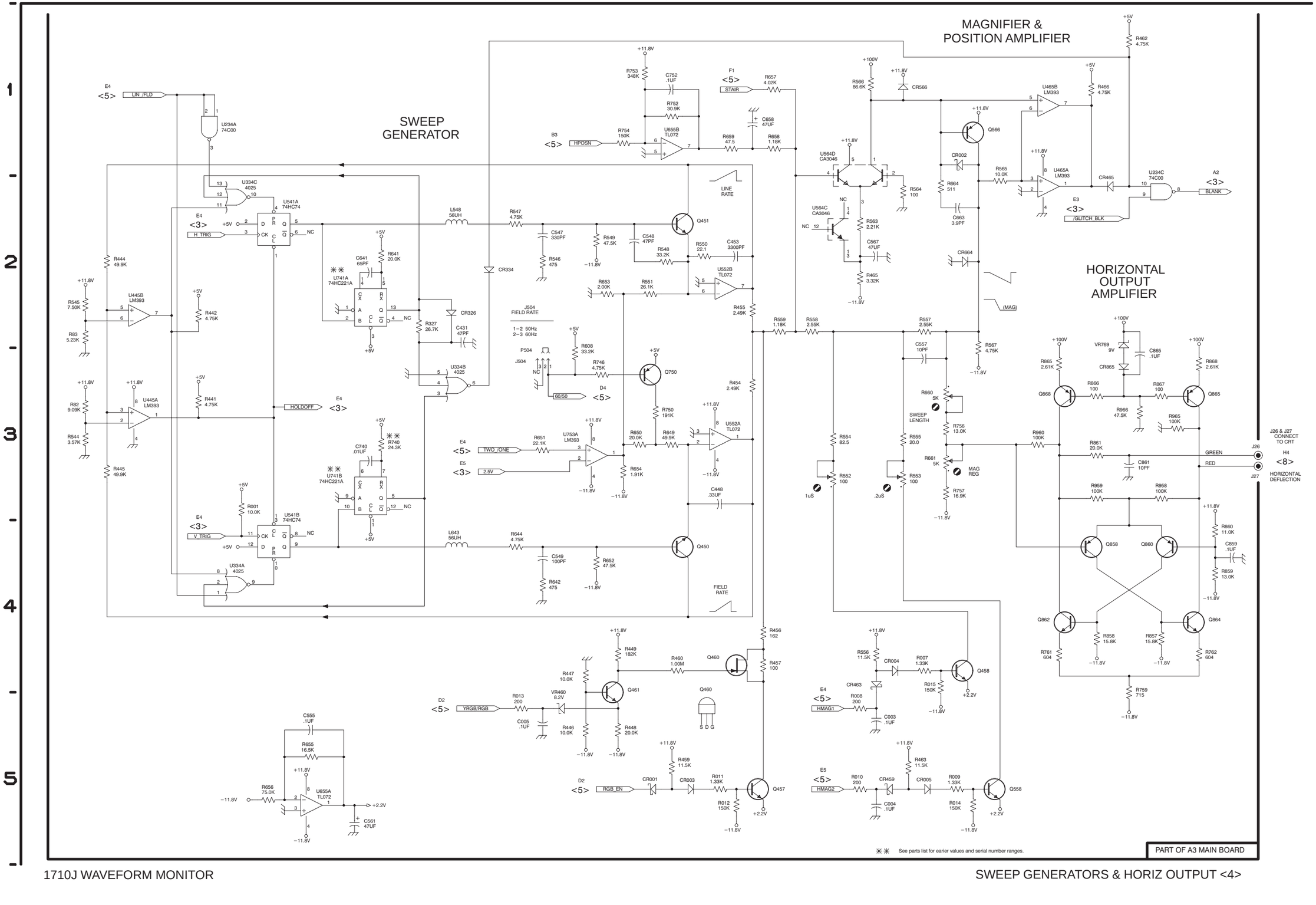
A3 Main Board Schematic <4> Component Locator

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram. The etched circuit boards follow a numbering sequence starting with the lowest number at the upper left corner, as pictured in this manual.

Assembly A3 *Partial Assembly A3 also shown on Schematics 1, 2, 3, and 5.*

Circuit Number	Schematic Diagram Location
C003	F5
C004	F5
C005	D5
C431	C2
C448	E3
C453	E2
C547	D2
C548	D2
C549	D4
C555	B5
C557	F3
C561	C5
C567	F2
C641	C2
C658	E1
C663	F2
C740	C3
C752	E1
C859	H4
C861	G3
C865	G3
CR001	D5
CR002	F1
CR003	E5
CR004	F4
CR005	F5
CR326	C2
CR334	C2
CR459	F5
CR463	F4
CR465	G2
CR566	F1
CR664	F2
CR865	G3
J26	H3
J27	H3
J504	D3
L548	C2
L643	C4
P504	D3
Q450	E4
Q451	E2
Q457	E5
Q458	F4
Q460	E4
Q461	D4
Q558	F5
Q566	F1
Q750	D3
Q858	G4
Q860	H4
Q862	G4
Q864	H4
Q865	H3
Q868	G3
R001	B3
R007	F4
R008	F5
R009	F5
R010	F5
R011	E5
R012	E5
R013	D5
R014	F5
R015	F4
R82	A3
R83	A2
R327	C2
R441	B3
R442	B2
R444	A2
R445	A3
R446	D5
R447	D4
R448	D5
R449	D4
R454	E3
R455	E2
R456	E4
R457	E4
R459	E5
R460	E4
R462	G1
R463	F5
R465	F2
R466	G1
R544	A3
R545	A2
R546	D2
R547	D2
R548	D2
R549	D2
R550	E2
R551	D2
R552	E3
R553	F3
R554	F3
R555	F3
R556	F4
R557	F2
R558	E2
R559	E2
R563	F2
R564	F2
R565	G2
R566	F1
R567	F2
R608	D2
R641	C2
R642	D4
R644	D4
R649	D3
R650	D3
R651	D3
R652	D4
R653	D2
R654	D3
R655	B5
R656	B5
R657	E1
R658	E1
R659	E1
R660	F3
R661	F3
R664	F2
R740	C3
R746	D3
R750	D3
R752	D1
R753	D1
R754	D1
R756	F3
R757	F3
R759	G4
R761	G4
R762	H4
R857	H4
R858	G4
R859	H4
R860	H4
R861	G3
R865	G3
R866	G3
R867	H3
R868	H3
R958	H3
R959	G3
R960	G3
R965	H3
R966	G3
U234A	B1
U234C	G2
U334A	B4
U334B	C3
U334C	B2
U445A	A3
U445B	A2
U465A	G2
U465B	G1
U541A	B2
U541B	B4
U552A	E3
U552B	E2
U564C	F2
U564D	F1
U655A	B5
U655B	D1
U741A	C2
U741B	C3
U753A	D3
VR460	D5
VR769	G2

Figure 10–5: A3 Main Board Schematic <4> component locator


SWEEP GENERATOR
MAGNIFIER & POSITION AMPLIFIER
HORIZONTAL OUTPUT AMPLIFIER
LINE RATE
FIELD RATE
J504 FIELD RATE
1–2 50Hz
2–3 60Hz
UN /FLD
H TRIG
V TRIG
HOLDOFF
HPOSN
STAIR
TWO /ONE
2.5V
YRGB/RGB
RGB EN
HMAG1
HMAG2
/GLITCH BLK
BLANK
(MAG)
SWEEP LENGTH
MAG REG
1uS
.2uS
GREEN
RED
J26 & J27 CONNECT TO CRT
HORIZONTAL DEFLECTION
See parts list for earier values and serial number ranges.
PART OF A3 MAIN BOARD

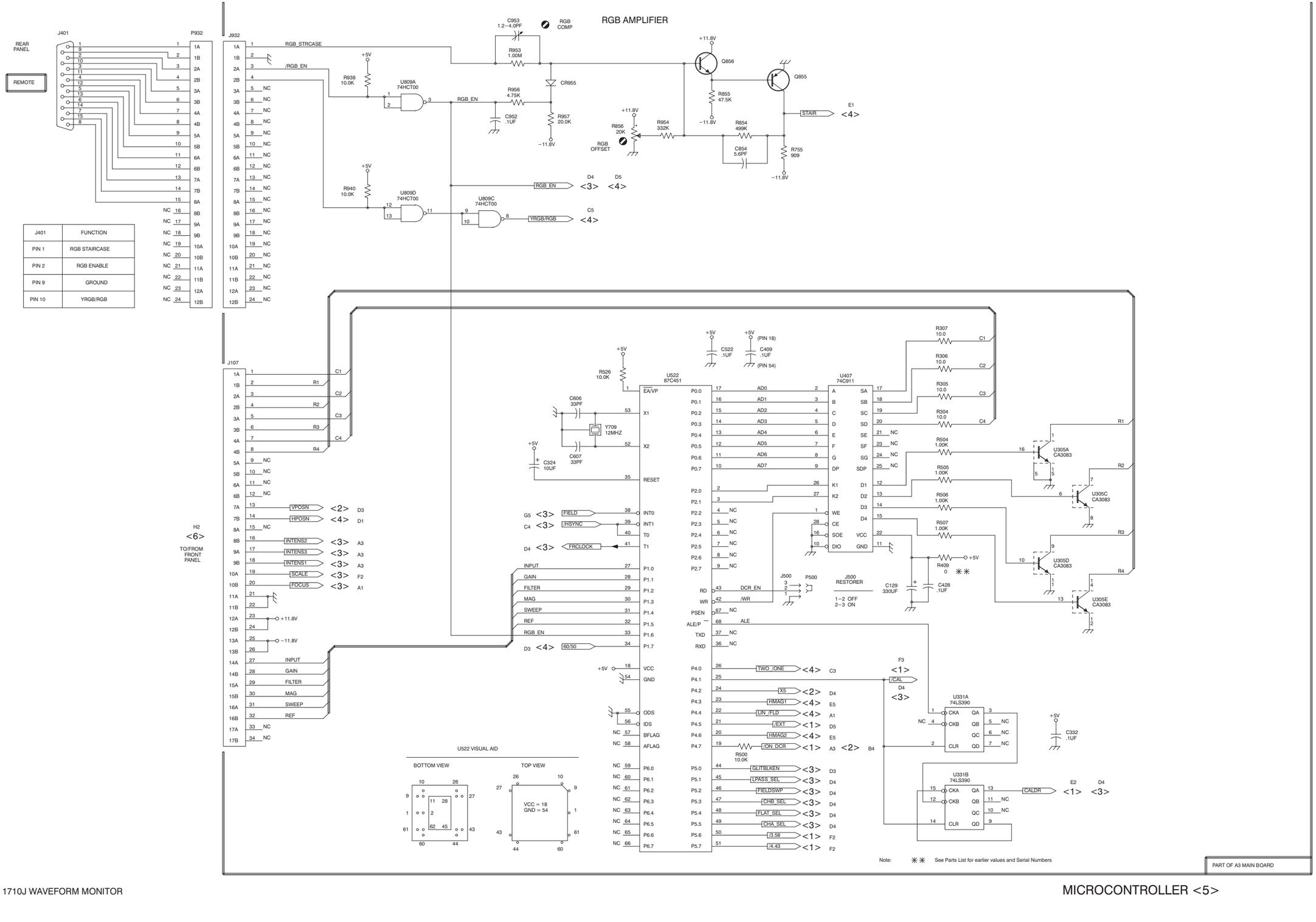
A3 Main Board Schematic <5> Component Locator

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram. The etched circuit boards follow a numbering sequence starting with the lowest number at the upper left corner, as pictured in this manual.

Assembly A3 *Partial Assembly A3 also shown on Schematics 1, 2, 3, and 4.*

Circuit Number	Schematic Diagram Location
C129	F4
C324	D3
C332	G5
C409	E3
C428	F4
C522	E3
C606	D3
C607	D3
C854	E1
C952	D1
C953	D1
CR955	D1
J107	B3
J500	E4
J932	B1
P500	E4
Q855	E1
Q856	E1
R221	D3
R304	F3
R305	F3
R306	F3
R307	F2
R409	F4
R500	E5
R504	F3
R505	F3
R506	F3
R507	F4
R526	D3
R755	E1
R854	E1
R855	E1
R856	D1
R938	C1
R940	C2
R953	D1
R954	E1
R956	D1
R957	D1
U305A	G3
U305C	G3
U305D	G4
U305E	G4
U331A	F5
U331B	F5
U407	F3
U522	D3
U809A	C1
U809C	C2
U809D	C2
Y709	D3

Figure 10–6: A3 Main Board Schematic <5> component locator



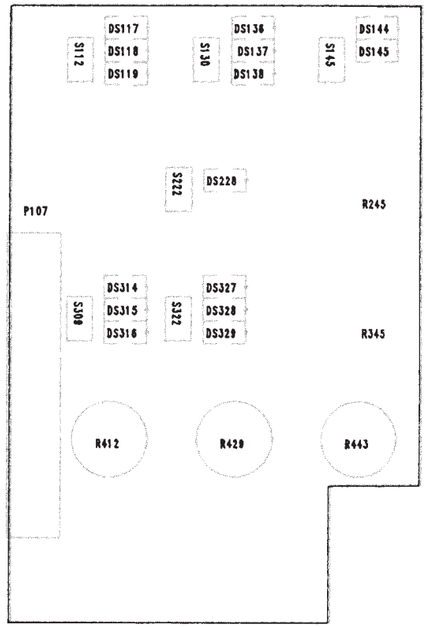
1710J WAVEFORM MONITOR

MICROCONTROLLER <5>

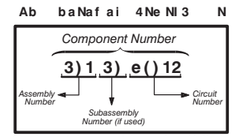
A2 Front Panel Board Schematic <6> Component Locator

The schematic diagram has an alpha-numeric grid to assist in locating parts within that diagram. The etched circuit boards follow a numbering sequence starting with the lowest number at the upper left corner, as pictured in this manual.

ASSEMBLY A2



A2 Front Panel Board



Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

STATIC SENSITIVE DEVICES

Circuit Number	Schematic Diagram Location
DS117	C1
DS118	C2
DS119	C2
DS136	C1
DS137	C2
DS138	C2
DS144	D1
DS145	D2
DS228	C3
DS314	C4
DS315	C4
DS316	C5
DS327	C4
DS328	C4
DS329	C5
P107	H2
R245	G2
R345	G2
R412	G3
R429	G3
R443	G3
S112	F4
S130	F4
S145	G4
S222	F4
S309	F5
S322	F5

Figure 10–7: A2 Front Panel Board Schematic <6> component locator

A B C D E F G H

1 2 3 4 5

INPUT

VERTICAL

HORIZONTAL

FLAT DS117A
INT DS136A
CH A DS144A
LPASS DS117B
EXT DS136B
CH B DS144B
CHRM DS117C
CAL DS136C
X5 DS228
1uS DS314A
2 LINE DS327A
X25 DS314B
2 FLD DS327B
.2uS DS314C
1 LINE DS327C

C4 C1 R2 R1
C2 C3 C4 R4 R2 R1
C3 R4 R1
C2 R4
C4 C2 R3 R2
C1 C3 R3 R4
C1 C4 R3

VERTICAL

HORIZONTAL

DISPLAY

INPUT

VERTICAL

HORIZONTAL

+11.8V R245 20K −11.8V
+11.8V R345 20K
INTENS R443 20K
+11.8V R429 20K
SCALE
+11.8V R412 20K −11.8V
FOCUS

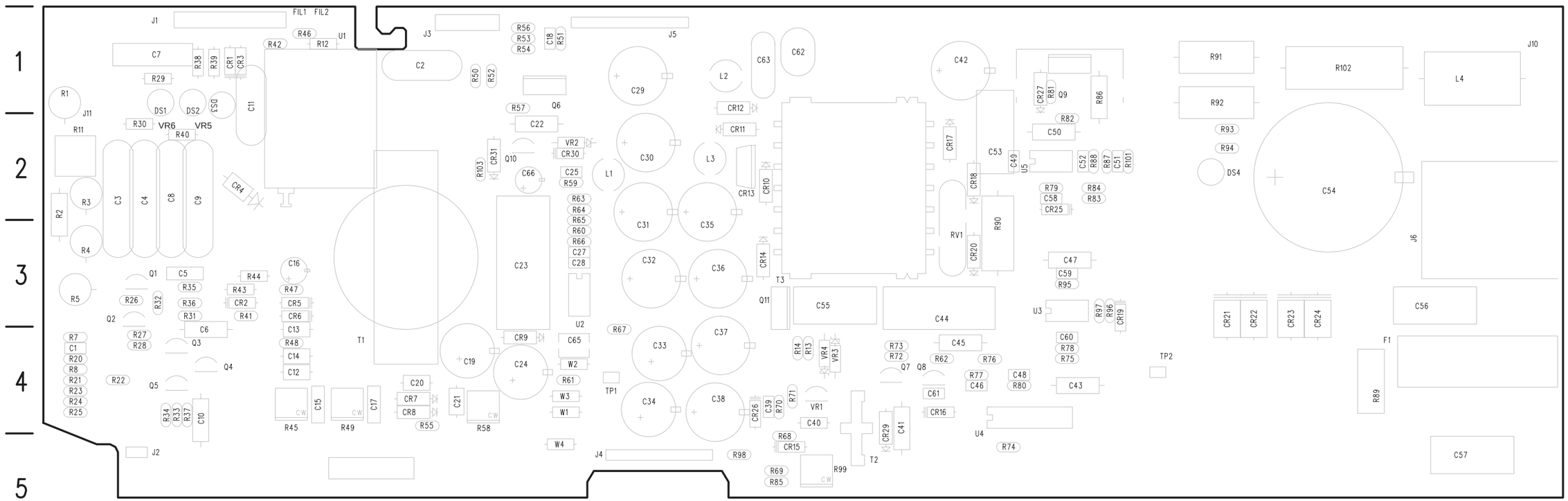
FILTER S112
REF S130
INPUT S145
GAIN S222
MAG S309
SWEEP S322

P107

C1	1	1A
R1	2	1B
C2	3	2A
R2	4	2B
C3	5	3A
R3	6	3B
C4	7	4A
R4	8	4B
NC	9	5A
NC	10	5B
NC	11	6A
NC	12	6B
VPOSN	13	7A
HPOSN	14	7B
NC	15	8A
INTENS2	16	8B
INTENS3	17	9A
INTENS1	18	9B
SCALE	19	10A
FOCUS	20	10B
	21	11A
	22	11B
+11.8V	23	12A
	24	12B
−11.8V	25	13A
	26	13B
INPUT	27	14A
GAIN	28	14B
FILTER	29	15A
MAG	30	15B
SWEEP	31	16A
REF	32	16B
NC	33	17A
NC	34	17B

B3 <5> TO/FROM A3 MAIN BOARD

A2 FRONT PANEL BOARD



A1 Power Supply Board

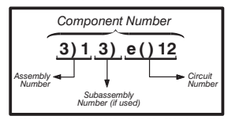
A1 Power Supply Board Schematic <7> Component Locator

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

Assembly A1. Partial Assembly A1 also shown on Diagram 8.

		1			1			1			1			1			
C29	F2	F1	C58	B3	J2	DS4	D2	L2	R72	D5	H4	R99	G4	H5
C30	F2	F2	C59	B4	J3	F1	B2	M4	R73	E5	H4	R101	C3	K2
C31	F3	F3	C60	B5	J4				R74	C4	J5	R102	C2	M1
C32	F2	F3	C61	D4	I4	J2	H5	B5	R75	B5	J4			
C33	G2	F4	C62	E1	H1	J4	H3	F5	R76	C5	I4	RV1	D2	I3
C35	F3	G3	C63	E1	G1	J5	H1	F1	R77	D4	I4			
C36	G2	G3				J6	A2	M3	R78	B4	J4	T2	E4	H5
C37	G3	G4	CR10	F1	G2	J10	A2	N1	R79	B3	J2	T3	E2	G3
C38	G2	G4	CR11	F2	G2				R80	C4	J4			
C39	E4	G4	CR12	F2	G1	L1	F3	F2	R81	D3	J1	TP1	F5	F4
C40	F4	H4	CR13	F3	G2	L2	F2	G1	R82	C3	J2	TP2	E5	K4
C41	E4	I4	CR14	E2	G3	L3	F2	G2	R83	C5	J2			
C42	D3	I1	CR15	E4	G5	L4	C2	N1	R84	B5	J2	U3A	C4	J3
C43	C4	J4	CR16	D5	I4				R85	G4	G5	U3B	B3	J3
C44	D2	I3	CR17	E2	I2	Q7	D5	I4	R86	D3	J1	U4A	D4	I5
C45	D4	I4	CR18	D2	I2	Q8	E4	I4	R87	D3	K2	U4B	C4	I5
C46	C5	I4	CR19	B3	K3	Q9	D3	J1	R88	B4	J2	U5	C3	J2
C47	A3	J3	CR20	E3	I3	Q11	G3	G3	R89	B2	M4			
C48	C4	J4	CR21	B2	L4				R90	E3	I3	VR1	F4	H4
C49	D3	J2	CR22	B2	L4	R13	F3	H4	R91	D2	K1	VR3	F3	H4
C50	C3	J2	CR23	B2	L4	R14	F3	H4	R92	D2	K1	VR4	F4	H4
C51	C3	K2	CR24	B2	L4	R62	D4	I4	R93	D2	L2			
C52	C4	J2	CR25	B3	J2	R67	F2	F4	R94	D2	L2	W1	G3	E4
C53	E3	I2	CR26	F4	G4	R68	F4	G5	R95	B4	J3	W2	G3	E4
C54	C2	M2	CR27	D3	J1	R69	G4	G5	R96	A4	K3	W3	G2	E4
C55	E3	H3	CR29	E4	H5	R70	G4	G4	R97	A3	J3	W4	G2	E5
C56	B2	M3				R71	F4	H4	R98	F4	G5			
C57	B2	N5												

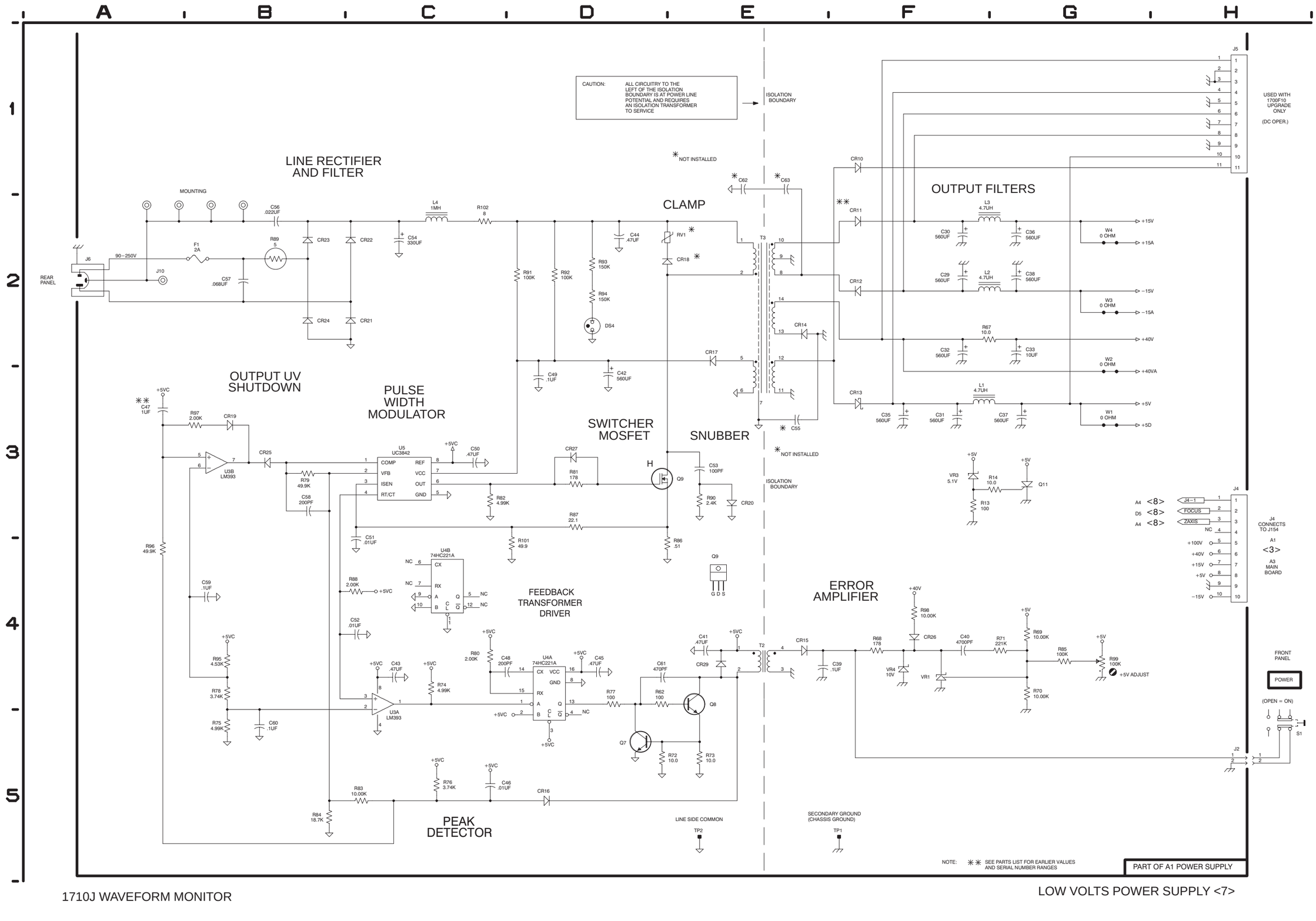
Ab baNaf ai 4Ne Nl 3 N

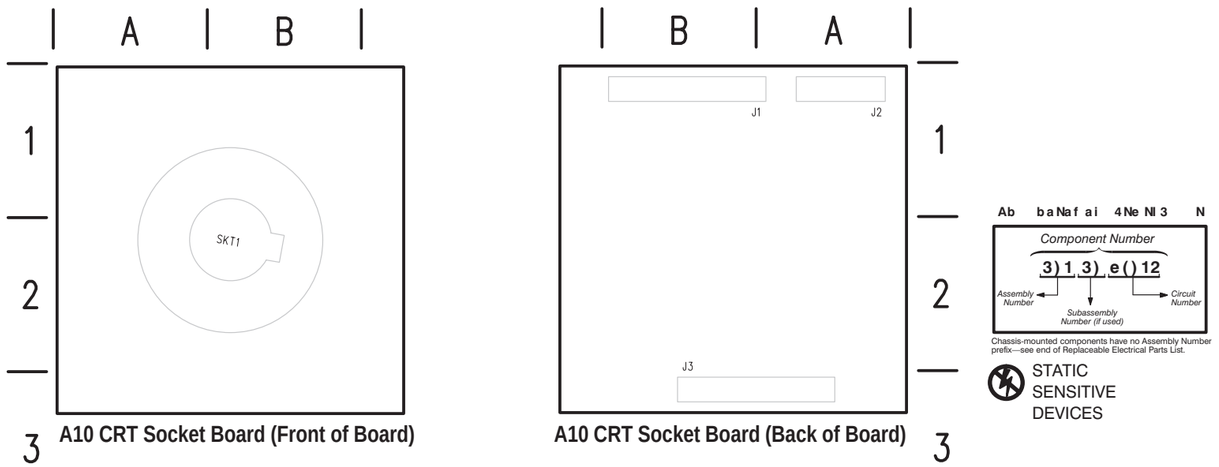


Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.

STATIC SENSITIVE DEVICES

Figure 10–8: A1 Power Supply Board Schematic <7> component locator


CAUTION: ALL CIRCUITRY TO THE LEFT OF THE ISOLATION BOUNDARY IS AT POWER LINE POTENTIAL AND REQUIRES AN ISOLATION TRANSFORMER TO SERVICE
ISOLATION BOUNDARY
LINE RECTIFIER AND FILTER
MOUNTING
REAR PANEL
J6
J10
90–250V
F1 2A
C56 .022UF
C57 .068UF
R89 5
CR23
CR22
CR24
CR21
L4 1MH
R102 8
C54 330UF
CLAMP
NOT INSTALLED
C62
C63
RV1
CR18
C44 .47UF
R91 100K
R92 100K
R93 150K
R94 150K
DS4
T3
OUTPUT FILTERS
CR10
CR11
CR12
CR13
CR14
CR17
L3 4.7UH
L2 4.7UH
L1 4.7UH
C30 560UF
C36 560UF
C29 560UF
C38 560UF
C32 560UF
C33 10UF
C35 560UF
C31 560UF
C37 560UF
R67 10.0
W4 0 OHM
W3 0 OHM
W2 0 OHM
W1 0 OHM
+15V
+15A
–15V
–15A
+40V
+40VA
+5V
+5D
J5
USED WITH 1700F10 UPGRADE ONLY
(DC OPER.)
OUTPUT UV SHUTDOWN
+5VC
C47 1UF
R97 2.00K
CR19
U3B LM393
PULSE WIDTH MODULATOR
U5 UC3842
COMP
VFB
ISEN
RT/CT
REF
VCC
OUT
GND
CR25
R79 49.9K
C58 200PF
C50 .47UF
R82 4.99K
C51 .01UF
R96 49.9K
SWITCHER MOSFET
CR27
R81 178
Q9
H
C53 100PF
R90 2.4K
CR20
R87 22.1
R101 49.9
R86 .51
SNUBBER
NOT INSTALLED
C55
C49 .1UF
C42 560UF
CR15
C39 .1UF
C41 .47UF
CR29
T2
C61 470PF
R62 100
Q8
Q7
R72 10.0
R73 10.0
R77 100
U4A 74HC221A
U4B 74HC221A
R80 2.00K
C48 200PF
C45 .47UF
C43 .47UF
R74 4.99K
U3A LM393
R95 4.53K
R78 3.74K
R75 4.99K
C60 .1UF
C59 .1UF
R88 2.00K
C52 .01UF
FEEDBACK TRANSFORMER DRIVER
Q9
G D S
ERROR AMPLIFIER
R98 10.00K
CR26
C40 4700PF
R71 221K
R69 10.00K
R85 100K
R99 100K
+5V ADJUST
R70 10.00K
VR4 10V
VR1
VR3 5.1V
R14 10.0
R13 100
Q11
R76 3.74K
C46 .01UF
CR16
R83 10.00K
R84 18.7K
PEAK DETECTOR
LINE SIDE COMMON
TP2
SECONDARY GROUND (CHASSIS GROUND)
TP1
J4
J4 CONNECTS TO J154
A1 <3>
A3 MAIN BOARD
A4 <8>
D5 <8>
A4 <8>
J4–1
FOCUS
ZAXIS
NC
+100V
+40V
+15V
+5V
–15V
FRONT PANEL
POWER
(OPEN = ON)
S1
J2
NOTE: ** SEE PARTS LIST FOR EARLIER VALUES AND SERIAL NUMBER RANGES
PART OF A1 POWER SUPPLY



A1 Power Supply Board Schematic <8> Component Locator

The schematic diagram has an alphanumeric grid to assist in locating parts within that diagram.

Assembly A1. Partial Assembly A1 also shown on Diagram 7.

		1			1			1			1			1
C1	C4	A4	C28	B1	E3	J11	F4	A2	R26	E5	A3	R51	F3	E1
C2	D3	D1	C34	D1	F4				R27	E5	A4	R52	F2	E1
C3	D3	A2	C65	B2	E4	Q1	E5	B3	R28	E5	A4	R53	F2	E1
C4	D3	A2	C66	A2	E2	Q2	E5	A3	R29	D2	B1	R54	F2	E1
C5	D4	B3				Q3	D4	B4	R30	D2	A2	R55	D2	D4
C6	C4	B4	CR1	E2	B1	Q4	D4	B4	R31	D4	B3	R56	F3	E1
C7	F3	B1	CR2	D4	B3	Q5	C4	B4	R32	E5	B3	R57	B2	E1
C8	C3	B2	CR3	E2	B1	Q6	B2	E1	R33	C4	B4	R58	D2	E4
C9	E2	B2	CR4	C2	B2	Q10	A2	E2	R34	C4	B4	R59	B1	E2
C10	C5	B4	CR5	D2	C3				R35	D4	B3	R60	C1	E3
C11	E2	B1	CR6	E2	C3	R1	E3	A1	R36	D4	B3	R61	D1	E4
C12	D2	C4	CR7	C2	D4	R2	E4	A2	R37	C5	B4	R63	A2	E2
C13	D2	C4	CR8	C2	D4	R3	E4	A2	R38	E2	B1	R64	C2	E2
C14	D2	C4	CR9	C1	E4	R4	E4	A3	R39	E2	B1	R65	B1	E3
C15	F2	C4	CR30	A2	E2	R5	E5	A3	R40	D2	B2	R66	B1	E3
C16	C2	C3	CR31	A2	E2	R7	B4	A4	R41	D4	B3	R103	A2	E2
C17	F2	D4				R8	B4	A4	R42	E3	C1			
C18	F3	E1	DS1	E2	B2	R11	F4	A2	R43	E2	B3	T1	B2	C4
C19	C1	D4	DS2	E2	B2	R12	D3	C1	R44	D2	B3			
C20	C2	D4	DS3	E3	B1	R20	C4	A4	R45	F2	C4	U1	D1	C1
C21	C1	D4				R21	C5	A4	R46	E3	C1	U2	B1	F4
C22	B2	E2	FIL1	C3	C1	R22	D5	A4	R47	D2	C3			
C23	B2	E3	FIL2	C3	C1	R23	B4	A4	R48	C2	C4	VR2	A2	E2
C24	D1	E4				R24	D5	A4	R49	F2	C4	VR5	F8	C2
C25	A3	E2	J1	F3	B1	R25	B4	A4	R50	F2	E1			
C27	B1	E3	J3	F2	D1									

Figure 10–9: A1 Power Supply Board Schematic <8> component locator

1710J WAVEFORM MONITOR

HIGH VOLTS POWER SUPPLY <8>

Replaceable Mechanical Parts

Replaceable Mechanical Parts

This section contains a list of the replaceable mechanical components for the 1710J-Series Waveform Monitors. Use this list to identify and order replacement parts.

Parts Ordering Information

Replacement parts are available through your local Tektronix field office or representative.

Changes to Tektronix products are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest 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 you order a part that has been replaced with a different or improved part, your local Tektronix 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 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 replacement parts. The following table describes the content of each column in the parts list.

Parts List Column Descriptions

Column	Column Name	Description
1	Figure & Index Number	Items in this section are referenced by figure and index numbers to the exploded view illustrations that follow.
2	Tektronix Part Number	Use this part number when ordering replacement parts from Tektronix.
3 and 4	Serial Number	Column three indicates the serial number at which the part was first effective. Column four indicates the serial number at which the part was discontinued. No entries indicates the part is good for all serial numbers.
5	Qty	This indicates the quantity of parts used.
6	Name & Description	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.
7	Mfr. Code	This indicates the code of the actual manufacturer of the part.
8	Mfr. Part Number	This indicates the actual manufacturer's or vendor's part number.

Abbreviations Abbreviations conform to American National Standard ANSI Y1.1–1972.

Chassis Parts Chassis-mounted parts and cable assemblies are located at the end of the Replaceable Electrical Parts List.

Mfr. Code to Manufacturer Cross Index The table titled Manufacturers Cross Index shows codes, names, and addresses of manufacturers or vendors of components listed in the parts list.

Manufacturers Cross Index

Mfr. Code	Manufacturer	Address	City, State, Zip Code
0JR05	TRIQUEST PRECISION PLASTICS	3000 COLUMBIA HOUSE BLVD PO BOX 66008	VANCOUVER, WA 98666–6008
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 97214–4657
0KB05	NORTH STAR NAMEPLATE INC	5750 NE MOORE COURT	HILLSBORO, OR 97124–6474
0KBZ5	Q & D PLASTICS INC	1812 – 16TH AVENUE PO BOX 487	FOREST GROVE, OR 97116–0487
06915	RICHCO	5825 N TRIPP AVE P.O. BOX 804238	CHICAGO, IL 60646
22670	GM NAMEPLATE INCORPORATED	2040 15TH AVE WEST	SEATTLE, WA 981192783
24931	BERG ELECTRONICS INC	BERG ELECTRONICS RF/COAXIAL DIV 2100 EARLYWOOD DR PO BOX 547	FRANKLIN, IN 46131
2K262	BOYD CORPORATION	6136 NE 87TH AVENUE	PORTLAND, OR 97220
31918	ITT SWITCH PRODUCTS	8081 WALLACE RD	EDEN PRAIRIE, MN 55344–8798
34785	DEK INC.	3480 SWENSEN AVE.	ST. CHARLES, IL 60174–3450
3L462	QUALITY PLASTICS	DIV OF MOLL PLASTICRAFTERS 2101 CRESTVIEW DR.	NEWBERG, OR 97132
55335	JKL COMPONENTS	13343 PAXTON ST	PACOIMA, CA 91331
55566	RAF ELECTRONIC HARDWARE INC	95 SILVERMINE ROAD	SEYMOUR, CT 06483
56501	THOMAS & BETTS CORPORATION	1555 LINFIELD RD	MEMPHIS, TN 38119
5F520	PANEL COMPONENTS CORP	PO BOX 115	OSKALOOSA, IA 52577–0115
71400	BUSSMANN	DIVISION COOPER INDUSTRIES INC PO BOX 14460	ST LOUIS, MO 63178
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD PO BOX 76500	COLD SPRINGS, KY 41076
7X318	KASO PLASTICS INC	11013 A NE 39TH	VANCOUVER, WA 98662
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON, OR 97077–0001
80126	PACIFIC ELECTRICORD CO	747 WEST REDONDO BEACH PO BOX 10	GARDENA, CA 90247–4203
85471	BOYD CORPORATION	13885 RAMONA AVE	CHINO, CA 91710
85480	BRADY USA	NAMEPLATE DIVISION P O BOX 571 346 ELIZABETH BRADY RD	HILLSBOROUGH, NC 27278
93907	CAMCAR DIV OF TEXTRON INC	ATTN: ALICIA SANFORD 516 18TH AVE	ROCKFORD, IL 611045181
9M860	ESAM INC	PO BOX 376	GRANTS PASS, OR 97526
TK1547	MOORE ELECTRONICS INC	19500 SW 90TH CT PO BOX 1030	TUALATIN, OR 97062
TK1617	CRAFT FACTORY PLASTICS	17145 SW ALEXANDER	ALOHA, OR 97007
TK1665	PORTLAND DIE & STAMPING CO INC	4805 SE 26TH AVE	PORTLAND, OR 97202
TK2364	CAPSTONE ELECTRONICS	9500 SW NIMBUS AVE BUILDING E	BEAVERTON, OR 97008–7163

Manufacturers Cross Index (Cont.)

Mfr. Code	Manufacturer	Address	City, State, Zip Code
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK HWY SUITE 2	VANCOUVER, WA 98661
TK2541	AMERICOR ELECTRONICS LTD	UNIT–H 2682 W COYLE AVE	ELK GROVE VILLAGE, IL 60007

Replaceable Mechanical Parts List

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
11–1–1	426–2102–00			1	FRAME,CRT:BEZEL	3L462	ORDER BY DESCR
–2	378–0258–00			1	FLTR,CONTRASTIN:GRAY,POLYCARBONATE	80009	378–0258–00
–3	211–0721–00			10	SCREW,MACHINE:6–32 X 0.375,PNH,STL,CDPL,T–15 TORX	0KB01	ORDER BY DESCR
–4	426–2101–01			1	FRAME SECT,CAB:FRONT	3L462	ORDER BY DESCR
–5	175–9872–01			1	CA ASSY,SP,ELEC:2,18 AWG,2.5 L,0–N	TK2364	175–9872–01
–6	174–2648–00			1	CA ASSY,SP:RIBBON,POWER SWITCH	TK2469	174–2648–00
–7	211–0100–00			2	SCREW,MACHINE:2–56 X 0.750,PNH,STL CD PL,POZ	0KB01	ORDER BY DESCR
–8	260–2465–00			1	SWITCH,PUSH:0.4A,125VAC,BTN W/YEL INDICATOR	31918	(602844)
–9	210–0405–00			2	NUT,PLAIN,HEX:2–56 X 0.188,BRS CD PL	73743	12157–50
–10	————————			1	CIRCUIT BD ASSY:FRONT PNL (SEE A2 REPL)		
–11	366–0616–00			6	PUSH BUTTON:0.585 X 0.3 X 0.150	7X318	ORDER BY DESCR
–12	333–3892–02			1	PANEL,FRONT:MAIN (1710J ONLY)	80009	333–3892–02
	333–3893–02			1	PANEL,FRONT:MAIN (1711J ONLY)	80009	333–3893–02
–13	366–1701–01		B041533	5	KNOB:GY,0.127 ID X 0.392 OD X 0.4 H (1710J ONLY)	80009	366–1701–01
–13	366–0807–00	B041534		5	KNOB:GRAY,0.127 ID X 0.392 OD X 0.525 H,NON–HEAT STAMPED,366–0807–00 (1710J ONLY)	0JR05	366–0807–00
–13	366–1701–01		B040483	5	KNOB:GY,0.127 ID X 0.392 OD X 0.4 H (1711J ONLY)	80009	366–1701–01
–13	366–0807–00	B040484		5	KNOB:GRAY,0.127 ID X 0.392 OD X 0.525 H,NON–HEAT STAMPED,366–0807–00 (1711J ONLY)	0JR05	366–0807–00
–14	333–3894–00			1	PANEL,FRONT:SMALL,1710J/11J	0KB05	333–3894–00
–15	211–0690–02			2	SCR,MACH:6–32 X 0.875,PNH,SST BLKOXD,TORX & SLOT	93907	B20–70430

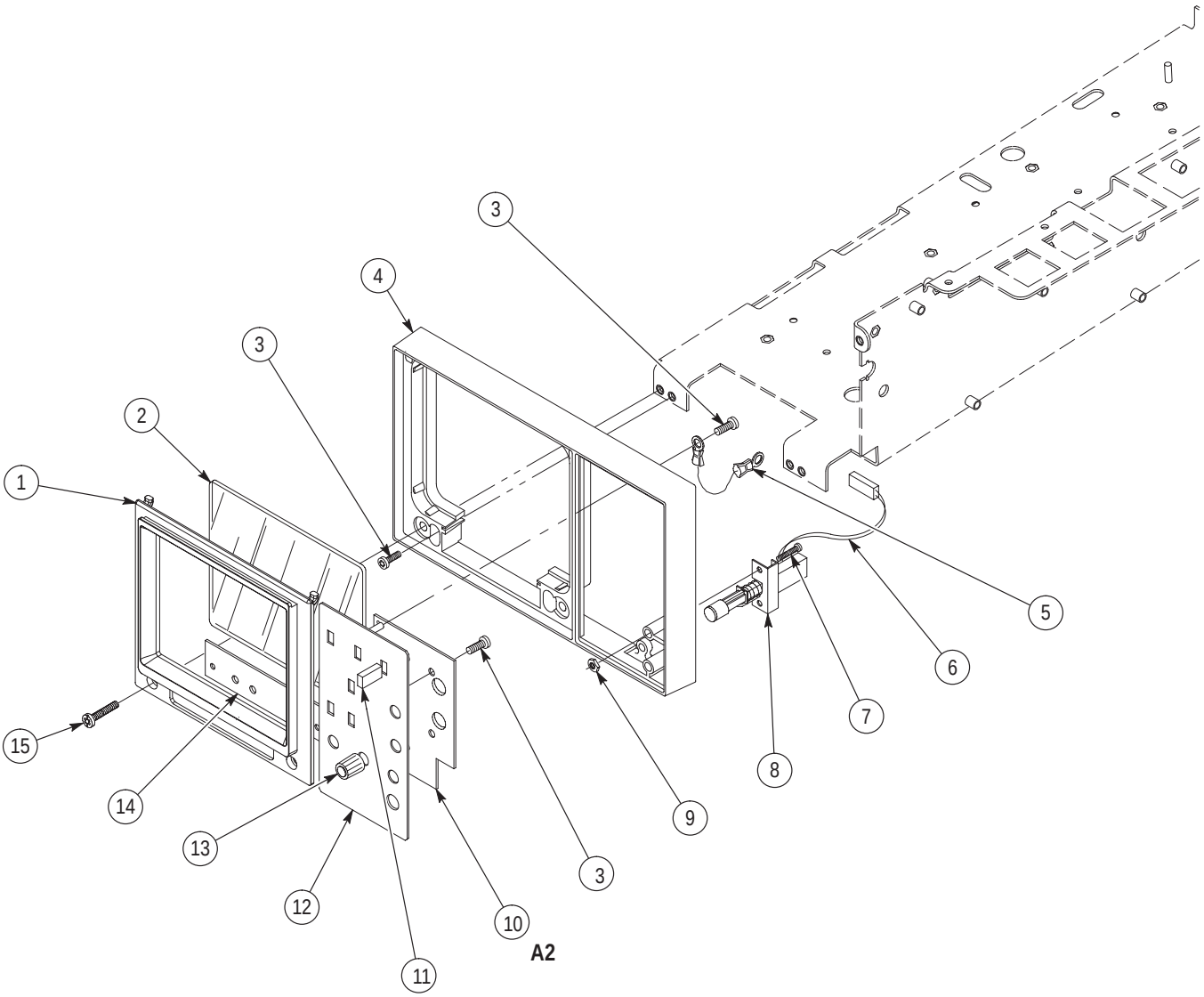


Figure 11–1: Front View

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
11–2–1	————————			1	ELECTRON,TUBE:CRT,FINISHED (SEE V1 REPL)		
–2	386–4443–00		B041270	1	SUPPORT,SHIELD:CRT,FRONT,PLASTIC	80009	386–4443–00
	386–6911–00	B041271		4	SUPPORT, SHIELD:CRT SHIELD SUPPORT,PLASTIC,1740A	7X318	1365
–3	334–1379–00			1	MARKER,IDENT:MKD HI VACUUM	22670	ORDER BY DESCR
–4	337–4064–00		B041270	1	SHIELD,ELEC:MU–METAL CRT SHIELD,SAF CONTROLLED	80009	337–4064–00
	337–4087–01	B041271		1	SHIELD,ELEC:MU–METAL CRT SHIELD,SAF CONTROLLED	80009	337–4087–01
–5	346–0133–00			1	STRAP,TIEDOWN,E:14.0 X 0.091,NYLON	56501	TY234M EURO DIRECT PURCH
–6	348–1464–00			1	MANCHET:CRT,END RUBBER MANCHET,31.5MM THK X 63MM OD,50.5 ID	80009	348–1464–00
–7	210–0457–00			2	NUT,PL,ASSEM WA:6–32 X 0.312,STL CD PL	0KB01	ORDER BY DESCR
–8	407–4395–00			1	BRACKET,CRT:BACK,0.062,AL	80009	407–4395–00
–9	————————			1	CIRCUIT BD ASSY:CRT SOCKET (SEE A10 REPL)		
–10	174–3511–01			1	CA ASSY,SP:DISCRETE,CPD,4,24 AWG, 8.0L,1X7,0.1CTR & 2, 24 AWG, 8.5L X STRAIN RELIEF PCB,	80009	174–3511–01
					ATTACHED PARTS		
	344–0111–00			2	INSUL,SPREADER:DEFL LEADS,POLYPROPYLENE	TK1617	NA
	343–0298–00			1	STRAP,RETAINING:0.25 DIA CABLE	85480	HCNY–250NA
					END ATTACHED PARTS		
–11	179–2997–01			1	WIRE HARNESS:DESCRETE,CRT ASSY 5,24AGW,5,26 AGW	9M860	179–2997–01
–12	426–2103–07			1	FRAME,CHASSIS:CHASSIS FRAME,ALUM	80009	426–2103–07
–13	337–3321–00			1	SHIELD,ELEC:CKT BD	85471	337–3321–00
–14	129–1308–00	B041023		1	SPACER,POST: 6–32 X 0.75, HEX, STL, CAD PL	55566	4538–632–S–3
–15	343–0013–00	B041023		1	CLAMP,LOOP:0.375 ID,PLASTIC,SAFETY CONTROLLED	06915	E6 CLEAR ROUND CABLE CLAMP
– 16	211–0720–01	B041023		1	SCREW,MACHINE:6–32 X 0.50 HEX,STL, CAD PL	0KB01	211–0720–01
–17	————————			1	CIRCUIT BD ASSY:MAIN (SEE A3 REPL)		
–18	343–0916–00		B041022	1	CLAMP,LOOP:0.5 ID,NYLON	34785	029–500
–18	211–0721–00		B041022	8	SCREW,MACHINE:6–32 X 0.375,PNH,STL,CDPL,T–15 TORX	0KB01	ORDER BY DESCR
–18	211–0721–00	B041023		7	SCREW,MACHINE:6–32 X 0.375,PNH,STL,CDPL,T–15 TORX	0KB01	ORDER BY DESCR
–19	————————			1	CIRCUIT BD ASSY:GRATICULE LIGHT (SEE A3A1 REPL)		
–20	348–0171–00			1	GROMMET,PLASTIC:BLACK,U–SHAPED,0.276 ID	0KBZ5	NA

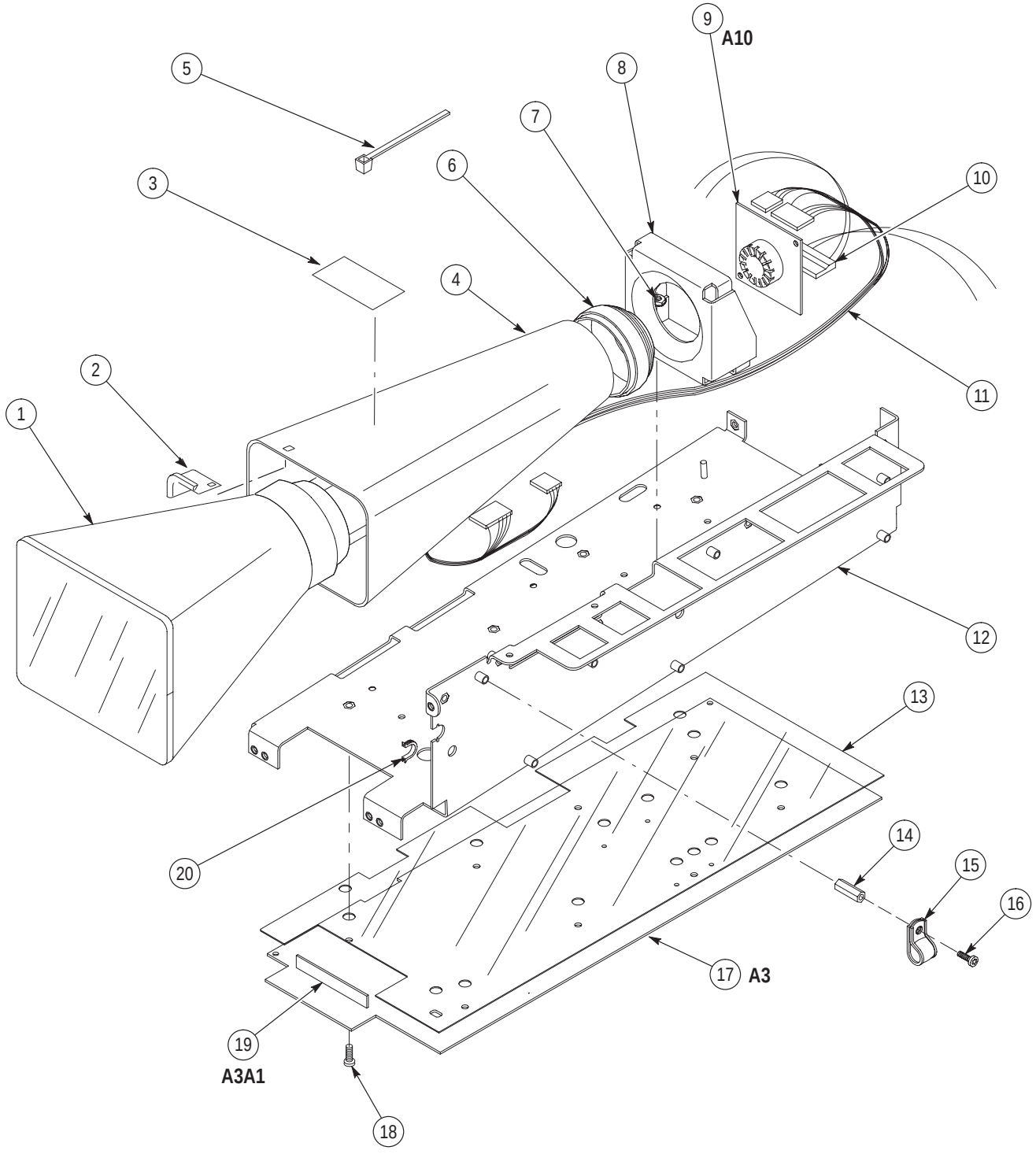


Figure 11–2: CRT, Chassis and Main Bd

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
11–3–1	174–2277–00			1	CA ASSY,SP:RIBBON,IDC,15,28AWG,20.0L	TK1547	174–2277–00
–2	333–3895–01		B040152	1	PANEL,REAR:1710J/1711J	80009	333–3895–01
–2	333–3895–02	B040153		1	PANEL,REAR:REAR PANEL,ALUM,1710J/1711J,	80009	333–3895–02
–3	211–0720–01			2	SCREW,MACH:6–32 X 0.50,PNH,STL,TORX T–15 WITH SLOT	0KB01	211–0720–01
–4	214–3903–01			2	SCREW,JACK:4–40 X 0.312 EXT THD,4–40 INT THD	0KB01	214–3903–01
–5	210–0255–00			1	TERMINAL,LUG:0.391 ID,LOCKING,BRS CD PL	TK1665	ORDER BY DESCR
–6	211–0721–00			10	SCREW,MACHINE:6–32 X 0.375,PNH,STL,CDPL,T–15 TORX	0KB01	ORDER BY DESCR
–7	131–0106–02			6	CONN,RF JACK:BNC,50 OHM,FEMALE	24931	28JR178–1
–8	211–0014–00			2	SCREW,MACHINE:4–40 X 0.5,PNH,STL CD PL,POZ	93907	ORDER BY DESCR
–9	131–3573–00			1	CONN,PLUG,ELEC:MALE,W/LOCKING ADAPTER	80126	B–0779
–10	337–3796–01			1	SHIELD,ELEC:0.032 BRASS,C26000,0.5 HARD	80009	337379601
–11	337–3931–00			1	SHIELD,ELEC:ALUMINUM	80009	337393100
–12	————————			1	CIRCUIT BD ASSY:MAIN (SEE A3 REPL)		
–13	337–3257–00			2	SHIELD,CKT BD:LV PWR SUPPLY	2K262	ORDER BY DESCR

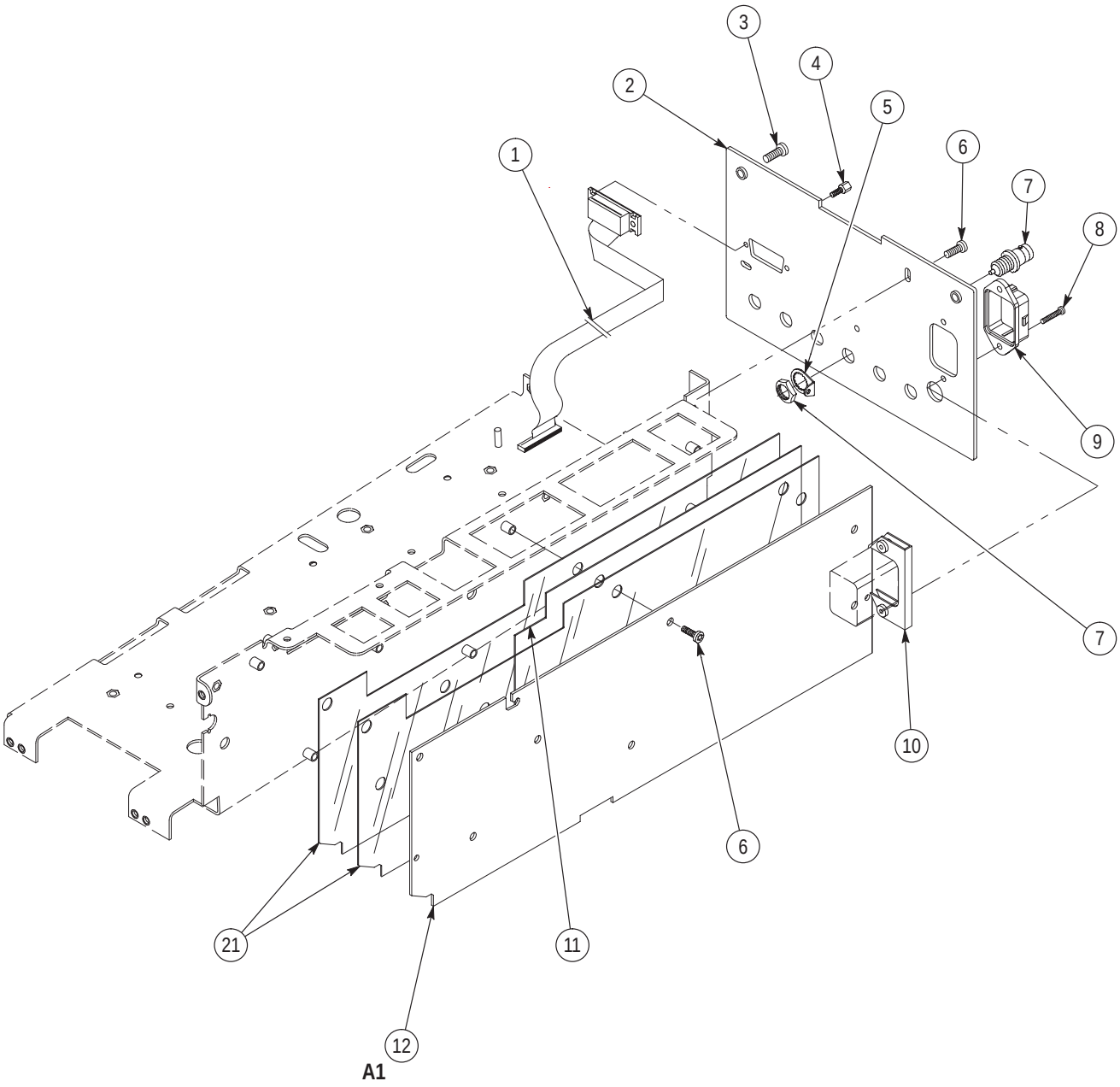


Figure 11–3: Power Supply and Rear

Fig. & Index Number	Tektronix Part Number	Serial No. Effective	Serial No. Discont'd	Qty	Name & Description	Mfr. Code	Mfr. Part Number
					STANDARD ACCESSORIES		
	070–9673–03			1	MANUAL,TECH:INSTRUCTION,WAVEFORM MONITOR,1710J/1711J	80009	070–9673–03
	011–0163–00			2	TERM,COAX:BNC,TERMINATION SINGLR ENDED,75 OHM	4Y264	BCP–TA
	159–0021–00			1	FUSE,CARTRIDGE:3AG,2A,250V,FAST BLOW	71400	AGC–2
	150–0168–00			4	LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 FOR SKT MT	55335	73W
	378–0335–00			4	FILTER,AIR:1.6 X 1.6,30PPI,0.188 THK	2K262	ORDER BY DESCR
11–4–1	161–0216–00			1	CABLE ASSY,PWR:3,18 AWG,2.5M L,BLACK	80126	C7120–25M–BL
					OPTIONAL ACCESSORIES		
–2	161–0215–00			1	CABLE ASSY,PWR:3,0.75MU,2.5MM L,GREY (EUROPEAN OPTION A1 ONLY)	80126	0–5335–008–GY
–3	161–0066–10			1	CA ASSY,PWR:3,1.0 MM SQ,250V/10A,2.5 METER (UNITED KINGDOM OPTION A2 ONLY)	TK2541	ORDER BY DESCR
–4	161–0066–11			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER (AUSTRALIAN OPTION A3 ONLY)	80126	ORDER BY DESCR
–5	161–0066–12			1	CA ASSY,PWR:3,18 AWG,250V/10A,98 INCH (NORTH AMERICAN OPTION A4 ONLY)	S3109	ORDER BY DESCR
–6	161–0154–00			1	CA ASSY,PWR:3,1.0MM SQ,250V/10A,2.5 METER (SWISS OPTION A5 ONLY)	5F520	86515030
	016–0475–00			1	VIEWING HOOD:1740	80009	016–0475–00
	200–3897–01			1	COVER,FRONT:1700F02,HOT STAMPED	80009	200–3897–01
	————————			1	CAMERA,SCOPE:C9 (OPTION 20 ONLY)		
					FIELD UPGRADES		
	————————			1	PLAIN CASE ASSY:1700F00		
	————————			1	PTD CASE ASSY:1700F02		
	————————			1	RACK ADAPTER:1700F05		
	————————			1	FILLER PANEL:1700F06		
	————————			1	DRAWER,UTILITY:1700F07		

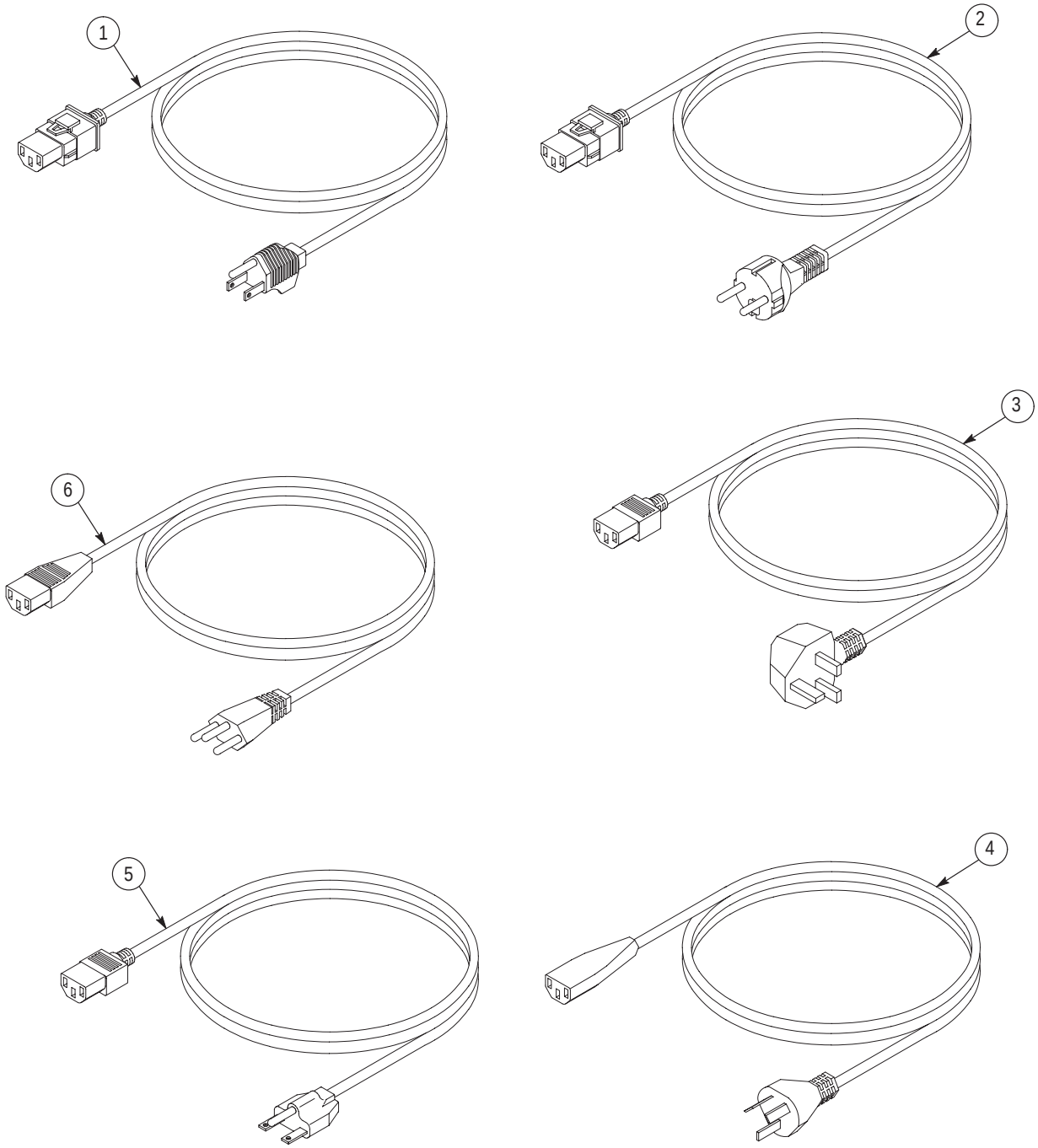


Figure 11–4: Accessories

Glossary

Accuracy
The closeness of the indicated value to the true value.

Black Level
The level of the picture signal that corresponds to the maximum black peaks.

Blanking Level
The level of the picture signal that separates the picture information from the synchronizing information. Also see *Setup*.

Chrominance
The property of light that produces a sensation of color in the human eye apart from any variation in luminance that may be present.

Chrominance Filter
A specially designed filter that passes the chrominance portion of the color signal while reducing the amplitude of other frequencies.

Clamp
A circuit that adds a fixed bias level to a particular portion of the television waveform. Also see *DC Restorer.*

Color Bar Signal
A test signal typically containing eight basic colors (white, yellow, cyan, green, magenta, red, blue, and black) that is used to check chrominance functions of the color television system.

Color Burst
A sample of chrominance subcarrier frequency that establishes a reference for demodulating the chrominance signal.

Composite Video
A signal containing vertical (field), horizontal (line) synchronizing signals, color synchronizing (burst) signal, and the picture luminance and chrominance information.

DC Restorer
A circuit used in waveform monitors and picture monitors to clamp one point of the waveform to a fixed DC level.

Differential Gain
The difference in output amplitude, expressed in percent of dB, of a small high frequency sine wave signal at two stated levels of a low frequency signal on which it is superimposed.

Differential Phase
The difference in output phase of a small high frequency sine wave signal at two stated levels of a low frequency signal on which it is superimposed.

Field Tilt
The distortion of the television waveform where the amplitude of the signal displays a sloping distortion over the duration of at least one full field of video.

Flat
The non-filtered display of the television signal.

K-Factor
A method of determining the visual impairment of the television signal.

Low-Pass Filter
A filter having a single transmission band extending from zero frequency up to a specified cutoff frequency.

Luminance
The amount of light intensity, which is perceived by the eye as brightness.

Luminance Filter
A low-pass filter whose upper frequency limit is set by the luminance signal frequency of the television system.

NTSC
National Television Systems Committee. The organization that developed the television standard currently in use in the United States, Canada, and Japan. Now generally used to refer to that standard.

PAL
Phase Alternate Line. Refers to one of the television systems used in Europe and many other parts of the world. The phase of one of the color difference signals alternates from line to line to help cancel out phase errors.

Pulse-to-Bar Ratio
A test method to measure short time distortions of the television signal.

Return Loss
The ratio, in dB, of the power incident upon a discontinuity and the power reflected from the discontinuity.

RGB/YRGB
Red, green, and blue. The three primary colors used in color television's additive color reproduction system. These are the three color components generated by the camera and used by the receiver to reproduce a picture. YRGB is the color components plus the luminance component (Y).

Setup Level (NTSC)
The difference between the blanking level and the reference black level. Normally 7.5% (7.5 IRE) is the amount of setup employed.

Staircase Signal
A video test signal containing several steps of equal amplitude at increasing luminance levels. The staircase signal is usually amplitude modulated by a subcarrier frequency and is useful in checking amplitude and phase linearities in the video system.

Sync, Horizontal (Line Rate)
A pulse signal occurring at the line rate of the television scanning system that is used to stop and start horizontal scanning.

Sync, Vertical (Field Rate)
A pulse signal occurring at the field rate of the television scanning system that is used to stop and start vertical scanning. This signal consists of a serrated block pulse surrounded by horizontal equalizing pulses, which occur at twice the horizontal sync rate.

Sync Stripper
A circuit whose function is to remove the synchronizing components from the composite television signal and deliver the synchronizing pulses to the display circuits.

Vertical Interval
The period of time during which the display device performs vertical retrace. This interval contains the vertical synchronizing pulse and the horizontal equalizing pulses.

Waveform Monitor
A specialized oscilloscope that is triggered by either horizontal or vertical sync pulses to display a time versus amplitude display of television signal elements.

White Level
The picture signal level corresponding to a specified limit for the white peaks.

Index

Numbers

A

B

C

E

F

G

H

I

L

M

N

O

P

R

S

T

V

W