

Service Manual



TAS 465 Analog Oscilloscope B020100 and Above

070-9403-00

Warning

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

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
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Safety Summary

Please take a moment to review these safety precautions. They are provided for your protection and to prevent damage to the oscilloscope. This safety information applies to all operators and service personnel.

Symbols and Terms

These two terms appear in manuals:

-  statements identify conditions or practices that could result in damage to the equipment or other property.
-  statements identify conditions or practices that could result in personal injury or loss of life.

These two terms appear on equipment:

- *CAUTION* indicates a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.
- *DANGER* indicates a personal injury hazard immediately accessible as one reads the marking.

This symbol appears in manuals:



Static-Sensitive Devices

These symbols appear on equipment:



DANGER
High Voltage



Protective
ground (earth)
terminal



ATTENTION
Refer to
manual

Specific Precautions

Observe all of the following precautions to ensure your personal safety and to prevent damage to either the TAS 465 Analog Oscilloscope or equipment connected to them.

Do Not Perform Service While Alone

Do not perform internal service or adjustment of this product unless another person capable of rendering first aid and resuscitation is present.

Use Care When Servicing With Power On

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections or components while power is on. Disconnect power before removing protective panels, soldering, or replacing components.

Power Source

The TAS 465 Analog Oscilloscope are intended to operate from a power source that will not apply more than 250 V_{RMS} between the supply conductors or between either supply conductor and ground. A protective ground connection, through the grounding conductor in the power cord, is essential for safe system operation.

Grounding the Oscilloscope

The TAS 465 Analog Oscilloscope are grounded through the power cord. To avoid electric shock, plug the power cord into a properly wired receptacle where earth ground has been verified by a qualified service person. Do this before making connections to the input or output terminals of the oscilloscope.

Without the protective ground connection, all parts of the TAS 465 Analog Oscilloscope are potential shock hazards. This includes knobs and controls that may appear to be insulators.

Use the Proper Power Cord

Use only the power cord and connector specified for your product. Use only a power cord that is in good condition.

Use the Proper Fuse

To avoid fire hazard, use only the fuse specified in the parts list for your product. It must be identical in type, voltage rating, and current rating.

Do Not Remove Covers or Panels

To avoid personal injury, do not operate the TAS 465 Oscilloscope without the panels or covers.

Do Not Operate in Explosive Atmospheres

The TAS 465 Oscilloscope provide no explosion protection from static discharges or arcing components. Do not operate the TAS 465 Oscilloscope in an atmosphere of explosive gasses.

Electric Overload

Never apply a voltage to a connector on the TAS 465 Oscilloscope that is outside the range specified for that connector.

Safety Summary

Preface

This is the Service Manual for the TAS 465 Analog Oscilloscope. This manual provides you with both service and limited operation information.

Use the *Introduction* section to learn what the TAS 465 Analog Oscilloscope can do and about the available options and accessories.

Use the *Operation* section to learn about applying power. This section also contains brief examples of how to use the controls.

Use the *Specifications* section as a reference for all nominal, warranted, and typical characteristics for the TAS 465 Analog Oscilloscope.

Use the *Theory* section to help you understand the operation of the oscilloscope to the block level.

Use the *Performance Verification* section to verify the functionality and warranted characteristics of the oscilloscope.

Use the *Adjustment* section to bring the TAS 465 Analog Oscilloscope into conformance with the warranted characteristics listed in the *Specifications* section. You should adjust the oscilloscope if indicated by the *Performance Verification* procedures.

Use the *Maintenance* section to learn how to perform general maintenance of your product. Procedures to disassemble and troubleshoot the oscilloscope are also located in this section.

Use the *Replaceable Electrical Parts List* section for a list of the electrical parts.

Use the *Diagrams* section for troubleshooting the oscilloscope. This section contains board dollies, block diagrams and schematics for each board.

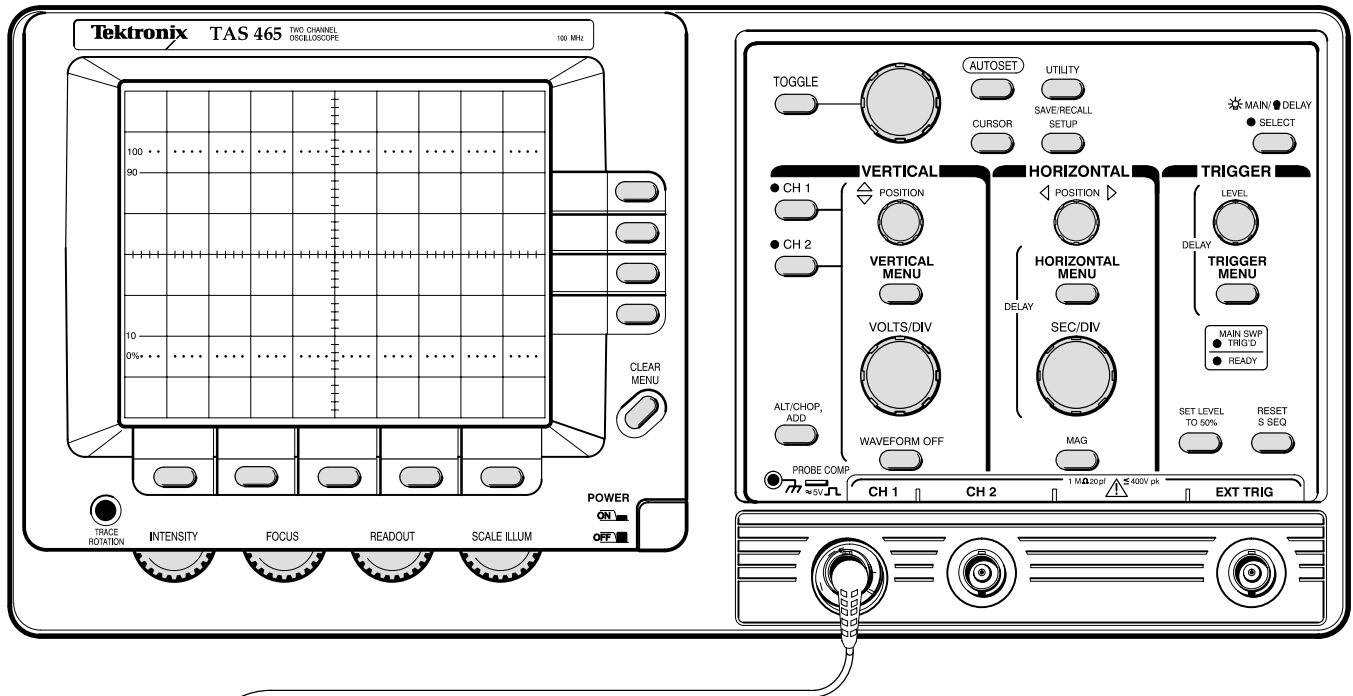
Use the *Replaceable Mechanical Parts List* section for a list of the mechanical parts.

Related Manuals

Other documentation for the TAS 465 Analog Oscilloscope include:

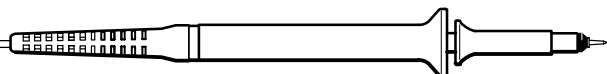
- The *Reference* (Tektronix part number 070-8522-XX) gives you a quick overview of how to operate your TAS 400 Series Analog Oscilloscopes.
- The *Instruction* manual (Tektronix part number 070-8523-XX) contains detailed operating information and module-level service information.
- The *XYZs of Analog and Digital Oscilloscopes* (Tektronix part number 070-8690-XX) provides you with a basic understanding of oscilloscopes and their use.

Product Description



Your Tektronix TAS 465 Analog Oscilloscope is a superb tool for processing and displaying electrical signals. Its performance addresses the needs of both benchtop and portable applications with the following features:

- 100 MHz minimum bandwidth
- Two-channel input
- Complete cursor measurement system
 - Voltage
 - Time
 - Frequency
- Delayed time base
- AUTOSET feature
- Front panel setup memory
- External trigger input



The features of the TAS 465 Analog Oscilloscope are briefly described here to help get you acquainted with the operating systems.

User Interface

This oscilloscope uses a combination of front-panel buttons, knobs, and on-screen menus to control its many functions. The front-panel controls are grouped according to function: vertical, horizontal, trigger, and special. Within each group, any function adjusted often, such as vertical positioning or the time base setting, is set directly by its own front-panel control.

AUTOSET

The **AUTOSET** button provides you with a usable, triggered display of a signal applied to an input channel. Many instrument controls and menus are set to a pre-defined state, providing you with a known starting point for your measurements.

Menus

Those functions for which control settings changed less often, such as vertical coupling and trigger mode, are set indirectly. That is, pressing a front-panel button, such as **VERTICAL MENU**, displays a menu of functions at the bottom of the screen related to that button. (For the button **VERTICAL MENU**, the menu displayed contains functions such as coupling and bandwidth.) The buttons below this main menu select a function, such as coupling and displays a sub menu of settings for that function, such as DC, AC, or GND, at the right side of the screen. The buttons to the right of the menu select a setting, such as DC.

General Purpose Knob and TOGGLE

Some menus assign the General Purpose Knob to a selected adjustment. The method employed is the same as for *selecting* a function, except the final selection in the side menu causes the General Purpose Knob to *adjust* some function, such as the position of measurement cursors on screen. Pressing the **CLEAR MENU** button clears the assignment of the General Purpose Knob except when assigned to adjust cursors or delay time.

The **TOGGLE** button works in conjunction with the General Purpose Knob when positioning cursors. Each press of the **TOGGLE** button switches which cursor is active, and therefore controlled by the General Purpose Knob.

Save/Recall Setups

You can store up to four complete front panel setups in memory. Once you complete a complex setup and then save it in one of the four memory locations, you can retrieve it at any time. Saved front panel settings do not include the assignment of the General Purpose Knob.

Vertical System

The vertical system provides two vertical channels with calibrated vertical scale factors from 2 mV to 5 V per division.

Both channels can be displayed, vertically positioned, bandwidth limited (to either Full or 20 MHz), inverted, and vertical coupling specified.

Besides the two channels, a math waveform is available for display. (A math waveform results when you add the two channels.)

Horizontal System

There are three horizontal display modes: main, delayed, and XY.

The main display is the standard horizontal display mode with calibrated sec/div scales.

The delayed display can be delayed by time with respect to the main trigger. The delayed display can also be set to display at the first valid trigger after the delay. The delayed display also has a calibrated sec/div scale.

XY mode is useful to measure the phase difference of two signals.

Trigger System

The triggering system comprises a complete set of features for triggering the horizontal system. You can configure trigger for source, slope, coupling, mode, and holdoff. Video triggers are available for triggering on video signals.

You can adjust the trigger level or automatically set it to 50% of the trigger signal with the press of a button.

Measurement Cursors

Once you have set up to take your measurements, the cursors can help you take those measurements quickly.

The TAS 465 Oscilloscope has two types of cursors for taking measurements on the displayed waveforms: delta (difference) and absolute. The General Purpose Knob controls the placement of the cursors. The **TOGGLE** button selects which cursor is active.

Delta voltage measures the voltage between the horizontal bar cursors. Delta time measures the time between vertical bar cursors. These are delta measurements; that is, measurements based on the difference between two cursors.

Absolute voltage measures the voltage position of a single horizontal bar cursor. The displayed voltage level readout is made with respect to the ground reference level of the channel.

Product Description

The bar cursors remain displayed even if you change the function of the General Purpose Knob. This allows you to use them as reference points or markers to easily identify if measurement signals remain within the parameters set by the cursors. Remove the cursor display by turning the cursor measurement off.

Nominal Traits

This subsection contains a collection of tables that list the various *nominal traits* that describe the TAS 465 Analog Oscilloscope. Included are electrical and mechanical traits.

Nominal traits are described using simple statements of fact such as “Two, both identical” for the trait “Number of Input Channels,” rather than in terms of limits that are performance requirements.

Table 1-1: Nominal Traits — Vertical Deflection System

Name	Description
Number of Input Channels	Two, both identical, called CH 1 and CH 2.
Input Coupling	DC, AC, or GND. GND input coupling disconnects the input connector from the attenuator and connects a ground reference to the input of the attenuator.
Sensitivity Range	2 mV/div to 5 V/div. The sensitivity ranges from 2 mV/div to 5 V/div in a 1–2–5 sequence.
Trace Separation Control Range	$\geq \pm 4$ divisions.
Bandwidth Selections	20 MHz and FULL, selected independently for each channel.
TAS 465 Rise Time	≤ 3.5 ns. Nominal rise times are calculated from the following formula: $\text{Rise Time (ns)} = \frac{350}{\text{BW (MHz)}}$
Vertical Position Range	$\geq \pm 10$ divisions from graticule center.
TekProbe Interface	Detects 1X, 10X, and 100X attenuator probes.

Table 1-2: Nominal Traits — Time Base System

Name	Description
Main Seconds/Division Range	20 ns/div to 0.5 s/div. The seconds/division ranges from 20 ns/div to 0.5 s/div in a 1–2–5 sequence of settings. The X10 magnifier extends the maximum sweep speed to 2 ns/div.
Delayed Seconds/Division Range	20 ns/div to 5 ms/div. The seconds/division ranges from 20 ns/div to 5 ms/div in a 1–2–5 sequence of settings. The X10 magnifier extends the maximum sweep speed to 2 ns/div.
Sweep Length	> 10 divisions.
Delay Control Range	0.15 division to 10 times the Main seconds/division setting. The maximum value can not exceed the end of the Main sweep.
Delta Time Control Range	0 to 10 divisions to the right of setting of the delay control, but maximum value does not exceed end of the Main sweep.

Table 1-3: Nominal Traits — Triggering System

Name	Description										
Trigger Level or Threshold Ranges	The ranges are as follows:										
	<table border="1"> <thead> <tr> <th><i>Source</i></th> <th><i>Range</i></th> </tr> </thead> <tbody> <tr> <td>Internal</td> <td>±15 divisions from center of screen with ground at center graticule.</td> </tr> <tr> <td>External 1X</td> <td>±1.5 V.</td> </tr> <tr> <td>External 10X</td> <td>±15 V.</td> </tr> <tr> <td>Line</td> <td>±400 V.</td> </tr> </tbody> </table>	<i>Source</i>	<i>Range</i>	Internal	±15 divisions from center of screen with ground at center graticule.	External 1X	±1.5 V.	External 10X	±15 V.	Line	±400 V.
<i>Source</i>	<i>Range</i>										
Internal	±15 divisions from center of screen with ground at center graticule.										
External 1X	±1.5 V.										
External 10X	±15 V.										
Line	±400 V.										

Table 1-4: Nominal Traits — Video Triggering System

Name	Description
Slope Selection	Slope selection must match the polarity of the sync (i.e., for negative going sync, negative slope must be selected). A default slope selection for TV trigger modes can be entered in the scope configuration menu.

Table 1-5: Nominal Traits — Cursors

Name	Description
Cursor Functions	Δ Time, $1/\Delta$ Time, Absolute Volts, Δ Volts, Track Trig Level, Ground.

Table 1-6: Nominal Traits — XY Operation

Name	Description
Sensitivity Range	Same as Vertical Deflection System. Volts/div variables in calibrated settings.

Table 1-7: Nominal Traits — Setup Memory Characteristics

Name	Description
Nonvolatile Setup Memory	4 Setups.

Table 1-8: Nominal Traits — Power Fuse

Name	Description									
Fuse Rating	Either of two fuses may be used. Fuse types are as follows:									
	<table border="1"> <thead> <tr> <th><i>Voltage Range</i></th> <th><i>Fuse (250 V) UL 198.6 (5 × 20 mm)</i></th> <th><i>Fuse (250 V) IEC 127 (5 × 20 mm)</i></th> </tr> </thead> <tbody> <tr> <td>90 — 132 VAC</td> <td>3 A Fast.</td> <td>3.15 A Fast.</td> </tr> <tr> <td>180 — 250 VAC</td> <td>3 A Fast.</td> <td>1.5 A Fast.</td> </tr> </tbody> </table>	<i>Voltage Range</i>	<i>Fuse (250 V) UL 198.6 (5 × 20 mm)</i>	<i>Fuse (250 V) IEC 127 (5 × 20 mm)</i>	90 — 132 VAC	3 A Fast.	3.15 A Fast.	180 — 250 VAC	3 A Fast.	1.5 A Fast.
<i>Voltage Range</i>	<i>Fuse (250 V) UL 198.6 (5 × 20 mm)</i>	<i>Fuse (250 V) IEC 127 (5 × 20 mm)</i>								
90 — 132 VAC	3 A Fast.	3.15 A Fast.								
180 — 250 VAC	3 A Fast.	1.5 A Fast.								

Table 1-9: Nominal Traits — Mechanical

Name	Description
Weight	<p>Weights that follow are nominal:</p> <ul style="list-style-type: none"> ■ 7.7 kg (17 lbs.), stand-alone instrument. ■ 9.3 kg (20.5 lbs.), with front cover, accessories and accessories pouch installed. ■ 13.6 kg (30 lbs.), when packaged for domestic shipment.
Overall Dimensions	<p>Dimensions that follow are nominal:</p> <p>Height:</p> <ul style="list-style-type: none"> ■ 191 mm (7.5 in.), when feet and accessories pouch are installed. ■ 165 mm (6.5 in.), without the accessories pouch installed. <p>Width:</p> <ul style="list-style-type: none"> ■ 362 mm (14.25 in.), with handle. <p>Depth:</p> <ul style="list-style-type: none"> ■ 471 mm (18.55 in.), stand-alone instrument. ■ 490 mm (19.28 in.), with optional front cover installed. ■ 564 mm (22.20 in.), with fully handle extended.
Cooling Method	Forced-air circulation with no air filter.
Finish Type	Tektronix Blue textured paint finish on an aluminum cabinet.
Construction Material	Chassis parts constructed of aluminum alloy; front panel constructed of plastic laminate; circuit boards constructed of glass-laminate. Tektronix Blue textured paint finish on an aluminum cabinet. Plastic parts are polycarbonate.
Weight of rackmounted instrument and the rackmount conversion kit	<p>Weights that follow are nominal:</p> <ul style="list-style-type: none"> ■ 4.5 kg (10 lbs.), for the rackmount conversion kit only; 7.9 kg (17.5 lbs.), when kit is packaged for domestic shipping. ■ 7.3 kg (16 lbs.) plus weight of rackmount Parts, for the rack-mounted instrument (option 3R). ■ 15.4 kg (34 lbs.), when the rackmounted instrument is packaged for domestic shipment (no manuals tray).
Overall Dimensions of the rackmount instrument	<p>Dimensions that follow are nominal:</p> <ul style="list-style-type: none"> ■ Height: 178 mm (7 in.). ■ Width: 483 mm (19 in.). ■ Depth: 472 mm (18.6 in.). Including handles: 517 mm (20.35 in.).

Warranted Characteristics

This subsection lists the various *warranted characteristics* that describe the TAS 465 Analog Oscilloscope. Included are electrical and environmental characteristics.

Warranted characteristics are described in terms of quantifiable performance limits which are warranted. This subsection lists only warranted characteristics. A list of *typical characteristics* starts on page 1-15.

NOTE

*In these tables, those warranted characteristics that are checked in the Performance Verification procedure, found in Section 4, appear in **boldface type** under the column Name.*

Performance Conditions

The electrical characteristics found in these tables of warranted characteristics apply under the following conditions:

- The oscilloscope has been adjusted at an ambient temperature between +20° C and +30° C
- A warm-up period of at least 20 minutes has occurred
- The operating temperature is between –10° C and +55° C (unless otherwise noted)
- The Temperature Compensation Calibrations (signal path compensation) have been performed

Table 1-10: Warranted Characteristics — Vertical Deflection System

Name	Description						
Input Impedance, DC Coupled	1 MΩ ±1% in parallel with 20 pF ±2.0 pF.						
Variable Range	Increases deflection factor by ≥ 2.5:1.						
DC Gain Accuracy	The limits are as follows:						
	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Condition</th> <th style="text-align: left;">Accuracy</th> </tr> </thead> <tbody> <tr> <td>+15° C to +35° C</td> <td>±2.5% over the center 5 divisions after signal path compensation.</td> </tr> <tr> <td>–10° C to +15° C and +35° C to +55° C</td> <td>±3.5% over the center 5 divisions after signal path compensation.</td> </tr> </tbody> </table>	Condition	Accuracy	+15° C to +35° C	±2.5% over the center 5 divisions after signal path compensation.	–10° C to +15° C and +35° C to +55° C	±3.5% over the center 5 divisions after signal path compensation.
Condition	Accuracy						
+15° C to +35° C	±2.5% over the center 5 divisions after signal path compensation.						
–10° C to +15° C and +35° C to +55° C	±3.5% over the center 5 divisions after signal path compensation.						
TAS 465 Bandwidth at the BNC input	100 MHz.						

Warranted Characteristics

Table 1-10: Warranted Characteristics — Vertical Deflection System (Cont.)

Name	Description	
TAS 465 Bandwidth at the probe tip, using the Standard-Accessory Probe	The limits are as follows:	
	<i>Condition</i>	<i>Bandwidth</i>
	+15° C to +35° C	100 MHz.
	-10° C to +15° C and +35° C to +55° C	90 MHz.
Lower Frequency Limit, AC Coupled	<p>≤ 10 Hz with 1X probe.</p> <p>The AC Coupled Lower Frequency Limits are reduced by a factor of 10 when 10X, passive probes are used.</p>	
TAS 465 Crosstalk (Channel Isolation)	≥ 50 dB at 10 MHz, ≥ 35 dB at 100 MHz.	
Delay Between Channels, Full Bandwidth	≤ 200 ps between channels 1 and 2 for equal volts/div and coupling settings.	
Common-mode Rejection Ratio (CMRR)	≥ 10:1 at ≤ 50 MHz.	
Trace Shift	The limits are as follows:	
	<i>Condition</i>	<i>Allowable Trace Shift</i>
	Changing volts/div settings	<±(0.1 division + 0.2 mV).
	Selecting invert	≤ 0.5 division.
	Changing from bandwidth limit to full bandwidth	≤ 0.1 division.
Maximum Input Voltage	±400 V (DC + peak AC); derate at 20 dB/decade from 100 kHz to 13 V at 3 MHz.	
Low Frequency Linearity	Within ±5%.	

Table 1-11: Warranted Characteristics — Time Base System

Name	Description
Time Base Accuracy, Magnify Off	The limits are as follows:
	<i>Conditions</i> <i>Time Measurement Accuracy</i>
	+15° C to + 35° C ±2%.
	–10° C to + 15° C and +35° C to + 55° C ±3%.
	Sweep accuracy applies over the center eight divisions. Excludes the greater of either the first ¼ division or 25 ns from the sweep start of the magnified sweep and anything beyond the 100th magnified division.
Time Base Accuracy, Magnify On	The limits are as follows:
	<i>Conditions</i> <i>Time Measurement Accuracy</i>
	–10° C to + 55° C
	Excluding 5 ns/div and 2 ns/div ±4%.
	+15° C to + 35° C
	5 ns/div and 2 ns/div ±3%.
–10° C to + 15° C and +35° C to + 55° C	
	5 ns/div and 2 ns/div ±5%.
	Sweep accuracy applies over the center eight divisions. Excludes the greater of either the first ¼ division or 25 ns from the sweep start of the magnified sweep and anything beyond the 100th magnified division.
Horizontal Position Control Range	The position control is able to move the start of the sweep to the right of the center vertical graticule and able to move a time mark corresponding to the tenth division on an unmagnified sweep to the left of the graticule center.
Variable Control Range	Continuously variable between calibrated seconds/division settings. Extends both the Main and Delayed sweep seconds/division settings by a factor of 2.5 times.
Delay Accuracy, Main Sweep Trigger Point to Start of Delayed Sweep	±(0.5% of reading + 5% of 1 division of the Main sweep + 25 ns).
Delta Delay Accuracy	±(0.5% of reading + 5% of 1 division of the Main sweep + 10 ns).

Table 1-12: Warranted Characteristics — Triggering System

Name	Description		
TAS 465 Edge-Type Trigger Sensitivity, DC Coupled	The limits are as follows:		
	<i>Trigger Source</i> <i>Sensitivity</i>		
	Internal, Any Channel	0.30 division from DC to 25 MHz, increasing to 1 div at 150 MHz.	
	External X1	35 mV from DC to 25 MHz, increasing to 100 mV at 150 MHz.	
External X10	350 mV from DC to 25 MHz, increasing to 1 V at 150 MHz.		
Trigger Level or Threshold Accuracy	The limits are as follows for signals having rise and fall times ≥ 20 ns:		
	<i>Coupling</i> <i>Source</i> <i>Accuracy</i>		
	DC	All except Line and External	$\pm(5\%$ of reading + 0.4 division + 1 mV)
		External (X1)	$\pm(5\%$ of reading + 40 mV)
		External (X10)	$\pm(5\%$ of reading + 400 mV)
	Noise Reject	All except Line and External	$\pm(5\%$ of reading + 1.1 division + 1 mV)
		External (X1)	$\pm(5\%$ of reading + 110 mV)
		External (X10)	$\pm(5\%$ of reading + 1.1 V)
	HF Reject	All except Line and External	$\pm(5\%$ of reading + 0.35 division + 1 mV)
		External (X1)	$\pm(5\%$ of reading + 35 mV)
External (X10)		$\pm(5\%$ of reading + 350 mV)	
Delay Difference Between Ext Input and Any Channel	<2 ns.		
External Trigger Input Impedance	1 M Ω $\pm 2\%$ in parallel with 20 pF ± 2.0 pF.		
Maximum Input Voltage	± 400 V (DC + peak AC); derate at 20 dB/decade from 100 kHz to 13 V at 3 MHz.		

Table 1-13: Warranted Characteristics — Video Triggering

Name	Description
Sensitivity	0.75 divisions of composite sync will achieve a stable display.
60 Hz Rejection	Stable video trigger with up to 4 divisions of 60 Hz on the video signal.
Sync Offset	Stable video trigger if sync tip is ± 15 divisions, referenced to input ground.
Sync Separation	Stable trigger on positive or negative composite horizontal sync (lines) video, for all 525/60 and 625/50 video systems which include: NTSC, PAL, and SECAM.
Field Interval	Stable trigger on vertical sync interval $> 20 \mu\text{s}$.

Table 1-14: Warranted Characteristics — Cursors

Name	Description						
ΔTime Cursor to Signal Accuracy	Same as Time Base Accuracy + 0.1 division.						
1/ΔTime Accuracy	Readouts calculated using Δ Time cursor difference.						
Absolute Volts Accuracy	Accuracies are as follows:						
	<table border="1"> <thead> <tr> <th>Condition</th> <th>Accuracy</th> </tr> </thead> <tbody> <tr> <td>$-10^\circ \text{ C to } +30^\circ \text{ C}$</td> <td>$\pm(1\% \text{ of reading} + 2\% \text{ of one vertical division} + \text{HF display errors} + 0.5 \text{ mV} + \text{trace shift errors})$.</td> </tr> <tr> <td>$+30^\circ \text{ C to } +55^\circ \text{ C}$</td> <td>$\pm(1\% \text{ of reading} + 2\% \text{ of one vertical division} + \text{HF display errors} + 4 \text{ mV} + \text{trace shift errors})$.</td> </tr> </tbody> </table>	Condition	Accuracy	$-10^\circ \text{ C to } +30^\circ \text{ C}$	$\pm(1\% \text{ of reading} + 2\% \text{ of one vertical division} + \text{HF display errors} + 0.5 \text{ mV} + \text{trace shift errors})$.	$+30^\circ \text{ C to } +55^\circ \text{ C}$	$\pm(1\% \text{ of reading} + 2\% \text{ of one vertical division} + \text{HF display errors} + 4 \text{ mV} + \text{trace shift errors})$.
Condition	Accuracy						
$-10^\circ \text{ C to } +30^\circ \text{ C}$	$\pm(1\% \text{ of reading} + 2\% \text{ of one vertical division} + \text{HF display errors} + 0.5 \text{ mV} + \text{trace shift errors})$.						
$+30^\circ \text{ C to } +55^\circ \text{ C}$	$\pm(1\% \text{ of reading} + 2\% \text{ of one vertical division} + \text{HF display errors} + 4 \text{ mV} + \text{trace shift errors})$.						
ΔVolts Cursor to Signal Accuracy	$\pm(1.6\% \text{ of reading} + 2\% \text{ of one vertical division} + \text{HF display errors})$.						

Table 1-15: Warranted Characteristics — XY Operation

Name	Description
XY Accuracy	$\pm 4\%$.
X Bandwidth	DC to at least 3 MHz.
Phase Difference Between X and Y Amplifiers	$\pm 3^\circ$, DC to 150 kHz.

Warranted Characteristics

Table 1-16: Warranted Characteristics — Power Requirements

Name	Description
Source Voltage and Frequency	90–132 VAC _{RMS} continuous range for 48 through 440 Hz. 180–250 VAC _{RMS} continuous range for 48 through 440 Hz.
Power Consumption	≤ 85 watts (150 VA).

Table 1-17: Warranted Characteristics — Environmental and Safety

Name	Description
Third Party Certifications	This product shall conform to and be certified where appropriate according to the following requirements: <i>Certification</i> Underwriter’s Laboratories (UL) Listed or Recognized Component, Electrical and Electronic Measuring and Testing Equipment UL 1244. Canadian Standards CSA Association (CSA) Category Certified Electronic Development and Test Equipment, CSA 22.2 no. 231. Self-Certification International Electro-Technical Commission (IEC) Self-certified by Tektronix to comply with IEC 348 recommendation.
Temperature: Operating and Nonoperating	Operating: –10° C to +55° C. Nonoperating: –51° C to +71° C.
Humidity: Operating and Nonoperating	To 95% relative humidity at or below +40° C to 75% relative humidity form +41° C to +55° C. A more sever test than stated in MIL–T–28800E, para. 4.5.5.1.1.2.
Altitude: Operating and Nonoperating	Operating: To 4572 m (15,000 ft.). Nonoperating: To 12192 m (40,000 ft.).
Random Vibration: Nonoperating	2.46 g _{RMS} , from 5 to 500 Hz, 10 minutes each axis.
Random Vibration: Operating	0.31 g _{RMS} , from 5 to 500 Hz, 10 minutes each axis.
Emissions	The instrument meets or exceeds the EMC requirements of the following standards: ■ VFG 243. ■ FCC Code of Federal Regulations, 47 CFR, Part 15, Subpart B, Class A.
Electrostatic Discharge Susceptibility	IEC 801–2.

Typical Characteristics

This subsection contains tables that lists the various *typical characteristics* that describe the TAS 465 Analog Oscilloscope.

Typical characteristics are described in terms of typical or average performance. Typical characteristics are not warranted.

This subsection lists only typical characteristics. A list of warranted characteristics starts on page 1-9.

Table 1-18: Typical Characteristics — Vertical Deflection System

Name	Description						
Upper-Frequency Limit, 20 MHz Bandwidth Limited	20 MHz.						
Trace Shift Leakage	The typical amount of trace shift while changing the input coupling between GND and 1 MΩ DC is as follows:						
	<table border="1"> <thead> <tr> <th>Condition</th> <th>Typical Trace Shift</th> </tr> </thead> <tbody> <tr> <td>−10° C to +35° C</td> <td><0.5 mV.</td> </tr> <tr> <td>+35° C to +55° C</td> <td><2 mV.</td> </tr> </tbody> </table>	Condition	Typical Trace Shift	−10° C to +35° C	<0.5 mV.	+35° C to +55° C	<2 mV.
Condition	Typical Trace Shift						
−10° C to +35° C	<0.5 mV.						
+35° C to +55° C	<2 mV.						
Variable Volts/Div Offset	0.5 division trace shift while changing the variable volts/div setting.						
Chop Mode Clock Rate	>500 kHz, <1 MHz. Chop mode is allowed from 0.5 s to 10 μs sec/div settings.						
Noise (measured tangentially)	<ul style="list-style-type: none"> ■ ≤0.06 div at ≥ 10 mV/div (600 μV). ■ ≤0.10 div at 5 mV/div (500 μV). ■ ≤0.14 div at 2 mV/div (280 μV). 						

Table 1-19: Typical Characteristics — Time Base System

Name	Description
Time Base Linearity	±5%. Sweep linearity applies over the center eight divisions. Excludes the greater of either the first ¼ division or 25 ns from the sweep start of the magnified sweep and anything beyond the 100th magnified division.
Delay Jitter	≤ 1 part in 10,000 (20,000 for 1 ms and slower) + 2 ns, peak-to-peak during a two-second time interval. Exclude the first 0.15 divisions of the Main sweep.

Typical Characteristics

Table 1-20: Typical Characteristics — Triggering System

Name	Description
TAS 465 Edge-Type Trigger Sensitivity, Not DC Coupled	The typical sensitivities are as follows:
	<i>Trigger Source</i> <i>Typical Signal Level for Stable Triggering</i>
	Noise Reject 1.2 divisions from DC to 25 MHz, in- creasing to 2.2 divisions at 150 MHz. 0.5 division or less will not trigger.
	HF REJ 0.30 division from DC to 10 kHz; attenu- ates signals above the upper –3 dB cut- off frequency of 50 kHz.
	LF REJ 0.30 division from 100 kHz to 25 MHz, increasing to 1.0 division at 150 MHz; attenuates signals below the lower –3 dB cutoff frequency of 50 kHz.
	AC 0.30 division from 350 Hz to 25 MHz, increasing to 1.0 division at 150 MHz; attenuates signals below the –3 dB cut- off frequency of 160 Hz.
Typical signal levels for External Triggering are derived by convert- ing divisions to volts, where 1 division equals 100 mV of trigger signal level.	
Lowest Frequency for Successful Oper- ation of “Set Level to 50%” Function	50 Hz with 1 division.
Holdoff Control Range	Increases Main sweep holdoff time by a factor of 10.

Table 1-21: Typical Characteristics — Video Triggering System

Name	Description
Field Separation	Stable trigger on odd or even fields in interlaced video systems with line rates between 12 kHz and 17 kHz.

Table 1-22: Typical Characteristics — Z-Axis

Name	Description
Sensitivity	The sensitivity is as follows:
	<i>Condition</i> <i>Sensitivity</i>
	DC to 2 MHz Positive voltage decreases intensity; +2 V blanks a maximum intensity trace.
	2 MHz to 20 MHz +2 V modulates a normal intensity trace. +2 V (DC to 20 MHz) blanks a 1 μ A CRT beam.
Rise Time	<15 ns.
Input Resistance	10 k Ω \pm 10%.
Maximum Input Voltage	\pm 25 V peak; 25 V _{p-p} AC at 10 kHz or less.

Table 1-23: Typical Characteristics — Probe Compensator

Name	Description
Probe Compensator Output Voltage and Frequency	The limits are as follows:
	<i>Characteristic</i> <i>Limits</i>
	Output Voltage 5 V (base-top) \pm 10% into a 1 M Ω load.
	Frequency 1 kHz \pm 5%.

Table 1-24: Typical Characteristics — Setup Memory

Name	Description
Nonvolatile Memory Retention Time	Internal batteries, installed at time of manufacture, have a life of \geq 10 years when operated and/or stored at an ambient temperature from 0° C to +50° C. Retention time of the nonvolatile memories is equal to the remaining life of the batteries. Battery life can be reduced when the instrument is stored for extended time above +50° C. Retained data may be lost when stored for extended time below 0° C.

Typical Characteristics

Installation and Power On

Before you begin using the TAS 465 Analog Oscilloscope, perform this procedure to properly install and power it on.

1. Check that you have the proper electrical connections. The TAS 465 Analog Oscilloscope requires 90 to 132 VAC_{RMS} or 180 to 250 VAC_{RMS}, continuous range from 48 Hz to 440 Hz. A maximum of 85 Watts may be required.
2. Check that the Line Voltage Range switch (Figure 2-1) is at the proper setting for your power system.
3. Check the fuse to ensure it is the proper type and rating (the rear panel provides you with this information). The TAS 465 Analog Oscilloscope is shipped with the UL approved fuse installed. Figure 2-2 illustrates how to open the fuse drawer.
4. Connect the proper power cord from the rear-panel power connector (Figure 2-1) to the power system.

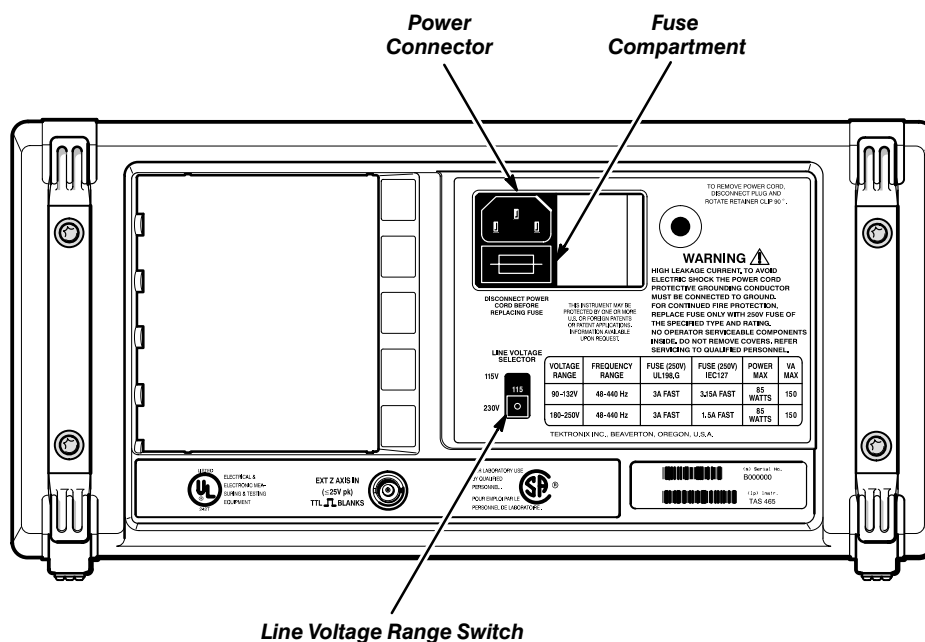


Figure 2-1: Rear Panel

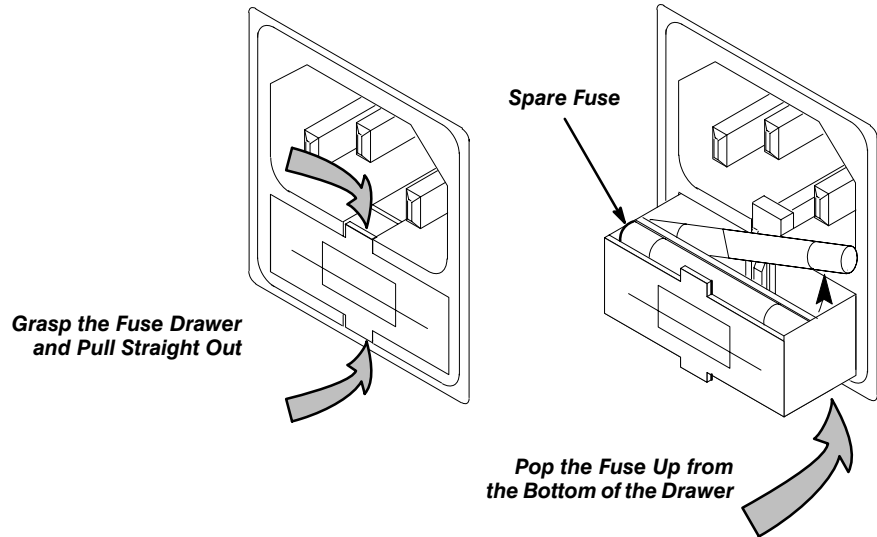


Figure 2-2: Fuse Compartment

5. Be sure you have the appropriate operating environment. Specifications for temperature, relative humidity, altitude, vibrations, and emissions are in Section 1, *Specifications*.
6. Leave space for cooling. Do this by verifying that the air intake and exhaust holes on the sides of the cabinet are free of any airflow obstructions. Leave at least 5.1 cm (2 in.) free on each side.
7. Press the **POWER** button to power on the oscilloscope. See Figure 2-3.

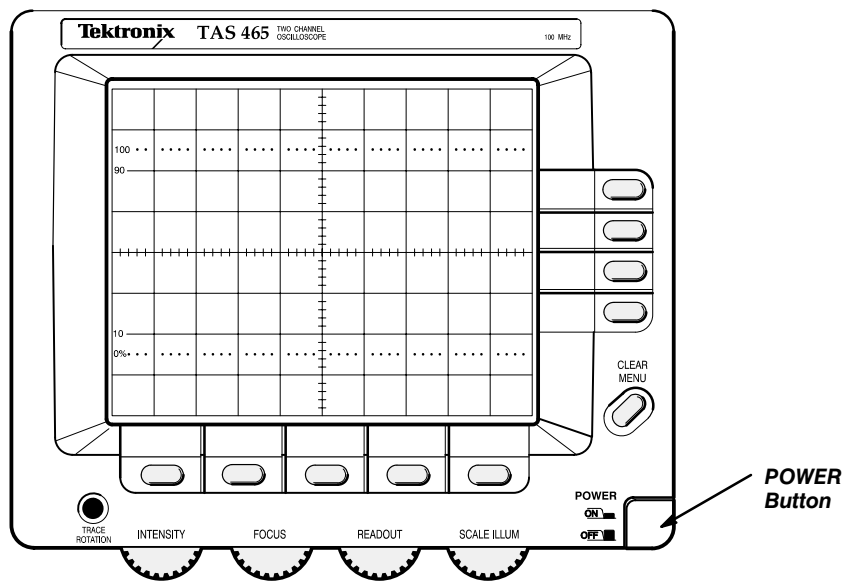


Figure 2-3: POWER Button

Quick Start

This section helps you get acquainted with basic controls and operating systems of the TAS 465 Analog Oscilloscope once you have power applied.

Selecting and Deselecting Input Channels

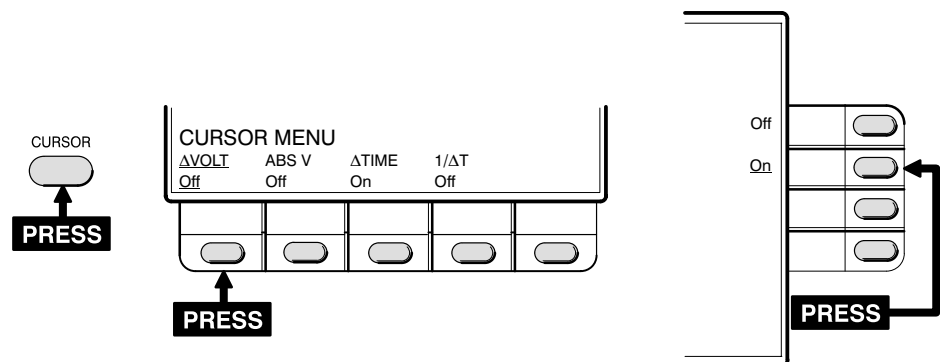
The TAS 465 Oscilloscope has two input channels. You can display the channels separately or simultaneously. The following steps demonstrate how to select and deselect channels for display.

1. Power on the oscilloscope and wait for the self tests to complete.
2. Press the **CH 1** button located on the front panel. The **CH 1** indicator lights, channel 1 is displayed, and vertical controls and menus are assigned to channel 1.
3. Press the **CH 2** button located on the front panel. The **CH 2** indicator lights, channel 2 is displayed, and controls and menus are assigned to channel 2.
4. Press the **CH 1** button, assigning control to channel 1.
5. Press the **WAVEFORM OFF** button, removing channel 1 from the display and leaving channel 2 displayed.

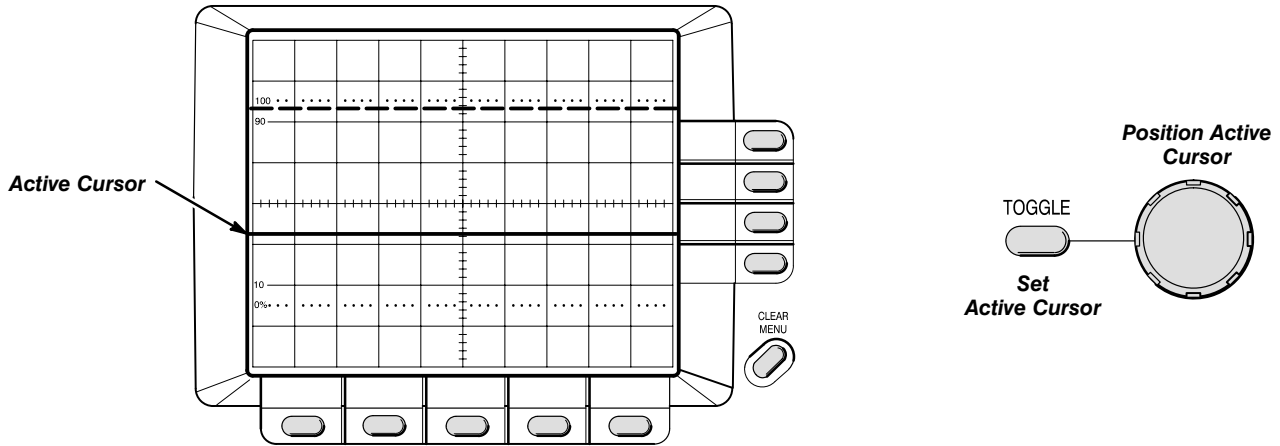
Using the Menus

The TAS 465 Oscilloscope uses menus for making many instrument settings. In the following steps, you will set only channel 1 on and turn the cursors on.

1. Press the **WAVEFORM OFF** button until only channel 1 is displayed.
2. Press the **CURSOR** menu button.
3. Set the delta volts (Δ VOLT) cursors on (using the following guide).



4. Now two horizontal bar cursors are displayed. The active (movable) one is a solid line and the inactive one is a dashed line. Use the General Purpose Knob to move the active cursor and use the **TOGGLE** button to select which cursor is active.



Connecting a Signal

The TAS 465 Oscilloscope accepts signals through the front panel input connectors labeled **CH 1** and **CH 2**. The probes you use for taking measurements should only be those supplied with the TAS 465 Oscilloscope. Connecting signals to the TAS 465 Oscilloscope is also possible with the use of 50 Ω coaxial cables.

Before using any probe to take measurements, compensate the probe to match the input channel. See *Compensating the Probe* on page 2-5.

Using AUTOSET

The **AUTOSET** feature of the TAS 465 Oscilloscope automatically sets most of the front panel controls.

1. Connect the probe compensation signal (from the **PROBE COMP** connector on the front panel) to either channel of the oscilloscope and display that channel (see Figure 2-5). Turn all other channels off.
2. Press the **AUTOSET** button on the front panel. Wait one to three seconds to allow the instrument to adjust all the control settings.

The instrument will trigger on the waveform, display at least one complete cycle, and center it horizontally on the CRT. The baseline of the waveform will be at the center horizontal graticule line (see Figure 2-4). The intensity level is increased if set too low for a viewable display.

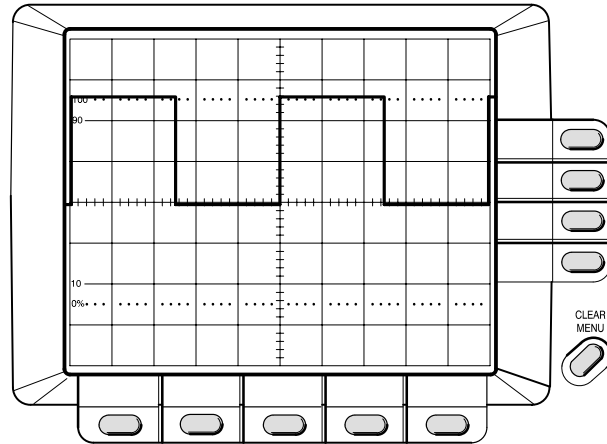


Figure 2-4: Probe Compensation Signal Displayed after AUTOSET

Compensating the Probe

Passive probes require compensation to ensure maximum distortion-free input to the TAS 465 Oscilloscope. Before taking any measurements using a probe, first check the compensation of the probe and adjust it to match the channel inputs. The signal source for this check is the front-panel **PROBE COMP** signal (Figure 2-5).

1. Attach the probe to either the **CH 1** or **CH 2** input connectors along the lower right of the front panel.
2. Attach the probe tip to the **PROBE COMP** connector.

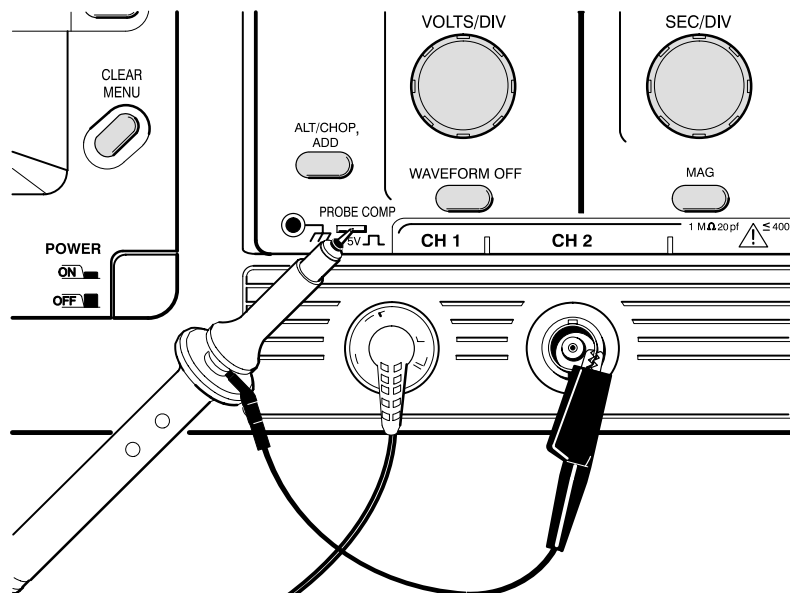
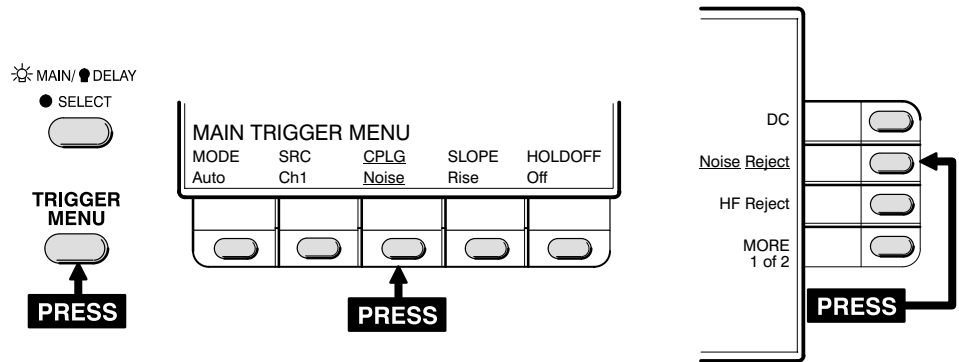
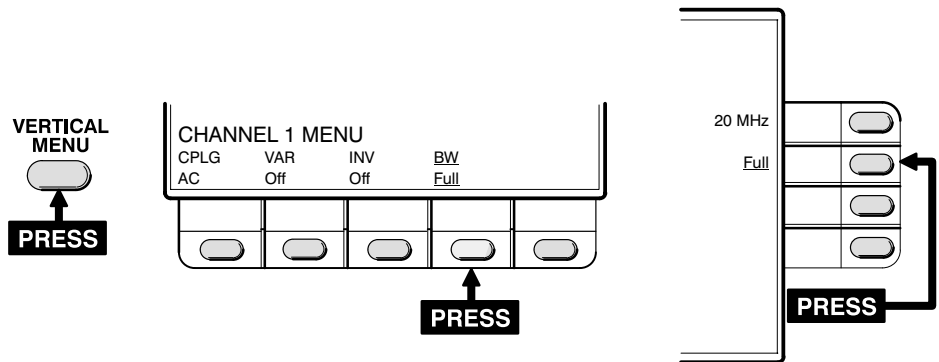


Figure 2-5: Connections for Compensating a Probe

3. Select the appropriate input channel, channel 1 or channel 2, by pressing the **CH 1** or **CH 2** front-panel button.
4. With the probe attached between an input channel and the probe compensation output of the oscilloscope, press the **AUTOSET** button on the front panel.
5. Set the vertical scale to 1 V using the **VOLTS/DIV** control.
6. Center the waveform vertically using the vertical **POSITION** control.
7. Set the horizontal scale to 200 μ s using the **SEC/DIV** control.
8. Set the trigger coupling to **Noise Reject** (use the following guide).



9. Set the vertical bandwidth to **Full** (use the following guide).



10. Check that the displayed waveform is a square wave with flat tops and bottoms. See Figure 2-6 for illustrations indicating proper and improper probe compensation.

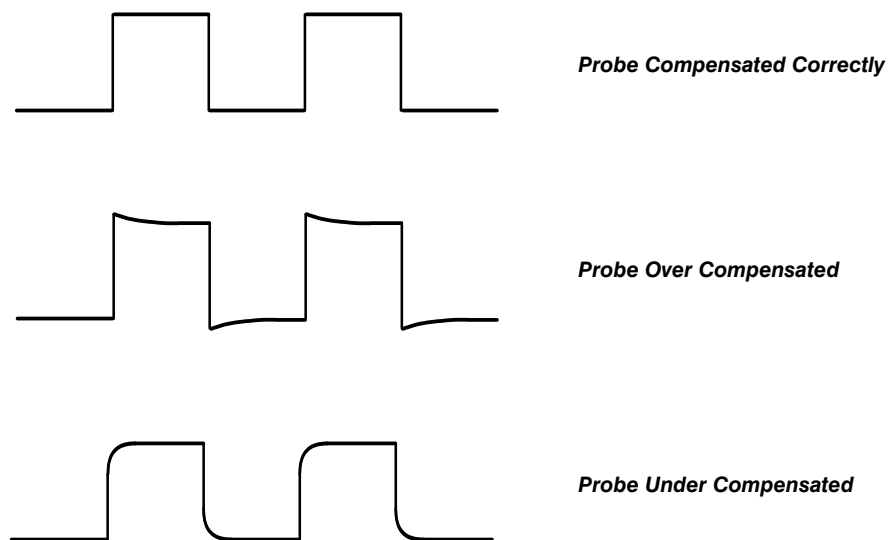


Figure 2-6: How Probe Compensation Affects Signals

11. Adjust the low frequency compensation adjustment, located in the probe body, for the best possible square wave. See Figure 2-7 for the location of the low frequency adjustment.

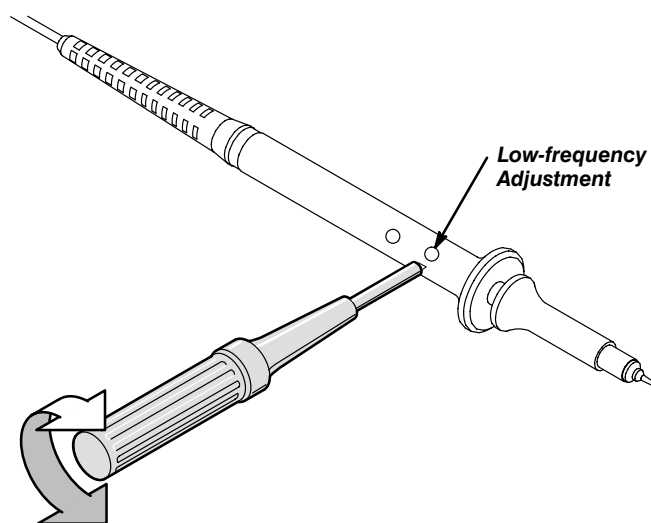


Figure 2-7: Location of Probe Head Adjustment

Menu Map

Figure 2-8 is a map of the menus to help you locate menu-driven functions and their available settings. Refer to the *Instruction* manual for operating information about each menu.

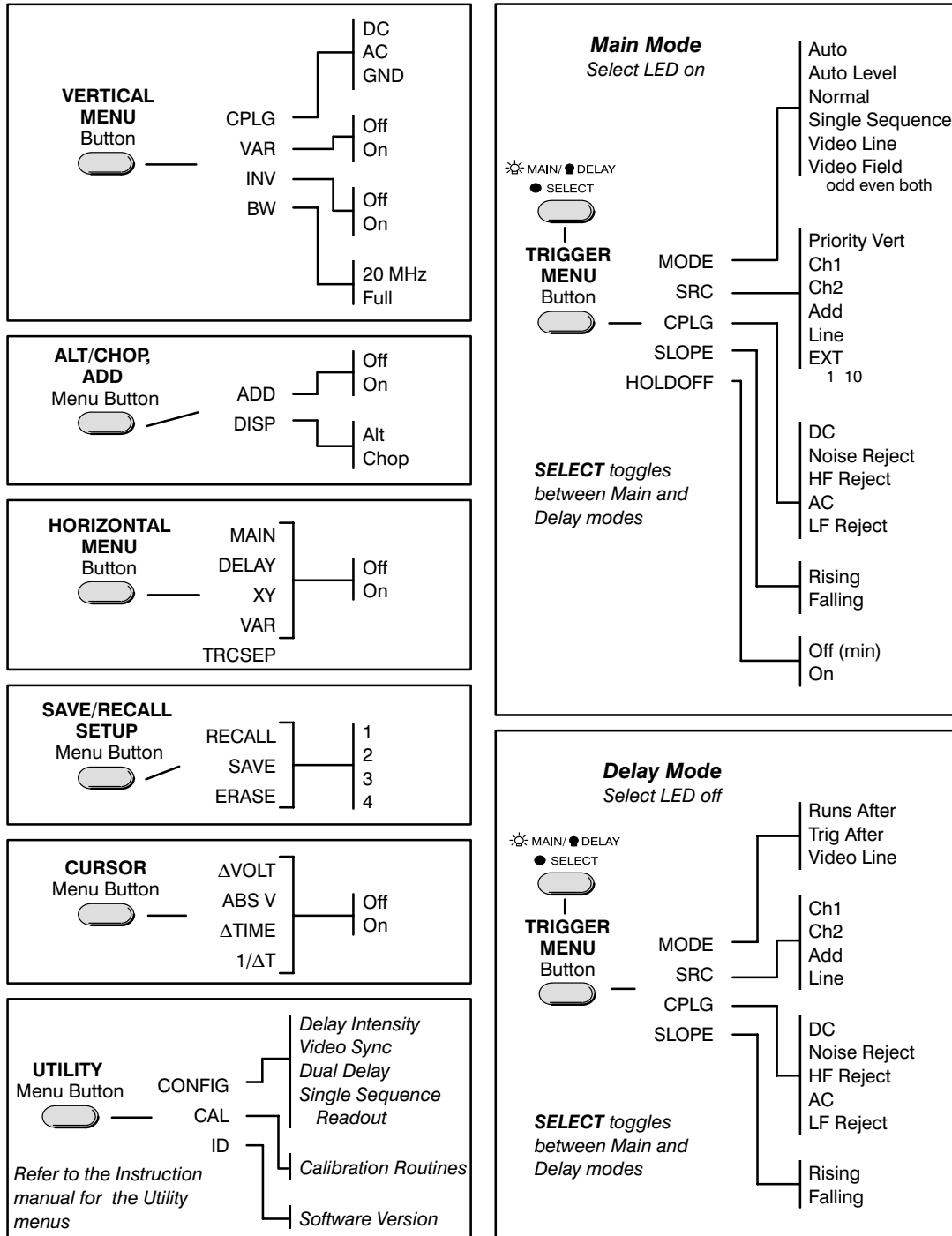


Figure 2-8: Menu Map

Circuit Description

This section describes the electrical operation of the Tektronix TAS 465 Analog Oscilloscope. Refer to the schematics in the *Diagrams* section as necessary.

Logic Conventions

This manual refers to digital logic circuits with standard logic symbols and terms. Unless otherwise stated, all logic functions are described using the positive logic convention: the more positive of the two logic levels is the high (1) state and the more negative level is the low (0) state. Signal states may also be described as “true” meaning their active state or “false” meaning their non-active state. The specific voltages that constitute a high or low state vary among the electronic devices.

Active-low signals are indicated by a tilde (~) prefixed to the signal name (~RESET). Signal names are considered to be either active-high, active-low, or to have both active-high and active-low states.

Module Interconnection

Figure 3-1 shows the interconnection paths between the modules of the TAS 465 Oscilloscope.

Circuit Description

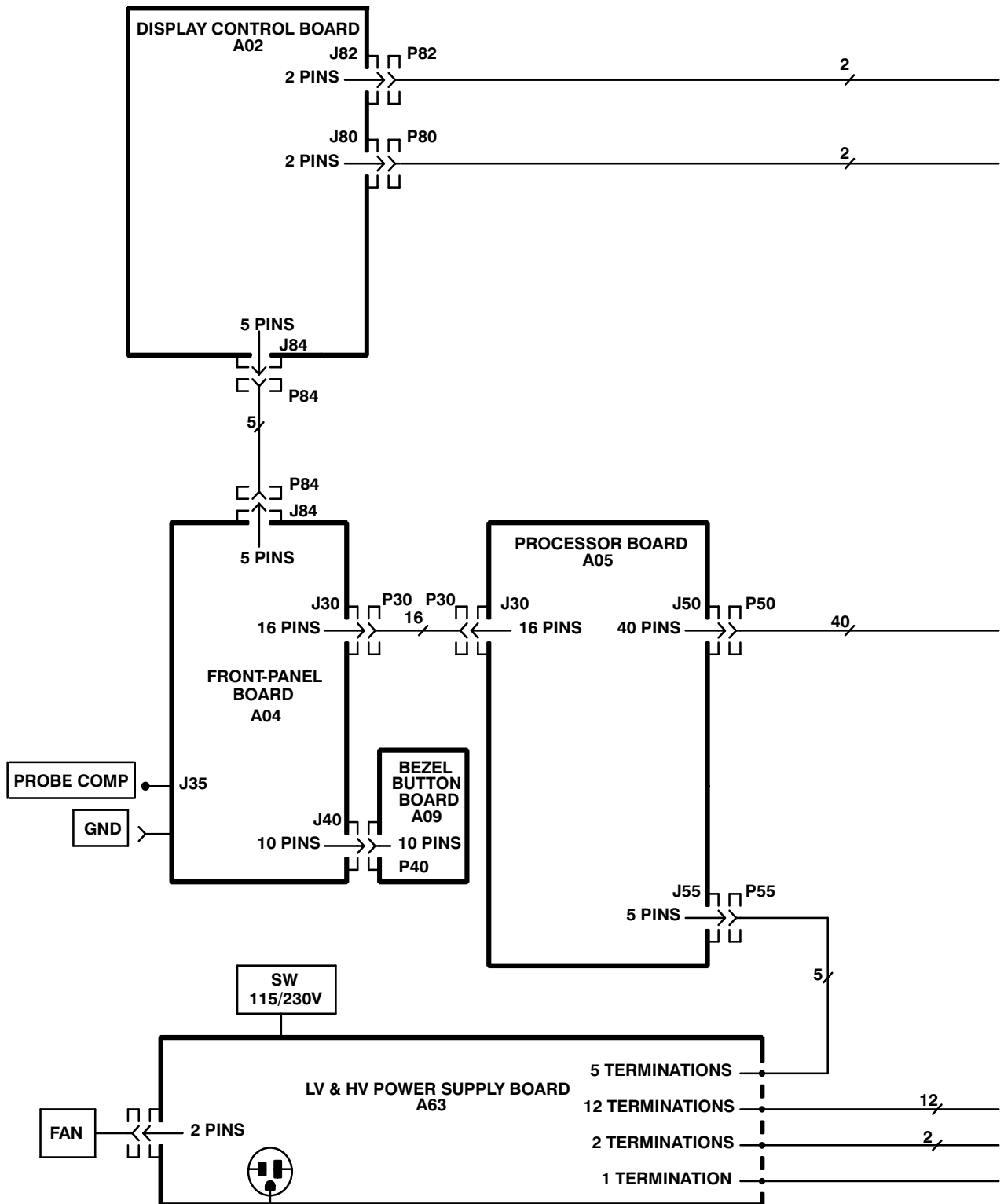
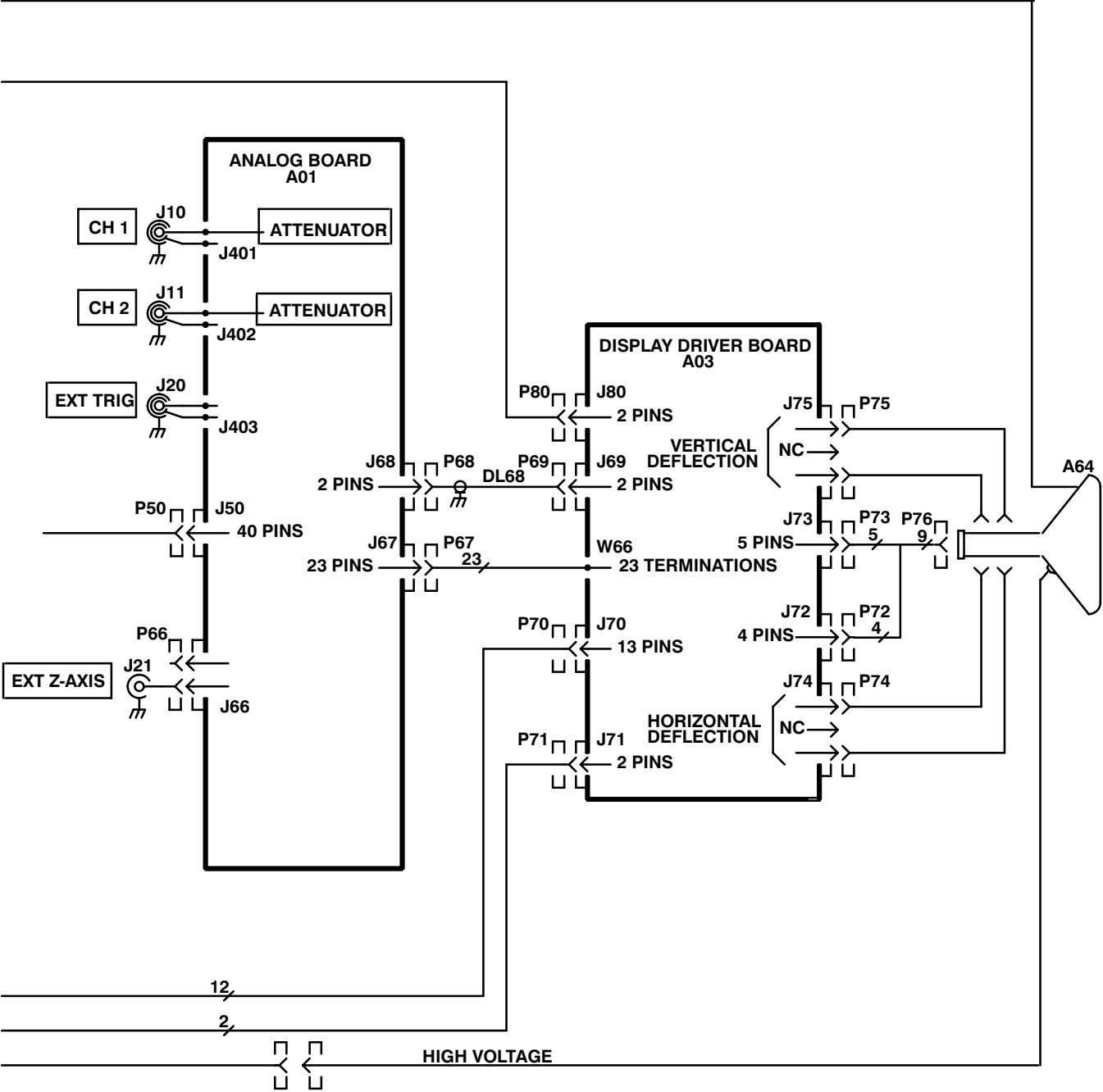


Figure 3-1: Block Diagram



Analog Board

A signal enters the oscilloscope through a probe connected to a BNC on the A1 Analog board.

Attenuators A1

The attenuator hybrids AT401 and AT402, and the vertical preamplifier IC, select the input coupling, attenuation factor, variable gain, and the invert function. The processor system controls and calibrates the attenuators.

Probe Coding Interface A1

Probe coding interface signals pass through the A1 Analog board to the A5 CPU board and then to the A4 Front Panel board. The probe interface signals are digitized on the Front Panel board and communicated to the processor system to control the instrument.

Analog Acquisition Hybrid A1

The input signals are routed to the highly integrated analog acquisition hybrid, U405, which does the analog processing required to provide vertical, horizontal, and Z-axis signals to the A3 Display Driver board. Under control of the processor, the hybrid provides vertical signal processing, triggers, sweeps, sequencing logic, and intensity control.

External Trigger A1

A high impedance buffer is used to interface the external trigger signal to the analog acquisition hybrid.

Processor System

The processor board is a microcontroller design. Microcontroller U201 is the core of the circuit, operating at 16 MHz. The primary function of the processor is to receive input from the front panel, display the readout, and control the A1 Analog board.

The processor board can be divided into five subsystems: the processor, the ROM/RAM, the readout, the front-panel interface, and the analog board interface. A description of each subsystem follows.

Processor Subsystem A5

The processor subsystem consists of a 32-bit integrated microcontroller and its supporting circuits. It contains four peripheral modules: the CPU, a general-purpose timer (GPT), a queued serial module (QSM), and a system integration module (SIM).

The CPU is based on the MC68020 instruction set and can utilize the extensive software base for the Motorola M68000 Family.

The GPT inputs are used for measuring the main and delay sweep gates, as well as the measurement latches. The outputs of the GPT are used for loading or resetting various sections of the analog board.

The QSM is primarily used as a synchronous bus for setting up the internal register bits of the GCS, HS, preamp and DACs on the analog board.

The SIM module does all of the chip selecting for all of the addressable ICs on the processor board. U201 has three types of support circuitry. The first type is pull-up resistors for IRQ lines and for configuring the processor boot up. The second type is a crystal oscillator. The crystal oscillates at 32 kHz. The processor uses a phase lock loop to create a 16 MHz system clock from this crystal. The third type is a power-on reset circuit. The reset circuit, consisting mainly of U207, is a passive circuit that monitors VCC. When the power supply exceeds 4.5V, U207 releases the reset line allowing the processor to run. If VCC drops below 4.5V a reset occurs.

ROM/RAM Subsystem A5

The ROM/RAM subsystem consists of 256 kb of Flash ROM, 256 kb of static RAM, and 64 kb of non-volatile static RAM. The Flash ROM has a requirement which states that it must not have an OE during a write cycle. Consequently, the gates of U221 in this subsystem prevent this from happening.

Readout Subsystem A5

The readout subsystem consists of a custom readout IC, two DACs, a 2.5 V reference voltage, and some support resistors and capacitors for compensation and filtering. The readout IC has an internal RAM into which the processor puts ascii characters. The processor also controls the state of the readout IC for calibration, cursor positioning, and update rate. The readout IC itself then drives the vertical and horizontal DACs as well as the blanking.

Front-Panel Interface Subsystem A5

The front-panel interface subsystem consists of U215 (DUART), and its 3.686 MHz crystal. The processor communicates to the front-panel processor through an RS232 like interface. This interface is maintained by the DUART, running at 9600 baud. The DUART is connected to IRQ5 on the processor. U201 talks to U215 using data lines D8 through D15.

Analog Board Interface Subsystem A5

The analog board interface subsystem consists of an ECL to CMOS converter and a CMOS to ECL converter. The SGMAIN lines coming from the analog board are ECL. These lines were converted to CMOS by using two transistors and a couple of resistors.

The EXTTRIG lines going to the analog board need to be ECL. These lines were converted using three resistors each.

Display Assembly

All information (waveforms, text, and cursors) is displayed by the A3 Display Driver board. It generates the high voltages necessary to drive the CRT. It also contains the vertical and horizontal amplifier circuitry.

Vertical Output A3

The vertical output amplifier provides the final stage of amplification of the vertical signal. The output of the vertical amplifier is connected to the CRT vertical plates. Vertical time and frequency compensation networks, some which are adjustable are also contained in this circuit block. The compensation networks corrects for errors in the time response of the vertical delay-line and variations in time and frequency response of the total vertical system. The vertical signal at the input of the vertical output stage is sampled and feedback to the trigger circuitry on the analog board. This feedback vertical signal is used for purposes of calibration.

Horizontal Output A3

The horizontal output amplifier provides the final stage of amplification of the horizontal signal and drives the CRT horizontal plates directly. The input signal from the analog board is current in and the output signal to the CRT is a voltage.

High Voltage A3

This circuitry provides the necessary static and dynamic levels to support the CRT biasing and Z-axis drive. The Z-axis amplifier provides amplification of the Z-axis signal from the analog board which is a current. The output of the Z-axis amplifier is then applied to the DC restorer circuitry which level shifts this signal to the cathode level. A focus amplifier receives its input signal from a user control on the front panel. This enables the user the ability to optimize the CRT focus. Additional circuitry is provided to support the necessary bias and operation levels for the CRT.

The External Z-Axis connector provides the ability to modulate the Z-axis amplifier circuit on the A3 Display Driver board, thus modulating or blanking the intensity of the CRT display.

Front Panel

The processor system sends and receives information to and from the A4 Front Panel board. The Front Panel board reads the front-panel controls and changes in their settings are reported to the processor system. The front-panel processor turns the LEDs on and off, generates the probe compensation signal, and processes the probe coding interface signals.

Menu Switches A4

Front-panel menu switches are read by the Front Panel board and changes in menu selections are sent to the processor system.

CPU A4

U101 is the front-panel processor (FPP) and monitors the front-panel controls. It is a single chip microprocessor with built-in RAM, ROM, A-to-D converter, programmable timer, and serial communications interface.

The front-panel processor reports any changes in state of the front-panel controls to the U201 on the A5 CPU board via the serial communication interface.

The programmable timer TCMP1 (U101 pin 2) produces a 0 to 5V, 1kHz square wave signal (CALSIG) that is used for probe compensation. TCMP2 (U101 pin 1) produces a 0 to 5V, 1 kHz signal that is converted to ECL level (DITHER) by the resistive divider R503–R505. DITHER is used by the Analog Signal Processor on the analog board.

FPP Pots & Probes A4

The pot/probe scanner working with the A-to-D converter internal to the front-panel processor digitizes the inputs and reports the amount a pot has turned and the type of probe used.

Control lines to the analog multiplexers U420 and U421 determine whether to scan for pots or probes. If pots are to be scanned, one of 10 possible pot inputs are read from either multiplexer U420 or U421. The voltage at the wiper of the pot selected is applied to the front-panel processor and digitized. The amount and direction of change from the previous stored value is calculated and sent to the host processor 68331 on the processor board.

The intensity and readout intensity pots on the front bezel are stopped pots and represent one input each on the analog multiplexer U420. The other 8 pot inputs on U420 and U421 represent the 4 continuous rotation pots on the front panel which are made of two wipers separated by 180 degrees and contact a single resistive arc. Each continuous rotation pot represents two inputs to the multiplexers.

The analog multiplexer U420 also doubles for selecting one of the 4 possible probe inputs. The probe code resistance from the P6139 probe is converted to a voltage by the pull-up resistors R411–R414. This voltage is read by the pot/probe scanner and the probe type is determined and sent to the host processor.

LEDs & Driver A4

There are five LEDs (light emitting diodes) on the front panel which are connected between the outputs of an 8 bit LED latch U202 and a pull-up resistor to +5 V. When a particular LED needs to be turned on or off, the

Circuit Description

front-panel processor converts the LED identification received from the host processor to the correct LED address on the latch (U202) and changes the state of the LED.

Switches A4

The front-panel switches and menu switches are arranged in an array of 9 rows and 8 columns. The switch scanner sets the nine row lines low in sequence and performs an eight column scan to check for any changes in state and reports these changes to the host processor. When a switch is closed, one row is connected to one column line through an isolation diode and the column line is pulled low indicating a switch closure.

Power Supply

The power supply is a switching power converter. It supplies power to all oscilloscope circuitry.

Two generations of power supplies were produced. The early version required the operator to configure it to the incoming line voltage; the later version automatically adjusts to the incoming line voltage and has no external adjustments. This service manual documents the power supply beginning with the introduction of the new version.

The **POWER** switch, located on the front panel, controls all power to the oscilloscope including the power supply.

Fan

The fan provides forced air cooling for the oscilloscope. It connects to +12 V on the A63 Power Supply board.

General Instructions

This Performance Verification section is divided into two subsections, *Brief Performance Checks* and *Performance Tests*.

The *Brief Performance Checks* section contains procedures to verify the operation of the TAS 465 Analog Oscilloscope.

The *Performance Tests* section contains procedures to confirm the performance of the TAS 465 Oscilloscope to its warranted specifications.

Using the Brief Performance Checks Procedures

The *Brief Performance Checks* contain three procedures: *Power-On Self Tests*, *Functional Tests*, and *Temperature Compensation Calibrations*. Completing these checks takes approximately one hour.

The *Self Tests* are performed each time the oscilloscope is powered on.

The *Functional Tests* use the probe compensation output on the front panel as a test-signal source for further verifying that the oscilloscope functions properly. A standard-accessory probe, included with this oscilloscope, is the only equipment required.

To rapidly confirm that this oscilloscope functions and was adjusted properly, perform the procedures in the *Functional Tests* section; which begin on page 4-3.

Advantages: These procedures are quick to do, require no external equipment or signal sources, and provide high confidence that the oscilloscope will perform properly. These also provide hands-on experience to become familiar with the controls and menus.

The *Temperature Compensation Calibrations* allow you to adjust the display accuracy of the oscilloscope.

Using the Performance Tests Procedures

The *Performance Tests* confirm that the TAS 465 Oscilloscope performs as specified. The *Performance Tests* begin on page 4-13. Completing these tests takes approximately two hours and requires suitable test equipment. (See *Equipment Required* on page 4-13.)

Advantages: These procedures add direct checking of warranted specifications.

Conventions

The procedures in this section provide the following information:

- Title of test
- Equipment required (if applicable)
- Procedure

Where instructed to use a front-panel control or select from a menu, the name appears in boldface type. For example, “press **VERTICAL MENU**;

then “set **CPLG** to **DC**.”



The symbol at the left is accompanied by information you must read to do the procedure properly.

These procedures make references to the graticule lines. For example, “position the cursor to the second vertical graticule line.” Figure 4-1 shows how to interpret the references.

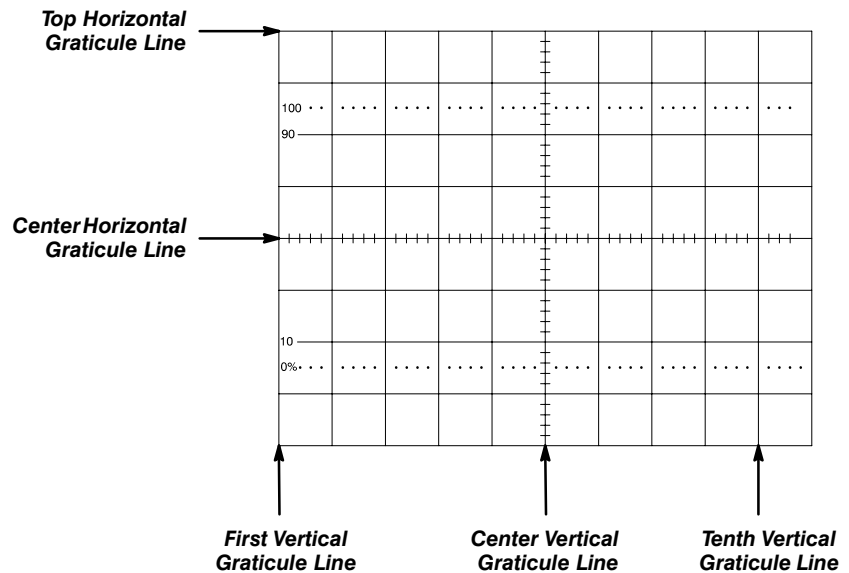


Figure 4-1: Graticule References

These procedures may ask you to check for a stable display. A stable display is consistent. The display should not have its trigger point switching slopes (double trigger) nor should it “free-run.” The **MAIN SWP TRIG'D** LED should remain lit.

Brief Performance Checks

This section contains three brief procedures: two that verify the operation of the TAS 465 Analog Oscilloscope and one to perform a brief calibration to compensate for temperature variances.

The *Power-On Self Tests* use internal routines (performed at each power on) to confirm basic functionality and proper adjustment.

The *Functional Tests* further verify that the oscilloscope functions properly. These tests utilize the front panel **PROBE COMP** signal and a standard accessory probe.

The *Temperature Compensation Calibrations* use internal routines and actions from you to adjust the display accuracy of the oscilloscope. These adjustments are typically necessary only when the operating temperature and the last calibration temperature varies more than 5° C. However, performing these compensations before making a critical measurement ensures optimum accuracy.

If any of these tests return a failed message or do not perform as stated, contact your local Tektronix service center or sales engineer for more information.

Power-On Self Tests

These tests verify that the internal power-on diagnostics passed by confirming no error messages are reported on screen.

Functional Tests

The purpose of these procedures is to confirm that this oscilloscope functions properly. The only equipment required is a standard-accessory probe.



These procedures verify function; that is, they verify that the oscilloscope *operates*. They do *not* verify that it operates within limits.

Therefore, when the functional tests that follow instruct you to verify that a signal appears on screen “that is about five divisions in amplitude” or “has a period of about six horizontal divisions,” do *not* interpret the quantities given as limits. Operation within limits is checked in *Performance Tests*, which begin on page 4-13.



DO NOT make changes to the front-panel settings that are not called out in the procedures. Each verification procedure requires you to set the oscilloscope to certain default settings before verifying functions. If you make changes to these default settings, other than those called out in the procedure, you may obtain invalid results. In this case, begin the procedure again from step 1.

Functional Tests Prerequisites

1. Power on the oscilloscope and allow a 20 minute warm-up before performing this procedure; adjust the **READOUT** control to display the readout and the **INTENSITY** control to display waveforms.
2. Disable the dual delay with the following menu selections.
 - a. Press the **UTILITY** button and select **CONFIG** from the main menu.
 - b. Select **MORE** until you can select **Dual Delay Disabled**.
3. Press the **ALT/CHOP, ADD** button and set **ADD** to **Off**.
4. Install the probe on **CH 1**. Connect the probe tip to **PROBE COMP** on the front-panel; connect the probe ground to the ground barrel of an unused input BNC (see Figure 4-2).

Some functional checks require that you install the probe on connectors other than **CH 1**. All functional checks use the **PROBE COMP** on the front-panel as the signal source.

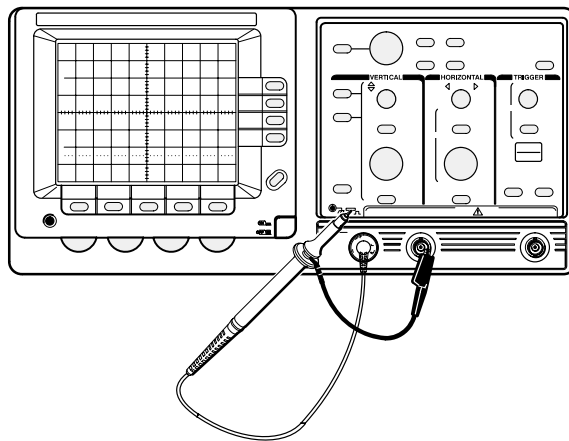


Figure 4-2: Test Hookup for Functional Tests

Verify the Probe Compensator Output

1. Press the **WAVEFORM OFF** button until the readout indicates that only channel 1 is selected.
2. Press the **AUTOSET** button.
3. Press the **VERTICAL MENU** button and set **CPLG** to **DC**.
4. Set the volts/div scale to 1 V and vertically center the display.
5. Set the sec/div scale to 500 μ s.
6. Press the **CURSOR** button and set Δ **VOLT** to **On**.
7. Align the active cursor to the top of the signal using the General Purpose Knob.

8. Press the **TOGGLE** button and align the active cursor to the bottom of the signal using the General Purpose Knob.
9. Verify that the Δ Volts readout is about 5.2 V.
10. Set **1/ Δ T** to **On**.
11. Align the active cursor to a rising edge of the signal using the General Purpose Knob.
12. Press the **TOGGLE** button and align the active cursor to the next rising edge of the signal using the General Purpose Knob.
13. Verify that the $1/\Delta T$ readout is about 1 kHz.
14. Set **Δ TIME** to **On**.
15. Verify that the Δ Time readout is about 1 ms.

Verify the Input Channels

1. Display the channel to be verified and turn all others off.
2. Install the probe on the channel to be verified.
3. Press the **AUTOSET** button.
4. Press the **VERTICAL MENU** button and set **CPLG** to **DC**.
5. Verify that the channel is operational, confirming the following statements are true:
 - The vertical scale readout is set to 2 V for the channel under test and a square wave signal about 2.6 divisions in amplitude is on-screen.
 - Pressing the **SET LEVEL TO 50%** button sets the trigger level readout to approximately 2.7 V.
 - Turning vertical **POSITION** control moves the signal up and down the screen when rotated. Return the bottom portion of the displayed waveform to the center horizontal graticule line.
 - Turning the **VOLTS/DIV** control counterclockwise and clockwise decreases and increases the amplitude of the waveform. Return the volts/div scale to 2 V.
6. Press the **VERTICAL MENU** button and select **CPLG**. Select the following coupling types and verify the display.
 - Select **DC** coupling and verify that the waveform amplitude is positive-going from the center horizontal graticule line.
 - Select **AC** coupling, press the **SET LEVEL TO 50%** button, and verify that the waveform is centered at about the center horizontal graticule line.
 - Select **GND** coupling and verify that a straight line is displayed (no waveform).

7. Return the coupling to **DC** and press the **CLEAR MENU** button.
8. Repeat this procedure until all input channels are verified.

Verify the Alt/Chop and Add Functions

1. Install the probe on **CH 1**.
2. Press the **WAVEFORM OFF** button until the readout indicates channel 1 is the only selected channel.
3. Press the **AUTOSET** button.
4. Press the **CH 2** button, then position the channel 2 trace to the bottom horizontal graticule line.
5. Press the **WAVEFORM OFF** button, removing the channel 2 display.
6. Press the **ALT/CHOP, ADD** button and set **ADD** to **On**.
7. Verify that a second waveform of approximately 2.6 divisions amplitude has been added to the display.
8. Set **DISP** to **Chop**.
9. Set the sec/div scale to 100 ms.
10. Verify that the two waveforms are displayed simultaneously.
11. Set **DISP** to **Alt**.
12. Verify that the two waveforms are displayed alternately.
13. Set **ADD** to **Off**.
14. Press the **CLEAR MENU** button.

Verify the Time Base

1. Press the **WAVEFORM OFF** button until the readout indicates channel 1 is the only selected channel.
2. Install the probe on **CH 1**.
3. Press the **AUTOSET** button.

4. Verify that the main time base is operational, confirming the following statements are true.
 - One period of the square wave is about five horizontal divisions.
 - Rotating the **SEC/DIV** control clockwise expands the waveform (more horizontal divisions per period of waveform); rotating it counterclockwise contracts the waveform.
 - Setting the sec/div scale to 1 ms displays approximately one period of waveform per horizontal division.
 - Rotating the horizontal **POSITION** control moves the waveform left and right on-screen.
 - Pressing the **MAG** button changes the sec/div scale from 1 ms to 100 μ s and one period of the square wave is about ten horizontal divisions. Return to a non-magnified display by pressing the **MAG** button again.
5. Press the **HORIZONTAL MENU** button and set **DELAY** to **On**.
6. Set the delayed sec/div scale to 500 μ s.
7. Press the **TRIGGER MENU** button and set **MODE** to **Runs After**.
8. Press the **HORIZONTAL MENU** button.
9. Select **TRCSEP** from the main menu and vertically position the delayed time base below the main time base using the General Purpose Knob.
10. Select **DELAY** from the main menu.
11. Verify that the delayed time base is operational, confirming the following statements are true:
 - The main sweep has an intensified zone of approximately 5.5 horizontal divisions. Adjust the **INTENSITY** level if necessary to view the entire intensified zone.
 - Rotating the General Purpose Knob clockwise moves the intensified zone to the right on-screen. Position the intensified portion to the center of the screen.
12. Adjust the delayed sec/div scale to 200 μ s.
13. Set **MAIN** to **Off** and confirm that only the delayed sec/div scale is displayed and the period of the square-wave signal is about five horizontal divisions.
14. Set **MAIN** to **On** and **DELAY** to **Off**.

Verify the Trigger System

1. Press the **WAVEFORM OFF** button until the readout indicates channel 1 is the only selected channel.
2. Press the **AUTOSET** button.

3. Set the sec/div scale to 1 ms.
4. Press the **TRIGGER MENU** button and set **MODE** to **Auto**.
5. Verify that the main trigger is operational, confirming that the following statements are true:
 - Rotating the trigger **LEVEL** control changes the main trigger level readout.
 - Rotating the trigger **LEVEL** control through its range triggers and untriggers the display. Leave the signal untriggered.
 - Pressing the **SET LEVEL TO 50%** button triggers the signal and the trigger level readout indicates approximately 2.7 V.
6. Press the **HORIZONTAL MENU** button and set **DELAY** to **On**.
7. Set the delayed sec/div scale to 500 μ s.
8. Verify that the delayed sweep is operational, confirming that an intensified zone appears on the main sweep.
9. Press the **TRIGGER MENU** button and set **MODE** to **Trig After** and **SRC** to **Ch1**.
10. Verify that the delayed trigger is operational, confirming that the following statements are true:
 - Rotating the trigger **LEVEL** control changes the delayed trigger level readout.
 - Rotating the trigger **LEVEL** control through its range triggers and untriggers (intensified zone displayed and not displayed) the delayed sweep. Leave the signal untriggered.
 - Pressing the **SET LEVEL TO 50%** button triggers the signal, the trigger level readout indicates approximately 2.7 V, and the intensified zone is displayed.
11. Press the **HORIZONTAL MENU** button and set **DELAY** to **Off**.
12. Set the sec/div scale to 50 ms.
13. Press the **TRIGGER MENU** button and set **MODE** to **Single Sequence** and confirm the following statements are true:
 - There is no waveform displayed.
 - Pressing the **RESET S SEQ** button causes one sweep of the waveform display to occur.
14. Set the sec/div scale to 1 ms.
15. Set **MODE** to **Auto Level**.
16. Disconnect the probe from the oscilloscope.

Verify the External Trigger

1. Press the **TRIGGER MENU** button; set **MODE** to **Normal** and **SRC** to **EXT <1>**. Confirm that no sweep is displayed.
2. Install the probe on the **EXT TRIG** connector. Connect the probe tip to **PROBE COMP** on the front-panel; connect the probe ground to the ground barrel of an unused input BNC.
3. Press the **SET LEVEL TO 50%** button.
4. Verify that the main sweep is triggered and a single trace is displayed.
5. Press the **AUTOSET** button.
6. Disconnect the probe from the oscilloscope.

Temperature Compensation Calibrations

The procedures that follow allow you to quickly compensate the calibration of the oscilloscope for any external temperature variations. This ensures the most accurate measurements. No test equipment is required to perform these procedures.



Optimum instrument performance depends on the recommended 20 minute minimum warm-up time prior to performing the following calibration routines. All calibration routines require a successful completion (no “failed” message).



The Temperature Compensation Calibrations affect the accuracy of the display system; therefore, they should only be performed by a qualified technician.

Horizontal Sweep Path

1. Press the **AUTOSET** button.
2. Press the **UTILITY** button and select **CAL** from the main menu.
3. Select **Horizontal Sweep Path** from the sub menu, initiating the routine.

The **Horizontal Sweep Path** routine takes about 20 seconds to complete its initial calibrations. Once complete, two dots are displayed. The displayed dots are used for the next horizontal calibration steps.

NOTE

*The following steps use both the General Purpose Knob and the **TOGGLE** button to make adjustments. The General Purpose Knob performs two functions: to adjust gain and centering. Pressing the **TOGGLE** button selects the function of the General Purpose Knob.*

4. Use a combination of the **TOGGLE** button and the General Purpose Knob to position the two dots eight divisions apart, centered horizontally (see Figure 4-3).

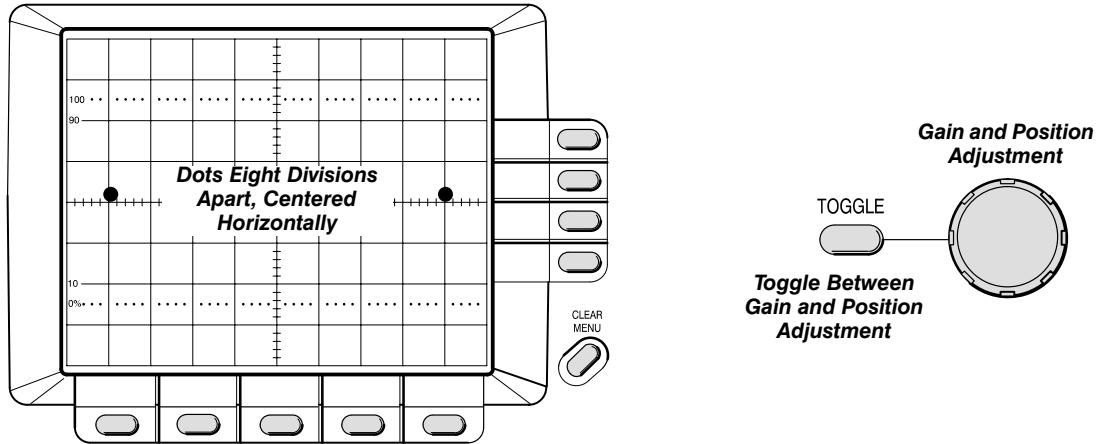


Figure 4-3: Horizontal Adjustments (One)

5. Select **Done** when you have the appropriate display.
6. Again, use a combination of the **TOGGLE** button and the General Purpose Knob to position the two dots eight divisions apart, centered horizontally (see Figure 4-3).
7. Select **Done** when you have the appropriate display.
8. One dot is now displayed.
9. Use a combination of the **TOGGLE** button and the General Purpose Knob to horizontally center the single dot at the center of the screen (see Figure 4-4).

Continue to press the **TOGGLE** button and adjusting the dot to center screen with the General Purpose Knob until the dot stays horizontally centered while pressing the **TOGGLE** button.

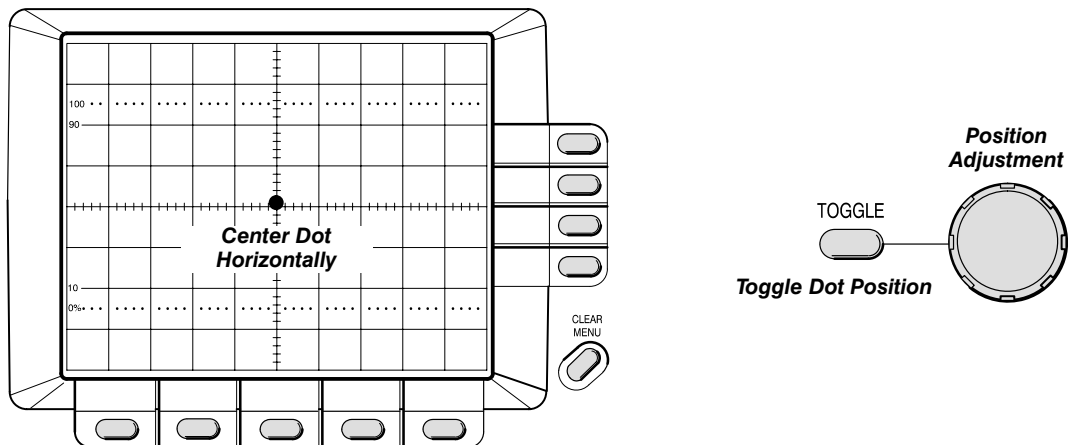


Figure 4-4: Horizontal Adjustments (Two)

10. Select **Done** when you have the appropriate display.
11. Two vertical lines are now displayed.

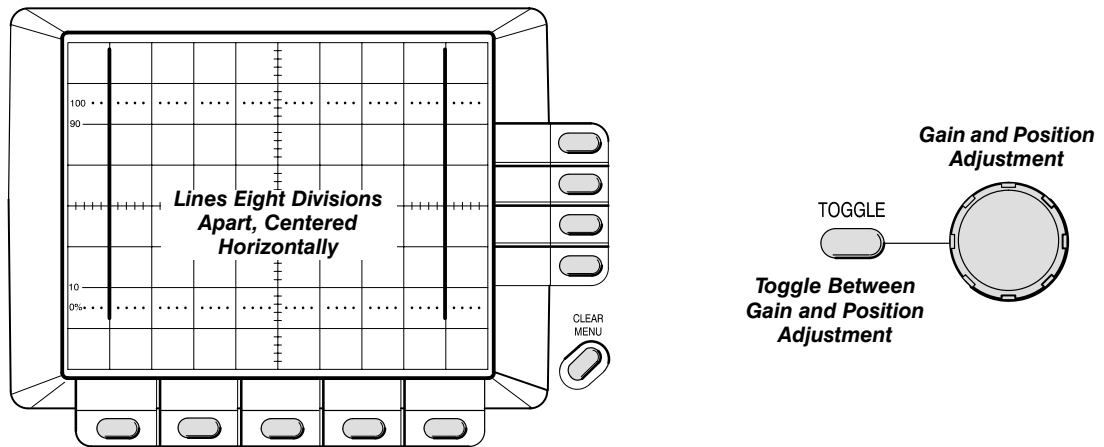


Figure 4-5: Horizontal Adjustments (Three)

12. Use a combination of the **TOGGLE** button and the General Purpose Knob to position the two lines eight divisions apart, centered horizontally (see Figure 4-5).
13. Select **Done** when you have the appropriate display.
14. A **pass** or **failed** status appears on the screen.
15. Select **Done** to exit the routine, displaying a **Calibration Finished** message.

Vertical Signal Path

1. Press the **AUTOSET** button.
2. Press the **UTILITY** button and select **CAL** from the main menu.
3. Select **Vertical Signal Path** from the sub menu, initiating the routine.
4. Remove any input signals from the oscilloscope.
5. Select **Done**.

The **Vertical Signal Path** routine takes about one minute to complete. When finished, a **pass** or **failed** status will appear on the screen.

6. Press **Done** to exit the routine, displaying a **Calibration Finished** message.
7. Press the **CLEAR MENU** button.

Brief Performance Checks

Performance Tests

This subsection contains procedures to verify that the TAS 465 Analog Oscilloscope performs as warranted.

The procedures are arranged in three logical groupings: *Vertical Checks*, *Horizontal Checks*, and *Trigger Checks*. They check all the characteristics that are designated as checked in Section 1, *Specifications*. (The checked characteristics appear in **boldface** type under *Warranted Characteristics* in Section 1.)

These procedures *extend* the confidence level provided by the *Brief Performance Checks* in this section.

Performance Tests Prerequisites



The tests in this subsection comprise an extensive, valid confirmation of performance and functionality when the following requirements are met:

- The cabinet must be installed on the oscilloscope.
- The *Power-On Self Tests* show no failures.
- You must have completed the *Temperature Compensation Calibrations*, beginning on page 4-9.
- The oscilloscope must have an operating warm-up period of at least 20 minutes at an ambient temperature between -10°C and $+55^{\circ}\text{C}$.
- You have set the **INTENSITY** and **READOUT** controls for nominal viewing levels.
- You have set the delayed sweep intensity to **Intensity Delay > Main** in the Utility Configure menu.

Related Information — Read *General Instructions* that start on page 4-1. If you are not familiar with operating this oscilloscope, read *Quick Start* in Section 2 before performing these procedures.

Equipment Required

These procedures use external, traceable signal sources to directly check warranted characteristics. Table 4-1 lists the required test equipment.

Performance Tests

Table 4-1: Required Test Equipment

Item Number and Description	Minimum Requirements	Example	Purpose
1 Attenuator, 5X ¹	Ratio: 5X; Impedance 50 Ω; Connectors: female BNC input, male BNC output	Tektronix part number 011–0060–02	Signal attenuation
2 Attenuator, 10X	Ratio: 10X; Impedance 50 Ω; Connectors: female BNC input, male BNC output	Tektronix part number 011–0059–02	Signal attenuation
3 Termination, 50 Ω (two required)	Impedance 50 Ω; Connectors: female BNC input, male BNC output	Tektronix part number 011–0049–01	Signal interconnection
4 Termination, 75 Ω	Impedance 75 Ω; Connectors: female BNC input, male BNC output	Tektronix part number 011–0102–01	Signal interconnection, video
5 Cable, Precision Coaxial	50 Ω, 36 in, male-to-male BNC connectors	Tektronix part number 012–0482–00	Signal interconnection
6 Cable, Coaxial	75 Ω, 36 in, male-to-male BNC connectors	Tektronix part number 012–1338–00	Signal interconnection, video
7 Coupler, Dual-Input	Female-BNC-to-dual-male-BNC	Tektronix part number 067-0525-02	Signal interconnection
8 Generator, Leveled Sine Wave	200 kHz to 250 MHz; Variable amplitude from 5 mV to 4 V _{p-p} into 50 Ω	Wavetek 9100 Universal Calibration System with Oscilloscope Calibration Module (Option 250)	Trigger and bandwidth checks
9 Generator, Time Mark	Variable marker frequency from 10 ms to 10 ns; accuracy within 25 ppm		Timing accuracy checks
10 Generator, Pulse	High Amplitude pulse with variable amplitude of 60 V to 100 V		Gain accuracy checks
11 Generator, DC Calibration	DC voltage levels from 100 mV to 10 V		Gain accuracy checks
12 Probe, 10X, included with this instrument	Standard accessory probe	TEKTRONIX P6109B	Signal interconnection
13 Digital Multimeter	DC voltage to 10 V	TEKTRONIX DM 2510	Power Supply Adjustment
14 Generator, Video Signal	Provides NTSC compatible outputs	TEKTRONIX TSG 100	Video trigger check
15 Adjustment Tool ¹	0.1 inch hex on both ends	GC Electronics #8606	Internal adjustments

¹ This item is used only when performing the Adjustment Procedures.

Vertical System Checks

These procedures check those characteristics that relate to the vertical system and are listed as checked under *Warranted Characteristics* in Section 1, *Specifications*.

Check DC Gain and Voltage Measurement Accuracy

Equipment Required: One pulse generator (item 10) and one precision coaxial cable (item 5).

1. Display the channel to be verified, turning all others off.
2. Press the **AUTOSET** button.
3. Set the sec/div scale to 500 μ s.
4. Press the **TRIGGER MENU** button and set **CPLG** to **Noise Reject**.
5. Press the **CURSOR** button and set Δ **Volt** to **On**.
6. Press the **VERTICAL MENU** button and make the following selections:
 - Set **CPLG** to **DC**
 - Set **BW** to **20 MHz**
7. Set the volts/div scale to 2 mV.
8. Position the trace three divisions below the center horizontal graticule line.
9. Connect the standard amplitude output of the pulse generator to the input of the channel to be verified as shown in Figure 4-6.

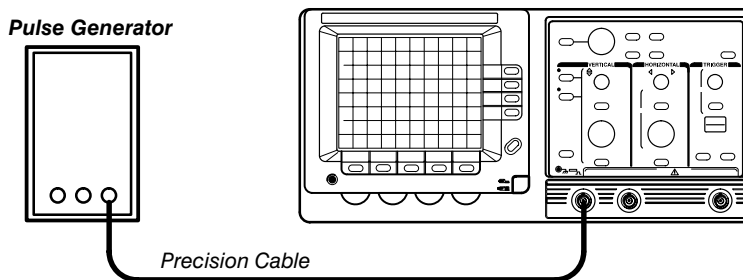


Figure 4-6: Gain and Voltage Test Setup

10. Set the pulse generator for 10 mV amplitude output.
11. Use the General Purpose Knob and **TOGGLE** button to precisely align the cursors to the signal peaks.
12. Check the Displayed Signal Accuracy and Volts Readout Accuracy while setting the Volts/Div Scale and the Input Amplitude given in Table 4-2.

Table 4-2: DC Gain and Delta Volts Accuracy

Volts/Div Scale	Input Amplitude	Displayed Signal Accuracy	Delta Volts Readout Accuracy
2 mV	10 mV	4.87 to 5.13 div	9.80 mV to 10.2 mV
5 mV	20 mV	3.9 to 4.1 div	19.6 mV to 20.4 mV
10 mV	50 mV	4.87 to 5.13 div	49.0 mV to 51.0 mV
20 mV	0.1 V	4.87 to 5.13 div	98.0 mV to 102 mV
50 mV	0.2 V	3.9 to 4.1 div	196 mV to 204 mV
100 mV	0.5 V	4.87 to 5.13 div	490 mV to 510 mV
1 V	5 V	4.87 to 5.13 div	4.90 V to 5.10 V

13. Return the volts/div scale to 2 mV and set the pulse generator for 10 mV amplitude output.
14. Press the **VERTICAL MENU** button and set **VAR** to **On**.
15. Check that rotating the General Purpose Knob counterclockwise reduces the displayed signal amplitude to two divisions or less. Set **VAR** to **Off**.
16. Disconnect the test setup from the oscilloscope.
17. Repeat this procedure until you have verified all input channels.
18. Press the **CURSOR** button and set Δ **Volt** to **Off**.

Check Trigger Level Accuracy

Equipment Required: One DC calibration generator (item 11) and one precision coaxial cable (item 5).

1. Display channel 1, turning all others off.
2. Press the **AUTOSET** button.
3. Set the sec/div scale to 500 μ s.
4. Press the **TRIGGER MENU** button and make the following selections:
 - Set **CPLG** to **DC**
 - Set **SLOPE** to **Rising**
5. Press the **VERTICAL MENU** button and make the following selections:
 - Set **CPLG** to **DC**
 - Set **BW** to **20 MHz**
6. Set the volts/div scale to 50 mV.
7. Position the trace three divisions below the center horizontal graticule line.

- Connect the DC calibration generator to the **CH 1** input as shown in Figure 4-7.

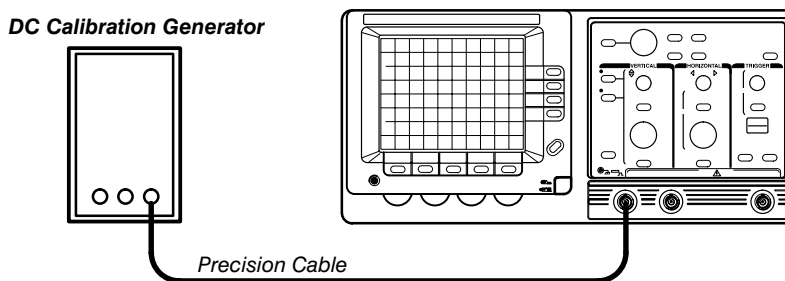


Figure 4-7: Trigger Level Test Setup

- Set the DC calibration generator for a 200 mV output.
- Press the **SET LEVEL TO 50%** button.
- Check that the Trigger Level Accuracy readout is in the range of 169 mV to 231 mV.
- Press the **TRIGGER MENU** button and set **SLOPE** to **Falling**.
- Press the **SET LEVEL TO 50%** button.
- Check that the Trigger Level Accuracy readout is in the range of 169 mV to 231 mV.
- Press the **MAIN/DELAY SELECT** button, displaying the delay trigger menu.
- Set **MODE** to **Runs After** and **SRC** to **Ch1**.
- Press the **SET LEVEL TO 50%** button.
- Check that the Trigger Level Accuracy readout is in the range of 169 mV to 231 mV.
- Disconnect the test setup from the oscilloscope.
- Press the **MAIN/DELAY SELECT** button and set **SLOPE** to **Rising**.
- Press the **HORIZONTAL MENU** button and set **DELAY** to **Off**.

Check DC Coupling Bandwidth

Equipment Required: One leveled sine wave generator (item 8), one precision coaxial cable (item 5), and one 50 Ω termination (item 3).

- Display the channel to be verified, turning all others off.
- Connect the output of the sine wave generator to the channel to be verified as shown in Figure 4-8.

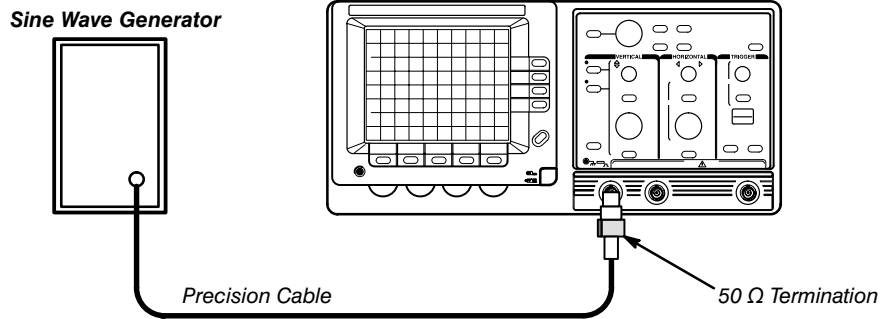


Figure 4-8: Bandwidth Test Setup

3. Press the **AUTOSET** button.
4. Set the volts/div scale to 2 mV.
5. Set the sec/div scale to 200 μ s.
6. Set the sine wave generator for a 50 kHz reference frequency and adjust the amplitude for a six division display.
7. Press the **TRIGGER MENU** button and set **CPLG** to **Noise Reject**.
8. Use the following substeps (a to c) and the settings and limits given in Table 4-3 to confirm the bandwidth of the input channels.
 - a. Set the volts/div scale as indicated.
 - b. Set the signal generator for the specified amplitude at the reference frequency.
 - c. While confirming the Display Amplitude remains greater than the minimum number of divisions, increase the signal generator frequency to 100 MHz.

Table 4-3: DC Coupled Bandwidth

Volts/Div Scale	50 kHz Reference Amplitude	Display Amplitude
		TAS 465 To 100 MHz
2 mV	6 division	≥ 4.2 division
5 mV	6 division	≥ 4.2 division
10 mV	6 division	≥ 4.2 division
20 mV	6 division	≥ 4.2 division
50 mV	6 division	≥ 4.2 division
100 mV	6 division	≥ 4.2 division
1 V	5 division	≥ 3.5 division

9. Disconnect the test setup from the oscilloscope.
10. Repeat this procedure until all input channels are verified.

Check X-Axis Gain

Equipment Required: One pulse generator (item 10) and one precision coaxial cable (item 5).

1. Display channel 1, turning all others off.
2. Connect the output of the pulse generator to the **CH 1** input as shown Figure 4-9.

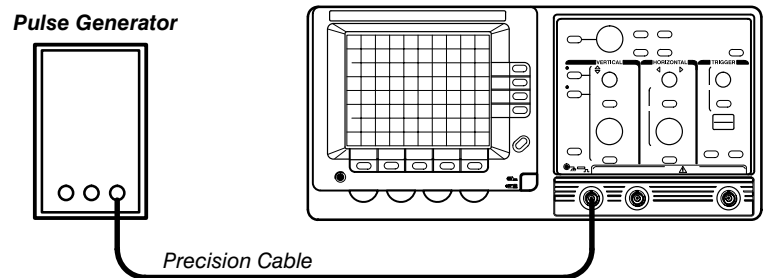


Figure 4-9: X-Axis Gain Test Setup

3. Set the output of the pulse calibration generator for 50 mV.
4. Press the **AUTOSET** button.
5. Set the volts/div scale to 10 mV.
6. Center the display using the vertical **POSITION** control.
7. Press the **HORIZONTAL MENU** button and set **XY** to **On**.
8. Check that the amplitude of the X-axis signal is 4.8 to 5.2 divisions.
9. Set **XY** to **Off**.
10. Disconnect the test setup from the oscilloscope.

Horizontal System Checks

These procedures check those characteristics that relate to the horizontal system and are listed as checked under *Warranted Characteristics* in Section 1, *Specifications*.

Check Time Base and Time Cursor Accuracy

Equipment Required: One time marker generator (item 9), one precision coaxial cable (item 5), and one 50 Ω termination (item 3).

1. Display channel 1, turning all others off.
2. Connect the output of the time marker generator to the **CH 1** input as shown in Figure 4-10.

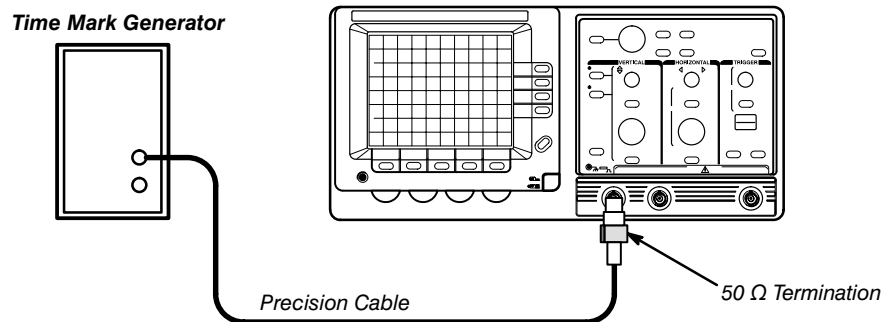


Figure 4-10: Timing Test Setup

3. Set the output of the generator for 20 ns markers.
4. Press the **AUTOSET** button.
5. Set the sec/div scale to 20 ns.
6. Set the volts/div scale to 500 mV.
7. Center the time mark display vertically.
8. Press the **CURSOR** button and set Δ TIME to **On**.
9. Position the rising edge of the second time mark to the second vertical graticule line.
10. Align the active cursor to the second time mark at the point the rising edge intersects the center horizontal graticule line using the General Purpose Knob.
11. Press the **TOGGLE** button and align the second cursor to the tenth time mark at the point the rising edge intersects the center horizontal graticule line using the General Purpose Knob.
12. Check that the Time-mark to Graticule Accuracy and the Time Cursor Readout Accuracy over the center eight divisions are within the limits shown for each Sec/Div Scale listed in Table 4-4.

Table 4-4: Time Base and Cursor Accuracies (Mag Off)

Sec/Div Scale (Mag Off)	Time Mark Setting	Time-mark to Graticule Accuracy	Time Cursor Readout Accuracy
		Over Center 8 Divisions	2nd and 10th Time Marks
20 ns	20 ns	±0.16 division	157 ns to 163 ns
50 ns	50 ns	±0.16 division	392 ns to 408 ns
100 ns	0.1 µs	±0.16 division	784 ns to 816 ns
200 ns	0.2 µs	±0.16 division	1.57 µs to 1.63 µs
500 ns	0.5 µs	±0.16 division	3.92 µs to 4.08 µs
1 µs	1 µs	±0.16 division	7.84 µs to 8.16 µs
2 µs	2 µs	±0.16 division	15.7 µs to 16.3 µs
5 µs	5 µs	±0.16 division	39.2 µs to 40.8 µs
10 µs	10 µs	±0.16 division	78.4 µs to 81.6 µs
20 µs	20 µs	±0.16 division	157 µs to 163 µs
50 µs	50 µs	±0.16 division	392 µs to 408 µs
100 µs	0.1 ms	±0.16 division	784 µs to 816 µs
200 µs	0.2 ms	±0.16 division	1.57 ms to 1.63 ms
500 µs	0.5 ms	±0.16 division	3.92 ms to 4.08 ms
1 ms	1 ms	±0.16 division	7.84 ms to 8.16 ms
2 ms	2 ms	±0.16 division	15.7 ms to 16.3 ms
5 ms	5 ms	±0.16 division	39.2 ms to 40.8 ms

13. Set Δ TIME to **Off**.
14. Set the time mark generator to 20 ns.
15. Set the main sec/div scale to 20 ns.
16. Press the **HORIZONTAL MENU** button and set **DELAY** to **On** and **MAIN** to **Off**.
17. Set the delayed sec/div scale to 20 ns.
18. Set the delay time to 3 ns using the General Purpose Knob.
19. Position the edge of the second time mark to the second vertical graticule line.
20. Check that the Time Mark to Graticule Accuracy over the center eight divisions are within the limits shown for each sec/div scale listed in Table 4-4 (disregard the Time Cursor Readout Accuracy column).

21. Set **MAIN** to **On**.
22. Set the main sec/div scale to 20 ns.
23. Set **MAIN** to **Off**.
24. Press the **MAG** button, turning magnification on.
25. Set the time mark generator for 5 ns markers.
26. Set the volts/div scale to 200 mV.
27. Check that the timing accuracies at the beginning, middle, and end of sweep over the center eight divisions are within the limits shown for each of the sec/div scales given in Table 4-5. Exclude the first and last five divisions of the magnified sweep for accuracy measurements.

Table 4-5: Time Base Accuracy (Mag On)

Sec/Div Scale (Mag On)	Time Marker Setting	Time Mark to Graticule Over Center 8 Divisions
2 ns	5 ns ¹	±0.24 division ²
5 ns	5 ns ¹	±0.24 division
10 ns	10 ns	±0.24 division
100 ns	0.1 μs	±0.24 division
100 μs	0.1 ms	±0.24 division

¹ Change the volts/div scale as necessary to maintain vertical amplitude.

² At this setting, two cycles of the signal are displayed for every five horizontal divisions.

28. Set **MAIN** to **On** and **DELAY** to **Off**.
29. Set the sec/div scale to 2 ns.
30. Set the time mark generator for 5 ns markers.
31. Check that the timing accuracies at the beginning, middle, and end of sweep over the center eight divisions are within the limits shown for each Sec/Div Scale given in Table 4-5. Exclude the first and last five divisions of the magnified sweep for accuracy measurements.
32. Press the **MAG** button, turning magnification off.

Check Dual Delay Accuracy

Equipment Required: One time marker generator (item 9), one precision coaxial cable (item 5), and one 50 Ω termination (item 3).

1. Display channel 1, turning all others off.
2. Connect the output of the time marker generator to the **CH 1** input as shown in Figure 4-11.

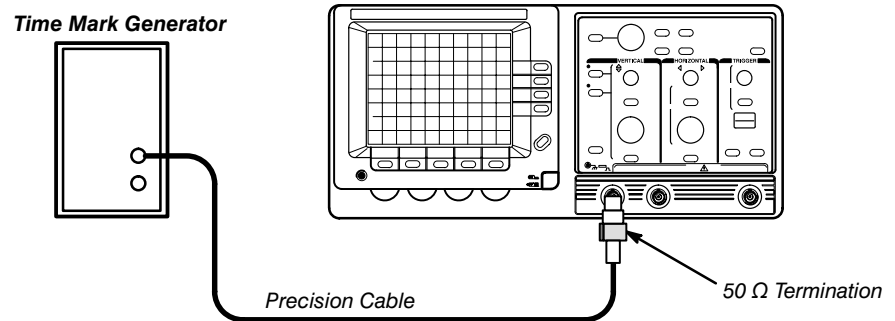


Figure 4-11: Dual Delay Test Setup

3. Set the output of the time marker generator for 0.5 ms markers.
4. Press the **AUTOSET** button.
5. Set the sec/div scale to 500 μ s.
6. Set the volts/div scale to 500 mV.
7. Position the time marker display to the upper half of the graticule and align the first time marker to the second vertical graticule line.
8. Press the **TRIGGER MENU** button and then the **MAIN/DELAY SELECT** button.
9. Set **MODE** to **Runs After**.
10. Set the delayed sec/div scale to 50 μ s.
11. Press **HORIZONTAL MENU**.
12. Select **TRCSEP** and position the delayed time marker display to the lower half of the graticule using the General Purpose Knob.
13. Select **DELAY**.
14. Using the General Purpose Knob, position the intensified zone on the main sweep to the second time marker; then, slightly adjust the General Purpose Knob until the delayed sweep time marker is at the graticule center.
15. Press the **UTILITY** button and select **CONFIG** from the main menu.
16. Select **MORE** until you can select **Dual Delay Enabled** from the sub menu.
17. Press the **CURSOR** button and set Δ **TIME** to **On**.
18. Using the General Purpose Knob, position the second intensified zone on the main sweep to the third time marker; then, slightly adjust the General Purpose Knob to superimpose the delayed sweep time markers at the graticule center. Press the **TOGGLE** button to assign the General Purpose Knob to the second intensified zone if necessary.
19. Check the Dual Delay Accuracy Reading for each time marker pair listed in Table 4-6.

Table 4-6: 500 μ s Dual Delay Accuracy

Time Markers Intensified	Dual Delay Accuracy Reading Limits
Second and third	473 μ s to 527 μ s
Second and fourth	970 μ s to 1.03 ms
Second and sixth	1.97 ms to 2.03 ms
Second and tenth	3.96 ms to 4.04 ms

20. Press the **MAIN/DELAY SELECT** button and set the main sec/div scale to 200 ns.
21. Press the **MAIN/DELAY SELECT** button and set the delayed sec/div scale to 20 ns.
22. Set the time mark generator for 0.2 μ s markers.
23. Using the General Purpose Knob, position the second intensified zone on the main sweep to the tenth time marker; then, slightly adjust the General Purpose Knob to superimpose the delayed sweep time markers at the graticule center.
24. Check the dual delay accuracy (Δ Time) reading is in the range of 1.58 μ s to 1.62 μ s.
25. Press the **CURSOR** button and set Δ TIME to **Off**.
26. Press the **UTILITY** button and select **Dual Delay Disabled**.
27. Press the **HORIZONTAL MENU** button and set **DELAY** to **Off**.
28. Disconnect the test setup from the oscilloscope.

Trigger System Checks

These procedures check those characteristics that relate to the trigger system and are listed as checked under *Warranted Characteristics* in Section 1, *Specifications*.

Check Trigger Sensitivity

Equipment Required: One sine wave generator (item 8), one 10X attenuator (item 2), one precision coaxial cable (item 5), one dual-input coupler (item 7), and two 50 Ω terminations (item 3).

Low Frequency — The following steps check trigger sensitivity at 25 MHz.

1. Display channel 1, turning all others off.
2. Connect the output of the sine wave generator to the **CH 1** and **EXT TRIG** inputs as shown in Figure 4-12.

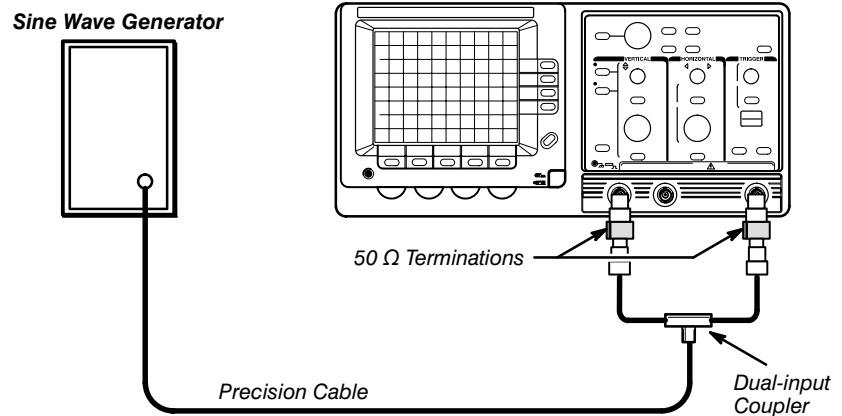


Figure 4-12: Trigger Sensitivity Test Setup (One)

3. Set the frequency of the sine wave generator to 25 MHz.
4. Press the **AUTOSET** button.
5. Set the volts/div scale to 50 mV.
6. Set the sec/div scale to 100 ns.
7. Press the **VERTICAL MENU** button and set **CPLG** to **DC**
8. Press the **TRIGGER MENU** button and make the following selections from the main trigger menu:
 - Set **MODE** to **Auto**
 - Set **SRC** to **Ch1**
 - Set **CPLG** to **DC**
 - Set **SLOPE** to **Rising**
9. Press the **MAIN/DELAY SELECT** button and make the following selections from the delay trigger menu:
 - Set **MODE** to **Runs After**
 - Set **SRC** to **Ch1**
 - Set **CPLG** to **DC**
 - Set **SLOPE** to **Rising**
10. Set the delayed sec/div scale to 50 ns.
11. Press the **HORIZONTAL MENU** button and select **DELAY**.
12. Set the delay time to 15 ns using the General Purpose Knob.
13. Set **DELAY** to **Off**.
14. Adjust the sine wave generator amplitude for a three division display.
15. Add a 10X attenuator to the test setup as shown in Figure 4-13.

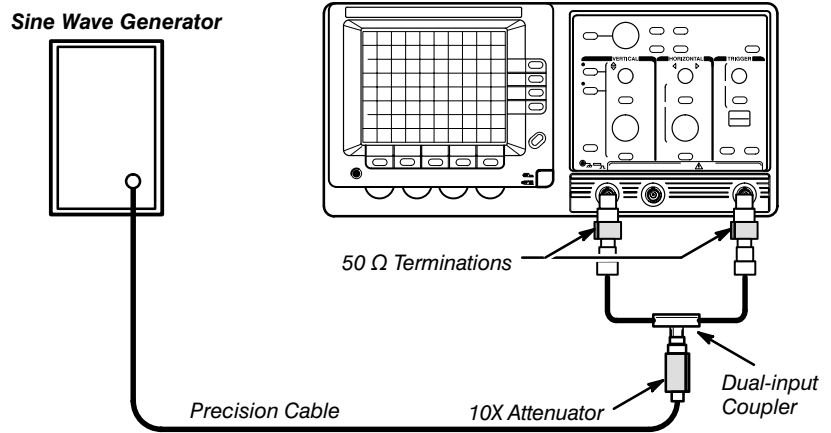


Figure 4-13: Trigger Sensitivity Test Setup (Two)

16. Press the **SET LEVEL TO 50%** button and confirm a stable display.
17. Press the **TRIGGER MENU** button and set **SLOPE** to **Falling**.
18. Press the **SET LEVEL TO 50%** button and confirm a stable display.
19. Press the **HORIZONTAL MENU** button and set **DELAY** to **On**.
20. Select **TRCSEP** and position the delayed sweep below the main sweep using the General Purpose Knob.
21. Press the **TRIGGER MENU** button and set **MODE** to **Trig After**.
22. Press the **SET LEVEL TO 50%** button and confirm a stable delayed sweep display.
23. Set **SLOPE** to **Falling**.
24. Press the **SET LEVEL TO 50%** button and confirm a stable delayed sweep display.
25. Press the **HORIZONTAL MENU** button and set **DELAY** to **Off**.
26. Set the volts/div scale to 10 mV.
27. Set the sine wave generator to 50 kHz.
28. Set the sec/div scale to 50 μ s.
29. Adjust the sine wave generator amplitude for a 3.5 division display.
30. Set the sine wave generator frequency to 25 MHz.
31. Set the main sec/div scale to 100 ns.
32. Press the **TRIGGER MENU** button and set **SRC** to **EXT <1>**.
33. Press the **SET LEVEL TO 50%** button and confirm a stable display.

High Frequency — The following steps check trigger sensitivity at 150 MHz (TAS 465).

1. Remove the 10X attenuator from the test setup. Reconnect as shown in Figure 4-14.

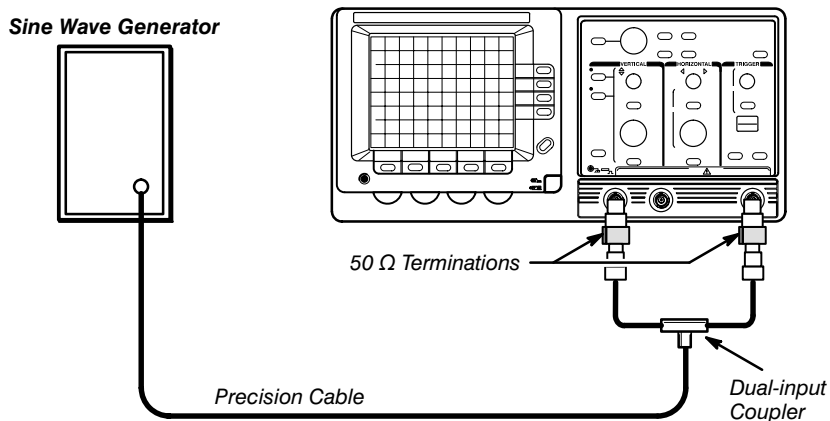


Figure 4-14: Trigger Sensitivity Test Setup (Three)

2. Set the volts/div scale to 1 V.
3. Adjust the sine wave generator amplitude for a one division display at 25 MHz.
4. Set the sine wave generator frequency as follows:
 - TAS 465 — 150 MHz
5. Press the **MAG** button.
6. Set **SRC** to **EXT <10>**.
7. Press the **SET LEVEL TO 50%** button and confirm a stable display.
8. Add a 10X attenuator to the test setup as shown in Figure 4-15.

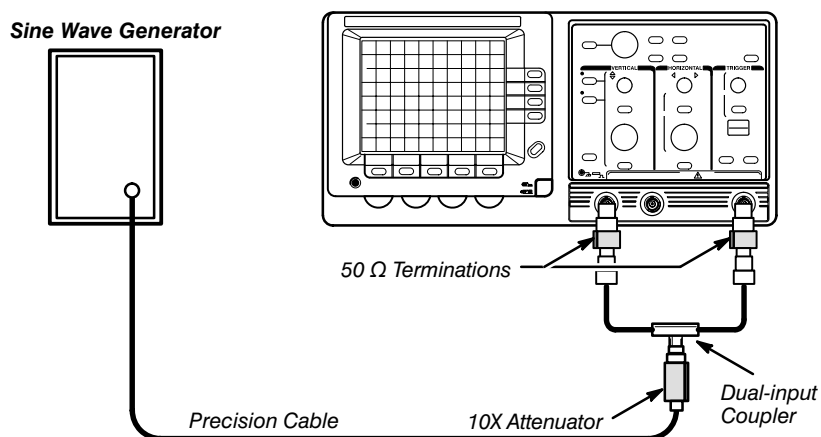


Figure 4-15: Trigger Sensitivity Test Setup (Four)

9. Set the volts/div scale to 50 mV.
10. Adjust the sine wave generator amplitude for a one division display.
11. Set **SRC** to **Ch1**.
12. Press the **SET LEVEL TO 50%** button and confirm a stable display.
13. Set **SLOPE** to **Rising**.
14. Press the **SET LEVEL TO 50%** button and confirm a stable display.
15. Press the **MAIN/DELAY SELECT** button (selecting delay).
16. Press the **SET LEVEL TO 50%** button and confirm a stable delayed sweep display (see the following note).

NOTE

*A slight adjustment of the delay time may be necessary to obtain a stable delayed sweep display. Press the **Horizontal Menu** button and adjust the delay time using the General Purpose Knob. Press the **Trigger Menu** button after confirming a stable display.*

17. Set **SLOPE** to **Rising**.
18. Press the **SET LEVEL TO 50%** button and confirm a stable delayed sweep display.

NOTE

*A slight adjustment of the delay time may be necessary to obtain a stable delayed sweep display. Press the **Horizontal Menu** button and adjust the delay time using the General Purpose Knob.*

19. Press the **HORIZONTAL MENU** button and set **DELAY** to **Off**.
20. Disconnect the test setup from the oscilloscope.

Video Trigger Sensitivity

The following steps check the video trigger sensitivity.

Equipment Required: One NTSC Television signal generator (item 14), one 75 Ω termination (item 4), and one 75 Ω coaxial cable (item 6).

1. Display channel 1, turning all others off.
2. Connect the composite sync output of the television signal generator to the **CH 1** input as shown in Figure 4-16.

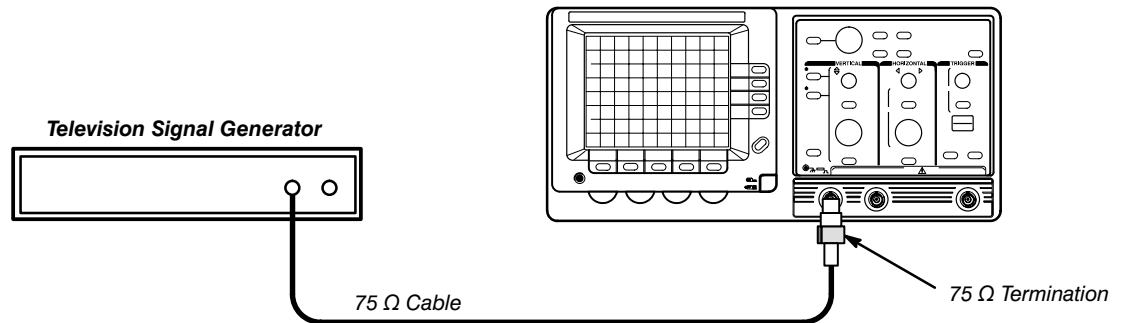


Figure 4-16: Video Trigger Test Setup

3. Press the **AUTOSET** button.
4. Set the volts/div scale to 200 mV.
5. Set the sec/div scale to 100 μ s.
6. Press the **UTILITY** button and select **CONFIG**.
7. Select **MORE** until you can select **Video Sync Negative** from the sub menu.
8. Press the **TRIGGER MENU** button and make the following selections:
 - Set **MODE** to **Video Field <odd>**
 - Set **SLOPE** to **Falling**
9. Confirm a stable display of the video field.
10. Set **MODE** to **Video Field <even>**.
11. Confirm a stable display of the video field.
12. Disconnect the test setup from the oscilloscope.

Adjustment Procedures

This section contains information needed to adjust the TAS 465 Analog Oscilloscope.

Description — The *Adjustment Procedures* are divided into two parts:

- General information about adjusting the oscilloscope
- Written procedures for calibrating the oscilloscope

Purpose — Use these procedures to return the oscilloscope to conformance with its *Warranted Characteristics* as listed in Section 1, *Specifications*. They also optimize the performance of the oscilloscope.

These procedures are *not* required to verify the oscilloscope conforms with its warranted characteristics. Performance verification procedures are found in Section 4, *Performance Verification*.

Adjustment Interval — As a general rule, perform these adjustments after every 2,000 hours of operation or once a year if used infrequently.

Requirements for Performance

Before you perform this procedure, you need to address the following requirements.

Personnel

This procedure is only to be performed by trained service technicians.

Access to Adjustments

The cabinet must be removed to perform the adjustment procedure. Refer to Section 6, *Maintenance*, for procedures to remove the cabinet. The adjustment procedures make references to adjustments located on internal circuit boards. Figure 5-1 shows the location of each board with adjustments. The end of this section contains figures that show the location of each adjustment for each circuit board.

Warm-Up Period

This oscilloscope requires a 20 minute warm-up period in a 20° C to 30° C environment before performing this adjustment procedure. Adjustments performed before the operating temperature has stabilized may cause errors in performance.

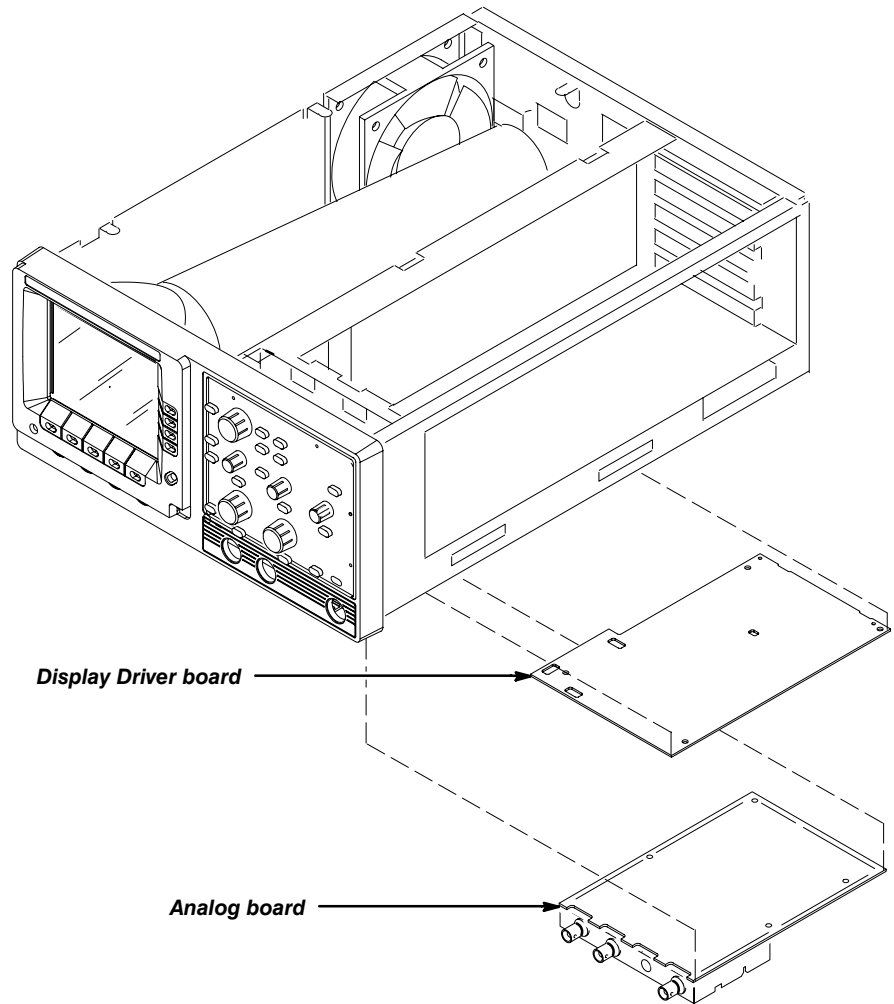


Figure 5-1: Location of Boards for Adjustments

Equipment Required

These procedures use external, traceable signal sources to adjust the TAS 465 Oscilloscope. Table 4-1 on page 4-14 lists all the test equipment required for these procedures.

Performing the Adjustment Procedures

The following topics cover what is required to adjust the oscilloscope. Also, the performance of individual adjustments is discussed.

The **Factory Horizontal Cal** and **Factory Vertical Cal** adjustment routines are selected from the Utility menu of the oscilloscope. These routines use both front-panel controls and external standards you provide in response to instructions displayed on the CRT readout.

Complete Adjustment

A complete adjustment consists of a sequence of individual adjustment steps performed in the order shown:

1. Power Supply Adjustment
2. CRT Adjustment
3. Low Frequency Output Compensation
4. Factory Horizontal Cal
5. Factory Vertical Cal
6. High Frequency Step Response Adjustment
7. Attenuator Compensation
8. Vertical Gain Adjustment

Partial Adjustment

The Adjustment Procedures allow you to make individual adjustments of the steps outlined above; however, usually all adjustment steps are made. Read the information under *Adjustment Dependencies* that follows before performing an individual adjustment.

Adjustment Dependencies

Some adjustments depend on the successful prior completion of other adjustments. Generally, the procedures should be performed in the order shown under *Complete Adjustment*. Some adjustments do not depend on completion of other adjustments. Table 5-1 lists the adjustments and their dependencies.

Table 5-1: Adjustments and Dependencies

Adjustment	Prior Completion Requirements
Power Supply	None
CRT Adjustment	None
Low Frequency Output Compensation	None
Factory Horizontal Cal	CRT Adjustment
Factory Vertical Cal	Low Frequency Output Compensation and Factory Horizontal Cal
High Frequency Step Response	Factory Vertical Cal
Attenuator Compensation	Low Frequency Output Compensation
Vertical Gain Adjustment	Low Frequency Output Compensation, Factory Vertical Cal, and Attenuator Compensation

Adjustment Instructions

The following instructions will guide you through each of the adjustments outlined in *Complete Adjustments*. Each adjustment section lists all necessary equipment required to perform the adjustments.

Power Supply Adjustment

Equipment Required: One digital multimeter (item 13) and one adjustment tool (item 15).

Adjustment Locations: This procedure requires adjustment to the Power Supply board. See Figure 5-16 on page 5-22 for the location of the adjustment.

1. Connect the digital voltmeter low lead to chassis ground and connect the volts lead to the -8.6 V supply (W55-2) on the CPU board.
2. Measure the -8.6 V supply. If the supply measures from -8.56 V to -8.64 V, the supply is adjusted properly and you may disconnect the voltmeter.
3. If the power supply is not within the limits specified in step 2, adjust the -8.6 V ADJ potentiometer (R43) for a voltmeter reading of -8.60 V.
4. Disconnect the voltmeter from the instrument.

CRT Adjustments

Equipment Required: One time marker generator (item 9), one precision coaxial cable (item 5), and one 50 Ω termination (item 3).

Adjustment Locations: This procedure requires adjustments to the Display Driver board. See Figure 5-14 on page 5-20 for the location of the adjustments.

1. Disconnect all signal inputs from the oscilloscope.
2. Display channel 1, turning all others off.
3. Press the **AUTOSET** button.
4. Set the volts/div scale to 50 mV.
5. Set the sec/div scale to 2 μ s.
6. Press the **VERTICAL MENU** button and make the following selections from the menu:
 - Set **CPLG** to **GND**
 - Set **BW** to **20 MHz**
7. Position the channel 1 trace to the center horizontal graticule line and adjust the **FOCUS** control for a well-defined display.
8. Adjust the **TRACE ROTATION** control (screw-driver adjustment) to align the trace with the center horizontal graticule line.
9. Press the **HORIZONTAL MENU** button and set **XY** to **On**.
10. Set the **INTENSITY** control fully counterclockwise (off).
11. Adjust R321 on the Display Driver board until the dot is visible, then re-adjust R321 until the dot just extinguishes.
12. Set **XY** to **Off**.
13. Connect the output of the time mark generator to the **CH 1** input as shown in Figure 5-2.

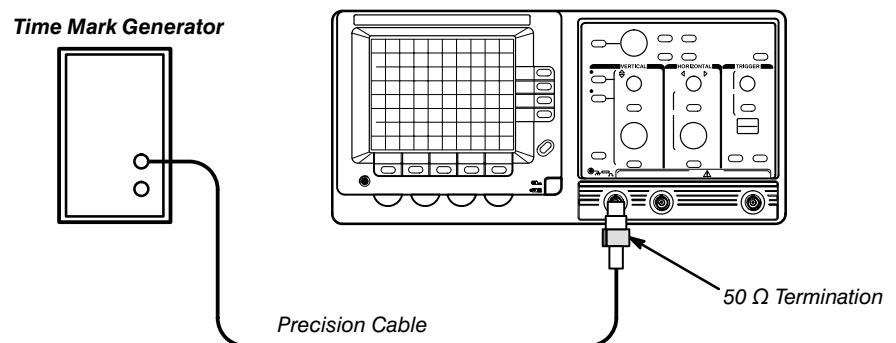


Figure 5-2: CRT Adjustments Calibration Setup

14. Set the time mark generator for 1 μ s markers.
15. Set the **INTENSITY** control to view the display.
16. Press the **VERTICAL MENU** button and set **CPLG** to **DC**
17. Press the **SET LEVEL TO 50%** button.
18. Adjust the **FOCUS** and R322 on the Display Driver board for the best focus of the time mark display and readout display.
19. Set the vertical **POSITION** control counterclockwise, moving the base-line of the time mark display down off the graticule area.
20. Set the **READOUT INTENSITY** control fully counterclockwise (off).
21. Adjust R323 on the Display Driver for the best geometry (minimum bowing) of the time mark display across the entire graticule area.
22. Set the **READOUT INTENSITY** control to view the readout.
23. Disconnect the calibration setup from the oscilloscope.

Low Frequency Output Compensation

Equipment Required: One pulse generator (item 10), one precision coaxial cable (item 5), one 50 Ω termination (item 3), and one dual-input coupler (item 7).

Adjustment Locations: This procedure requires adjustments to the Display Driver board. See Figure 5-14 on page 5-20 for the location of the adjustments.

1. Display channel 1, turning all others off.
2. Press the **AUTOSET** button.
3. Set the volts/div scale to 50 mV.
4. Set the sec/div scale to 1 ms.
5. Press the **ALT/CHOP, ADD** button and set **DISP** to **Alt**.
6. Press the **VERTICAL MENU** button and set **CPLG** to **AC**.
7. Connect the positive fast rise pulse output of the pulse generator to the **CH 1** and **CH 2** input connectors as shown in Figure 5-3.

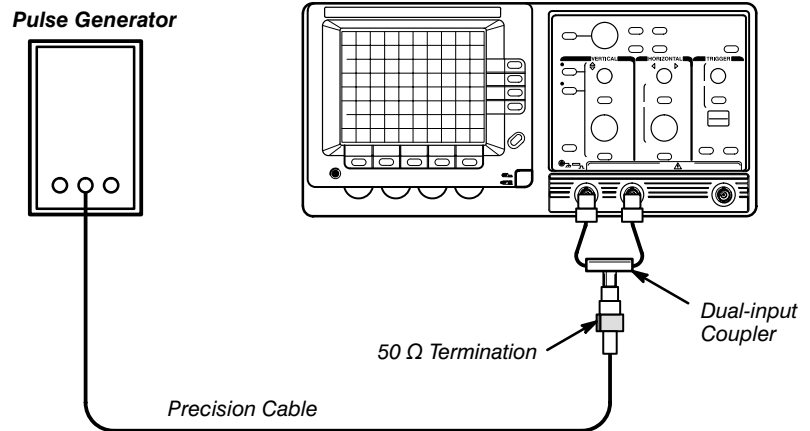


Figure 5-3: Low Frequency Output Compensation Calibration Setup

8. Set the pulse generator for fast rise period of 1 ms and a 4 division display.
9. Press the **SET LEVEL TO 50%** button.
10. Press the **CURSOR** button and set Δ VOLT to **On**.
11. Set the cursors 5 divisions apart using the General Purpose Knob and the **TOGGLE** button.
12. Set the volts/div scale to 20 mV.
13. Press the **CH 2** button.
14. Set the channel 2 volts/div scale to 20 mV.
15. Press the **VERTICAL MENU** button and make the following selections from the menu (channel 2):
 - Set **CPLG** to **GND**
 - Set **VAR** to **Off**
 - Set **INV** to **Off**
 - Set **BW** to **Full**
16. Position the channel 2 trace to the center vertical graticule line.
17. Set **CPLG** to **AC**.
18. Adjust R111 located on the Display Driver board for minimum vertical movement of the readout (over the entire graticule area).
19. Disconnect the test setup from the oscilloscope.

Factory Horizontal Cal

Equipment Required: One time mark generator (item 9), one precision coaxial cable (item 5), and one 50 Ω termination (item 3).

Prerequisites: CRT adjustment procedure.

NOTE

To enable factory calibration on oscilloscopes with firmware version 2.10 or above, remove jumper J205 (CAL–DIS) on the CPU board. (See Figure 5-17 on page 5-23 for the location of J205.) If you do not remove this jumper, the message “See manual to enable Factory Cal” appears when you select the factory calibration routine.

Firmware versions below 2.10 do not have the calibration lockout feature and the factory calibration routine can still execute with J205 installed.

1. Disconnect all signal inputs from the oscilloscope.
2. Press the **UTILITY** button to display the Utility menu.



To avoid replacing the calibration constants with erroneous values, be sure to complete all steps of this procedure after initiating the calibration routine.

3. Select **CAL** from the main menu.
4. Select **Factory Horizontal Cal**, initiating the calibration routine.

This routine takes about 20 seconds to complete its initial calibrations. Once complete, 2 dots are displayed and the message “**Toggle to set 8div about center**” appears. The displayed dots are used for the next horizontal calibration steps.

NOTE

*The following steps use both the General Purpose Knob and the **TOGGLE** button to make adjustments. The General Purpose Knob performs two functions: to adjust horizontal gain and centering. The **TOGGLE** button selects the function of the General Purpose Knob.*

5. Use a combination of the **TOGGLE** button and the General Purpose Knob to position the dots 8 divisions apart, centered horizontally (see Figure 5-4).
6. Select **Done** when you have the appropriate display.

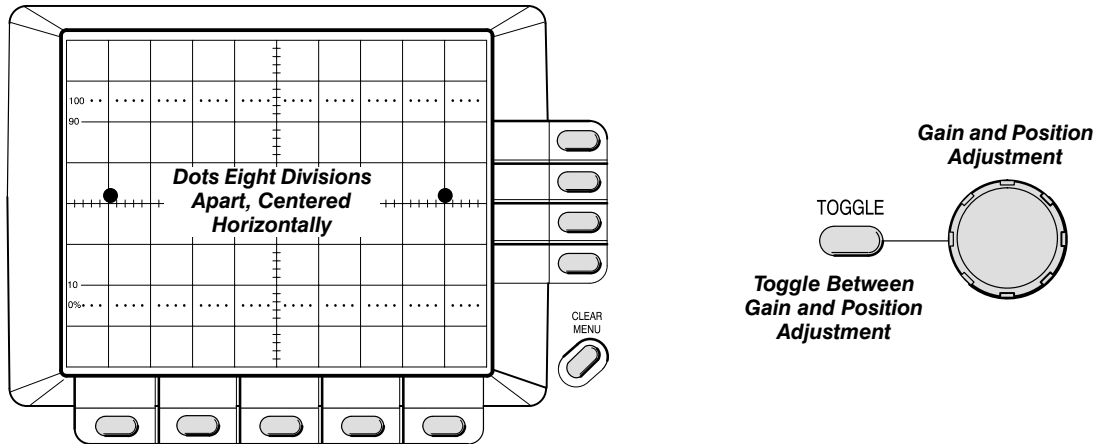


Figure 5-4: Horizontal Adjustments (One)

7. Again, use a combination of the **TOGGLE** button and the General Purpose Knob to position the dots 8 divisions apart, centered horizontally (see Figure 5-4).
8. Select **Done** when you have the appropriate display.
9. One dot is displayed.
10. Use a combination of the **TOGGLE** button and the General Purpose Knob to center the single dot at the center of the screen (see Figure 5-5).

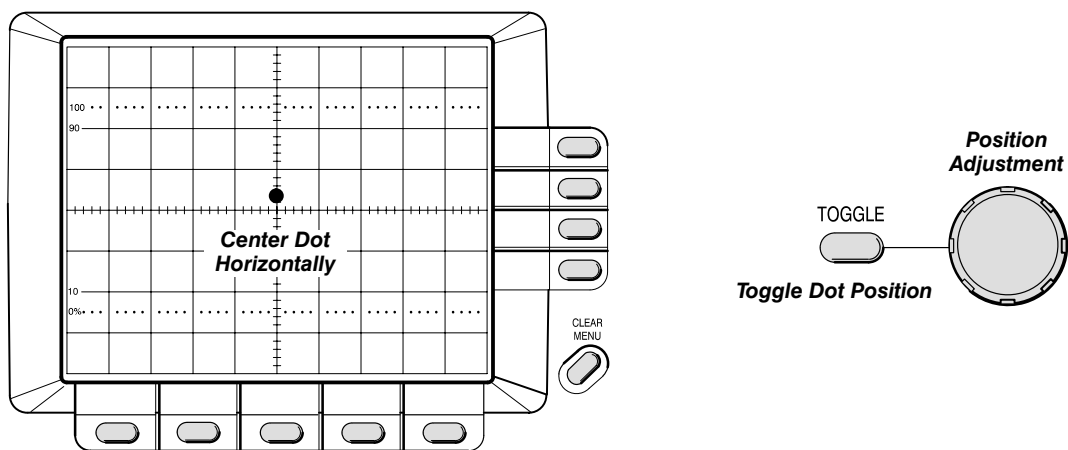


Figure 5-5: Horizontal Adjustments (Two)

11. Continue to press the **TOGGLE** button and adjusting the dot to center screen with the General Purpose Knob until the dot stays centered while pressing the **TOGGLE** button.
12. Select **Done** when you have the appropriate display.
13. Two vertical cursor lines are displayed.
14. Use a combination of the **TOGGLE** button and the General Purpose Knob to position the vertical lines 8 divisions apart, centered horizontally (see Figure 5-6).

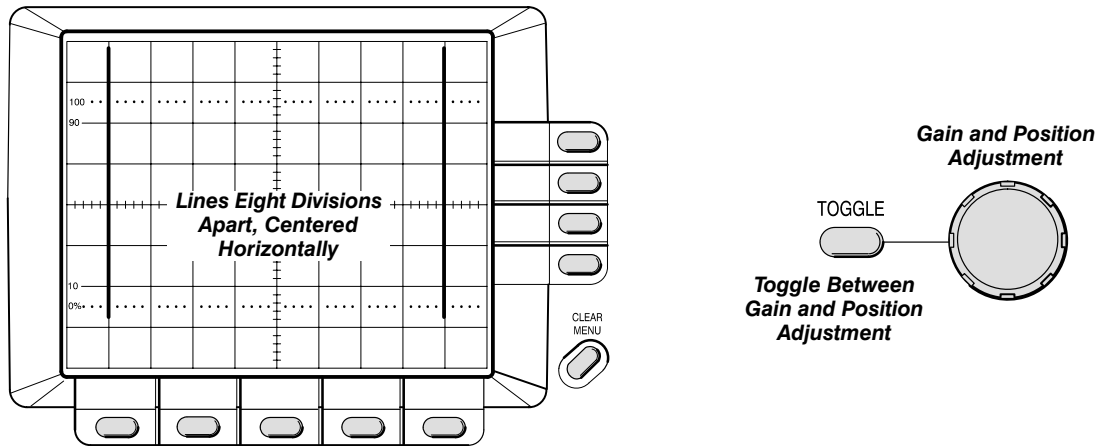


Figure 5-6: Horizontal Adjustments (Three)

15. Select **Done** with the menu button when you have the appropriate display.

NOTE

*At this time, the calibration routine can be terminated by selecting **Abort** instead of **Done**. The abort option appears through the remainder of this Factory Horizontal Cal routine.*

16. Select **Done** to continue or **Abort** to terminate the calibration routine.
17. Connect the output of the time mark generator to the **CH 1** input as shown in Figure 5-7.

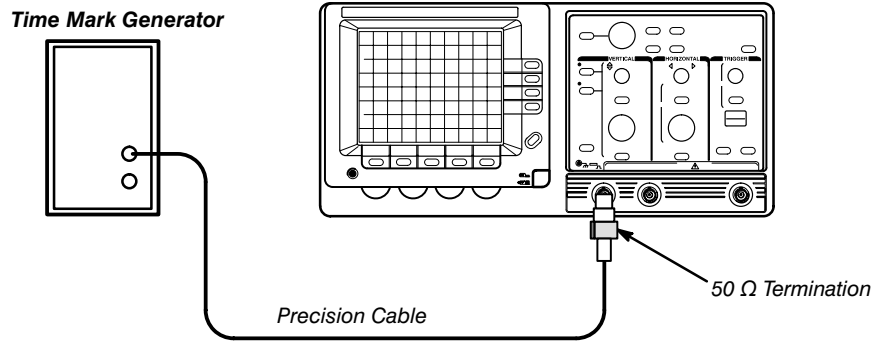


Figure 5-7: Horizontal Output Calibration Setup

18. Set the time mark generator for 5 ns markers.
19. Select **Done** when completed.
20. Adjust the 5 ns main sweep accuracy by performing these substeps.
 - a. Using the General Purpose Knob, adjust the display for 1 time marker per division over the center 8 divisions.
 - b. Select **Done** when adjusted.
21. Adjust the 5 ns delay sweep accuracy by performing these substeps.
 - a. Using the General Purpose Knob, adjust the display for 1 time marker per division over the center 8 divisions.
 - b. Select **Done** when adjusted.
22. Adjust the 2 ns main sweep accuracy by performing these substeps.
 - a. Using the General Purpose Knob, adjust the display for 2 time markers per 5 divisions over the center 8 divisions.
 - b. Select **Done** when adjusted.
23. Adjust the 2 ns delay sweep accuracy by performing these substeps.
 - a. Using the General Purpose Knob, adjust the display for 2 time markers per 5 divisions over the center 8 divisions.
 - b. Select **Done** when adjusted; a **Cal Passed** message appears.
24. Select **Done** to exit the routine.
25. Disconnect the test setup from the oscilloscope.
26. If you do not intend to proceed with Factory Vertical CAL, replace J205 (CAL-DIS) to lock out the calibration routine. (This jumper only works with firmware version **2.10** and above.)



To prevent accidental loss of calibration, be sure the calibration lockout jumper (J205) is in place. If J205 is not in place, erroneous calibration constants can result if the calibration routine is accidentally invoked and not properly completed.

Factory Vertical Cal

Equipment Required: One DC calibration generator (item 11), one precision coaxial cable (item 5), and one dual-input coupler (item 7).

Prerequisites: Low Frequency Output Compensation adjustment and Self Cal Horizontal adjustment procedures.

NOTE

To enable factory calibration on oscilloscopes with firmware version 2.10 or above, remove jumper J205 (CAL-DIS) on the CPU board. (See Figure 5-17 on page 5-23 for the location of J205.) If you do not remove this jumper, the message "See manual to enable Factory Cal" appears when you select the factory calibration routine.

Firmware versions below 2.10 do not have the calibration lockout feature and the factory calibration routine can still execute with J205 installed.

1. Press the **UTILITY** button.



To avoid replacing the calibration constants with erroneous values, be sure to complete all steps of this procedure after initiating the calibration routine.

2. Select **CAL** from the main menu.
3. Select **Factory Vertical Cal**, initiating the calibration routine.

The calibration routine displays user prompts on-screen throughout this procedure.

NOTE

At this time, the calibration routine can be terminated by selecting **Abort**. The abort option appears through the remainder of this Factory Vertical Cal routine.

- Set the DC calibration generator for 10 VDC output and connect to the **CH 1** and **CH 2** inputs as shown in Figure 5-8.

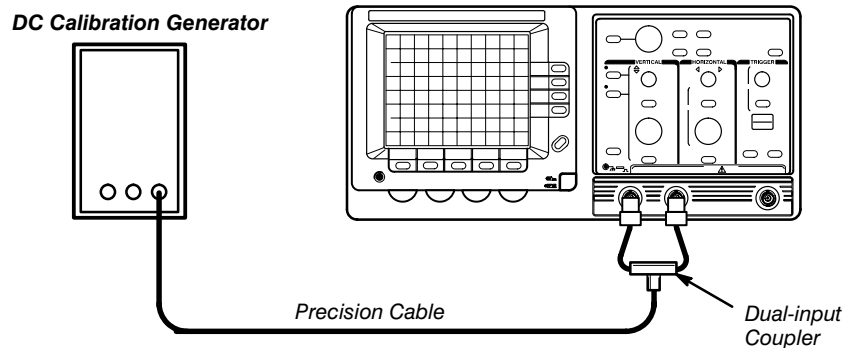


Figure 5-8: Factory Vertical Calibration Setup

- Select **Done** when completed.
- Set the DC calibration generator for 1 VDC output.
- Select **Done** when completed.
- Set the DC calibration generator for 100 mVDC output.
- Select **Done** when completed.
- Disconnect the test setup.
- Select **Done** when completed.

This portion of the routine takes about one minute to complete.

- Connect the DC calibration generator to the **EXT TRIG** input as shown in Figure 5-9.

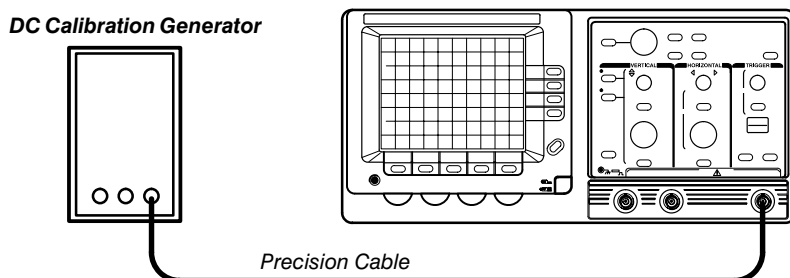


Figure 5-9: External Trigger Calibration Setup

13. Set the DC calibration generator for 500 mVDC output.
14. Select **Done** when completed.
15. Set the DC calibration generator for 5 VDC output.
16. Select **Done** when completed.

NOTE

*The following steps use both the General Purpose Knob and the **TOGGLE** button to make adjustments. The General Purpose Knob performs two functions: adjust horizontal gain and centering. The **TOGGLE** button selects the function of the General Purpose Knob.*

17. Use a combination of the **TOGGLE** button and the General Purpose Knob to position the dots 6 divisions apart, centered horizontally (see Figure 5-10).

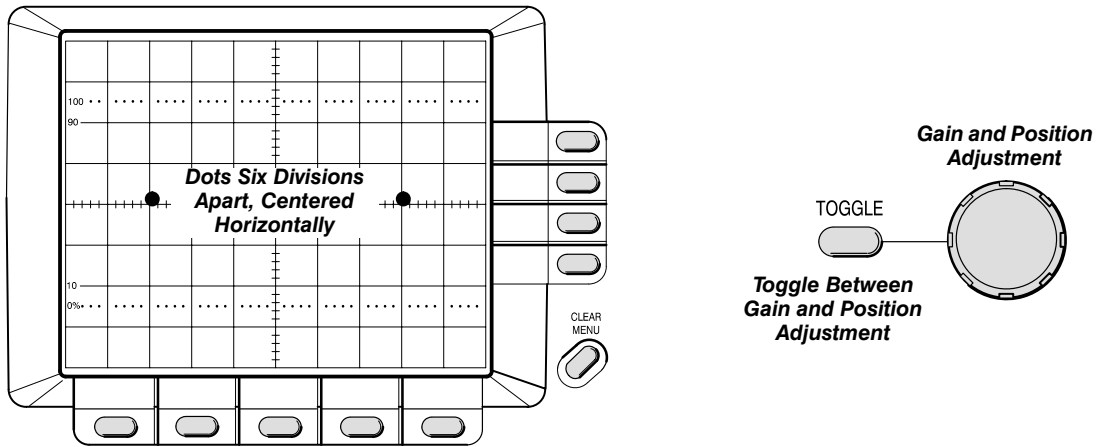


Figure 5-10: Vertical Adjustments

18. Select **Done** when you have the appropriate display.
19. Adjust R112 (vertical gain) and R154 (vertical centering) on the Display Driver board, setting the horizontal cursors 6 divisions apart, centered vertically (see Figure 5-11).

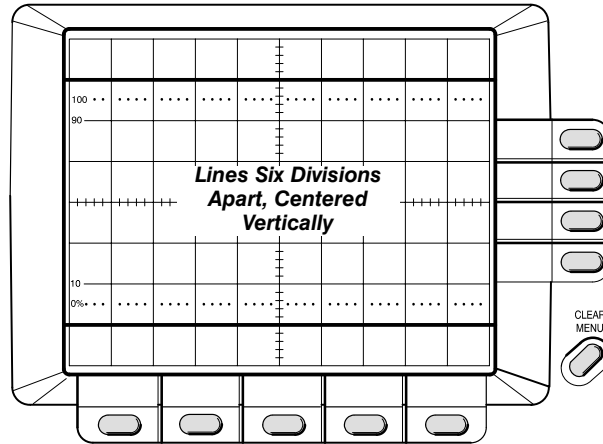


Figure 5-11: Adjusting Vertical Gain and Centering

20. Select **Done** when you have completed the adjustments.
21. Select **Done** again to exit the routine.
22. Replace J205 (CAL–DIS) to lock out the calibration routine. (This jumper only works with firmware version **2.10** and above.)



To prevent accidental loss of calibration, be sure the calibration lockout jumper (J205) is in place. If J205 is not in place, erroneous calibration constants can result if the calibration routine is accidentally invoked and not properly completed.

High Frequency Step Response

Equipment Required: One pulse generator (item 10), one precision coaxial cable (item 5), one 5X attenuator (item 1), and one 50 Ω termination (item 3).

Adjustment Locations: This procedure requires adjustments to the Display Driver board. See Figure 5-14 on page 5-20 for the location of the adjustments.

Prerequisites: Factory Vertical Cal adjustment procedure.

1. Display channel 1, turning all others off.
2. Connect the positive fast rise pulse output of the pulse generator to the **CH 1** input as shown in Figure 5-12.

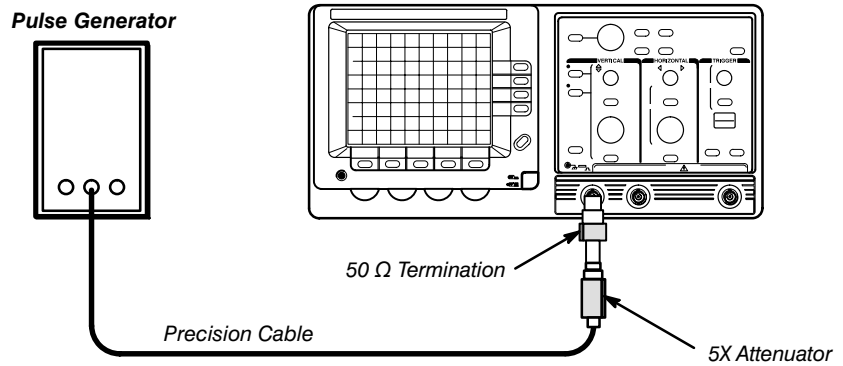


Figure 5-12: High Frequency Step Response Test Setup

3. Set the pulse generator fast rise period to 1 μ s and pulse amplitude to mid-range.
4. Press the **AUTOSET** button.
5. Set the volts/div scale to 10 mV.
6. Set the sec/div scale to 200 ns.
7. Press the **VERTICAL MENU** button and set **CPLG** to **DC**.
8. Adjust the vertical **POSITION** control and the generator pulse amplitude to obtain a 5 division, vertically centered, display.
9. **TAS 465 Only** — Adjust R141 and C122 on the Display Driver board for flattest long term response of the pulse front corner.
10. Set the sec/div scale to 20 ns.
11. Adjust R140 and C121 on the Display Driver board for minimum signal aberrations of the pulse front corner.

NOTE

Some interaction of the adjustments made in steps 9 and 11 may occur. For optimum oscilloscope performance, these steps should be rechecked after making adjustments.

12. Disconnect the calibration setup from the oscilloscope.

Attenuator Compensation

Equipment Required: One pulse generator (item 10), one precision coaxial cable (item 5), one 50 Ω termination (item 3), and one dual-input coupler (item 7).

Adjustment Locations: This procedure requires adjustments to the Analog board. See Figure 5-15 on page 5-21 for the location of the adjustments.

Prerequisites: Low Frequency Output Compensation adjustment procedure.

1. Display channel 1, turning all others off.
2. Connect the high amplitude output of the pulse generator to the **CH 1** and **CH 2** inputs as shown in Figure 5-13.

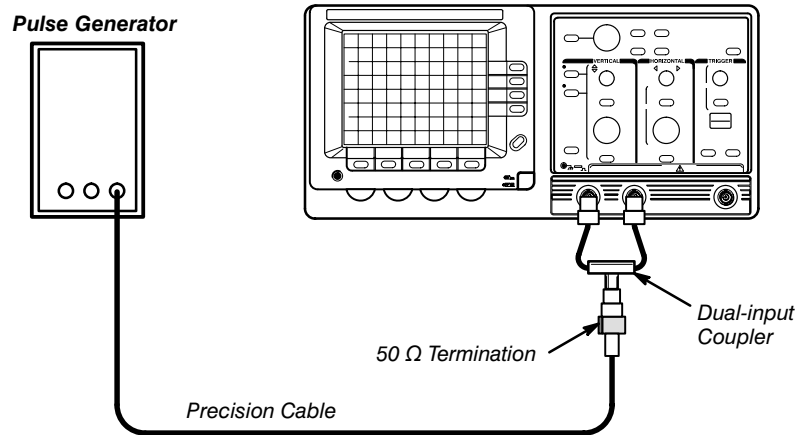


Figure 5-13: Attenuator Compensation Test Setup

3. Set the pulse generator high amplitude period to 1 ms.
4. Press the **AUTOSET** button.
5. Press the **VERTICAL MENU** button and set **CPLG** to **DC**.
6. Set the volts/div scale to 200 mV.
7. Set the sec/div scale to 200 μ s.
8. Using the vertical **POSITION** control and the generator pulse amplitude, obtain a 5 division, vertically centered display of channel 1.
9. Set the volts/div scale to 100 mV.
10. Press the **CH 2** button.
11. Press the **VERTICAL MENU** button and make the following selections from the menu:
 - Set **CPLG** to **DC**
 - Set **VAR** to **Off**
 - Set **INV** to **Off**
 - Set **BW** to **Full**
 - Set the volts/div scale to 100 mV
 - Position the channel 2 display approximately 0.5 divisions below the channel 1 display

12. Press the **CH 1** button.
13. Adjust Ch 1 10X on the Analog board for the flattest response of the most positive portion of the channel 1 waveform.
14. Set the channel 1 volts/div scale to 1 V.
15. Press the **CH 2** button.
16. Adjust Ch 2 10X adjustment on the Analog board for the flattest response of the most positive portion of the channel 2 waveform.
17. Set the channel 2 volts/div scale to 1 V.
18. Set the pulse generator amplitude to maximum.
19. Adjust Ch 2 100X on the Analog board for the flattest response of the channel 2 waveform.
20. Adjust Ch 1 100X on the Analog board for the flattest response of the channel 1 waveform.
21. Disconnect the test setup from the oscilloscope.

Vertical Gain Adjust (Cabinet On)

Equipment Required: None.

Adjustment Locations: This procedure requires adjustments to the Display Driver board. See Figure 5-14 on page 5-20 for the location of the adjustments.

Prerequisites: Low Frequency Output Compensation, Factory Vertical Cal, and Attenuator Compensation adjustment procedures.

1. Slide the cabinet on the instrument and allow a 20-minute warm up.
2. Press the **CURSOR** button and set Δ VOLT to **On**.
3. Set the volts/div scale to 1 V.
4. Position the cursors 6 divisions apart, centered vertically and check that the Δ Volts readout is between 5.96 V and 6.04 V.

NOTE

If the readout in step 4 is within the limits given, stop here. The calibration is complete.

If the readout is outside the limits, continue with this procedure.

5. Adjust the cursors until the Δ Volts readout is 6 V.
6. Note the cursor display error (are the cursors more or less than six divisions apart).

7. Slide the cabinet off the instrument and adjust R112 on the Display Driver board to compensate for the display error noted in step 6.

For example, if you noted in step 6 that with the Δ Volts readout at 6 V, the cursor display equaled 6.2 divisions. Compensate by adjusting the cursor display to 5.8 divisions with R112.

8. Slide the cabinet on the instrument and repeat this procedure until the cursor display matches the Δ Volts readout.

Adjustment Complete

The adjustment procedure is complete. Install the cabinet and rear cover.

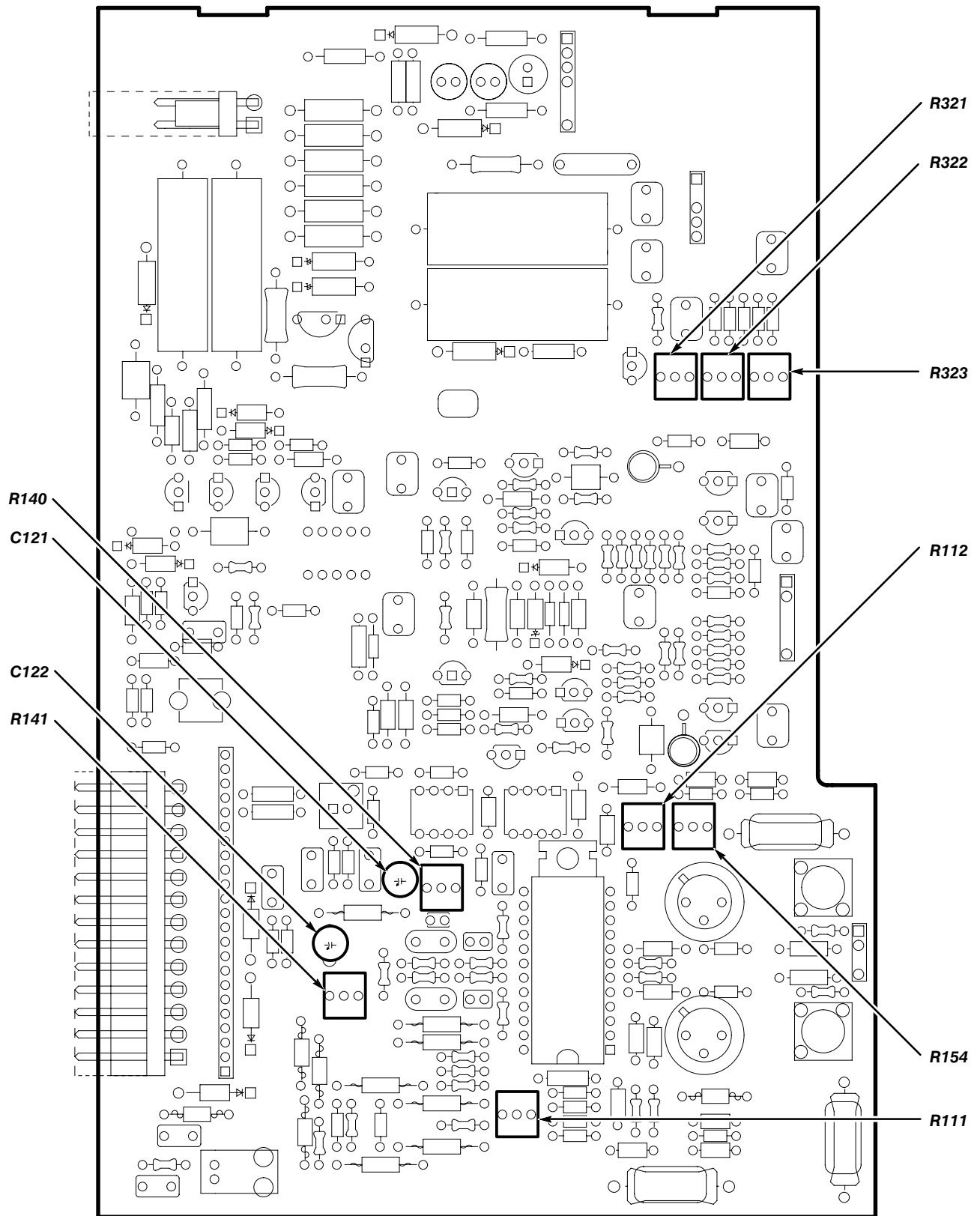


Figure 5-14: Display Driver Board Adjustment Locations

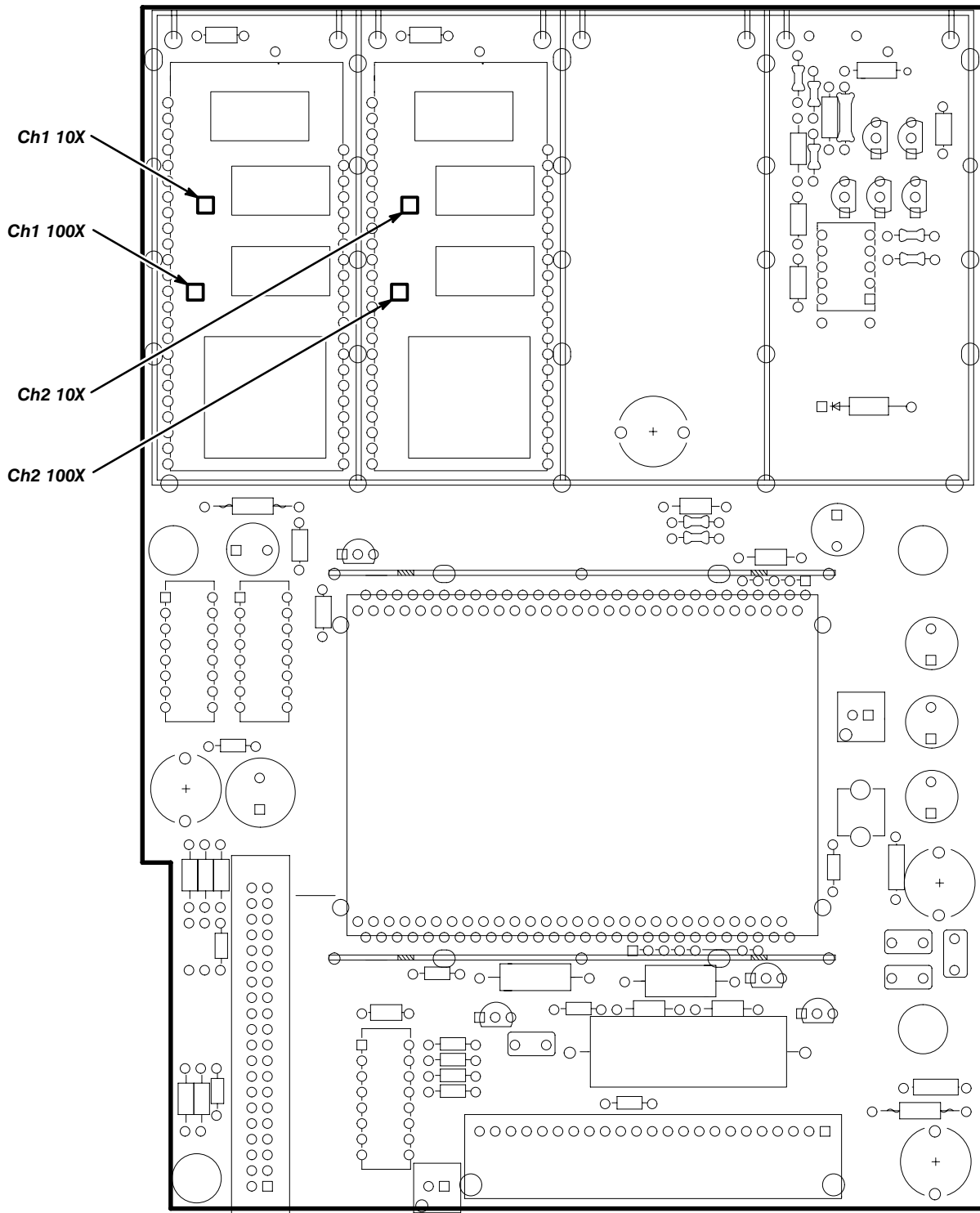


Figure 5-15: Analog Board Adjustment Locations

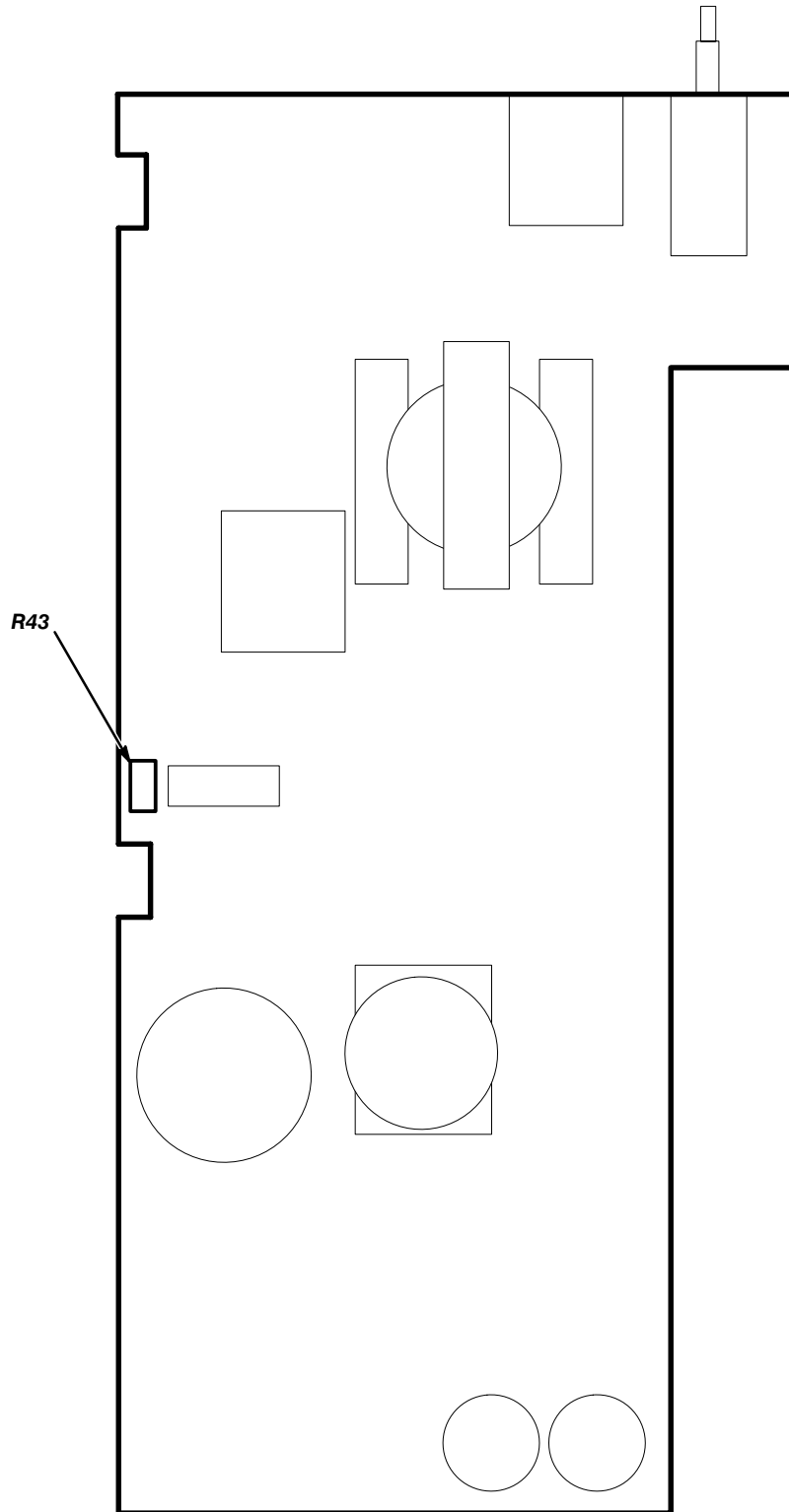


Figure 5-16: Power Supply Adjustment Location

J205 (CAL-DIS)

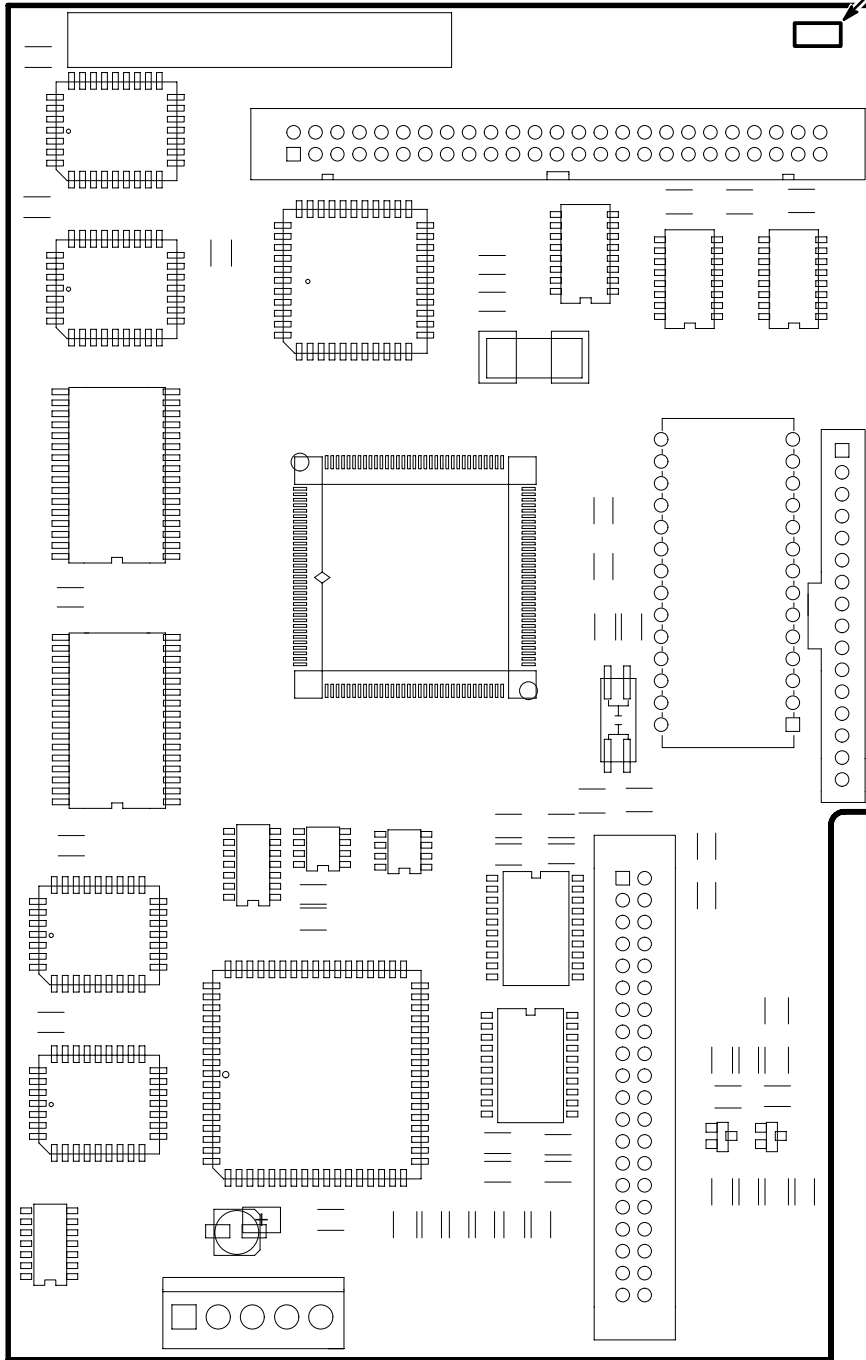


Figure 5-17: Location of J205 (CAL-DIS) on the CPU Board

Maintenance Information

This section contains the information needed to do periodic maintenance on the TAS 465 Analog Oscilloscope:

- **Maintenance Information** — This subsection. It includes this introduction, servicing information, plus general information on preventing damage to internal modules when doing maintenance.
- **Inspection and Cleaning** — Information and procedures for inspecting the oscilloscope and cleaning its external and internal modules.
- **Removal and Installation Procedures** — Procedures for removing and installing the modules, circuit boards, and mechanical parts.
- **Troubleshooting Aids** — Procedures that help isolate problems to a module.

Before Servicing

This manual is for servicing of the TAS 465 Analog Oscilloscope. To prevent injury to yourself or damage to the oscilloscope, do the following before you attempt service.

- Be sure you are a qualified service person.
- Read the *Safety Summary* found at the beginning of this manual.

When using this manual for servicing, be sure to heed all warnings, cautions, and notes.

Tektronix Service

Tektronix provides service to cover repair under warranty as well as other services 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 TAS 465 Analog Oscilloscope. Tektronix technicians are apprised of the latest information on improvements to the product as well as the latest new options.

Warranty Service

Tektronix warrants this product for three years from date of purchase, excluding probes for which the warranty is one year. Tektronix technicians provide warranty service at most Tektronix service locations worldwide. Your Tektronix product catalog lists all service locations worldwide.

Repair or Calibration Service

Tektronix offers several types of service contracts that you may purchase to tailor repair and/or calibration of your TAS 465 Analog Oscilloscope to fit your requirements.

Refer to the *Warranty-Plus Service Options*, page 7-1, for a list of the available service contracts for the TAS 465 Analog Oscilloscope.

Self Service

This manual contains all the information needed for periodic maintenance and repair of the TAS 465 Analog Oscilloscope.

For periodic maintenance, use these sections:

- Performance verification procedures
- Adjustment procedures

For instrument repair, use these sections:

- Troubleshooting aids to help isolate problems to a module
- Disassembly procedures
- Electrical schematics
- Parts lists

Replace failed modules with fully tested modules obtained from the factory. Schematics of each module are provided for repair to the component level of the circuit boards where feasible.

For information, contact your local Tektronix service center or sales engineer on any repair services.

Preventing ESD

When performing any service which requires internal access to the oscilloscope, adhere to the following precautions to avoid damaging internal modules and their components due to electrostatic discharge (ESD).



Static discharge can damage any semiconductor component in this oscilloscope.

1. Minimize handling of static-sensitive modules.
2. Discharge the static voltage from your body by wearing a grounded antistatic wrist strap while handling these modules. All service must be done at a static-free work station.

3. Do not remove the oscilloscope cabinet unless you have met precaution number 2, above. Consider all internal modules static sensitive.
4. Remove anything capable of generating or holding a static charge from the work station surface.
5. Do not slide the modules over any surface.
6. Do not use high-velocity compressed air when cleaning dust from modules.

Table 6-1 lists the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Table 6-1: Relative Susceptibility to Static-Discharge Damage

Semiconductor Classes	Relative Susceptibility Levels ¹
MOS or CMOS microcircuits or discrete circuits, or linear microcircuits with MOS inputs (most sensitive)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFET	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (least sensitive)	9

¹Voltage equivalent for levels (voltage discharged from a 100 pF capacitor through resistance of 100 ohms):

- | | |
|------------------|--------------------------|
| 1 = 100 to 500 V | 6 = 600 to 800 V |
| 2 = 200 to 500 V | 7 = 400 to 1000 V (est.) |
| 3 = 250 V | 8 = 900 V |
| 4 = 500 V | 9 = 1200 V |
| 5 = 400 to 600 V | |

Inspection and Cleaning

Inspection and Cleaning describes how to inspect and clean the TAS 465 Analog Oscilloscope. Inspection and cleaning are preventive maintenance. Preventive maintenance, when done regularly, may prevent oscilloscope malfunction and enhance its reliability.

Preventive maintenance consists of visually inspecting and cleaning the oscilloscope and using general care when operating it.

How often to do maintenance depends on the severity of the environment in which you use the oscilloscope. A proper time to perform preventive maintenance is just before oscilloscope adjustment.

General Care

The cabinet helps keep dust out of the oscilloscope and it is a major component of its cooling system. It should normally be in place when operating the oscilloscope. The oscilloscope front cover protects the front panel and display from dust and damage. Install it when storing or transporting the oscilloscope.

Inspection and Cleaning Procedures

Inspect and clean the oscilloscope as often as operating conditions require. The collection of dirt on components inside can cause them to overheat and breakdown. (Dirt acts as an insulating blanket, preventing efficient heat dissipation.) Dirt also provides an electrical conduction path that could cause an oscilloscope failure, especially under high-humidity conditions.



Avoid the use of chemical cleaning agents that might damage the plastics used in this oscilloscope. Use a 75% isopropyl alcohol solution as a cleaner and rinse with deionized water. Use only deionized water when cleaning the menu buttons or front-panel buttons. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Avoid the use of high pressure compressed air when cleaning dust from the interior of this instrument. (High pressure air can cause ESD.) Instead, use low pressure compressed air (about 9 psi).

Inspection — Exterior

Inspect the outside of the oscilloscope for damage, wear, and missing parts. Use Table 6-2 as a guide. Oscilloscopes that appear to have been dropped or otherwise abused should be checked thoroughly to verify correct operation and performance. Repair defects that could cause personal injury or lead to further damage to the oscilloscope immediately.

Table 6-2: External Inspection Check List

Item	Inspect For	Repair Action
Cabinet, front panel, and cover	Cracks, scratches, deformations, damaged hardware or gaskets.	Replace defective module.
Front-panel knobs	Missing, damaged, or loose knobs.	Repair or replace missing or defective knobs.
Connectors	Broken shells, cracked insulation, and deformed contacts. Dirt in connectors.	Replace defective modules. Clear or wash out dirt.
Carrying handle and cabinet feet	Correct operation.	Repair or replace defective module.
Accessories	Missing items or parts of items, bent pins, broken or frayed cables, and damaged connectors.	Replace damaged or missing items.

Cleaning Procedure — Exterior

1. Remove loose dust on the outside of the oscilloscope with a lint free cloth.
2. Remove remaining dirt with a lint free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.



To prevent getting moisture inside the oscilloscope during external cleaning, use only enough liquid to dampen the cloth or applicator.

3. Clean the CRT screen with a lint-free cloth dampened with either a 75% isopropyl alcohol solution or, preferably, a gentle, general purpose detergent-and-water solution.

NOTE

If the CRT Implosion Shield needs further cleansing, refer to the procedure on page 6-7.

Cleaning Procedure — Interior



If, after doing steps 1 and 2, a module is clean upon inspection, skip the remaining steps.

1. Blow off dust with dry, low-pressure, deionized air (approximately 9 psi).
2. Remove any remaining dust with a lint free cloth dampened in isopropyl alcohol (75% solution) and rinse with a warm deionized water. (A cotton-tipped applicator is useful for cleaning in narrow spaces and on circuit boards.)
3. If steps 1 and 2 do not remove all the dust or dirt, the oscilloscope may be spray washed using a solution of 75% isopropyl alcohol by doing steps 4 through 8.
4. Gain access to the parts to be cleaned by removing easily accessible shields and panels (see *Removal and Installation Procedures*).
5. Spray wash dirty parts with the isopropyl alcohol solution and wait 60 seconds for the majority of the alcohol to evaporate.
6. Use hot (+50° C to +60° C) deionized water to thoroughly rinse them.
7. Dry all parts with low-pressure, deionized air.
8. Dry all components and assemblies in an oven or drying compartment using low-temperature (+50° C to +60° C) circulating air.

Cleaning the CRT Implosion Shield



This procedure describes how to clean both sides of the CRT Implosion Shield, thus requiring its removal. Perform this procedure only if cleaning the backside of the Implosion Shield is necessary.

1. Remove the Implosion Shield as described in the removal and replacement procedures beginning on page 6-28.
2. Clean the shield with a lint free cloth dampened in a general purpose detergent-and-water solution. Do not use abrasive cleaners.
3. Remove any static charge that may have accumulated by holding the shield in a deionized air flow.
4. Install the shield as described in the removal and replacement procedures beginning on page 6-28.

Removal and Installation Procedures

This subsection contains procedures for removal and installation of all replaceable mechanical and electrical modules. Replaceable mechanical and electrical modules are listed in Sections 8 and 10 of this manual.

Preparation — Please Read

WARNING

Before doing this or any other procedure in this manual, read the Safety Summary found at the beginning of this manual. Also, to prevent possible injury to service personnel or damage to oscilloscope components, read Installation and Power On in Section 2, and Preventing ESD in this section.

This subsection contains the following items:

- This preparatory information that you need to properly do the procedures that follow.
- A list of equipment required to remove and disassemble all modules.
- Procedures for removal and reinstallation of the electrical and mechanical modules.
- Three module locator diagrams for finding all the modules in this oscilloscope. (See Figures 6-2, 6-3, and 6-4.)

WARNING

Before doing any procedure in this subsection, disconnect the power cord from the line voltage source. Failure to do so could cause serious injury or death.

Cable Removal

Cables are partially or completely removed in the course of removing a board or module they plug into.

General Instructions



READ THESE GENERAL INSTRUCTIONS BEFORE REMOVING A MODULE.

First read over the *Summary of Procedures* that follows to understand how the procedures are grouped. Then read *Equipment Required* for a list of the tools needed to remove and install modules in this oscilloscope.

Procedures refer to the “front,” “rear,” “top,” and other portions of the oscilloscope. Figure 6-1 illustrates these references.

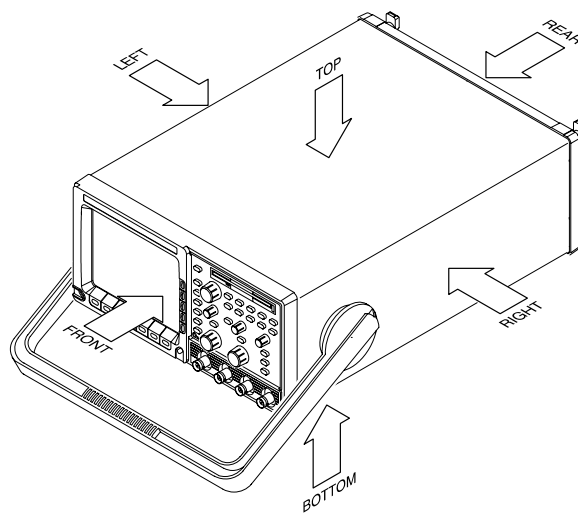


Figure 6-1: Oscilloscope Orientation

Summary of Procedures

The procedures are described in the order in which they appear in this section. In addition, you can look up any procedure for removal and reinstallation of any module in the *Table of Contents* of this manual.

Equipment Required — Table 6-3 lists the tools required to completely disassemble the oscilloscope into its modules.

All the tools are standard tools readily available from tool suppliers.

Table 6-3: Tools Required for Module Removal

Item No.	Name	Description
1	Screwdriver handle	Accepts Torx®-driver bits.
2	T-15 Torx tip	Torx®-driver bit for T-15 size screw heads.
3	T-20 Torx tip	Torx®-driver bit for T-20 size screw heads. Used only for removal of the cabinet handle.
4	Nut driver, 5/16 inch	Used for removing the CRT earth ground cable.
5	Angle-tip tweezers	Used for knob and shaft removal.
6	Flat-bladed spudger	A non-metallic probe-like tool with a flat bladed tip. Used to remove the front-panel trim and front module.
7	Slip-jaw pliers	Used for removing the front feet from the cabinet.

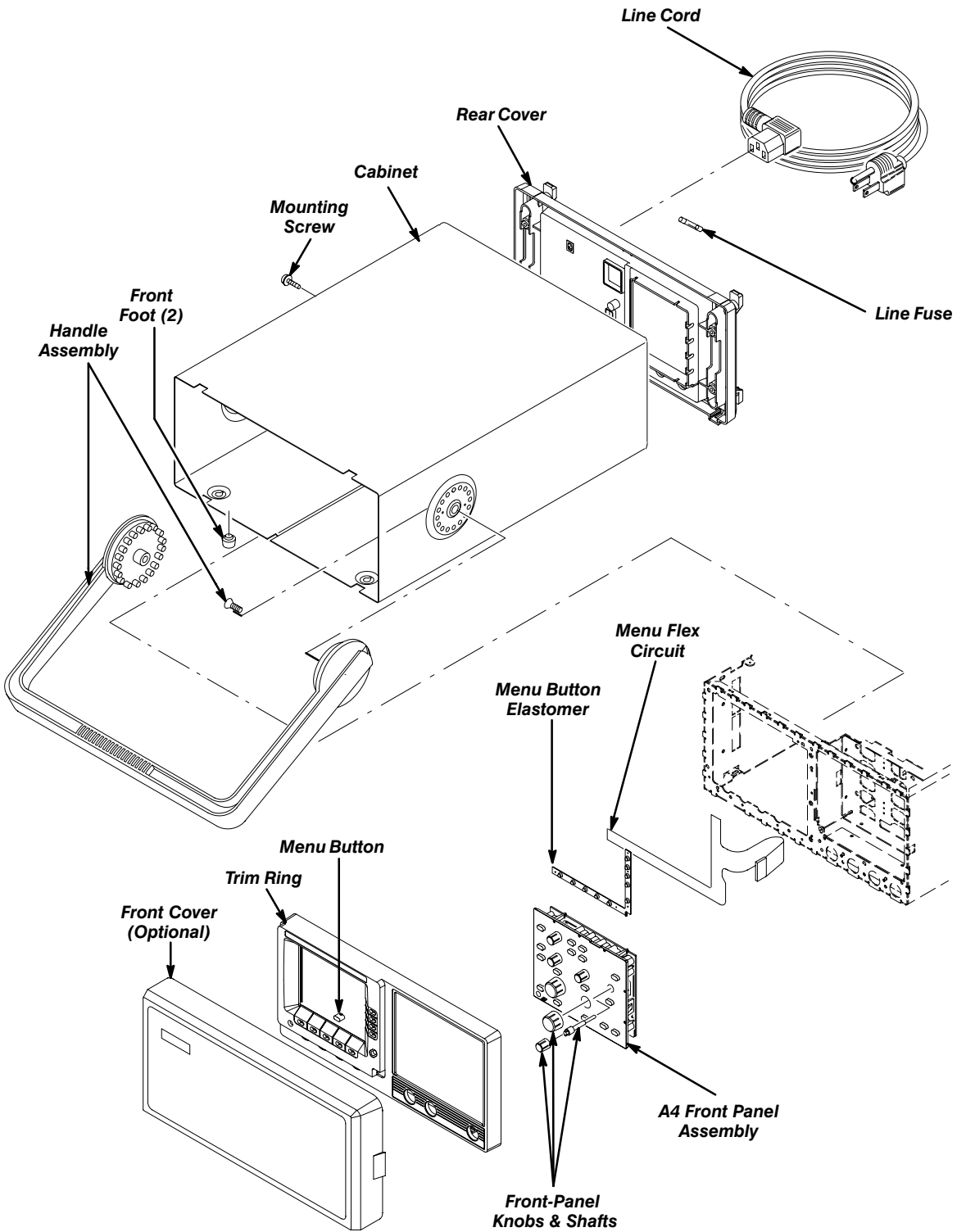


Figure 6-2: Cabinet and Front-Panel Mounted Modules

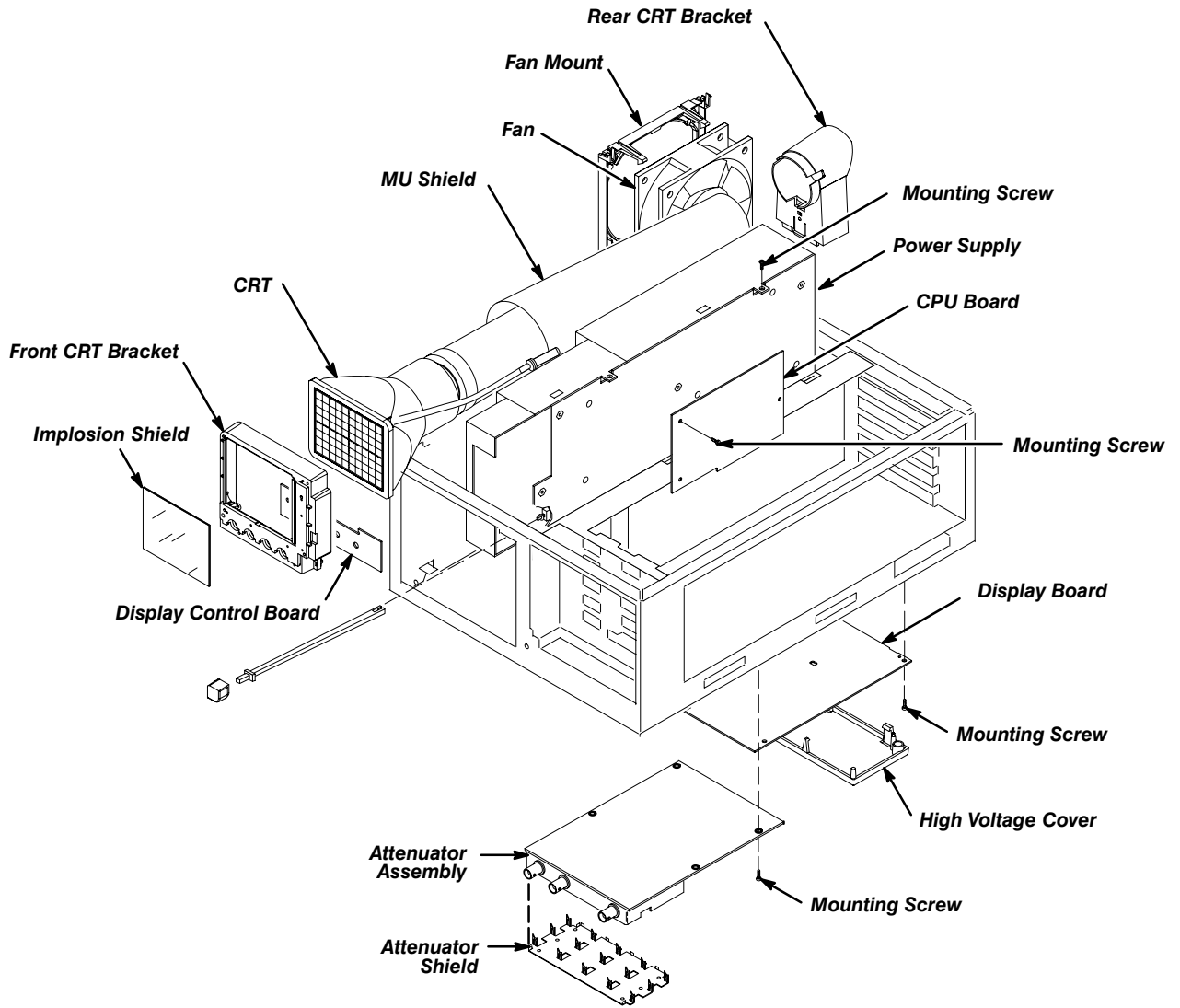


Figure 6-3: Internal Modules

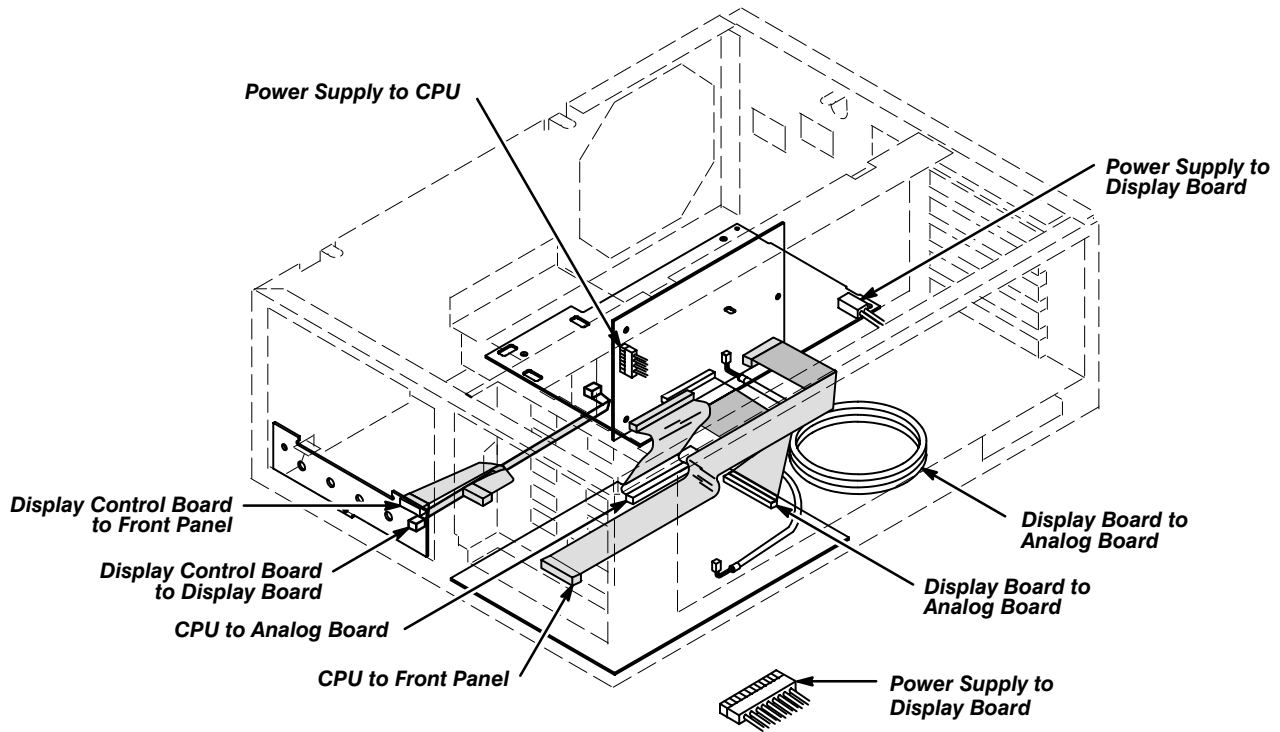


Figure 6-4: Cables and Cable Routing

Line Cord and Line Fuse

The following procedures describe how to remove and install the line cord and line fuse located on the back side of the oscilloscope.

WARNING

Unplug the line cord from the line voltage power source before continuing. Failure to do so can cause injury or death.

Prepare the oscilloscope by positioning the bottom side down on the work surface and facing the back side toward you. Refer to Figure 6-5.

Line Cord

1. Unplug the line cord from the power source.
2. Unplug the other end of the line cord from the back of the oscilloscope.
3. Grasp the end of the line cord and retaining clamp and rotate them 90 degrees counterclockwise (Figure 6-5).
4. Pull the line cord and clamp away from the back of the oscilloscope.

5. Perform this procedure in reverse order to install the power cord on the oscilloscope.

Line Fuse

1. Unplug the line cord from the power source.
2. Pull out the fuse holder drawer and remove the fuse (Figure 6-5).
3. Perform this procedure in reverse order to install the fuse.

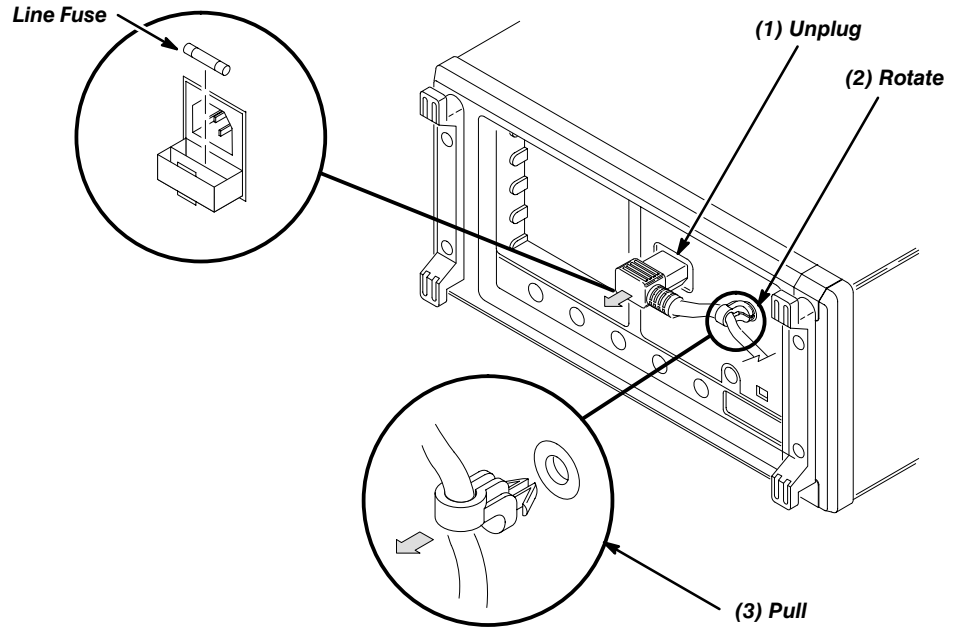


Figure 6-5: Line Fuse and Line Cord Removal

Front-Panel Knobs and Shafts

Use the following procedures to remove and install front-panel knobs and shafts.

Prepare the oscilloscope by setting it bottom side down on the work surface and facing the front side toward you.

Removing Front-Panel Knobs and Shafts

1. Remove any knob by pulling it straight out from the front panel slightly. This will create some clearance between the base of the knob and the front panel to create some clearance between the base of the knob and the front panel.
2. Insert the tweezers between the knob and front panel and use them to remove the knob and attaching shaft (see Figure 6-6).
3. Pull the shaft out of the knob to separate the two pieces.

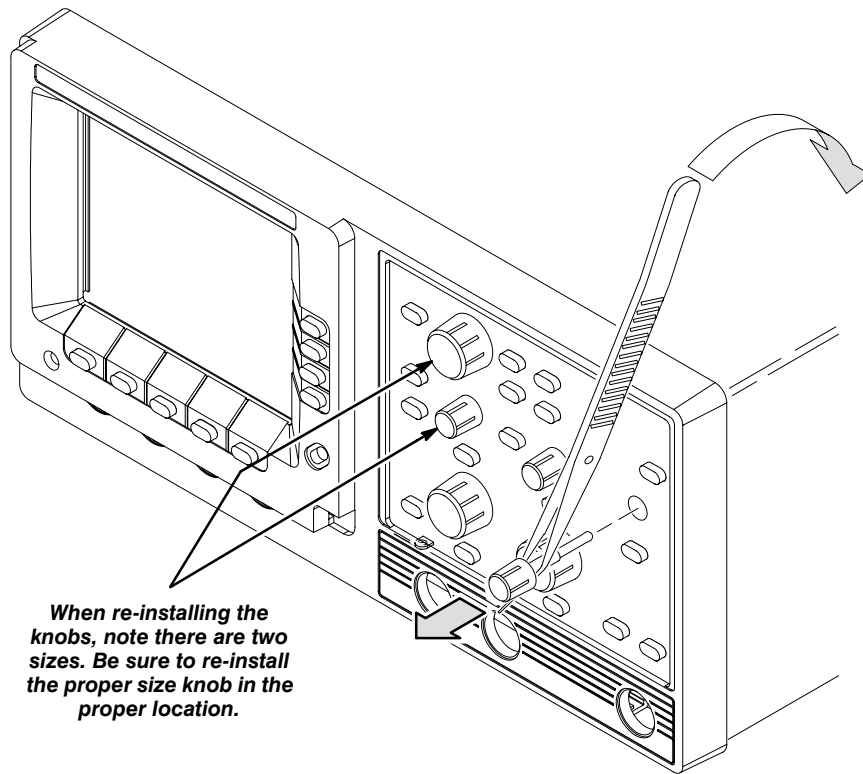


Figure 6-6: Knob and Shaft Removal

Installing Front-Panel Knobs and Shafts

1. Align the inside of the knob to the end of the shaft and push it in until it snaps.
2. Insert the shaft of the assembly into the proper hole on the front panel and push it in until it stops.
3. Lightly push in the knob and rotate it until the shaft slips into place.
4. Push the knob all the way in to seat the assembly.

Feet, Rear Cover, and Cabinet

Before removing the rear cover or cabinet, install the optional front cover on the front panel of the oscilloscope (if available) and then position the oscilloscope as indicated in Figure 6-7.

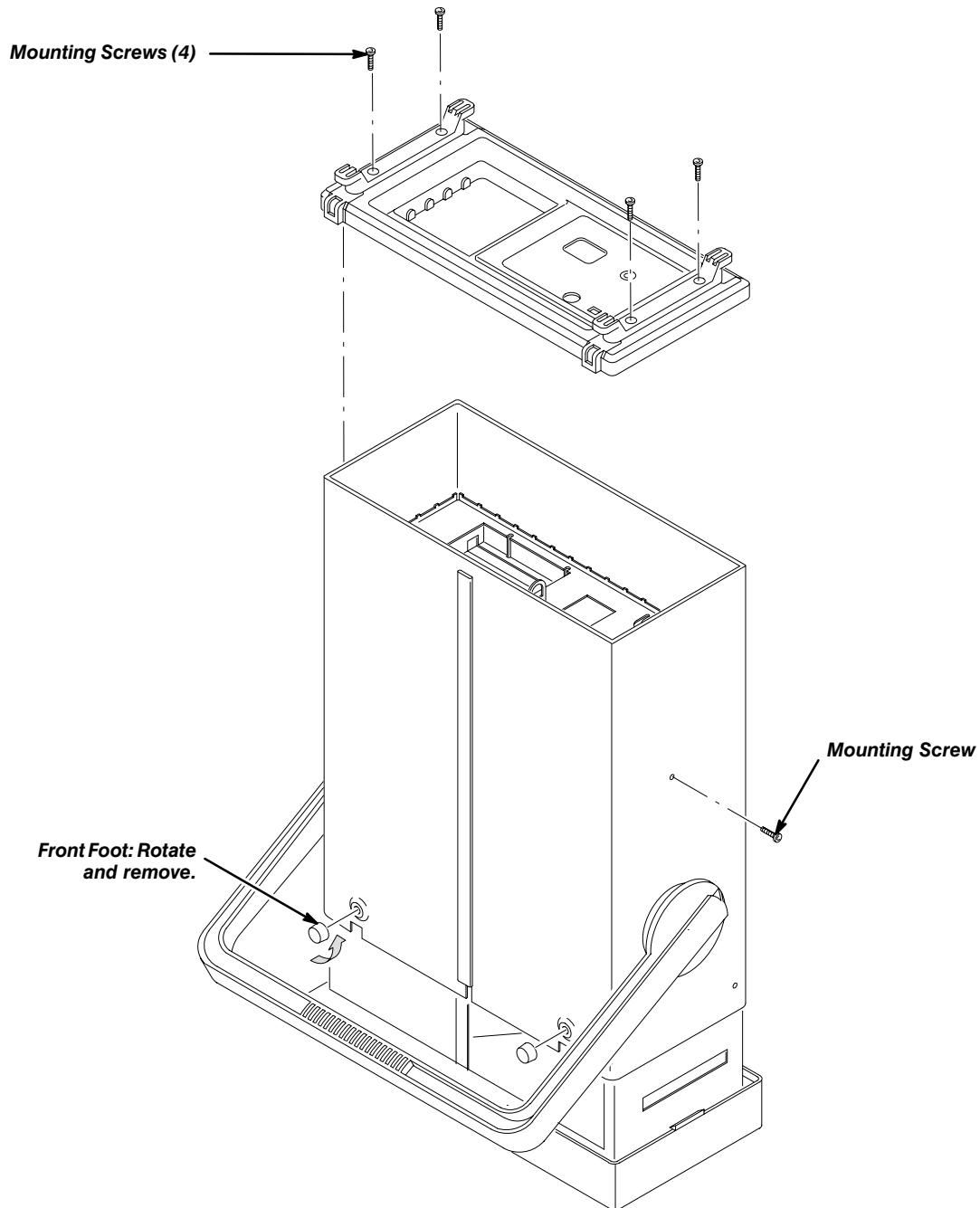


Figure 6-7: Rear Cover, Cabinet, and Feet Removal

Rear Cover

1. Position the oscilloscope as indicated in Figure 6-7.
2. Use the screwdriver to remove the four T-15 Torx screws that secure the rear cover to the oscilloscope.
3. Lift off the rear cover. Do these steps in reverse order to install the rear cover.

Cabinet

1. Remove the rear cover.
2. Remove the single T-15 Torx screw on the left side of the oscilloscope.
3. Grasp the two handle hubs and pull them outward as if to rotate the handle.
4. While holding the handle hubs out, lift the cabinet up and slide it off the oscilloscope. Take care not to bind or snag the cabinet on the internal cabling as you remove it.

Replacing the Front Feet

If you are replacing a front foot, use a pair of slip-jaw pliers to firmly grip the foot, then pull with a turning motion to remove. Do this step in reverse order to replace the foot.

Front-Panel Trim, Menu and Power Buttons, EMI Gasket

Use the following procedures to remove and install front-panel trim, buttons, and EMI gaskets.

Additional procedures required — These procedures require that the following procedures be performed first:

- Rear Cover Removal
- Cabinet Removal

Removing the Front Trim

1. Slide a flat-bladed spudger between the chassis and the plastic front trim, near one of the four flex locks. See Figure 6-8.
2. Gently pry the front trim up and slightly forward to disengage the flex lock. Do this until all four flex locks are disengaged.
3. Pull the front trim forward and off the instrument.

Menu Buttons and Elastomer

1. Lay the front trim on a flat surface.
2. Gently remove the menu button elastomer. Avoid touching the electrical contacts.
3. Remove the menu button(s).
4. Install menu buttons by placing a menu button in each menu button location.
5. Place the menu button elastomer over the menu buttons, ensuring that all standoffs protrude through the elastomer. Avoid touching the electrical contacts.

Power Button Replacement

1. With the front trim removed, grasp the power button and pull straight out from the chassis.
2. Install the power button by pushing the button onto the power button shaft until it locks into place.

Installing the Front Trim

1. If the menu buttons were removed, insert each button to its hole in the trim ring and install the menu button elastomer.
2. Align the front trim to the front of the instrument, without engaging any of the four flex locks.
3. Position the power button in line with the front-panel power button opening.
4. Slide the front trim onto the instrument, ensuring that all four flex locks engage.
5. If installing a new front trim, apply the appropriate front trim label.

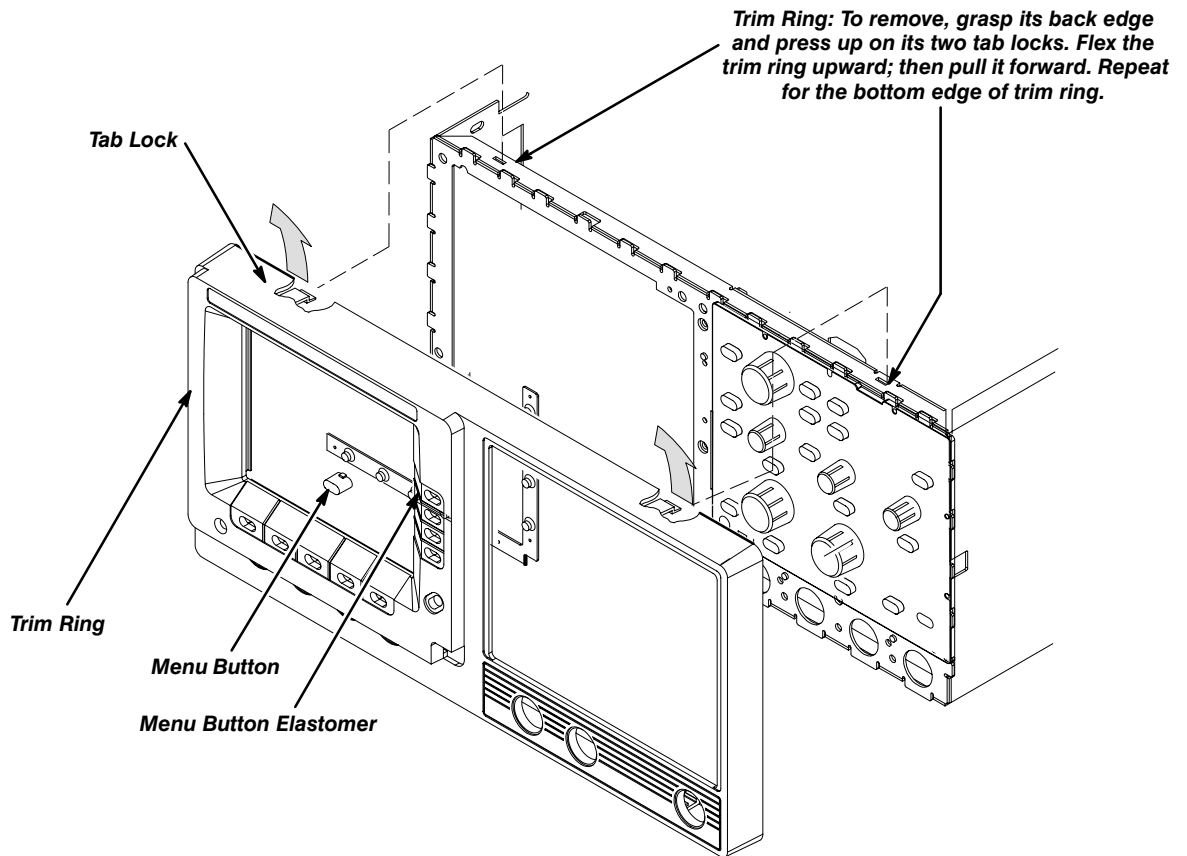


Figure 6-8: Trim Ring and Menu Buttons Removal

Installing the EMI Gaskets

The EMI gaskets were added to the oscilloscopes in order to improve performance. If your instrument does not have EMI gaskets, you can install them yourself.

1. If you are servicing the front EMI gaskets, discard the old ones.
2. Without installing the EMI gaskets, align the trim ring to the front of the chassis and push it on to seat. Be sure that both pairs of flex locks, one pair each at the inside top and bottom of the trim ring, snap over the edge of the chassis.
3. Lay the oscilloscope so its front cover is on the work surface.
4. Align an EMI gasket so it lies between any pair of adjacent flex locks along the groove between the cabinet and the trim ring.
5. Using a flat-bladed spudger, push the EMI gasket until it is firmly seated at the bottom of the groove (see Figure 6-9). It should not overlap either flex lock.
6. Repeat the process just described to install the remaining three gaskets.

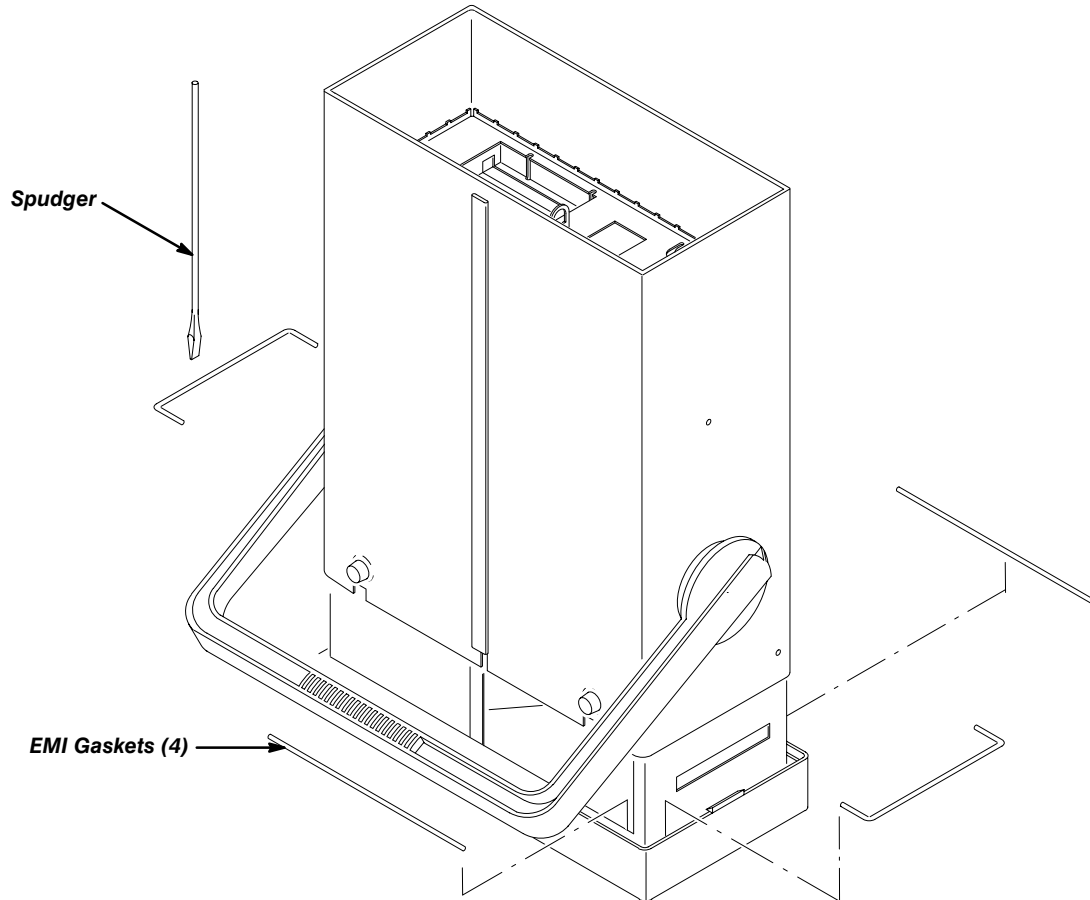


Figure 6-9: EMI Gasket Installation

A62 Front Panel Module Removal

The following procedure describes how to remove the A62 Front Panel module.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
 - Cabinet Removal
 - Front-Panel Trim Ring
1. Set the oscilloscope so its bottom is down on the work surface and its front is facing you.
 2. Insert the spudger into the slot at the front-right of the chassis. Push inwards to release the snap lock at the right side. (See Figure 6-10.)

Removal and Installation Procedures

3. Pull the Front Panel module slightly away from the front of the chassis until you can reach the interconnect cables at the rear of the module.
4. Unplug the following cables from their jacks on the Front Panel module:
 - The Display Control-to-front-panel cable at J84
 - The menu flex circuit-to-front panel at J40
 - The CPU-to-front-panel cable at J30
5. Lift the Front Panel module out from the chassis.

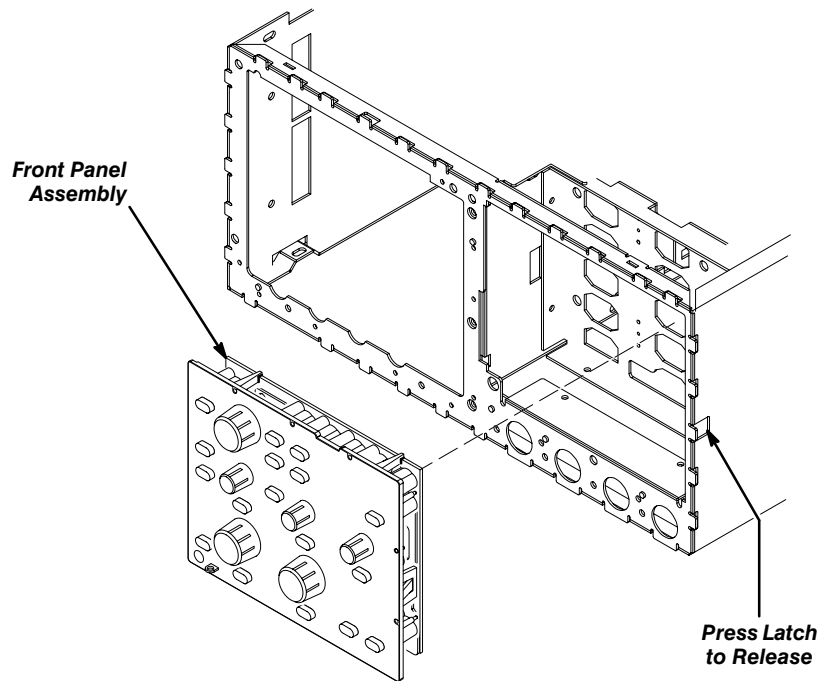


Figure 6-10: A62 Front Panel Module Removal

Front-Panel Module Disassembly/Assembly

The following procedures describe the disassembly of the Front Panel module into its subparts once it is removed from the instrument.

Additional procedures required — This procedure requires that the procedure *Front-Panel Knobs and Shafts Removal* be performed first.

A4 Front Panel board Removal — Perform the following steps to remove the Front Panel board.

1. Remove the front-panel knobs and shafts from the module.
2. Holding the Front Panel module, release the three snap locks at the edge of the circuit board, then tilt the board away from the assembly until it unplugs from J35. See Figure 6-11.
3. Slide the circuit board out from the retainers found at the edge opposite the snap locks and lift it away from the rest of the assembly.
4. At this point, the control potentiometers may be lifted out for cleaning (they are not field replaceable). Lift the two potentiometers out from the back of the front-panel assembly.

Front-Panel Buttons and Elastomer Removal — Perform the following steps only if replacing a damaged button or the front-panel button elastomer.

5. Remove the front-panel button elastomer from the back of the front-panel assembly. Do not touch the contacts with your fingers. See Figure 6-11.
6. Replace damaged buttons or elastomer.

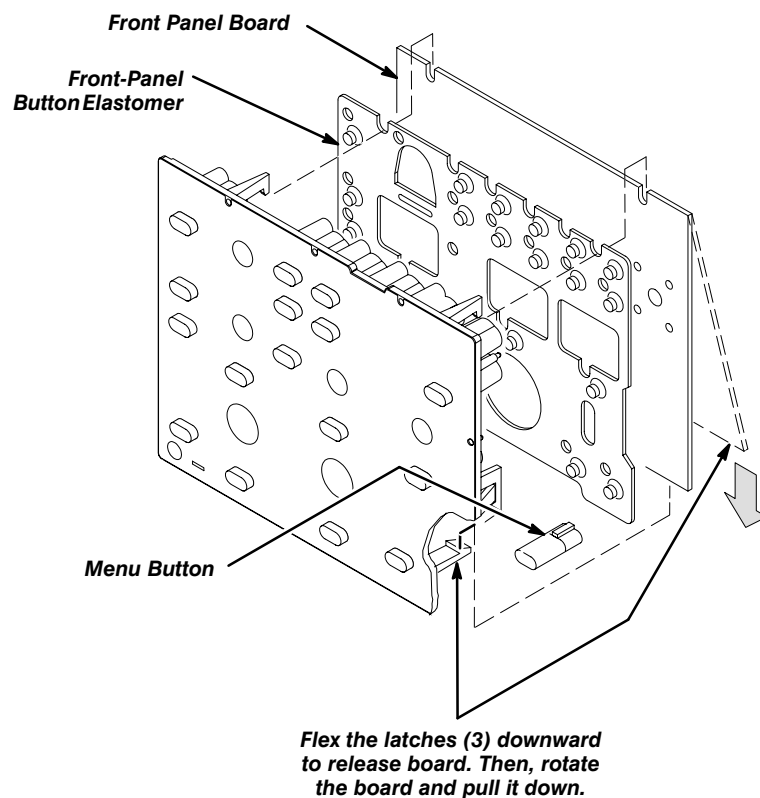


Figure 6-11: Disassembly of Front-Panel Assembly

Ground Spring Removal — Perform the next step only if replacing a damaged ground spring.

7. Using Figure 6-12 as a guide, grasp (compress) the base of the ground spring (to release the spring) with tweezers (Item 5) and pull the ground spring away from the assembly.

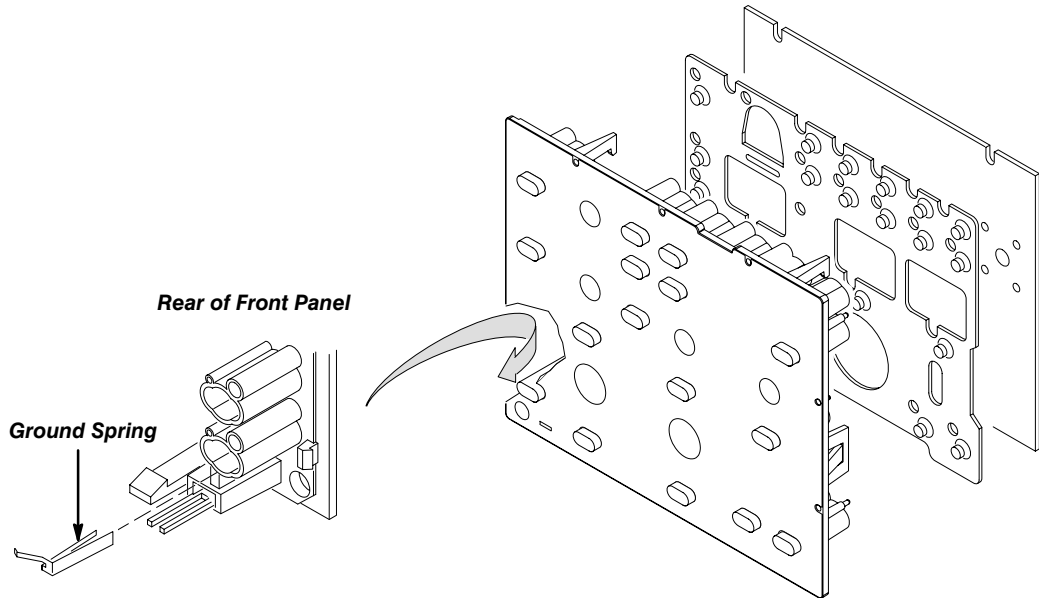


Figure 6-12: Front-Panel Ground Spring

Reassembly of the Front Panel Module

Perform the next steps to reassemble the Front Panel module.

1. If the front-panel assembly was disassembled for cleaning in step 4, apply a light, thin coating of bearing grease (Dow Corning #1292) to the two switch patterns (circular patterns for the vertical and horizontal scale rotary switches) on the circuit board.
2. Perform in reverse order each step taken during the disassembly of the Front Panel module.

Menu Flex Circuit Replacement



Perform this procedure only if replacing a failed or damaged menu flex circuit with a fresh unit from the factory. (Removal of the circuit will destroy it.)

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
 - Cabinet Removal
 - Front Trim Removal
 - A62 Front Panel Module Removal
1. Pull the flex circuit away from the front of the main chassis. (It is held on by its sticky backing.) See Figure 6-13.
 2. Wipe the front of the chassis using isopropyl alcohol and a clean, lint-free cloth. Let dry. (Some adhesive from the flex circuit you removed will be left on the front of the chassis. This is normal.)

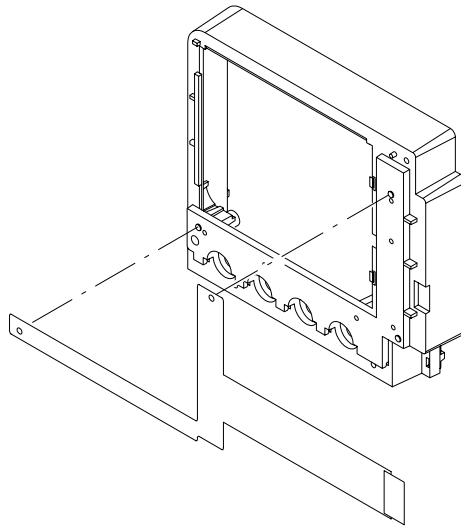


Figure 6-13: Menu Flex Circuit Board Removal

3. Find the score line in the adhesive backing and peel the backing off of the menu flex circuit.

NOTE

DO NOT touch the contacts on the menu flex circuit with your bare fingers. You should wear clean cloth gloves that are free of lint when installing the menu flex circuit on the front chassis.

Removal and Installation Procedures

4. Carefully align the three holes on the menu flex circuit to the locator studs on the front of the main chassis. When the alignment is correct, press the flex circuit against the chassis so it adheres to the chassis.
5. Clean the surface of the menu flex circuit just installed using isopropyl alcohol and a clean, lint-free cloth.
6. Repeat all procedures performed in reverse order to reassemble the instrument.

A1 Analog Board

The following procedure describes how to remove the A1 Analog board.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
 - Cabinet Removal
 - Front Trim Removal
1. Set the oscilloscope so its top side is down on the work surface and its front is facing you.
 2. Disconnect the delay line from its holder and at connector J68 on the Analog board.
 3. Disconnect the cables at connectors J50 and J67 on the Analog board.
 4. Disconnect the cable to the rear panel Z-axis connector.
 5. Using Figure 6-14 as a guide, remove the four T-15 Torx® screws securing the attenuator assembly to the front of the chassis. Next remove the four T-15 Torx® screws securing the attenuator board to the chassis.
 6. Lift the attenuator assembly away from the oscilloscope to complete its removal.
 7. Replace the attenuator assembly by reversing the removal procedure.

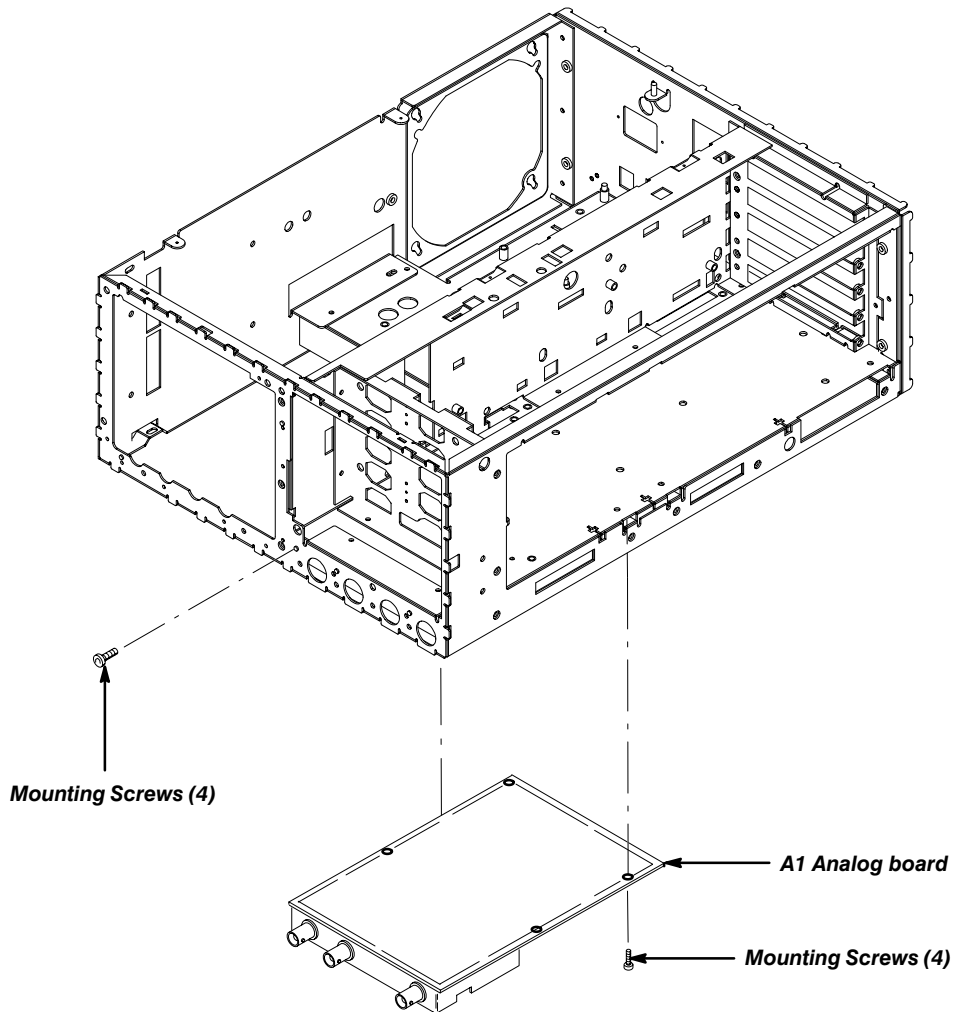


Figure 6-14: A1 Analog Board Removal

Display Driver Board (A3)

Remove and replace the Display Driver board as follows:

1. Remove the plastic high voltage cover from the rear of the Display Driver board (A3). Refer to Figure 6-15.
2. Disconnect the delay line from its holder and at connector J69 on the Display Driver board.
3. Disconnect the cables from J70, J71, J72, J73, J74, J75, and J80 on the Display Driver board.
4. Disconnect J67 from the Analog Board (A1).
5. Remove the four T-15 Torx screws used to attach the Display Driver board to the chassis.

Removal and Installation Procedures

6. Remove the Display Driver board from the chassis, but leave the clear plastic sheet in place.
7. Replace the Display Driver board by performing the reverse of the procedure described in steps 1 through 6.

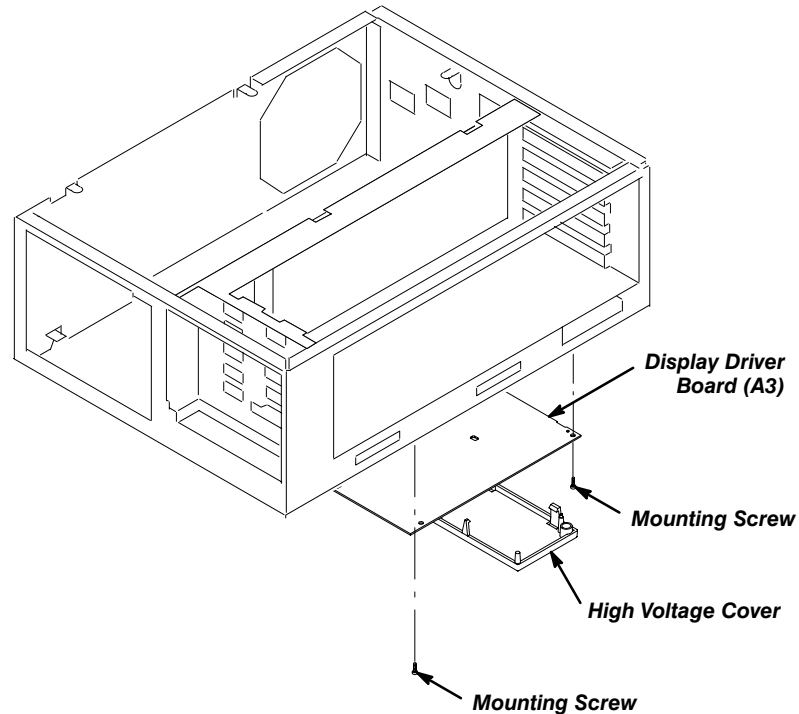


Figure 6-15: Location of Display Driver Board

CRT Implosion Shield

The procedures that follow describe how to remove and install the CRT implosion shield.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
 - Cabinet Removal
 - Front Trim Removal
1. From the front of the implosion shield, slip the spudger into the slot provided on the side of the CRT front bracket. See Figure 6-16.
 2. Carefully pry the implosion shield up and out of the CRT front bracket guides.

3. Re-install the implosion shield by placing the left side of the shield into the CRT front Bbracket guides. If installing a new implosion shield, remove the clear protective covers.
4. Snap the right side of the implosion shield into the CRT front bracket snaps.
5. Install all previously removed components.

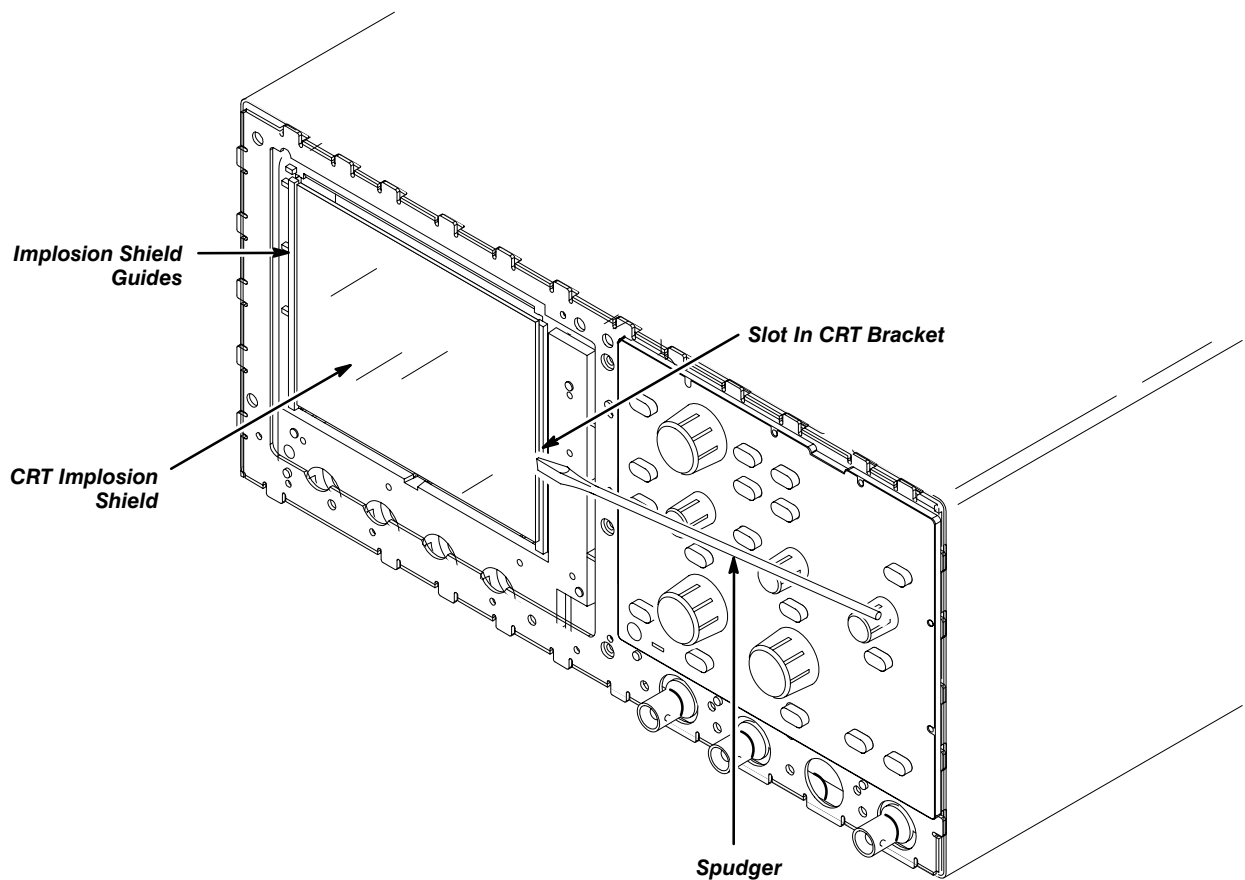


Figure 6-16: CRT Implosion Shield Removal

Fan and Fan Mount

The procedures that follow describe how to remove and install the Fan and Fan Mount.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
- Cabinet Removal

Fan and Fan Mount Removal

1. Set the oscilloscope so its bottom is down.
2. Unplug the fan power cable from the A63 Power Supply module.
3. Rotate the oscilloscope so the side that houses the fan mount is facing upwards.
4. Depress the two flex locks to release them (see Figure 6-18).
5. While holding the flex locks released, slide the fan mount so its four retainer lugs slide from their small retainer holes in the chassis into their large release holes. See Figure 6-17.

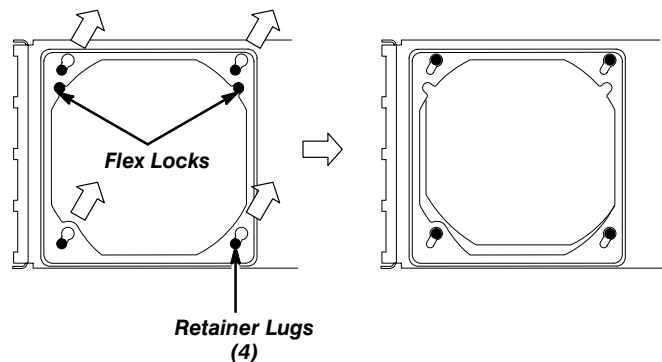


Figure 6-17: Fan Mount Removal

6. Move the fan mount inward so its retainer lugs are out of the large retainer holes and lift the fan mount and fan out of the chassis. See Figure 6-18.

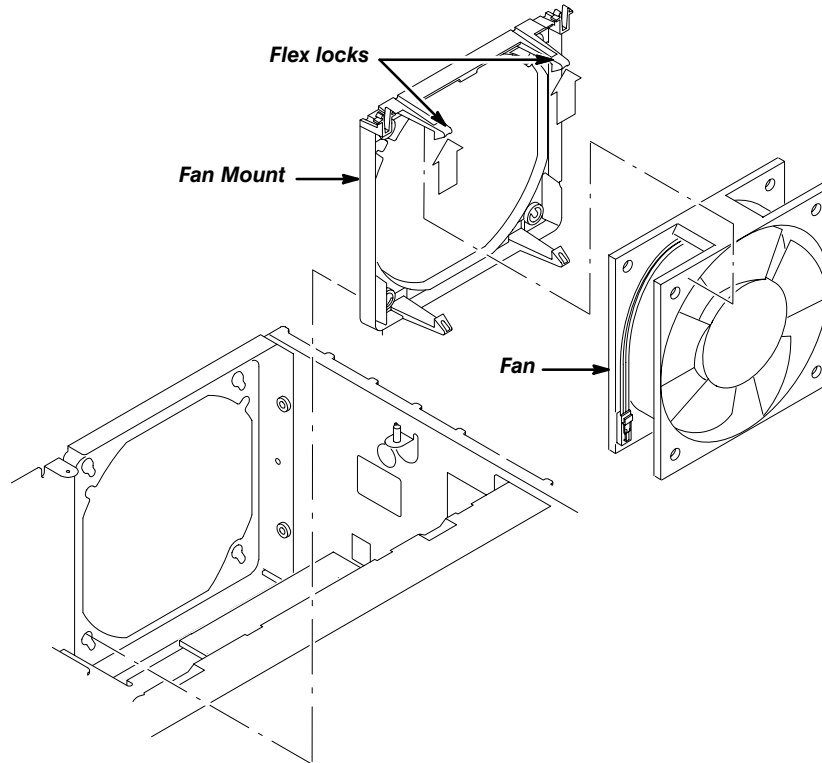


Figure 6-18: Fan and Fan Mount Removal



DO NOT remove the fan from the fan mount unless servicing a broken fan or fan mount or removing the mount for cleaning.

7. Release the two flex locks securing the top of the fan to the fan mount, then lift the fan out from the mount.

Fan and Fan Mount Installation

1. If the fan was removed from the fan mount, press the fan into the fan mount until the four retainer clips snap into place, securing the fan.
2. Install the fan assembly so that the retainer lugs on the mount are positioned in the large holes of the chassis; then, slide the fan assembly until the lugs slip into the small holes and the two flex locks snap into place.
3. Reconnect the fan power cable.
4. Re-install all removed components.

CRT

The procedures that follow describe how to remove and install the CRT. Refer to Figure 6-20 for this procedure.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
- Cabinet Removal
- Front Trim Removal
- A3 Display Driver Board

CRT Removal

1. Set the oscilloscope so its bottom is down on the work surface, with its front facing you.

WARNING

Breaking a CRT causes it to implode, scattering glass fragments with high velocity and possibly injuring you. Wear protective clothing and safety glasses (preferably a full-face shield). Avoiding striking the CRT with or against any object.

Store the CRT with its display face down in a protected location, placing it on a soft, nonabrasive surface to prevent scratching the face plate.

2. Unplug the the 2-wide red/black cable from the A2 Display Control board.

WARNING

High-voltage is present on the anode lead. Do not touch the end of the anode lead until it has been fully discharged to ground.

3. Disconnect the red CRT anode lead from the A63 Power Supply module and immediately discharge to chassis ground.
4. Using a $\frac{5}{16}$ inch nut driver, remove the nut securing the ground wire at the rear of the CRT.
5. From the bottom of the chassis, unsnap the Rear CRT Bracket from the chassis. See Figure 6-19.

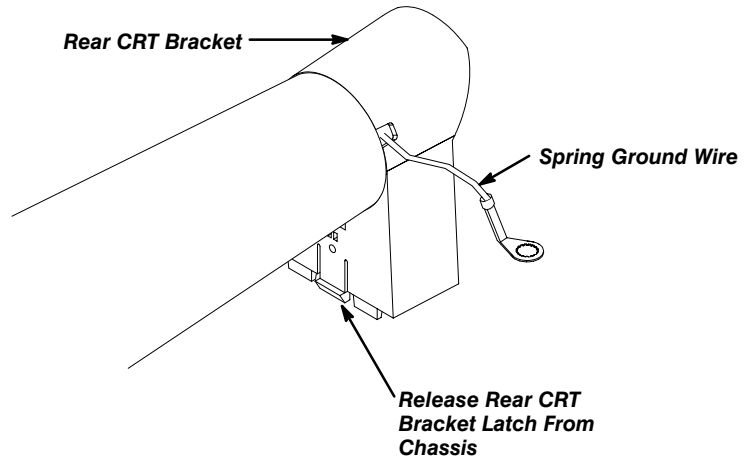


Figure 6-19: CRT Rear Bracket and Ground Wire

6. Lift the rear of the CRT until it is above the chassis. Then pull the CRT away from the CRT Front Bracket.



Stop here if you are removing the CRT assembly to gain access to other portions of the instrument. If you are installing a new CRT or hardware attached to the CRT, continue with this procedure.

7. Slide the Rear CRT Bracket from the CRT. The Spring Ground Wire will slide out also. (See Figure 6-20 on page 6-35.)
8. Remove the CRT Socket with its cover from the rear pin connector of the CRT.
9. Disconnect the vertical and horizontal control wires from the side of the CRT. Note the proper location of both sets of wires for reinstallation.
10. Slide the CRT shield and its front support off the CRT.
11. Store the CRT in a safe location.

CRT Installation

1. Slide the CRT shield and its front support onto the CRT as far forward as possible.
2. Align the holes in the shield so that the vertical and horizontal control pins on the side of the CRT are accessible.
3. Align the slot in the CRT Socket to the key on the CRT pin connector and slide the Socket onto the pins.
4. Slip the CRT socket wires through the Rear CRT Bracket and slide the bracket onto the rear of the CRT.
5. Ensure that the Rear CRT Bracket is properly aligned with the slots provided in the CRT Shield.

Removal and Installation Procedures

6. Slide the Spring Ground Clip into the slot provided in the Rear CRT Bracket.
7. Connect the vertical and horizontal control wires to the side CRT pins.
8. Guide the front of the CRT into the CRT Front Bracket. Ensure that the four CRT Cushions are in their proper place in each corner of the Bracket.
9. Lower the rear of the CRT into the chassis and press down on the CRT Rear Bracket until it snaps into the chassis.
10. Route the vertical and horizontal control cables to the bottom of the chassis.
11. Connect the red anode lead to its connector from the A63 Power Supply module.
12. Plug the the 2-wide red/black cable to the A2 Display Control board.
13. Install all previously removed components.

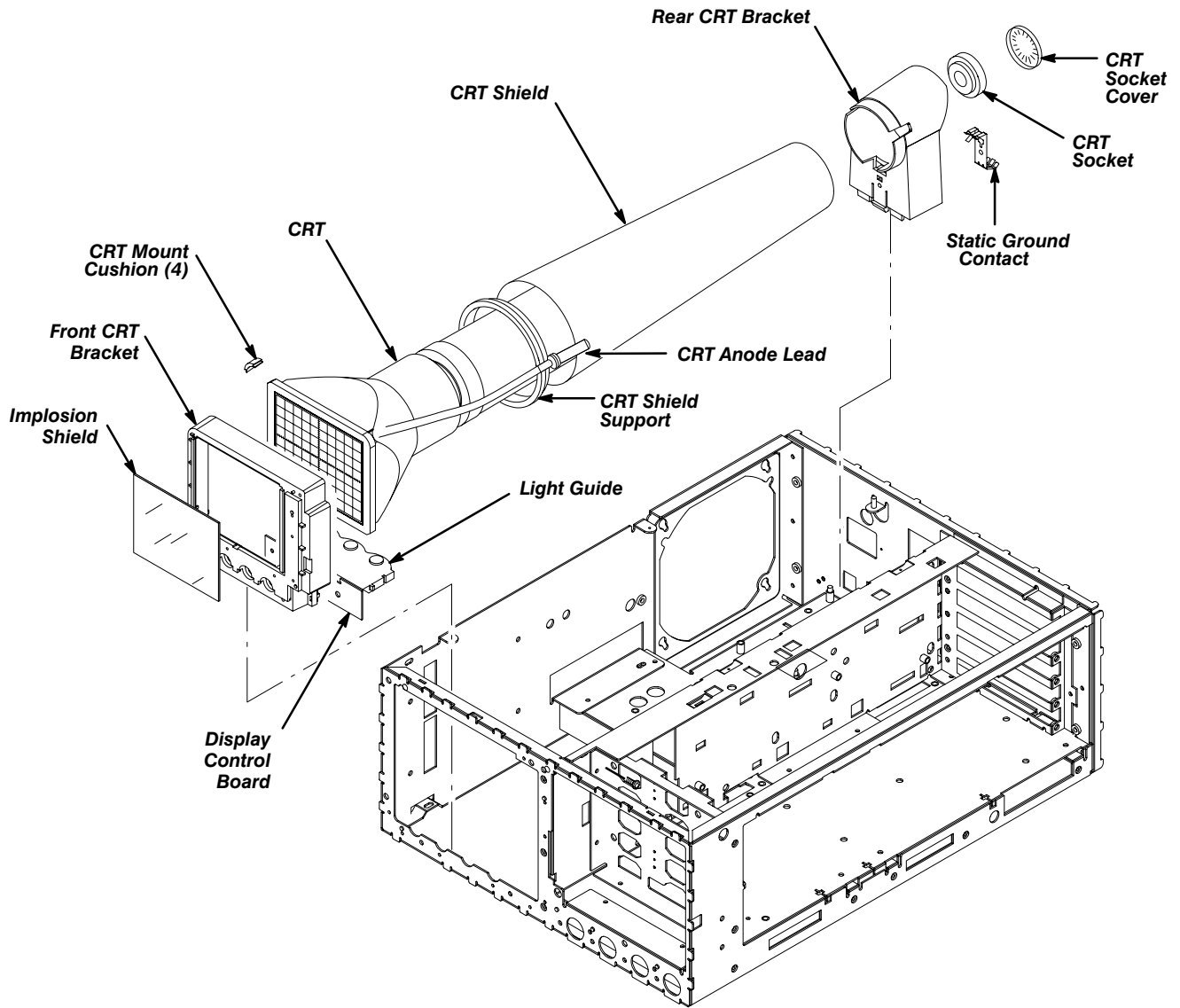


Figure 6-20: CRT Removal

CRT Light Guide

The procedures that follow describe how to remove and install the CRT Light Guide. Refer to Figure 6-20 on page 6-35 for this procedure.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
 - Cabinet Removal
 - Front Trim Removal
 - A3 Display Driver Board
 - CRT
1. Lift the light guide off the light bulbs on the A2 Display Control board.
 2. Re-install the light guide by sliding the guide over the light bulbs on the A2 Display Control board.

NOTE

To properly guide the light to the CRT, the beveled edge of the light guide must be facing up, toward the CRT.

3. Install all previously removed components.

CRT Front Bracket

The procedures that follow describe how to remove and install the CRT Front Bracket. Refer to Figure 6-20 for this procedure.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
 - Cabinet Removal
 - Front Trim Removal
 - A3 Display Driver Board
 - Fan Assembly
 - CRT
1. Remove the four screws securing the CRT front bracket to the chassis.
 2. Lift the CRT front bracket out from inside the chassis. See Figure 6-21.

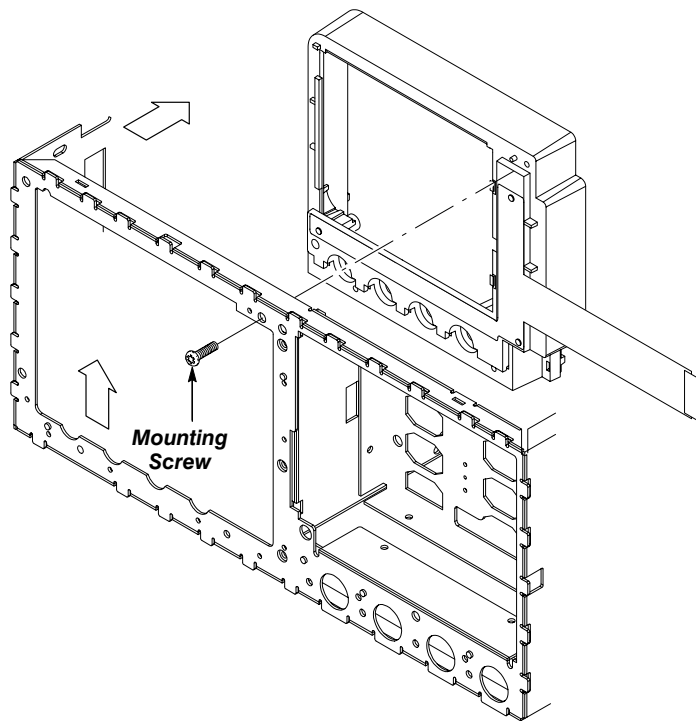


Figure 6-21: Removing the CRT Front Bracket

3. Re-install the CRT front bracket by sliding the bracket into the chassis and secure it with the four mounting screws.
4. Install all previously removed components.

A2 Display Control Board

The procedures that follow describe how to remove and install the CRT front bracket.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
- Cabinet Removal
- Front Trim Removal
- A3 Display Driver Board
- Fan Assembly
- CRT

1. Unplug the cables from connectors J80, J82, and J84 on the A2 Display Control board.

Removal and Installation Procedures

2. Lift the A2 Display Control board up toward the top of the chassis, sliding the board out of the board retainers. See Figure 6-22.

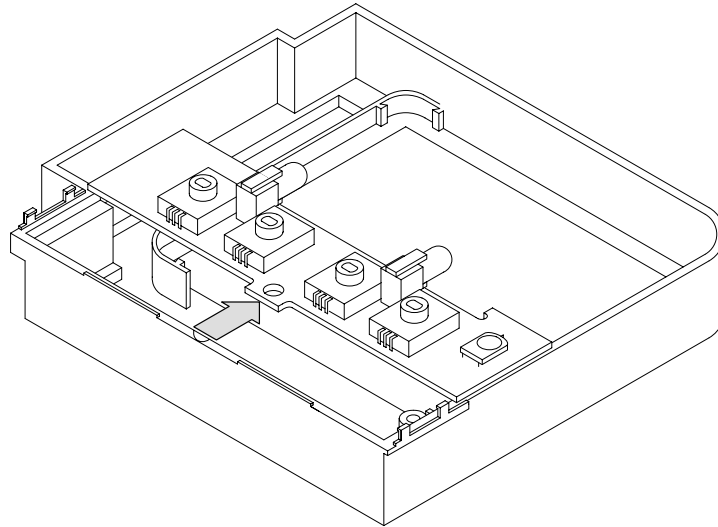


Figure 6-22: Removing the Display Control Board

3. Re-install the A2 Display Control board by sliding the board into the board retainers.
4. Re-install all cables at connectors J80, J82, and J84.
5. Install all previously removed components.

A63 Power Supply Module

The procedures that follow describe how to remove and install the Power Supply module.

Additional procedures required — This procedure requires that the following procedures be performed first:

- Rear Cover Removal
- Cabinet Removal

Power Supply Removal

1. Set the oscilloscope so its top is down on the work surface.
2. Disconnect the power button shaft from the power switch on the Power Supply module. See Figure 6-23.

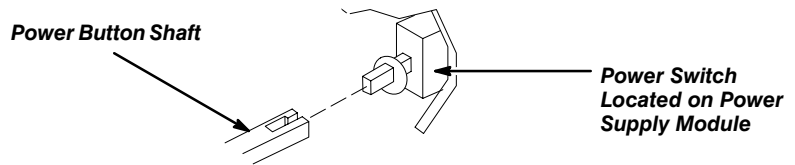


Figure 6-23: Power Button Shaft Disconnect

3. Unplug the cables going to the A3 Display Driver board at J70 and J71.
4. Set the oscilloscope so its bottom down on the work surface.
5. Unplug the cable going to the A5 CPU board at J55.
6. Unplug the two-wide cable from the fan.
7. Unplug the red CRT anode lead from the power supply connector.
8. Remove the two screws securing the Power Supply module to the chassis.
9. Lift the Power Supply module out of the chassis to complete its removal. (See Figure 6-24.)

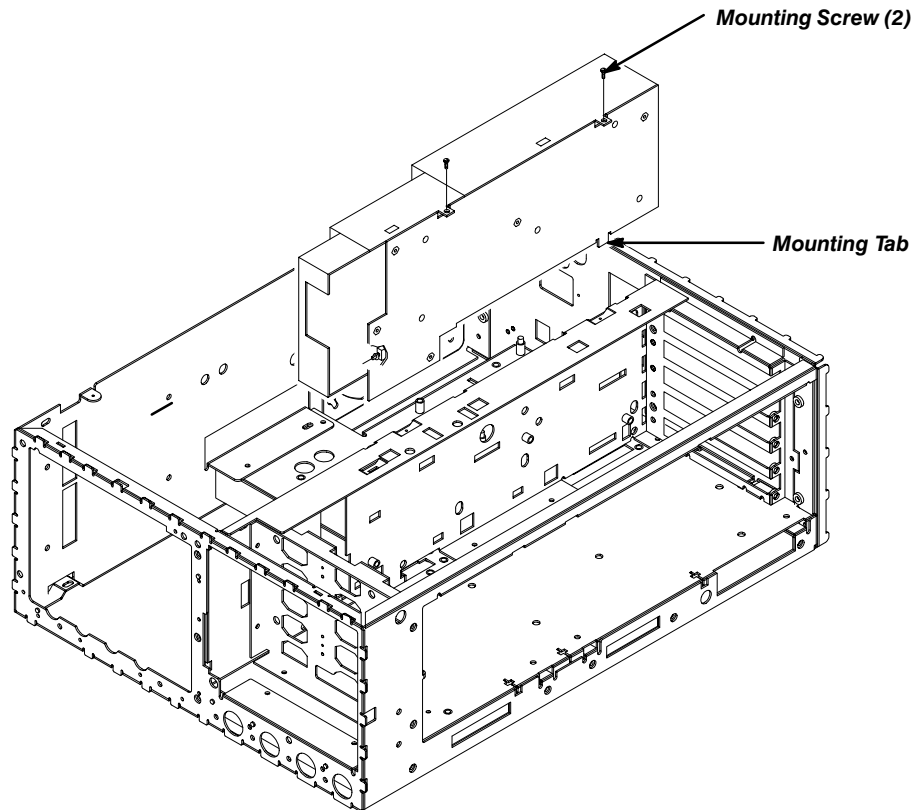


Figure 6-24: Power Supply Removal

Power Supply Installation

1. Slide the Power Supply module into the chassis, noting that the tab at the bottom of the Power Supply module slides into the slot at the bottom of the chassis. See Figure 6-24.
2. Reconnect all cables and wires disconnected during the removal procedure.
3. Re-install all components removed.

Troubleshooting

This subsection contains information and procedures designed to help you isolate problems to a faulty module in the oscilloscope. If a module needs to be removed for repair or replacement, follow the *Removal and Installation Procedures* located in this section.

Troubleshooting Procedure

If the oscilloscope does not perform correctly, note each symptom or failure. Next, refer to the Symptom Matrix Table (Table 6-5). Locate the symptoms that most closely resemble the symptoms you noted. If there are multiple symptoms, use a process of elimination to reduce the number of possible faulty modules. Identify possible faulty modules, and then perform the troubleshooting procedure/s indicated.

The cabinet must be removed to gain access to the modules for measuring signals and voltages. Refer to the *Removal and Installation Procedures* beginning on page 6-9 for instructions to remove the cabinet.

Equipment

Table 6-4 lists the equipment required to perform the troubleshooting procedures.

Table 6-4: Equipment Required for Troubleshooting

Equipment	Example
Test Oscilloscope	Tektronix TAS 465
Digital Multimeter (DMM)	Tektronix DMM249
High Voltage Probe	Fluke Model 80K-40



High voltages are present when the cabinet is removed. Do not remove the high voltage shield from the A3 Display Driver board unless it is necessary to measure the high voltage. Do not perform this procedure without the presence of another person who is capable of providing aid.

Symptom Matrix

The Symptom Matrix (Table 6-5) is an aid in determining which modules to troubleshoot. There is no separate troubleshooting procedure for the power supply, since each module troubleshooting procedure includes checks of the power supply. The CRT is checked in the display control and display driver troubleshooting procedures.

The ● indicates the troubleshooting procedure most likely to locate the failed module. The ○ indicates additional troubleshooting procedures that may help locate the failed module.

Table 6-5: Symptom Matrix

Symptom	Processor	Analog	Display Driver	Front Panel	Display Control
Display Problems					
No display at all	○	○	○	○	●
Traces or readout, but not both	○	●		○	○
Abnormal readout	●	○			
Abnormal traces	○	●			
Abnormal traces and readout	○	○	●		
Power-on diagnostics indicates a failure	●	●		○	
Self-calibration does not pass	○	●			
Volts/Div and Sec/Div controls					
One control works but not both	○	●		○	
Neither control works	○	○		●	
No control of Volts/Div or vertical position of a single channel	○	●			
No control of Volts/Div or vertical position of any channels	○	○		●	
Intensity Control Problems					
No control of readout and trace intensity	○	○		●	
Control of readout or trace intensity but not both		●		○	
Focus Problems					
No control of focus			○		●
Unable to focus properly			●		○
No control of trace rotation					●
No control of scale illumination					●

Table 6-5: Symptom Matrix (Cont.)

Symptom	Processor	Analog	Display Driver	Front Panel	Display Control
Trigger level, vertical position, and horizontal position					
The trace position controls nor the Trigger Level control works	○	○		●	
Some of these controls work but not all	○	●		○	
Probe Scale (X10) Problems					
Volts/Div readout does not change with a X10 probe on any channel				●	
Front Panel Control Problems					
Front panel controls do not work but readout display works	○			●	
Front panel controls do not work and the readout display is abnormal	●			○	
CRT Bezel buttons do not work but other buttons and knobs work				●	
Front panel LED Problems					
No LED's momentarily light at power-on but readout is okay	○			●	
No LED's momentarily light at power-on and abnormal readout	●			○	
Some LED's momentarily light at power-on, but not all do				●	
No trigger on line source	○	●	○		

Troubleshooting

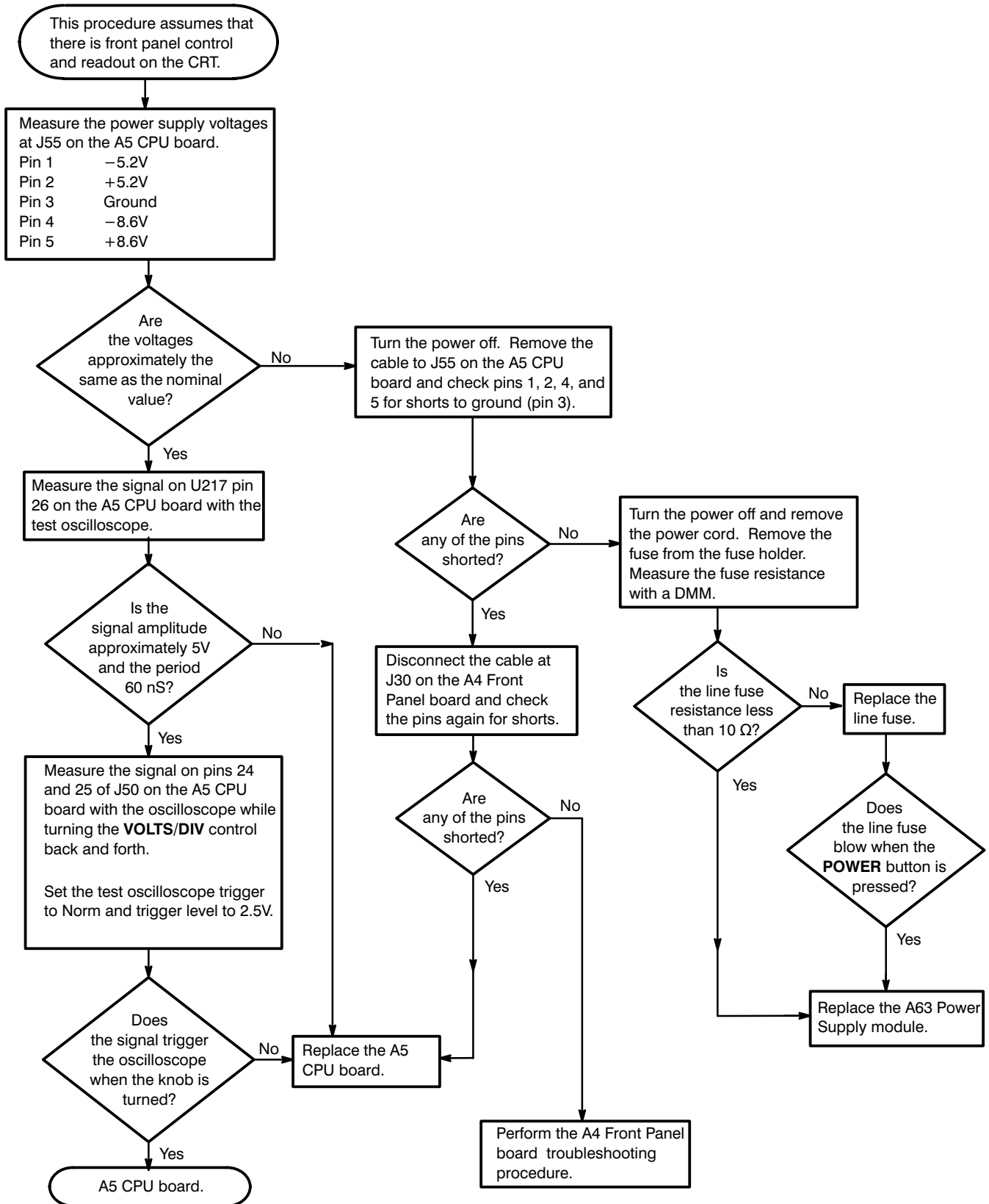


Figure 6-25: A5 CPU Board Troubleshooting Procedure

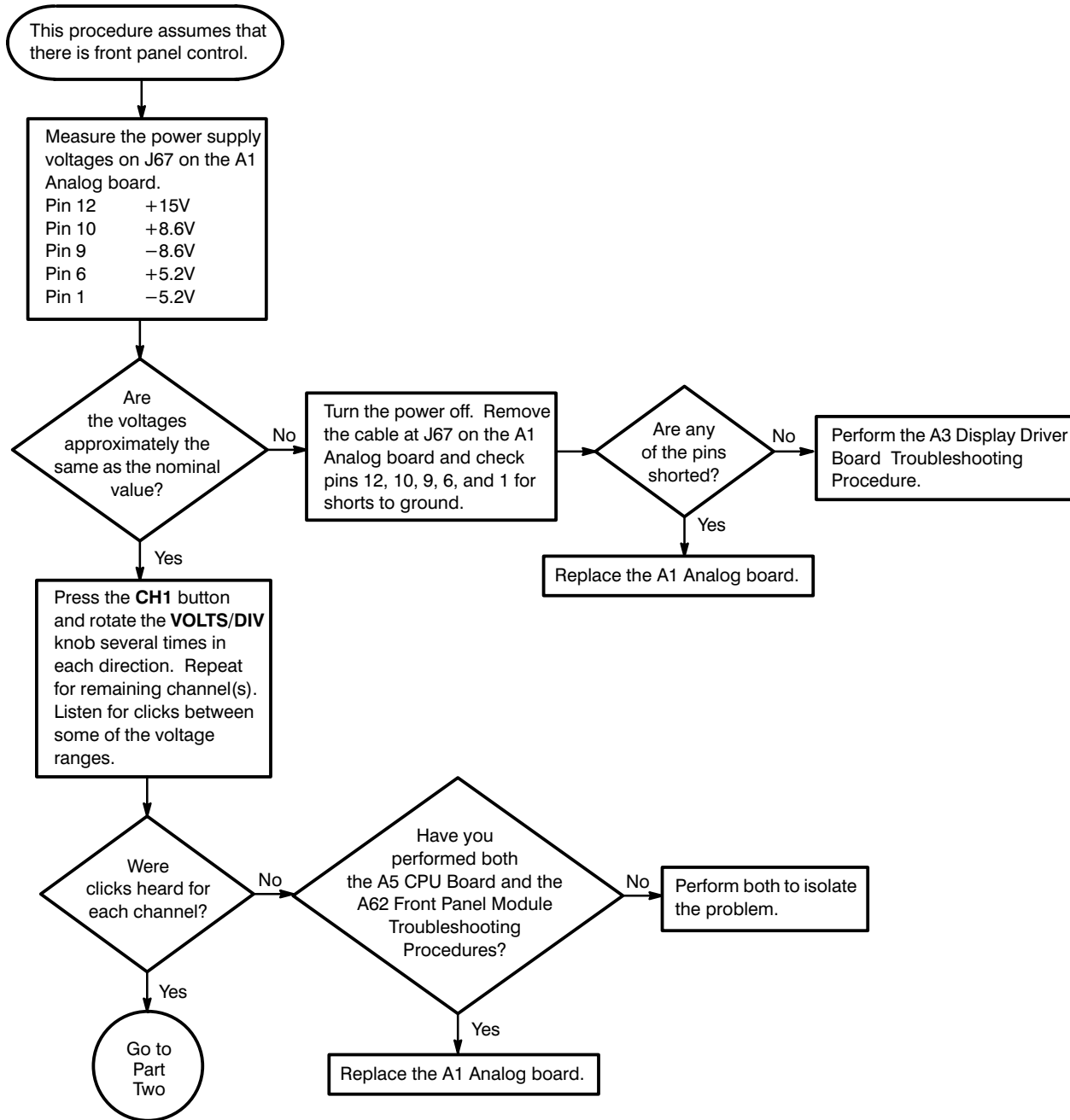


Figure 6-26: A1 Analog Board Troubleshooting Procedure

Troubleshooting

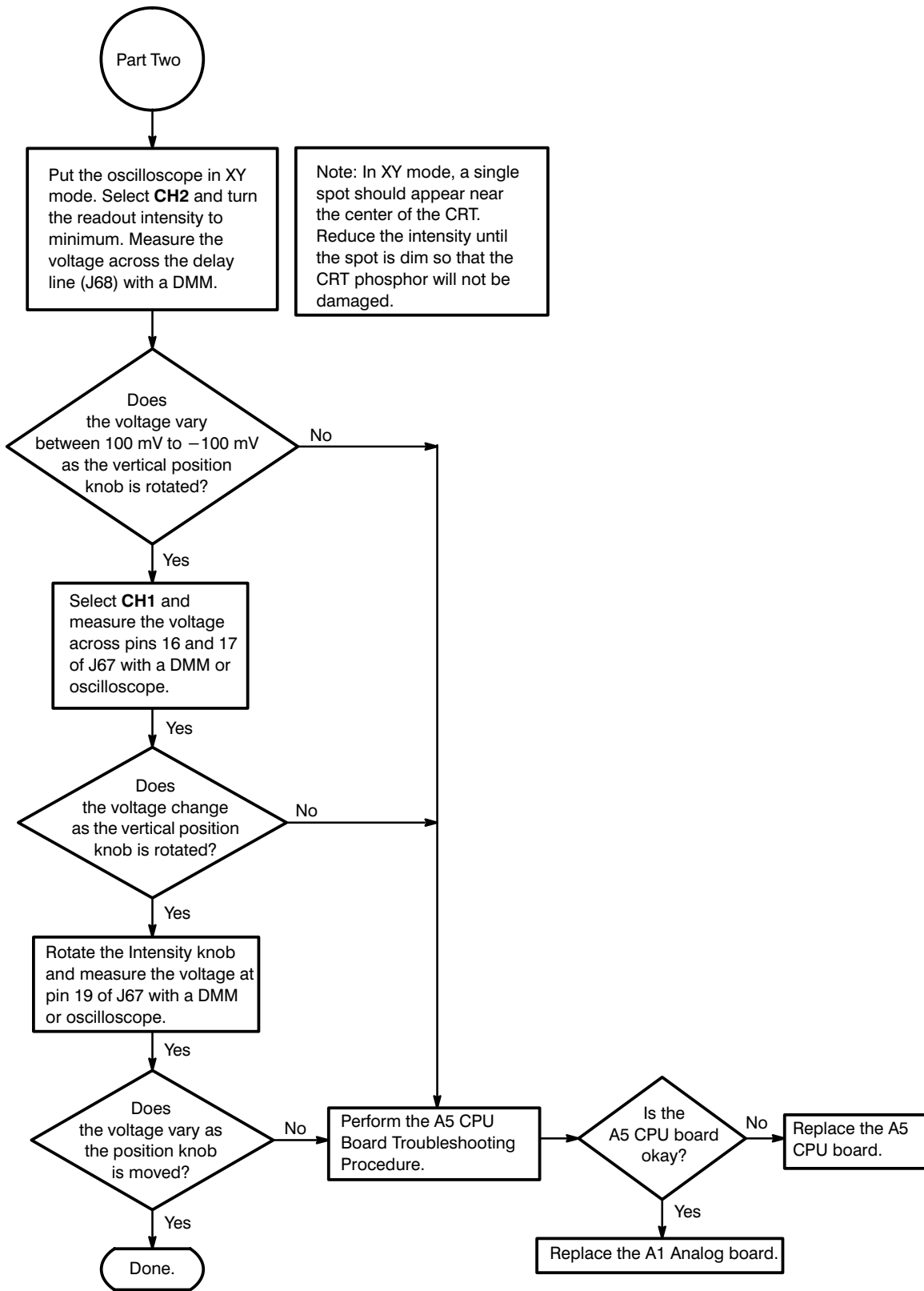


Figure 6-26: A1 Analog Board Troubleshooting Procedure (Cont.)

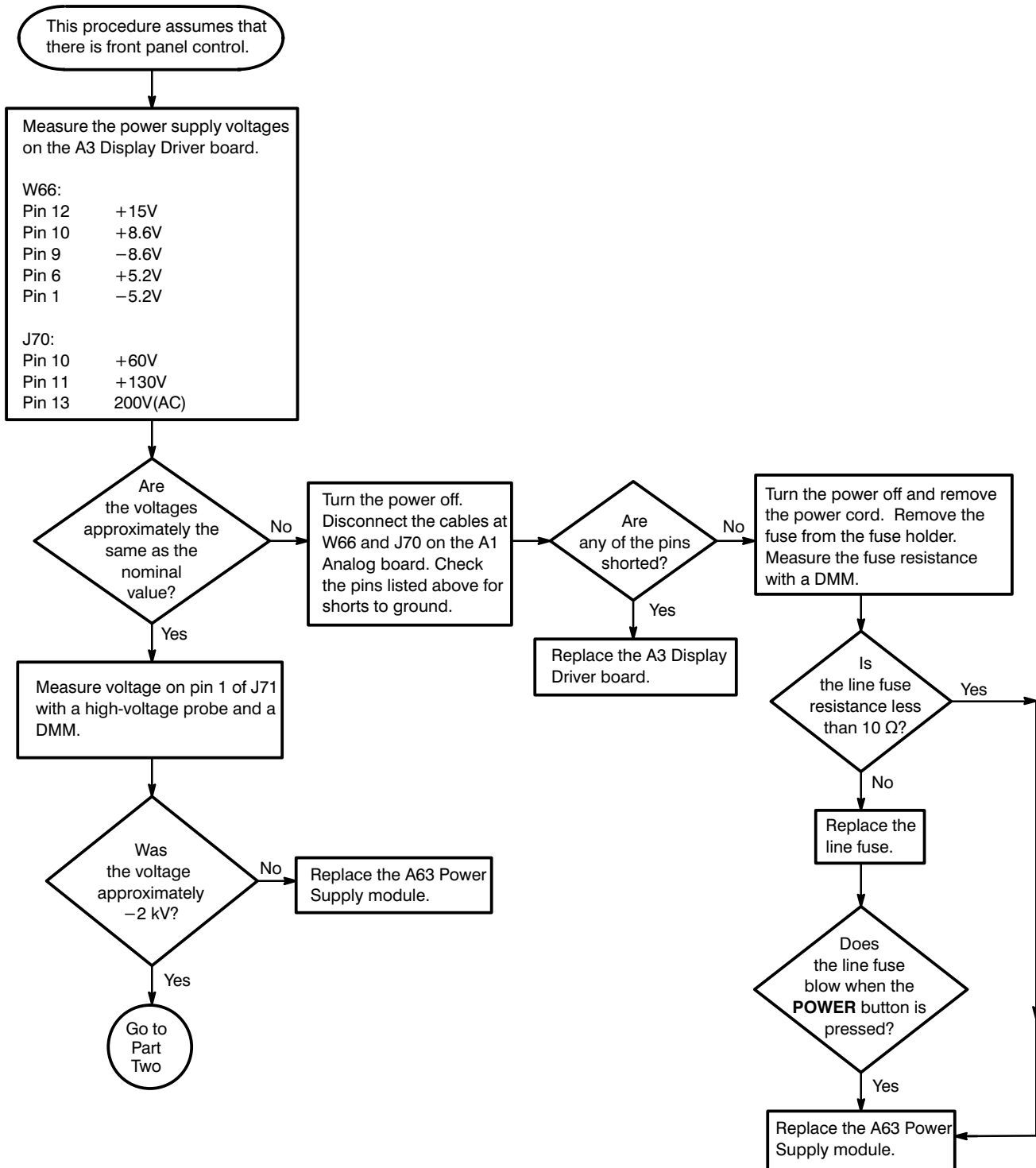


Figure 6-27: A3 Display Driver Board Troubleshooting Procedure

Troubleshooting

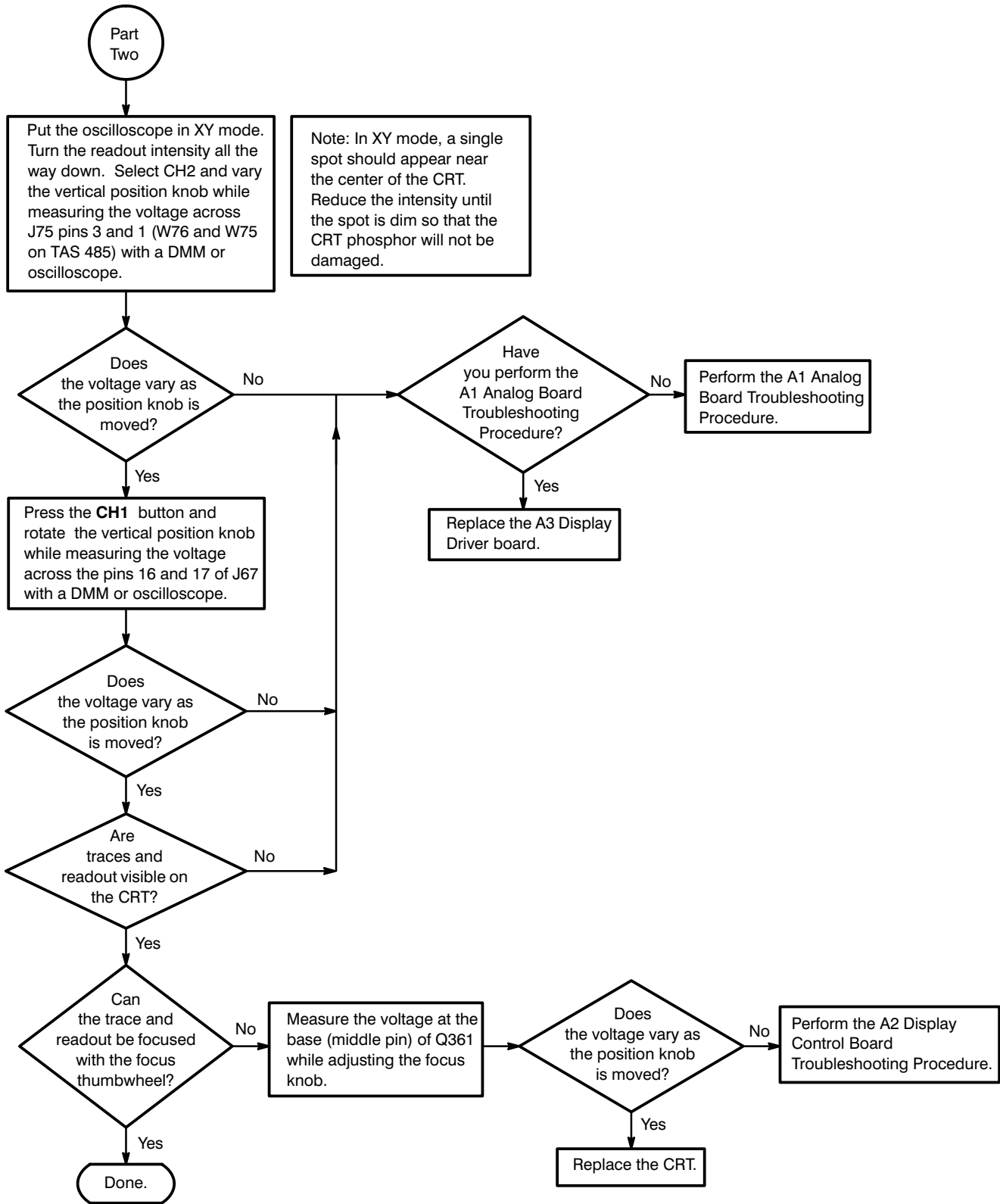


Figure 6-27: A3 Display Driver Board Troubleshooting Procedure (Cont.)

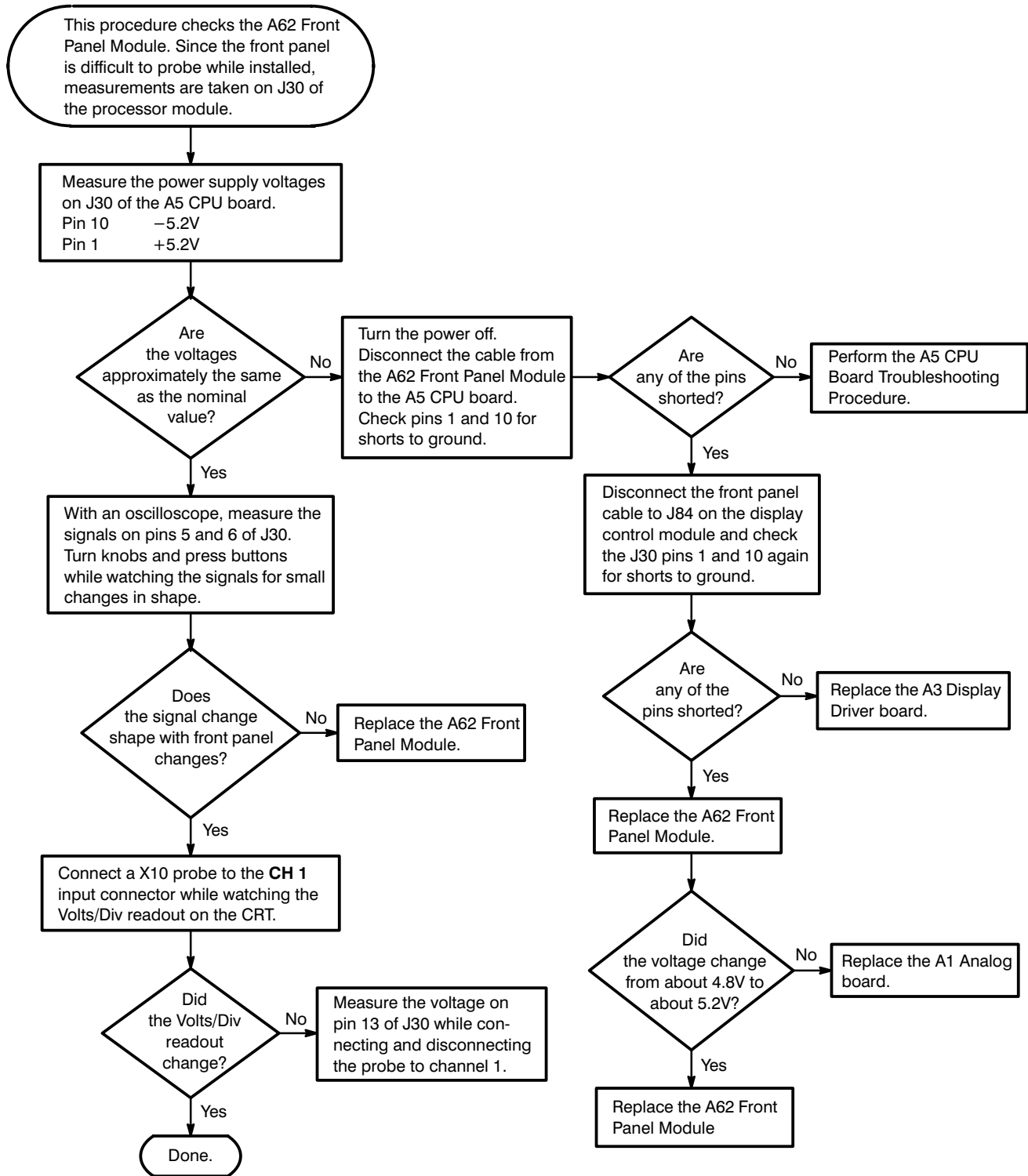


Figure 6-28: A62 Front Panel Module Troubleshooting Procedure

Troubleshooting

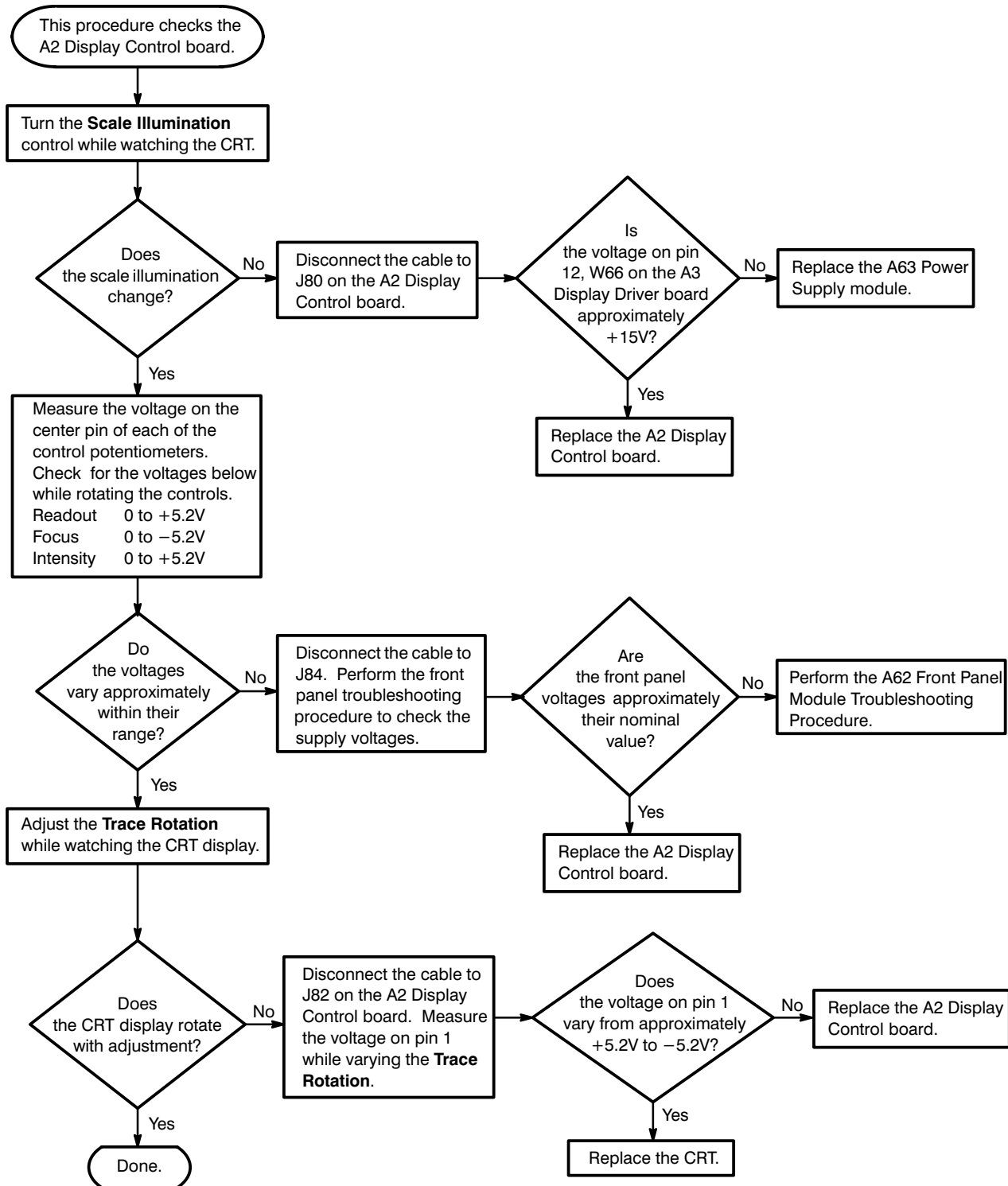


Figure 6-29: A2 Display Control Board Troubleshooting Procedure

Repackaging Information

If you ship the TAS 465 Oscilloscope, pack it in the original shipping carton and packing material. If the original packing material is not available, package the instrument as follows:

1. Obtain a corrugated cardboard shipping carton with inside dimensions at least 15 cm (6 in) taller, wider, and deeper than the TAS 465 Oscilloscope. The shipping carton must be constructed of cardboard with 170 kg (375 pound) test strength.
2. If you are shipping the TAS 465 Oscilloscope to a Tektronix field office for repair, attach a tag to the oscilloscope showing the instrument owner and address, the name of the person to contact about the instrument, the instrument type, and the serial number.
3. Wrap the oscilloscope with polyethylene sheeting or equivalent material to protect the finish.
4. Cushion the oscilloscope in the shipping carton by tightly packing dunnage or urethane foam on all sides between the carton and the oscilloscope. Allow 7.5 cm (3 in) on all sides, top, and bottom.
5. Seal the shipping carton with shipping tape or an industrial stapler.

Repackaging Information

Options

This section contains a list of options available for the TAS 465 Analog Oscilloscope.

Options A1 – A5: International Power Cords

Besides the standard North American, 110 V, 60 Hz power cord, Tektronix ships any of five alternate power cord configurations. See Table 7-1.

Table 7-1: International Power Cords

Option	Power Cord
A1	Universal European — 220 V, 50 Hz
A2	UK — 240 V, 50 Hz
A3	Australian — 240 V, 50 Hz
A4	North American — 240 V, 60 Hz
A5	Switzerland — 220 V, 50 Hz

Warranty-Plus Service Options

The following options add to the services available with the standard warranty. (The standard warranty appears following the title page in this manual.)

- **Option M2:** Tektronix provides five years of warranty/remedial service.
- **Option M3:** Tektronix provides five years of warranty/remedial service and four oscilloscope calibrations.
- **Option M8:** Tektronix provides four calibrations and four performance verifications, one of each in the second through the fifth years of service.

Option 3R: Rackmount

With this option, Tektronix ships the oscilloscope with a rackmount kit, providing all the necessary hardware to adapt the oscilloscope for installation into a standard 19 inch instrument rack. Customers with instruments can order a rackmount kit (Tektronix part number 016–1166–00) for conversion with instructions.

Option 02: Front Cover and Pouch

With this option, Tektronix ships a protective front cover to prevent damage to the front panel of the oscilloscope while not in use. An attachable pouch (attaches to the instrument top) provides storage for the manuals and probes supplied with your oscilloscope plus other additional accessories you may want to keep with your oscilloscope.

Option 23: Additional Probes

With this option, Tektronix ships two P6129B 1X — 10X switchable passive probes in addition to the two standard-accessory P6109B probes normally shipped with the instrument.

Option 9C: Certificate of Calibration and Test Data Report

Tektronix ships a Certificate of Calibration that states this instrument meets or exceeds all warranted specifications and has been calibrated using standards and instruments whose accuracies are traceable to the National Institute of Standards and Technology, an accepted value of a natural physical constant or a ratio calibration technique. The calibration is in compliance with U.S. MIL—STD—45662A. This option also includes a test data report for the instrument.

Replaceable Electrical Parts

This section provides informations for ordering replaceable electrical parts.

Parts Ordering Information

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

When ordering parts, include the following information in your order: part number, instrument type or number, serial number, and modification number if applicable.

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

List of Assemblies

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

Cross Index-Mfr. Code Number to Manufacturer

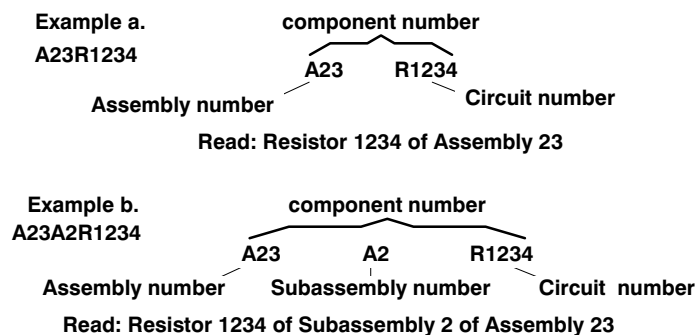
The Mfg. Code Number to Manufacturer Cross Index for the electrical parts list is located immediately after this page. The cross index provides codes, names, and addresses of manufacturers of components listed in the electrical parts list.

Abbreviations

Abbreviations conform to American National Standard Y1.1.

Component Number

(column 1 of the parts list)



Replaceable Electrical Parts

The circuit component number appears on the diagrams and circuit board illustrations. Each diagram and circuit board illustration is clearly marked with the assembly number. Assembly numbers are also marked on the mechanical exploded views located in the mechanical parts list. The component number is obtained by adding the assembly number prefix to the circuit number.

The electrical parts list is divided and arranged by assemblies in numerical sequence (e.g., assembly A1 with its subassemblies and parts, precedes assembly A2 with its subassemblies and parts).

Chassis-mounted parts have no assembly number prefix and are located at the end of the electrical parts list.

Tektronix Part No.

(column 2 of the parts list)

Indicates part number to be used when ordering replacement part from Tektronix.

Serial No.

(columns 3 & 4 of the parts list)

Column three (3) indicates the serial number at which the part was first used. Column four (4) indicates the serial number at which the part was removed. No serial number entered indicates part is good for all serial numbers.

Name & Description

(column five of the parts list)

In the parts list, an item name is separated from the description by a colon (:). Because of space limitations, an item name may sometimes appear as incomplete. For further item name identification, the U.S. Federal Catalog handbook H6-1 can be utilized where possible.

Mfr. Code

(column 6 of the parts list)

Indicates the code number of the actual manufacturer of the part. (Code to name and address cross reference can be found immediately after this page.)

Mfr. Part No.

(column 7 of the parts list)

Indicates the part number used by the manufacturer.

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
S4246	JAPAN SERVO CO LTD	7 KANDA MITOSHIRO-CHO CHIYODA-KU	TOKYO JAPAN
TK0213	TOPTRON CORP		TOKYO JAPAN
TK0515	ERICSSON COMPONENTS INC	403 INTERNATIONAL PKWY PO BOX 853904	RICHARDSON, TX 750853904
TK0860	LABEL GRAPHICS INC	ATTN: DALE GREMAUX 6700 SW BRADBURY CT	PORTLAND, OR 97224
TK1146	MITSUBISHI ELECTRIC CORP	1230 OAKMEAD PARKWAY	SUNNYVALE CA 94086
TK1442	TAIYO-YUDEN (USA) INC	ARLINGTON CENTER 714 W ALGONQUIN RD	ARLINGTON HEIGHTS IL 60005
TK1492	COFER COMPONENT PROCESSING	3270 KELLER ST UNIT 11	SANTA CLARA CA 95050
TK1727	PHILIPS NEDERLAND BV AFD ELONCO	POSTBUS 90050	5600 PB EINDHOVEN THE NETHERLANDS
TK1908	PLASTIC MOLDED PRODUCT INC	4336 S ADAMS	TACOMA, WA 98409
TK1913	WIMA THE INTER-TECHNICAL GROUP IND	ONE BRIDGE ST PO BOX 23	IRVINGTON NY 10533
TK1943	NEILSEN MANUFACTURING INC	3501 PORTLAND RD NE	SALEM, OR 97303
TK2058	TDK CORPORATION OF AMERICA	1600 FEEHANVILLE DRIVE	MOUNT PROSPECT, IL 60056
TK2073	TOCOS AMERICA INC	565 W GULF ROAD	ARLINGTON HEIGHTS IL 60005
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK WAY SUITE #2	VANCOUVER WA 98601
TK2597	MERIX CORP	1521 POPLAR LANE	FOREST GROVE, OR 97116
TK2606	VISPRO	PO BOX 6239	BEAVERTON, OR 970070239
TK6056	ASTEK USA	2880 SAN TOMES EXPRESSWAY SUITE 200	SANTA CLARA CA 95051
0ADN8	DELTA PRODUCTS	3225 LAURELVIEW CT	FREMONT, CA 94538
0B0A9	DALLAS SEMICONDUCTOR CORP	4350 BELTWOOD PKWY SOUTH	DALLAS TX 75244
0H1N5	MARCON AMERICA CORP	998 FIRST EDGE DRIVE	VERNON HILLS IL 60061
0JR03	ZMAN MAGNETICS INC	7633 S 180TH	KENT WA 98032
0JR04	TOSHIBA AMERICA INC ELECTRONICS COMPONENTS DIV BUSINESS SECTOR	2692 DOW AVE	TUSTIN CA 92680
0JR05	TRIQUEST PRECISION PLASTICS	3000 LEWIS & CLARK HWY PO BOX 66008	VANCOUVER, WA 98666-6008
0J7N9	MCX INC	30608 SAN ANTONIO ST	HAYWARD CA 94544
0J9R2	HARISON ELECTRIC CO LTD	2-1 ASAHIMACHI 5-CHOME IMARARI	EMINE, JAPAN 527R
0KB01	STAUFFER SUPPLY CO	810 SE SHERMAN	PORTLAND, OR 972144657
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
01295	TEXAS INSTRUMENTS INC SEMICONDUCTOR GROUP	13500 N CENTRAL EXPY PO BOX 655012	DALLAS TX 75265
01884	DEARBORN ELECTRONICS INC	1221 NORTH HIGHWAY 17/92	LONGWOOD, FL 32750

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
02114	PHILIPS COMPONENTS	FERROXCUBE DIV 5083 KINGS HWY	SAUGERTIES, NY 12477
04222	AVX CERAMICS DIV OF AVX CORP	19TH AVE SOUTH P O BOX 867	MYRTLE BEACH SC 29577
04713	MOTOROLA INC SEMICONDUCTOR PRODUCTS SECTOR	5005 E MCDOWELL RD	PHOENIX AZ 85008-4229
05828	GENERAL INSTRUMENT CORP GOVERNMENT SYSTEMS DIV	600 W JOHN ST	HICKSVILLE NY 11802
06090	ERICSSON RAYNET CORP	155 CONSTITUTION DR	MENLO PARK, CA 94025-1106
06383	PANDUIT CORP	17303 RIDGELAND AVE	TINLEY PARK, IL 60477-3048
09969	DALE ELECTRONICS INC	EAST HIGHWAY 50 P O BOX 180	YANKTON SD 57078
1CH66	PHILIPS SEMICONDUCTORS	811 E ARQUES AVENUE PO BOX 3409	SUNNYVALE CA 94088-3409
1W344	UNITED CHEMI-CON INC	9801 W HIGGINS SUITE 430	ROSEMONT IL 60018-4704
12697	CLAROSTAT MFG CO INC	LOWER WASHINGTON ST	DOVER NH 03820
12954	MICROSEMI CORP – SCOTTSDALE	8700 E THOMAS ROAD PO BOX 1390	SCOTTSDALE, AZ 85252-5252
12969	MICROSEMI CORP	WATERTOWN DIVISION 530 PLEASANT STREET	WATERTWON, MA 02172
14552	MICROSEMI CORP	2830 S FAIRVIEW ST	SANTA ANA CA 92704-5948
17856	SILICONIX INC	2201 LAURELWOOD RD	SANTA CLARA CA 95054-1516
18796	MURATA ERIE NORTH AMERICAN INC STATE COLLEGE OPERATIONS	1900 W COLLEGE AVE	STATE COLLEGE PA 16801-2723
19701	PHILIPS COMPONENTS DISCRETE PRODUCTS DIV RESISTIVE PRODUCTS FACILITY AIRPORT ROAD	PO BOX 760	MINERAL WELLS TX 76067-0760
20462	PREM MAGNETICS INC	3521 N CHAPEL HILL ROAD	MCHENRY, IL 60050
20932	KYOCERA INTERNATIONAL INC	11620 SORRENTO VALLEY RD PO BOX 81543 PLANT NO 1	SAN DIEGO CA 92121
22526	DU PONT E I DE NEMOURS AND CO INC DU PONT ELECTRONICS DEPT	515 FISHING CREEK RD	NEW CUMBERLAND PA 17070-3007
22670	GM NAMEPLATE INCORPORATED	2040 15TH AVE WEST	SEATTLE, WA 981192783
24165	SPRAGUE ELECTRIC CO	267 LOWELL ROAD	HUDSON NH 03051
24546	DALE ELECTRONICS INC	550 HIGH ST	BRADFORD, PA 16701
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
26769	PHILIPS COMPONENTS	CHIP TANTALUM FACILITY 5900 AUSTRALIAN AVE	WEST PALM BEACH, FL 33407-2330
27014	NATIONAL SEMICONDUCTOR CORP	2900 SEMICONDUCTOR DR	SANTA CLARA CA 95051-0606
27264	MOLEX INC	2222 WELLINGTON COURT	LISLE IL 60532-1613
2K262	BOYD CORPORATION	6136 NE 87TH AVENUE	PORTLAND, OR 97220
30983	MEPCOPAL	11468 SORRENTO VALLEY ROAD	SAN DIEGO CA 92121

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
31918	ITT CANNON SWITCH PRODUCTS	8081 WALLACE RD	EDEN PRAIRIE, MN 55344–8798
32997	BOURNS INC TRIMPOT DIV	1200 COLUMBIA AVE	RIVERSIDE CA 92507–2114
34371	HARRIS CORP HARRIS SEMICONDUCTOR PRODUCTS GROUP	200 PALM BAY BLVD PO BOX 883	MELBOURNE FL 32919
4T165	NEC ELECTRONICS USA INC ELECTRON DIV	401 ELLIS ST PO BOX 7241	MOUNTAIN VIEW CA 94039
50139	ALLEN–BRADLEY CO ELECTRONIC COMPONENTS	1414 ALLEN BRADLEY DR	EL PASO TX 79936
50434	HEWLETT–PACKARD CO OPTOELECTRONICS DIV	370 W TRIMBLE RD	SAN JOSE CA 95131
52769	SPRAGUE–GOODMAN ELECTRONICS INC	134 FULTON AVE	GARDEN CITY PARK NY 11040–5352
53387	MINNESOTA MINING MFG CO	PO BOX 2963	AUSTIN TX 78769–2963
54583	TDK ELECTRONICS CORP	12 HARBOR PARK DR	PORT WASHINGTON NY 11550
54937	DEYOUNG MFG INC	12920 NE 125TH WAY	KIRKLAND, WA 98034
55335	JKL COMPONENTS CORP	13343 PAXTON STREET	PACOIMA CA 91331
55680	NICHICON /AMERICA/ CORP	927 E STATE PKY	SCHAUMBURG IL 60195–4526
56845	DALE ELECTRONICS INC	2300 RIVERSIDE BLVD PO BOX 74	NORFOLK NE 68701–2242
57668	ROHM CORP	8 WHATNEY PO BOX 19515	IRVINE CA 92713
60386	SQUIRES ELECTRONICS	503 N 13TH AVE	CORNELIUS, OR 97113
61429	FOX ELECTRONICS FOX ENTERPRISES INC	PO BOX 1078	CAPE CORAL FL 33910–1078
62643	UNITED CHEMICON INC	9801 W HIGGINS ST SUITE 430	ROSEMONT, IL 60018–4771
62703	MICRO QUALITY SEMICONDUCTOR	1000 N SHILOH RD PO BOX 6676	GARLAND, TX 75040
65654	CHRISTIANA INDUSTRIES CORP	6500 N CLARK ST	CHICAGO IL 62606–4002
75498	MULTICOMP INC	3005 SW 154TH TERRACE SUITE #3	BEAVERTON, OR 97005
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077–0001
84411	AMERICAN SHIZUKI CORP OGALLALA OPERATIONS	301 WEST O ST	OGALLALA NE 69153–1844
91637	DALE ELECTRONICS INC	2064 12TH AVE PO BOX 609	COLUMBUS NE 68601–3632

Replaceable Electrical Parts List

Replaceable Electrical Parts List

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscnt			
A1				CIRCUIT BD ASSY:ANALOG		
A2				CIRCUIT BD ASSY:DISPLAY CONTROL		
A3				CIRCUIT BD ASSY:DISPLAY DRIVER		
A4				CIRCUIT BD ASSY:FRONT PANEL		
A5				CIRCUIT BD ASSY:CPU		
A9				FLEX CIRCUIT:BEZEL		
A62				CIRCUIT BD ASSY:FRONT PANEL MODULE		
A63				POWER SUPPLY		
A64				ELECTRON TUBE:CRT		

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A1	671-2219-09			CIRCUIT BD ASSY:ANALOG	80009	671221909
A1AT401	165-2500-03			MICROCKT,HYBRID:ATTENUATOR/PREAMP	80009	165250003
A1AT402	165-2500-03			MICROCKT,HYBRID:ATTENUATOR/PREAMP	80009	165250003
A1C402	285-1471-00			CAP,FXD,PLASTIC:METALIZED FILM;0.01 MFD,10%	84411	TEK-385
A1C403	285-1472-00			CAP,FXD,PLASTIC:METALIZED FILM;10 MFD,10%	84411	TEK-385
A1C404	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C405	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C406	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C407	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C408	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C409	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C410	281-0936-00			CAP,FXD,CERAMIC:MLC;39PF,5%,100V	04222	SA102A390JAA
A1C411	285-1473-00			CAP,FXD,PLASTIC:METALIZED FILM;0.1 MFD,10%	84411	TEK-385
A1C412	281-0788-00			CAP,FXD,CERAMIC:MLC;470PF,10%,100V	04222	SA102C471KAA
A1C413	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C415	281-0788-00			CAP,FXD,CERAMIC:MLC;470PF,10%,100V	04222	SA102C471KAA
A1C416	281-0788-00			CAP,FXD,CERAMIC:MLC;470PF,10%,100V	04222	SA102C471KAA
A1C417	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C418	281-0938-00			CAP,FXD,CER DI:20PF,2%,500V	04222	MA107A200GAA
A1C419	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C420	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C421	281-0776-00			CAP,FXD,CERAMIC:MLC;120PF,5%,100V	04222	SA102A121JAA
A1C424	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C426	290-0944-01			CAP,FXD,ELCTLT:220UF,20%,10V	0H1N5	CEBSM1C221M-T4
A1C427	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A1C429	290-0944-01			CAP,FXD,ELCTLT:220UF,20%,10V	0H1N5	CEBSM1C221M-T4
A1C430	283-0177-00			CAP,FXD,CER DI:1UF,+80-20%,25V	04222	SR303E105ZAA
A1C431	290-0944-01			CAP,FXD,ELCTLT:220UF,20%,10V	0H1N5	CEBSM1C221M-T4
A1C432	290-0944-01			CAP,FXD,ELCTLT:220UF,20%,10V	0H1N5	CEBSM1C221M-T4
A1C435	281-0788-00			CAP,FXD,CERAMIC:MLC;470PF,10%,100V	04222	SA102C471KAA
A1C436	281-0788-00			CAP,FXD,CERAMIC:MLC;470PF,10%,100V	04222	SA102C471KAA
A1C437	290-1198-00			CAP,FXD,ELCTLT:100UF,20%,10VAC	55680	UET1A101MPH
A1C438	283-0177-05			CAP,FXD,CER DI:1UF,+80-20%,25V SQUARE,MI	04222	SR303E105ZAAAP1
A1CR401	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A1J10	131-3731-00			CONN,RF JACK:BNC,;50 OHM,FEMALE,ST	24931	28JR377-1
A1J11	131-3731-00			CONN,RF JACK:BNC,;50 OHM,FEMALE,STR	24931	28JR377-1
A1J20	131-3731-00			CONN,RF JACK:BNC,;50 OHM,FEMALE,STR	24931	28JR377-1
A1J50	131-5346-00			CONN,HDR:PCB,;MALE,STR,2 X 20,0.1 CTR	00779	104338-8
A1J66	131-5419-00			CONN,HDR:PCB,;MALE,STR,1 X 2,0.1 CTR	00779	644486-2
A1J67	131-5347-00			CONN,HDR:PCB,;MALE,RTANG,1 X 23,0.1 CTR	00779	2-103673-2
A1J68	131-5419-00			CONN,HDR:PCB,;MALE,STR,1 X 2,0.1 CTR	00779	644486-2
A1K401	148-0249-00			RELAY,ARM:2 FORM C,COIL 5VDC,178 OHM	4T165	EA2-5NU
A1L401	108-1319-00			INDUCTOR,FIXED:33UH,10%,1.8A	54583	TSL1110-330K 1R

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A1L402	108-1319-00			INDUCTOR, FIXED:33UH, 10%, 1.8A	54583	TSL1110-330K 1R
A1L403	108-1352-00			COIL, RF: FIXED, 22UH, 10%	54583	SPT0305-220K
A1L404	108-1352-00			COIL, RF: FIXED, 22UH, 10%	54583	SPT0305-220K
A1L405	108-1319-00			INDUCTOR, FIXED:33UH, 10%, 1.8A	54583	TSL1110-330K 1R
A1L406	108-1319-00			INDUCTOR, FIXED:33UH, 10%, 1.8A	54583	TSL1110-330K 1R
A1Q401	151-0830-00			TRANSISTOR, SIG: BIPOLAR, NPN; 15V, 50MA, 600MHZ	27014	4392/X43153A
A1Q402	151-0830-00			TRANSISTOR, SIG: BIPOLAR, NPN; 15V, 50MA, 600MHZ	27014	4392/X43153A
A1Q403	151-0830-00			TRANSISTOR, SIG: BIPOLAR, NPN; 15V, 50MA, 600MHZ	27014	4392/X43153A
A1Q404	151-1042-00			TRANSISTOR, SIG: JFET, N-CH; 6V, 10-15MA	04713	SPF627M2
A1Q405	151-1042-00			TRANSISTOR, SIG: JFET, N-CH; 6V, 10-15MA	04713	SPF627M2
A1Q406	151-1042-00			TRANSISTOR, SIG: JFET, N-CH; 6V, 10-15MA	04713	SPF627M2
A1Q407	151-0190-00			TRANSISTOR, SIG: BIPOLAR, NPN; 40V, 200MA	04713	2N3904
A1Q408	151-0190-00			TRANSISTOR, SIG: BIPOLAR, NPN; 40V, 200MA	04713	2N3904
A1R401	313-1390-00			RES, FXD, FILM: 39 OHM, 5%, 0.2W	91637	CCF50-2-39R00J
A1R402	313-1103-00			RES, FXD, FILM: 10K OHM, 5%, 0.2W	91637	CCF50-2-10001J
A1R403	313-1103-00			RES, FXD, FILM: 10K OHM, 5%, 0.2W	91637	CCF50-2-10001J
A1R404	313-1103-00			RES, FXD, FILM: 10K OHM, 5%, 0.2W	91637	CCF50-2-10001J
A1R405	322-3446-00			RES, FXD, FILM: 432K OHM, 1%, 0.2W	91637	CCF50-2F43202F
A1R406	322-3446-00			RES, FXD, FILM: 432K OHM, 1%, 0.2W	91637	CCF50-2F43202F
A1R407	322-3398-00			RES, FXD, FILM: 137K OHM, 1%, 0.2W	91637	CCF501G13702FT
A1R408	322-3260-00			RES, FXD, FILM: 4.99K OHM, 1%, 0.2W	91637	CCF501G49900F
A1R409	322-3030-00			RES, FXD: METAL FILM; 20 OHM, 1%, 0.2W	91637	CCF50G20R00F
A1R410	322-3177-00			RES, FXD: METAL FILM; 681 OHM, 1%, 0.2W	91637	CCF50-2G681R0F
A1R411	322-3083-00			RES, FXD, FILM: 71.5 OHM, 1%, 0.2W	91637	CCF501G71R50F
A1R412	322-3177-00			RES, FXD: METAL FILM; 681 OHM, 1%, 0.2W	91637	CCF50-2G681R0F
A1R413	313-1103-00			RES, FXD, FILM: 10K OHM, 5%, 0.2W	91637	CCF50-2-10001J
A1R414	322-3177-00			RES, FXD: METAL FILM; 681 OHM, 1%, 0.2W	91637	CCF50-2G681R0F
A1R415	313-1102-00			RES, FXD, FILM: 1K OHM, 5%, 0.2W	91637	CCF50-2-10000J
A1R417	313-1102-00			RES, FXD, FILM: 1K OHM, 5%, 0.2W	91637	CCF50-2-10000J
A1R418	313-1102-00			RES, FXD, FILM: 1K OHM, 5%, 0.2W	91637	CCF50-2-10000J
A1R419	313-1390-00			RES, FXD, FILM: 39 OHM, 5%, 0.2W	91637	CCF50-2-39R00J
A1R420	313-1102-00			RES, FXD, FILM: 1K OHM, 5%, 0.2W	91637	CCF50-2-10000J
A1R421	313-1015-00			RES, FXD, FILM: 1.5 OHM, 5%, 0.2W	57668	TR20JT6801E5
A1R425	313-1101-00			RES, FXD, FILM: 100 OHM, 5%, 0.2W	91637	CCF50-2-100R0J
A1R426	313-1082-00			RES, FXD, FILM: 8.2 OHM, 5%, 0.2W	91637	CCF50-2-8R200J;
A1R427	313-1102-00			RES, FXD, FILM: 1K OHM, 5%, 0.2W	91637	CCF50-2-10000J
A1R428	313-1683-00			RES, FXD, FILM: 68K OHM, 5%, 0.2W	91637	CCF50-2-68001J
A1R429	322-3260-00			RES, FXD, FILM: 4.99K OHM, 1%, 0.2W	91637	CCF501G49900F
A1U403	156-0355-00			IC, LINEAR: 7- TRANSISTOR, COMMON EMITTER	34371	CA3081
A1U404	156-0355-00			IC, LINEAR: 7- TRANSISTOR, COMMON EMITTER	34371	CA3081
A1U405	165-2446-03			MICROCKT, HYBRID: ANALOG/TRIGGER/SWEEP	80009	165244603
A1U406	156-2605-00			IC, MISC: HCMOS, ANALOG MUX; 8 CHAN, 125 OHM	04713	MC74HC4051N/J
A1U407	156-1631-01			IC, LINEAR: BIPOLAR, VOLT REG; ADJ, 100MA, 2.2%	01295	TL431CLPM
A1W401	131-0566-00			BUS, CONDUCTOR: DUMMY RES, 0.094 OD X 0.225L	24546	OMA0207

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A1W406	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207
A1W429	196-3064-00			LEAD,ELECTRICAL:26 AWG,4.0 L,1-N	80009	196306400

Replaceable Electrical Parts List

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A2	671-2222-01			CIRCUIT BD ASSY:DISPLAY CONTROL	80009	671222201
A2C1	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A2DS1	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE	55335	73
A2DS3	150-0168-00			LAMP,INCAND:14V,0.08A,WEDGE BASE	55335	73
A2J80	131-5156-00			CONN,HDR:PCB,;MALE,STR,1 X 2,0.1 CTR	00779	103669-1
A2J82	131-0608-00			TERMINAL,PIN:PRESSFIT/PCB,;MALE,STR (QTY 2)	22526	48283-018
A2J84	131-5157-00			CONN,HDR:PCB,;MALE,STR,1 X 5,0.1 CTR	00779	103669-4
A2Q1	151-0736-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,600MA	0JR04	2N4401
A2Q3	151-0736-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,600MA	0JR04	2N4401
A2R1	313-1051-00			RES,FXD,FILM:5.1 OHM,5%,0.2W	91637	CT3-5R100J
A2R3	313-1051-00			RES,FXD,FILM:5.1 OHM,5%,0.2W	91637	CT3-5R100J
A2R4	311-2501-00			RES,VAR,TRMR:CERMET;2K OHM,20%,0.5W	32997	3386P-FE7-202
A2R5	311-2344-00			RES,VAR,NONWW:CKT BD,4.7K OHM,20%,1.25W	30983	P2322-510-90062
A2R6	311-2344-00			RES,VAR,NONWW:CKT BD,4.7K OHM,20%,1.25W	30983	P2322-510-90062
A2R7	311-1500-00			RES,VAR,NONWW:PNL,5K OHM,0.5W	12697	W-8097
A2R8	311-2344-00			RES,VAR,NONWW:CKT BD,4.7K OHM,20%,1.25W	30983	P2322-510-90062
A2R9	311-2344-00			RES,VAR,NONWW:CKT BD,4.7K OHM,20%,1.25W	30983	P2322-510-90062
A2X1	352-1008-00			HOLDER,LAMP:PRESS-IN MOUNT,RIGHT ANGLE	65654	CIC 6500L
A2X3	352-1008-00			HOLDER,LAMP:PRESS-IN MOUNT,RIGHT ANGLE	65654	CIC 6500L

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A3	671-2904-02			CIRCUIT BD ASSY:DISPLAY DRIVER	80009	671290402
A3C102	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C104	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C105	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C106	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C107	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305C474MAA
A3C108	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C109	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	04222	SA102A270MAA
A3C110	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	04222	SA102A270MAA
A3C111	283-0331-00			CAP,FXD,CER DI:43PF,2%,100V	18796	DD106B10NP0430J
A3C113	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C116	283-0331-00			CAP,FXD,CER DI:43PF,2%,100V	18796	DD106B10NP0430J
A3C117	283-0339-00			CAP,FXD,CER DI:0.22UF,10%,50V	04222	SR305C224KAA
A3C118	283-0108-02			CAP,FXD,CER DI:220PF,10%,200V	04222	SR075A221KAAAP1
A3C119	283-0108-02			CAP,FXD,CER DI:220PF,10%,200V	04222	SR075A221KAAAP1
A3C121	281-0306-00			CAP,VAR,CER DI:3.3-20PF	52769	GKU 18000
A3C122	281-0306-00			CAP,VAR,CER DI:3.3-20PF	52769	GKU 18000
A3C123	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C124	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C125	281-0759-00			CAP,FXD,CERAMIC:MLC;22PF,10%,100V	04222	SA102A220KAA
A3C126	281-0759-00			CAP,FXD,CERAMIC:MLC;22PF,10%,100V	04222	SA102A220KAA
A3C128	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C130	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C201	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C203	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C204	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C205	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C207	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C210	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V,0.100 X	04222	SA105C223MAA
A3C211	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C214	281-0765-00			CAP,FXD,CER DI:100PF,5%,100V	04222	SA102A101JAA
A3C216	281-0537-00			CAP,FXD,CER DI:0.68PF,20%,600V	54583	DA12COG2HR68M
A3C217	281-0537-00			CAP,FXD,CER DI:0.68PF,20%,600V	54583	DA12COG2HR68M
A3C218	281-0064-00			CAP,VAR,PLASTIC:0.25-1.5PF,600V	80009	281006400
A3C219	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C221	283-0341-01			CAP,FXD,CER DI:0.047UF,10%,100V	04222	SR301C473KAAAP1
A3C222	281-0810-00			CAP,FXD,CERAMIC:MLC;5.6PF,+/-0.5PF,100V	04222	SA102A5R6DAA
A3C223	281-0537-00			CAP,FXD,CER DI:0.68PF,20%,600V	54583	DA12COG2HR68M
A3C301	281-0771-00			CAP,FXD,CER DI:2200PF,20%,200V	04222	SA102C222MAA
A3C302	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C303	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C304	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C305	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C306	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V,5MM LEAD SPAC	TK1913	MKS 2 0.1/250/2
A3C308	281-0762-00			CAP,FXD,CER DI:27PF,20%,100V	04222	SA102A270MAA
A3C309	281-0903-00			CAP,FXD,CER DI:3.9PF,100V	04222	SA102A3R9DAA
A3C310	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V	TK1913	MKS 2 0.1/250/2

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A3C311	285-1184-00			CAP,FXD,MTLZD:0.01 UF,20%,4000V	24165	430P591
A3C312	285-1040-00			CAP,FXD,PLASTIC:1200PF,10%,4000V	84411	TEK-134-122940
A3C313	281-0771-00			CAP,FXD,CER DI:2200PF,20%,200V	04222	SA102C222MAA
A3C314	283-0279-00			CAP,FXD,CER DI:0.001UF,20%,3000V	18796	DHR12Y5S102M3KV
A3C315	285-1184-00			CAP,FXD,MTLZD:0.01 UF,20%,4000V	24165	430P591
A3C316	285-1040-00			CAP,FXD,PLASTIC:1200PF,10%,4000V	84411	TEK-134-122940
A3C317	281-0903-00			CAP,FXD,CER DI:3.9PF,100V	04222	SA102A3R9DAA
A3C319	281-0909-00			CAP,FXD,CERAMIC:MLC;0.022UF,20%,50V	04222	SA105C223MAA
A3C320	290-0776-01			CAP,FXD,ELCTLT:22UF,20%,10WVDC	55680	UVX1A220MAA1TD
A3C321	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V	TK1913	MKS 2 0.1/250/2
A3C322	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305C474MAA
A3C323	283-0203-00			CAP,FXD,CER DI:0.47UF,20%,50V	04222	SR305C474MAA
A3CR100	152-0066-00			DIODE,RECT.,400V,1A	05828	GP10G-020
A3CR101	152-0066-00			DIODE,RECT.,400V,1A	05828	GP10G-020
A3CR102	152-0066-00			DIODE,RECT.,400V,1A	05828	GP10G-020
A3CR201	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR202	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR301	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR302	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	14552	MB2501
A3CR303	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	14552	MB2501
A3CR304	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	14552	MB2501
A3CR305	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR306	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	14552	MB2501
A3CR307	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3CR308	152-0141-02			DIODE,SIG:,ULTRA FAST;40V,150MA,4NS,2PF	27014	FDH9427
A3DS301	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	TK0213	JH005/3011JA
A3DS302	150-0035-00			LAMP,GLOW:90V MAX,0.3MA,AID-T,WIRE LD	TK0213	JH005/3011JA
A3J69	131-5419-00			CONN,HDR:PCB,;MALE,STR,1 X 2,0.1 CT	00779	644486-2
A3J70	131-5349-00			CONN,HDR:PCB,;MALE,RTANG,1 X 13,0.156 CTR	00779	1-640387-3
A3J71	131-5350-00			CONN,HDR PWR:PCB;MALE,RTANG,1 X 2	00779	640387-2
A3J72	131-0589-00			TERMINAL,PIN:PRESSFIT/PCB,;MALE,STR (QTY 4)	22526	48283-087
A3J73	131-0589-00			TERMINAL,PIN:PRESSFIT/PCB,;MALE,STR (QTY 5)	22526	48283-087
A3J74	131-0589-00			TERMINAL,PIN:PRESSFIT/PCB,;MALE,STR (QTY 3)	22526	48283-087
A3J75	131-0589-00			TERMINAL,PIN:PRESSFIT/PCB,;MALE,STR (QTY 3)	22526	48283-087
A3J80	131-5348-00			CONN,HDR:PCB,;MALE,RTANG,1 X 2,0.1 CTR	00779	103672-1
A3L101	120-1906-00			TRANSFORMER,RF:COIL,RF,TAPPED INDUCTOR	0JR03	120-1906-00
A3L102	120-1906-00			TRANSFORMER,RF:COIL,RF,TAPPED INDUCTOR	0JR03	120-1906-00
A3L103	108-1352-00			COIL,RF:FIXED,22UH,10%	54583	SPT0305-220K
A3L104	108-0408-01			COIL,RF:FIXED,91NH ON FORM	0JR03	108-0408-01
A3L105	108-0170-02			COIL,RF:FIXED,360NH	0JR03	108-0170-02
A3L106	108-0736-01			COIL,RF:FIXED,828NH	0JR03	108-0736-01

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A3L107	108-0736-01			COIL,RF:FIXED,828NH	0JR03	108-0736-01
A3L108	108-0170-02			COIL,RF:FIXED,360NH	0JR03	108-0170-02
A3L109	108-0436-00			COIL,RF:FIXED,240UH ON FORM	0JR03	OBD
A3L110	108-0408-01			COIL,RF:FIXED,91NH	0JR03	108-0408-01
A3L111	108-1352-00			COIL,RF:FIXED,22UH,10%	54583	SPT0305-220K
A3L112	108-1352-00			COIL,RF:FIXED,22UH,10%	54583	SPT0305-220K
A3L113	108-1352-00			COIL,RF:FIXED,22UH,10%	54583	SPT0305-220K
A3L300	108-1352-00			COIL,RF:FIXED,22UH,10%	54583	SPT0305-220K
A3Q101	151-0411-00			TRANSISTOR,SIG:BIPOLAR,NPN;30V,400MA,1.2GHZ	04713	2N5943
A3Q102	151-0411-00			TRANSISTOR,SIG:BIPOLAR,NPN;30V,400MA,1.2GHZ	04713	2N5943
A3Q201	151-0711-02			TRANSISTOR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ	04713	MPSH10RLRP
A3Q202	151-0711-02			TRANSISTOR,SIG:BIPOLAR,NPN;25V,50MA,650MHZ	04713	MPSH10RLRP
A3Q204	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA	04713	2N3904
A3Q205	151-0347-00			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA	0JR04	2N5551
A3Q206	151-0347-00			TRANSISTOR,SIG:BIPOLAR,NPN;160V,600MA	0JR04	2N5551
A3Q208	151-0350-03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA	27014	S44295
A3Q209	151-0350-03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA	27014	S44295
A3Q210	151-0271-00			TRANSISTOR,SIG:BIPOLAR,PNP;15V,30MA,2.0GHZ	04713	MPSH69
A3Q211	151-0271-00			TRANSISTOR,SIG:BIPOLAR,PNP;15V,30MA,2.0GHZ	04713	MPSH69
A3Q212	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200M	04713	2N3904
A3Q301	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA	04713	2N3906
A3Q302	151-0188-00			TRANSISTOR,SIG:BIPOLAR,PNP;40V,200MA	04713	2N3906
A3Q303	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA	04713	2N3904
A3Q304	151-0190-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA	04713	2N3904
A3Q307	151-0199-00			TRANSISTOR,SIG:BIPOLAR,PNP;12V,80MA,SWITCH	04713	MPS3640
A3Q308	151-0350-03			TRANSISTOR,SIG:BIPOLAR,PNP;150V,600MA	27014	S44295
A3Q360	151-0749-00			TRANSISTOR,SIG:BIPOLAR,PNP;400V,500MA	04713	MPSA94
A3Q361	151-0749-00			TRANSISTOR,SIG:BIPOLAR,PNP;400V,500MA	04713	MPSA94
A3R101	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W	91637	CCF501G10R00F
A3R102	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W	91637	CCF501G10R00F
A3R103	313-1202-00			RES,FXD,FILM:2K OHM,5%,0.2W	91637	CCF50-2-20000J
A3R104	322-3217-00			RES,FXD,FILM:1.78K OHM,1%,0.2W	91637	CCF501G17800F
A3R105	313-1102-00			RES,FXD,FILM:1K OHM,5%,0.2W	91637	CCF50-2-10000J
A3R106	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R107	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R108	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	91637	CCF50-2-47R00J
A3R109	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	91637	CCF50-2-47R00J
A3R111	311-2234-00			RES,VAR,TRMR:CERMET;5K OHM,20%,0.5W	TK2073	GF06UT2 502 M L
A3R112	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W	TK2073	GF06UT2 501 M L
A3R113	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R114	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R115	313-1202-00			RES,FXD,FILM:2K OHM,5%,0.2W	91637	CCF50-2-20000J
A3R116	313-1103-00			RES,FXD,FILM:10K OHM,5%,0.2W	91637	CCF50-2-10001J
A3R117	313-1103-00			RES,FXD,FILM:10K OHM,5%,0.2W	91637	CCF50-2-10001J
A3R120	313-1103-00			RES,FXD,FILM:10K OHM,5%,0.2W	91637	CCF50-2-10001J
A3R121	313-1103-00			RES,FXD,FILM:10K OHM,5%,0.2W	91637	CCF50-2-10001J

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A3R122	307-1606-00			RES,FXD FILM:METAL,FILM,221 OHM,1%	56845	CPF-3-F2210F-T/
A3R123	307-1606-00			RES,FXD FILM:METAL,FILM,221 OHM,1%	56845	CPF-3-F2210F-T/
A3R124	308-0075-00			RES,FXD,WW:100 OHM,5%,3W	91637	CW2B-100R0J-T/R
A3R125	322-3068-00			RES,FXD:METAL FILM;49.9 OHM,1%,0.2W	91637	CCF501G49R90F
A3R126	313-1015-00			RES,FXD,FILM:1.5 OHM,5%,0.2W	57668	TR20JT6801E5
A3R127	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W	91637	CCF501G100R0F
A3R128	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R129	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W	91637	CCF501G10R00F
A3R130	322-3068-00			RES,FXD:METAL FILM;49.9 OHM,1%,0.2W	91637	CCF501G49R90F
A3R131	313-1015-00			RES,FXD,FILM:1.5 OHM,5%,0.2W	57668	TR20JT6801E5
A3R132	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W	91637	CCF501G100R0F
A3R133	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R134	322-3062-00			RES,FXD,FILM:43.2 OHM,1%,0.2W	57668	RB20FXE43E2
A3R135	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W	91637	CCF501G10R00F
A3R138	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R139	322-3039-00			RES,FXD,FILM:24.9 OHM,1%,0.2W	91637	CCF50-2-G24R90F
A3R140	311-2230-00			RES,VAR,TRMR:CERMET;500 OHM,20%,0.5W	TK2073	GF06UT2 501 M L
A3R141	311-2231-00			RES,VAR,TRMR:CERMET;1K OHM,20%,0.5W	TK2073	GF06UT2 102 M L
A3R142	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R144	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W	91637	CCF501G10R00F
A3R145	322-3001-00			RES,FXD:METAL FILM;10 OHM,1%,0.2W	91637	CCF501G10R00F
A3R147	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R148	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R149	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R150	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R151	322-3226-00			RES,FXD:METAL FILM;2.21K OHM,1%,0.2W	91637	CCF501G22100F
A3R152	313-1202-00			RES,FXD,FILM:2K OHM,5%,0.2W	91637	CCF50-2-20000J
A3R153	322-3039-00			RES,FXD,FILM:24.9 OHM,1%,0.2W	91637	CCF50-2-G24R90F
A3R154	311-2231-00			RES,VAR,TRMR:CERMET;1K OHM,20%,0.5W	TK2073	GF06UT2 102 M L
A3R155	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R156	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R157	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R201	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W	91637	CCF50G15002F
A3R202	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W	91637	CCF50G15002F
A3R205	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	91637	CCF50-2-68000J
A3R206	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	91637	CCF50-2-68000J
A3R207	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	91637	CCF50-2-47R00J
A3R210	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	91637	CCF50-2-510ROJ
A3R211	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	91637	CCF50-2-510ROJ
A3R212	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	91637	CCF50-2-10R00J
A3R213	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	91637	CCF50-2-10R00J
A3R214	313-1470-00			RES,FXD,FILM:47 OHM,5%,0.2W	91637	CCF50-2-47R00J
A3R215	313-1272-00			RES,FXD,FILM:2.7K OHM,5%,0.2W	91637	CCF50-2-27000J
A3R216	313-1272-00			RES,FXD,FILM:2.7K OHM,5%,0.2W	91637	CCF50-2-27000J
A3R217	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R218	322-3158-00			RES,FXD,FILM:432 OHM,1%,0.2W	57668	CRB2D FXE 432
A3R219	322-3287-00			RES,FXD,FILM:9.53K OHM,1%,0.2W	91637	CCF50G95300F
A3R220	322-3371-00			RES,FXD,FILM:71.5K OHM,1%,0.2W	91637	CCF50G71501F

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A3R221	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R222	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W	91637	CCF501G100R0F
A3R223	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W	91637	CCF501G100R0F
A3R224	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R225	322-3485-00			RES,FXD,FILM:5.0K OHM,1%,0.2W	91637	CCF501G50000F
A3R226	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R227	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R228	322-3485-00			RES,FXD,FILM:5.0K OHM,1%,0.2W	91637	CCF501G50000F
A3R229	313-1511-00			RES,FXD,FILM:510 OHM,5%,0.2W	91637	CCF50-2-510ROJ
A3R230	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R231	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R232	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R233	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R234	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R235	322-3485-00			RES,FXD,FILM:5.0K OHM,1%,0.2W	91637	CCF501G50000F
A3R236	322-3485-00			RES,FXD,FILM:5.0K OHM,1%,0.2W	91637	CCF501G50000F
A3R237	322-3485-00			RES,FXD,FILM:5.0K OHM,1%,0.2W	91637	CCF501G50000F
A3R238	322-3485-00			RES,FXD,FILM:5.0K OHM,1%,0.2W	91637	CCF501G50000F
A3R239	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R240	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R241	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R242	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R244	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R245	322-3243-00			RES,FXD:METAL FILM;3.32K OHM,1%,0.2W	91637	CCF50-1-G33200F
A3R246	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R255	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R256	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	91637	CCF50-2-68000J
A3R257	313-1333-00			RES,FXD,FILM:33K OHM,5%,0.2W	91637	CCF50-2-33001J
A3R258	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R259	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R260	315-0475-00			RES,FXD,FILM:4.7M OHM,5%,0.25W	TK1727	SFR25 2322-181-
A3R301	313-1681-00			RES,FXD,FILM:680 OHM,5%,0.2W	91637	CCF50-2-680ROJ
A3R303	315-0201-02			RES,FXD,CMPSN:200 OHM,5%,0.25W	50139	CB2015
A3R304	313-1203-00			RES,FXD,FILM:20K OHM,5%,0.2W	91637	CCF50-2-20001J
A3R305	315-0511-02			RES,FXD,CMPSN:510 OHM,.25W,5%	50139	CB5115 ALLEN BR
A3R306	313-1243-00			RES,FXD,FILM:24K OHM,5%,0.2W	91637	R20J24K
A3R307	315-0511-02			RES,FXD,CMPSN:510 OHM,.25W,5%	50139	CB5115 ALLEN BR
A3R308	313-1333-00			RES,FXD,FILM:33K OHM,5%,0.2W	91637	CCF50-2-33001J
A3R309	313-1104-00			RES,FXD,FILM:100K OHM,5%,0.2W	91637	CCF50-2-10002J
A3R310	313-1102-00			RES,FXD,FILM:1K OHM,5%,0.2W	91637	CCF50-2-10000J
A3R311	313-1102-00			RES,FXD,FILM:1K OHM,5%,0.2W	91637	CCF50-2-10000J
A3R312	313-1223-00			RES,FXD,FILM:22K,OHM,5%,0.2W	91637	CCF50-2-22001J
A3R313	313-1223-00			RES,FXD,FILM:22K,OHM,5%,0.2W	91637	CCF50-2-22001J
A3R314	313-1203-00			RES,FXD,FILM:20K OHM,5%,0.2W	91637	CCF50-2-20001J
A3R315	313-1203-00			RES,FXD,FILM:20K OHM,5%,0.2W	91637	CCF50-2-20001J
A3R316	322-3085-00			RES,FXD:METAL FILM;75 OHM,1%,0.2W	91637	CCF501G75R00F
A3R317	322-3402-00			RES,FXD:METAL FILM;150K OHM,1%,0.2W	91637	CCF50G15002F
A3R318	313-1681-00			RES,FXD,FILM:680 OHM,5%,0.2W	91637	CCF50-2-680ROJ

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A3R321	311-2237-00			RES,VAR,TRMR:CERMET;25K OHM,20%,0.5W	TK2073	GF06UT2 253 M L
A3R322	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W	TK2073	GF06UT2 104 M L
A3R323	311-2239-00			RES,VAR,TRMR:CERMET;100K OHM,20%,0.5W	TK2073	GF06UT2 104 M L
A3R324	313-1682-00			RES,FXD,FILM:6.8K OHM,5%,0.2W	91637	CCF50-2-68000J
A3R325	315-0472-03			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	50139	CB4725
A3R326	315-0103-03			RES,FXD,CMPSN:10K OHM,5%,0.25W	50139	CB1035
A3R329	315-0625-00			RES,FXD,FILM:6.2M OHM,5%,0.25W	TK1727	SFR25 2322-181-
A3R330	313-1683-00			RES,FXD,FILM:68K OHM,5%,0.2W	91637	CCF50-2-6800IJ
A3R331	313-1823-00			RES,FXD,FILM:82K OHM,5%,0.2W	91637	CCF50-2-8200IJ
A3R332	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	91637	CCF50-2-39000J
A3R333	313-1392-00			RES,FXD,FILM:3.9K OHM,5%,0.2W	91637	CCF50-2-39000J
A3R350	322-3306-00			RES,FXD:METAL FILM;15K OHM,1%,0.2W	91637	CCF50-2-G1502F
A3R351	315-0201-02			RES,FXD,CMPSN:200 OHM,5%,0.25W	50139	CB2015
A3R352	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R353	313-1027-00			RES,FXD,FILM:2.7 OHM,5%,0.2W	91637	CT3-2R700J
A3R360	301-0754-01			RES,FXD,CMPSN:750K OHM,5%,0.5W	50139	EB7545
A3R361	301-0394-00			RES,FXD,FILM:390K OHM,5%,0.5W	19701	5053CX 390K0J
A3R362	301-0434-00			RES,FXD,FILM:430K OHM,5%,0.5W	19701	5053CX430K0J
A3R363	301-0434-00			RES,FXD,FILM:430K OHM,5%,0.5W	19701	5053CX430K0J
A3R364	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W	91637	CMF6042G10003F
A3R365	322-0481-00			RES,FXD,FILM:1M OHM,1%,0.25W	91637	CMF6042G10003F
A3R366	322-3322-00			RES,FXD:METAL FILM;22.1K OHM,1%,0.2W	91637	CCF501G22101F
A3R367	301-0434-00			RES,FXD,FILM:430K OHM,5%,0.5W	19701	5053CX430K0J
A3R368	321-0385-00			RES,FXD,FILM:100K OHM,1%,0.125W	19701	5043ED100K0F
A3R369	301-0434-00			RES,FXD,FILM:430K OHM,5%,0.5W	19701	5053CX430K0J
A3R370	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207
A3R371	322-3097-00			RES,FXD:METAL FILM;100 OHM,1%,0.2W	91637	CCF501G100R0F
A3U101	155-0322-00			MICROCKT,LINEAR:VERTICAL OUTPUT AMPLIFIER	80009	155032200
A3U102	156-0158-00			IC,LINEAR:BIPOLAR,OP-AMP;DUAL	01295	MC1458P
A3U201	156-0158-00			IC,LINEAR:BIPOLAR,OP-AMP;DUAL	01295	MC1458P
A3VR201	152-0055-00			DIODE,ZENER;;11V,5%,0.4W	04713	SZG35009K1 1N96
A3VR360	152-0470-00			DIODE,ZENER;;200V,5%,0.4W	04713	1N992BRL
A3VR361	152-0470-00			DIODE,ZENER;;200V,5%,0.4W	04713	1N992BRL
A3W66	174-2602-00			CA ASSY,SP:FLAT FLEX;;FLX,23,26 AWG,6.5 L	TK2469	174-2602-00
A3W100	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207
A3W300	131-0566-00			BUS,CONDUCTOR:DUMMY RES,0.094 OD X 0.225L	24546	OMA0207

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A4	671-2911-00			CIRCUIT BD ASSY:FRONT PANEL	80009	671291100
A4C101	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C121	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C122	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C131	290-5034-01			CAP,FXD,ALUM::;33UF,20%,10V,5.7MM(0.224)	1W344	MVK10VC33RME60T
A4C132	290-5034-01			CAP,FXD,ALUM::;33UF,20%,10V,5.7MM(0.224)	1W344	MVK10VC33RME60T
A4C140	283-5201-00			CAP,FXD,CERAMIC:MLC;33PF,5%,100V,NPO,1206	04222	12061A330JAT1A
A4C141	283-5201-00			CAP,FXD,CERAMIC:MLC;33PF,5%,100V,NPO,1206	04222	12061A330JAT1A
A4C202	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C304	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C305	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C400	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C401	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C402	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C403	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C404	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C405	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C406	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C407	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C408	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C409	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C420	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C421	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A4C501	283-5203-00			CAP,FXD,CERAMIC:MLC;1000PF,10%,100V,X7R	04222	12061C102KAT1A
A4CR331	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR332	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR333	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR334	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR335	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR336	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR337	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR338	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR339	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4CR500	152-5018-00			DIODE,SIG:,ULTRA FAST;100V,0.74VF,4NS,2.0PF	27014	MMBD1203-HIGH
A4DS201	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21
A4DS202	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21
A4DS203	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21
A4DS204	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21
A4DS205	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21
A4DS206	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21
A4DS207	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21
A4DS208	150-5008-00			DIODE,OPTO:,LED;GRN,569NM,4.2MCD AT 10MA	50434	HLMP-6505-T21

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A4J30	131-5344-00			CONN,HDR:PCB,;MALE,STR,1 X 16,0.1 CTR	00779	1-103670-5
A4J35	131-5167-00			CONN,BOX PWR:PCB,;FEMALE,STR,1 X Y	27264	09-52-3022
A4J40	131-5158-00			CONN,HDR:PCB,;MALE,STR,1 X 10,0.1 CTR	00779	103669-9
A4J84	131-5157-00			CONN,HDR:PCB,;MALE,STR,1 X 5,0.1 CTR	00779	103669-4
A4R101	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R102	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R103	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R104	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R106	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R107	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R108	321-5018-00			RES,FXD:THICK FILM;1.0K OHM,1%,0.125W	50139	BCK1001FT
A4R109	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R140	321-5049-00			RES,FXD:THICK FILM;1M OHM,1%,0.125W	57668	MCR18FXEA1M
A4R201	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R202	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R203	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R204	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R205	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R206	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R207	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R208	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R300	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R301	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R302	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R303	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R304	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R305	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R306	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R307	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R330	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R331	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R332	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R333	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R334	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R335	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R336	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R337	321-5014-00			RES,FXD:THICK FILM;475 OHM,1%,0.125W	50139	BCK4750FT
A4R411	321-5018-00			RES,FXD:THICK FILM;1.0K OHM,1%,0.125W	50139	BCK1001FT
A4R412	321-5018-00			RES,FXD:THICK FILM;1.0K OHM,1%,0.125W	50139	BCK1001FT
A4R413	321-5018-00			RES,FXD:THICK FILM;1.0K OHM,1%,0.125W	50139	BCK1001FT
A4R414	321-5018-00			RES,FXD:THICK FILM;1.0K OHM,1%,0.125W	50139	BCK1001FT
A4R450	311-2843-00			RES,VAR,NONWW:SHAFTLESS,SNAP IN MOUNT	32997	11508004
A4R451	311-2843-00			RES,VAR,NONWW:SHAFTLESS,SNAP IN MOUNT	32997	11508004
A4R452	311-2843-00			RES,VAR,NONWW:SHAFTLESS,SNAP IN MOUNT	32997	11508004
A4R453	311-2843-00			RES,VAR,NONWW:SHAFTLESS,SNAP IN MOUNT	32997	11508004
A4R460	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A4R461	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R462	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R463	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R464	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R465	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R466	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R467	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R468	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R469	321-5047-00			RES,FXD:THICK FILM;100K OHM,1%,0.125W	50139	BCK1003FT
A4R501	321-5018-00			RES,FXD:THICK FILM;1.0K OHM,1%,0.125W	50139	BCK1001FT
A4R503	321-5030-00			RES,FXD:THICK FILM;10.0K OHM,1%,0.125W	50139	BCK1002FT
A4R504	321-5027-00			RES,FXD:THICK FILM;5.62K OHM,1%,0.125W	50139	BCK5621FT
A4R505	321-5025-00			RES,FXD:THICK FILM;3.92K OHM,1%,0.125W	50139	BCK3921FT
A4U202	156-5458-00			IC,DIGITAL:HCMOS,LATCH;8-BIT ADDRESSABLE	04713	MC74HC259D
A4U304	156-6135-01			IC,DIGITAL:HCMOS,DEMUX/DECODER;3-TO-8	0JR04	TC74HC138AFN(EL
A4U305	156-6135-01			IC,DIGITAL:HCMOS,DEMUX/DECODER;3-TO-8	0JR04	TC74HC138AFN(EL
A4U420	156-5050-01			IC,MISC:HCMOS,ANALOG MUX;8-CHANNEL	1CH66	74HC4051DT
A4U421	156-5050-01			IC,MISC:HCMOS,ANALOG MUX;8-CHANNEL	1CH66	74HC4051DT
A4Y140	119-4061-00			RESONATOR,CERAM:2.4576MHZ,50VAC,0.5%	20932	KBR-2.45MS

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A5	671-2221-04			CIRCUIT BD ASSY:CPU	80009	671222104
A5C201	290-5034-01			CAP,FXD,ALUM::33UF,20%,10V,5.7MM(0.224)	1W344	MVK10VC33RME60T
A5C202	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C203	283-5195-00			CAP,FXD,CERAMIC:MLC;10PF,5%,100V ,COG,1206	04222	12061A100JAT1A
A5C204	283-5007-00			CAP,FXD,CERAMIC:MLC;8PF,+/-0.5PF,50V,NPO	04222	12061A8R0DATMA
A5C205	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C206	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C207	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C208	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C209	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C211	283-5195-00			CAP,FXD,CERAMIC:MLC;10PF,5%,100V ,COG,1206	04222	12061A100JAT1A
A5C212	283-5107-00			CAP,FXD,CERAMIC:MLC;22PF,5%,100V,NPO,1206	04222	12061A220JAT1A
A5C213	283-5107-00			CAP,FXD,CERAMIC:MLC;22PF,5%,100V,NPO,1206	04222	12061A220JAT1A
A5C214	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C215	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C216	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C217	283-5195-00			CAP,FXD,CERAMIC:MLC;10PF,5%,100V ,COG,1206	04222	12061A100JAT1A
A5C218	283-5195-00			CAP,FXD,CERAMIC:MLC;10PF,5%,100V ,COG,1206	04222	12061A100JAT1A
A5C219	283-5107-00			CAP,FXD,CERAMIC:MLC;22PF,5%,100V,NPO,1206	04222	12061A220JAT1A
A5C220	283-5107-00			CAP,FXD,CERAMIC:MLC;22PF,5%,100V,NPO,1206	04222	12061A220JAT1A
A5C221	283-5107-00			CAP,FXD,CERAMIC:MLC;22PF,5%,100V,NPO,1206	04222	12061A220JAT1A
A5C223	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C224	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5C225	283-5004-00			CAP,FXD,CERAMIC:MLC;0.1UF,10%,25V,X7R,1206	04222	12063C104KAT3A
A5J30	131-5344-00			CONN,HDR:PCB,;MALE,STR,1 X 16,0.1 CTR	00779	1-103670-5
A5J50	131-5346-00			CONN,HDR:PCB,;MALE,STR,2 X 20,0.1 CTR	00779	104338-8
A5J55	131-4807-00			CONN,HDR PWR:PCB,;MALE,STR,1 X 5,0.156 CTR	00779	640444-5
A5J204	131-3147-00			CONN,HDR:PCB,;MALE,STR,2 X 25,0.1 CTR	53387	2550-6002UB
A5J205	131-5203-00			CONN,HDR:PCB,;MALE,STR,1 X 2,0.1 CTR	00779	104350-1
A5Q1	151-5001-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA	04713	MMBT3904LT1
A5Q2	151-5001-00			TRANSISTOR,SIG:BIPOLAR,NPN;40V,200MA	04713	MMBT3904LT1

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A5R201	321-5208-00			RES,FXD:THICK FILM;10M OHM,5%,0.125W	91637	CRCW1206-106JT
A5R202	321-5048-00			RES,FXD:THICK FILM;332K OHM,1%,0.125W	57668	MCR18FXEA332K
A5R203	321-5212-00			RES,FXD,FILM:4.99K OHM,1%,0.125W100PPM/DEG	91637	CRCW-12064991F
A5R204	321-5212-00			RES,FXD,FILM:4.99K OHM,1%,0.125W100PPM/DEG	91637	CRCW-12064991F
A5R205	321-5212-00			RES,FXD,FILM:4.99K OHM,1%,0.125W100PPM/DEG	91637	CRCW-12064991F
A5R206	321-5212-00			RES,FXD,FILM:4.99K OHM,1%,0.125W100PPM/DEG	91637	CRCW-12064991F
A5R207	307-5020-00			RES NTWK,FXD,FI:10K X 8,1%,0.250W	91637	SOMC-1603-1002F
A5R208	307-5020-00			RES NTWK,FXD,FI:10K X 8,1%,0.250W	91637	SOMC-1603-1002F
A5R209	307-5020-00			RES NTWK,FXD,FI:10K X 8,1%,0.250W	91637	SOMC-1603-1002F
A5R210	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R211	321-5007-00			RES,FXD:THICK FILM;121 OHM,1%,0.125W	50139	BCK1210FT
A5R212	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R213	321-5007-00			RES,FXD:THICK FILM;121 OHM,1%,0.125W	50139	BCK1210FT
A5R214	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R217	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R220	321-5000-00			RES,FXD:THICK FILM;10 OHM,1%,0.125W	91637	CRCW120610R0FT
A5R221	321-5000-00			RES,FXD:THICK FILM;10 OHM,1%,0.125W	91637	CRCW120610R0FT
A5R222	321-5022-00			RES,FXD:THICK FILM;2.21K OHM,1%,0.125W	50139	BCK2211FT
A5R223	321-5212-00			RES,FXD,FILM:4.99K OHM,1%,0.125W100PPM/DEG	91637	CRCW-12064991F
A5R224	321-5007-00			RES,FXD:THICK FILM;121 OHM,1%,0.125W	50139	BCK1210FT
A5R225	321-5007-00			RES,FXD:THICK FILM;121 OHM,1%,0.125W	50139	BCK1210FT
A5R227	321-5029-00			RES,FXD:THICK FILM;8.25K OHM,1%,0.125W	50139	BCK8251FT
A5R228	321-5029-00			RES,FXD:THICK FILM;8.25K OHM,1%,0.125W	50139	BCK8251FT
A5R230	321-5051-00			RES,FXD:THICK FILM;0 OHM,1%,0.125W	09969	CRCW1206 JUMPER
A5R231	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R232	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R233	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R234	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R235	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R236	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R237	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT
A5R238	321-5010-00			RES,FXD:THICK FILM;221 OHM,1%,0.125W	50139	BCK221FT

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A5U201	156-6298-00			IC,PROCESSOR:CMOS,MICROCONTROLLER	04713	MC68331CFC16
A5U202	156-6151-00			IC,MEMORY:CMOS,SRAM;128K X 8,100NS,15UA	TK1146	M5M51008FP-10LL
A5U203	156-6151-00			IC,MEMORY:CMOS,SRAM;128K X 8,100NS,15UA	TK1146	M5M51008FP-10LL
A5U205	156-6085-01			IC,MEMORY:CMOS,EPROM;128K X 8,200NS FLASH	80009	156646101
A5U206	156-6085-01			IC,MEMORY:CMOS,EPROM;128K X 8,200NS FLASH	80009	156646101
A5U207	156-6101-01			IC,MISC:BIPOLAR,PWR SUPPLY SUPERVISOR	04713	MC34164D-5R2
A5U208	156-4224-00			IC,MEMORY:CMOS,NVRAM;8K X 8,100NS	0B0A9	DS1225D-100
A5U215	156-6031-00			IC,PROCESSOR:NMOS,PERIPHERAL	04713	MC68681FN
A5U217	156-6325-00			IC,ASIC:CMOS,CUSTOM;CHARACTER DSPLYGEN	80009	156632500
A5U218	156-5157-01			IC,CONVERTER:BIPOLAR,D/A;12 BIT,300NS,MULTI	1CH66	AM6012DT (D/C88
A5U219	156-5157-01			IC,CONVERTER:BIPOLAR,D/A;12 BIT,300NS,MULTI	1CH66	AM6012DT (D/C88
A5U220	156-5588-01			IC,LINEAR:BIPOLAR,VOLT REF;POS1,2.5V,1.0%	04713	MC1403D
A5U221	156-5051-01			IC,DIGITAL:FTTL,GATE;QUAD 2-INPUT NOR	04713	MC74F02DR2
A5U222	156-5054-01			IC,DIGITAL:FTTL,GATE;QUAD 2-INPUT NOR	80009	156505401
A5U223	156-6085-01			IC,MEMORY:CMOS,EPROM;128K X 8,200NS FLASH	80009	156646101
A5U224	156-6085-01			IC,MEMORY:CMOS,EPROM;128K X 8,200NS FLASH	80009	156646101
A5XJ205	131-0993-00			CONN, BOX, SHUNT, FEMALE, STR,1X2,0.1 CTR	00779	530153-2
A5Y201	158-5013-00			XTAL UNIT QTZ:32.768KHZ, +/- 0.002%, RS 60K	61429	FSM327
A5Y202	158-5012-00			XTAL UNIT QTZ:3.6864MHZ, +/- 0.005%, ESR 150	61429	HC49SG

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A9	259-0091-00			FLEX CIRCUIT:BEZEL	80009	259009100
A62	672-1362-01			CIRCUIT BD ASSY:FRONT PANEL MODULE	80009	672136201

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A63	119-5033-00	B020100	B020966	POWER SUPPLY:HIGH POWER VERSION	80009	119503300
A63	119-5033-01	B020967		POWER SUPPLY:HIGH POWER VERSION	80009	119503301
A63C1	285-1381-00			CAP,FXD,MTLZD:1500PF,10%,250V Y RATED	TK051	PME271Y415K
A63C2	281-0812-00			CAP,FXD,CERAMIC:MLC;1000PF,10%,100V	04222	SA101C102KAA
A63C3	285-1381-00			CAP,FXD,MTLZD:1500PF,10%,250V Y RATED	TK051	PME271Y415K
A63C4	285-1252-00			CAP,FXD,PLASTIC:0.15UF,10%,250VAC	26769	719J1MH154PK251SD
A63C5	285-1255-00			CAP,FXD,PLASTIC:0.01UF,20%,3KV	01884	430P582
A63C6	285-1252-00			CAP,FXD,PLASTIC:0.15UF,10%,250VAC	26769	719J1MH154PK251SD
A63C7	281-0852-00			CAP,FXD,CERAMIC:MLC;1800PF,10%,100VDC	04222	SA101C182KAA
A63C8	285-1381-00			CAP,FXD,MTLZD:1500PF,10%,250V Y RATED	TK051	PME271Y415K
A63C9	285-1177-01			CAP,FXD,PLASTIC:1UF,10%,450V	84411	TEK326 1.0 10 450
A63C10	283-0203-02			CAP,FXD,CERAMIC:MLC;0.47UF,20%,50V	18796	RPE112902Z5U474M50V
A63C11	283-0481-00			CAP,FXD,CER DI:220PF,10%,250VAC	18796	DE7090B221KVA1-KC
A63C12	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50V	04222	SA105E104MAA
A63C13	285-1255-00			CAP,FXD,PLASTIC:0.01UF,20%,3KV	01884	430P582
A63C14	281-0775-01			CAP,FXD,CERAMIC:MCL;0.1UF,20%,50	04222	SA105E104MAA
A63C15	290-1206-00			CAP,FXD,ELCTLT:270UF,20%,450V	0H1N5	CEAUF2W271M41
A63C16	285-1460-00			CAP,FXD,MTLZD:0.1UF,20%,250V	TK191	MKS 2 0.1/250/20
A63C22	290-1221-00			CAP,FXD,ALUM::;100UF,20%,100V	62643	SXE100VB101M12X20LL
A63C23	290-0973-01			CAP,FXD,ALUM::;100UF,20%,25VDC	62643	SME35VB101M8X11FT
A63C24	290-0947-00			CAP,FXD,ELCTLT:33UF,+50-10%,160V	0H1N5	CEUSM2C330-Q
A63C25	290-1115-00			CAP,FXD,ALUM::;10UF,20%,100V	0H1N5	CEUSM2A100-T4
A63C28	290-0922-00			CAP,FXD,ALUM::;1000UF,20%,50V	55680	UVX1J102MHA
A63C29	290-0183-00			CAP,FXD,TANT:DRY;1UF,10%,35V	12954	AT513A105K035N
A63C30	290-0525-00			CAP,FXD,ELCTLT:4.7UF,20%,50V	12954	D4R7GSB50M
A63C32	290-0973-01			CAP,FXD,ALUM::;100UF,20%,25VDC	62643	SME35VB101M8X11FT
A63C33	290-0973-01			CAP,FXD,ALUM::;100UF,20%,25VDC	62643	SME35VB101M8X11FT
A63C35	290-0946-00			CAP,FXD,ELCTLT:270UF,+100-10%,40V	0H1N5	CEUFM1G271
A63C37	290-0946-00			CAP,FXD,ELCTLT:270UF,+100-10%,40V	0H1N5	CEUFM1G271
A63C90	290-0946-00			CAP,FXD,ELCTLT:270UF,+100-10%,40V	0H1N5	CEUFM1G271
A63CR1	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR2	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR3	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR4	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR5	152-0601-01			DIODE,RECT.,ULTRA FAST;150V,25NS,35A	12969	UES1103
A63CR6	152-0601-01			DIODE,RECT.,ULTRA FAST;150V,25NS,35A	12969	UES1103
A63CR7	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR8	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR9	152-0040-00			DIODE,RECT.;;600V,1A,50A IFSM;1N5061	04713	MR5061RLR
A63CR10	152-0040-00			DIODE,RECT.;;600V,1A,50A IFSM;1N5061	04713	MR5061RLR
A63CR11	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A63CR12	152-0040-00			DIODE,RECT.,:600V,1A,50A IFSM;1N5061	04713	MR5061RLR
A63CR13	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR14	152-0040-00			DIODE,RECT.,:600V,1A,50A IFSM;1N5061	04713	MR5061RLR
A63CR15	152-0141-02			DIODE,SIG.,ULTRA FAST;40V,150MA;1N4152	01295	1N4152R
A63CR16	152-1165-00			DIODE,RECT.,ULTRA FAST;600V,4A,50NS	04713	MUR460RL
A63CR17	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR18	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR19	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR20	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR21	152-0670-00			DIODE,RECT.,SCHTKY;40V,3A	04713	1N5822
A63CR22	152-0670-00			DIODE,RECT.,SCHTKY;40V,3A	04713	1N5822
A63CR23	152-0600-00			DIODE,RECT:;SCHTKY,;35V,15A	62703	VSK2035
A63CR24	152-0400-00			DIODE,RECT.,FAST RCVRY;400V,1A,200NS	04713	1N4936RL
A63CR25	152-0141-02			DIODE,SIG.,ULTRA FAST;40V,150MA;1N4152	01295	1N4152R
A63DS1	150-0035-00			LAMP;GLOW:NEON;90V,0.3MA;NE-2B	0J9R2	NE-2B(13)R-T
A63E1	276-0635-00			CORE,EM:TOROID;FERRITE,UO=5,000 20%	02114	768 T188/3E2A
A63ID5	342-0582-00			INSULATOR,PLATE:TRANSISTOR,CERAMIC	TK260	342-0582-00
A63L1	108-1319-00			INDUCTOR,FXD:POWER;33UH,10%	TK205	TSL1110-330K1R8
A63L2	108-1319-00			INDUCTOR,FXD:POWER;33UH,10%	TK205	TSL1110-330K1R8
A63L3	108-1319-00			INDUCTOR,FXD:POWER;33UH,10%	TK205	TSL1110-330K1R8
A63L5	108-1357-00			INDUCTOR,FXD:CUSTOM,POWER;2.2MH,10%	0JR03	108-1357-00
A63L6	108-1357-00			INDUCTOR,FXD:CUSTOM,POWER;2.2MH,10%	0JR03	108-1357-00
A63L7	108-1319-00			INDUCTOR,FXD:POWER;33UH,10%	TK205	TSL1110-330K1R8
A63Q1	151-0565-00			THYRISTOR,PWR:BIPOLAR,SCR;200V,8.0A	04713	SCR2117
A63Q2	151-0852-00			TRANSISTOR,PWR:BIPOLAR,NPN;100V,6.0A	04713	SJE6447
A63Q3	151-0852-00			TRANSISTOR,PWR:BIPOLAR,NPN;100V,6.0A	04713	SJE6447
A63Q4	151-0590-00			TRANSISTOR,SIG:BIPOLAR,NPN;80V,500MA	04713	MPSW06
A63Q5	151-1245-00			TRANSISTOR,PWR:MOS,N-CH;600V,6.0A	04713	MTP6N60E
A63Q6	151-0164-01			TRANSISTOR,SIG:BIPOLAR,PNP;60V,600MA	01295	
A63Q7	151-0276-01			TRANSISTOR,SIG:BIPOLAR,PNP;50V,50MA	01295	
A63Q8	151-0276-01			TRANSISTOR,SIG:BIPOLAR,PNP;50V,50MA	01295	
A63Q9	151-0164-01			TRANSISTOR,SIG:BIPOLAR,PNP;60V,600MA	01295	
A63Q10	151-0432-01			TRANSISTOR,SIG:BIPOLAR,NPN;80V,500MA	04713	MPS8099RLRP
A63Q60	151-1179-00			TRANSISTOR,PWR:MOS,N-CH;50V,15A	04713	MTP15N05EL
A63R1	307-0111-00			RES,FXD,CMPSN:3.6 OHM,5%,0.25W	50139	CB36G5
A63R2	322-3336-00			RES,FXD,FILM:30.9K OHM,1%,0.2W	91637	CCF50-2F30901F
A63R3	301-0560-00			RES,FXD,FILM:56 OHM,5%,0.5W	19701	5053CX56R00J

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A63R4	322-3378-00			RES,FXD,FILM:84.5K OHM,1%,0.2W	91637	CCF50-2F84501F
A63R5	315-0102-03			RES,FXD,CMPSN:1K OHM,5%,0.25W	50139	CB1025
A63R6	315-0102-03			RES,FXD,CMPSN:1K OHM,5%,0.25W	50139	CB1025
A63R7	301-0393-00			RES,FXD,FILM:39K OHM,5%,0.5W	19701	5053CX39K00J
A63R8	307-0111-00			RES,FXD,CMPSN:3.6 OHM,5%,0.25W	50139	CB36G5
A63R9	301-0106-00			RES,FXD,FILM:10M OHM,5%,0.50W	50139	EB1065
A63R10	322-3453-00			RES,FXD,FILM:511K OHM,1%,0.2W	91637	CCF50-2F51102F
A63R11	301-0274-00			RES,FXD,FILM:270K OHM,5%,0.5W	19701	5053CX270K0J
A63R12	322-3289-00			RES,FXD:METAL FILM;10K OHM,1%,0.2W	57668	CRB20 FXE 10K0
A63R13	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W	57668	CRB20 FXE 100K
A63R14	315-0472-03			RES,FXD,CMPSN:4.7K OHM,5%,0.25W	50139	CB4725
A63R15	322-3385-00			RES,FXD:METAL FILM;100K OHM,1%,0.2W	57668	CRB20 FXE 100K
A63R16	301-0393-00			RES,FXD,FILM:39K OHM,5%,0.5W	19701	5053CX39K00J
A63R17	322-3292-00			RES,FXD,FILM:10.7K OHM,1%,0.2W	57668	CRB20 FXE10K7
A63R18	307-0456-00			RES,V SENSITIVE:MOV; 250VRMS, 330VDC	34371	V250LA20A
A63R19	322-3273-00			RES,FXD:METAL FILM;6.81K OHM,1%,0.2W	57668	CRB20 FXE 6K81
A63R20	313-1124-00			RES,FXD,FILM:120K OHM,5%,0.2W	57668	TR20JE120K
A63R21	322-3234-00			RES,FXD,FILM:2.67K OHM,1%,0.2W	91637	CCF50-2F26700F
A63R22	303-0154-00			RES,FXD,CMPSN:150K OHM,5%,1W	24546	FP1 150 K
A63R23	301-0751-00			RES,FXD,FILM:750 OHM,5%,0.5W	19701	5053CX750R0J
A63R24	322-3239-00			RES,FXD,FILM:3.01K OHM,1%,0.2W	57668	CRB20 FXE 3K01
A63R25	315-0390-00			RES,FXD,FILM:39 OHM,5%,0.25W	50139	CB3905
A63R26	313-1330-00			RES,FXD,FILM:33 OHM,5%,0.2W	57668	TR20JT6833E
A63R27	313-1121-00			RES,FXD,FILM:120 OHM,5%,0.2W	57668	TR20JT68 120E
A63R28	322-3225-00			RES,FXD,FILM:2.15K OHM,1%,0.2W	57668	CRB20 FXE 2K15
A63R29	313-1330-00			RES,FXD,FILM:33 OHM,5%,0.2W	57668	TR20JT6833E
A63R30	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W	57668	CRB20 FXE 1K00
A63R31	308-0843-00			RES,FXD:WIREWOUND;0.2 OHM,5%,1W	91637	CW-1-R20JT
A63R32	308-0679-00			RES,FXD:0.51 OHM,5%,2W	91637	CPF-2-0R51JT1
A63R33	313-1100-00			RES,FXD,FILM:10 OHM,5%,0.2W	57668	TR20JE10E0
A63R34	322-3318-00			RES,FXD,FILM:METAL FILM;20K OHM,1%,0.2W	57668	CRB20 FXE 20K0
A63R37	322-3304-00			RES,FXD,FILM:14.3K OHM,1%,0.2W	57668	CRB20 FXE 14K3
A63R38	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W	57668	CRB20 FXE 1K00
A63R39	322-3283-00			RES,FXD,FILM:8.66K OHM,1%,0.2W	57668	CRR20 FXE 8K66
A63R40	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W	57668	CRB20 FXE 1K00
A63R41	322-3168-00			RES,FXD,FILM:549 OHM,1%,0.2W	91637	CCF50-2F549R0F
A63R42	322-3336-00			RES,FXD,FILM:30.9K OHM,1%,0.2W	91637	CCF50-2F30901F
A63R43	311-1248-00			RES,VAR,NONWW:TRMR,500 OHM,0.5W	32997	3386X-1-501
A63R44	315-0823-00			RES,FXD,FILM:82K OHM,5%,0.25W	50139	CB8235
A63R45	322-3318-00			RES,FXD,FILM:METAL FILM;20K OHM,1%,0.2W	57668	CRB20 FXE 20K0
A63R46	301-0472-00			RES,FXD,FILM:4.7K OHM,5%,0.5W	19701	5053CX4K700J
A63R60	322-3193-00			RES,FXD:METAL FILM;1K OHM,1%,0.2W	57668	CRB20 FXE 1K00
A63R90	303-0270-00			RES,FXD,CMPSN:27 OHM,5%,1W	24546	FP32 OR FP1

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A63RT1	307-1551-00			RES,THERMAL:20 OHM,10%	91637	2SS40-10%
A63S1	260-2443-00			SWITCH,PWR:DPDT;6A 250VAC/1A 100VDC	31918	NE18-00-EE-N-47-0 1A (130238)
A63T1	120-1401-00			TRANSFORMER,PWR:LINE TRIGGER;1:1	54937	DMI 500-2044
A63T2	120-1439-01			TRANSFORMER,RF:ENERGY STORAGE	20462	120-1439-01
A63T8	120-1955-00			TRANSFORMER:POWER,INVERTER	75498	129-3154-00
A63T9	120-1347-00			TRANSFORMER,SIG;;44T:2T:2T,PRI	TK205	BDT-001
A63U1	156-1627-00			IC,LINEAR:BIPOLAR,SW-REG CONTR	01295	TL594CN
A63U2	152-0806-00			MODULE,HV;;4KVAC IN,12KVDC OUT	12969	CMX647
A63VR1	152-0166-00			DIODE,ZENER;;6.2V,5%,0.4W;1N5995B	04713	1N5995BRL
A63VR2	152-0317-00			DIODE,ZENER;;6.2V,5%,0.4W;1N825	04713	1N825
A63VR3	152-0255-00			DIODE,ZENER;;51V,5%,0.4W;1N978B	04713	1N978BRL
A63VR60	152-0166-00			DIODE,ZENER;;6.2V,5%,0.4W;1N5995B	04713	1N5995BRL

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No.		Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont			
A64	154-0905-01			ELECTRON TUBE:CRT	80009	154090501

Replaceable Electrical Parts

Component Number	Tektronix Part No.	Serial No. Effective	Dscont	Mfr. Code	Mfr. Part No.
CHASSIS PARTS					
B90	119-1770-04			S4246	CUDC12D4
DL68	119-5023-00			TK2469	119-5023-00
J21	174-3005-00			0J7N9	ORDER BY DESC
P30	174-2598-00			80009	174259800
P50	174-2600-00			80009	174260000
P74	196-3374-00			0J7N9	196-3374-00
P74	196-3374-00			0J7N9	196-3374-00
P74	196-3374-01			0J7N9	196-3374-01
P75	196-3375-00			0J7N9	196-3375-00
P75	196-3375-00			0J7N9	196-3375-00
P75	196-3375-01			0J7N9	196-3375-01
P76	198-5790-01			0J7N9	198-5790-01
P80	174-2601-00			80009	174260100
P84	174-2284-00			80009	174228400

Diagrams and Circuit Board Illustrations

This section contains circuit board illustrations, component locator tables, waveform illustrations, and schematic diagrams for this oscilloscope.

Symbols

Graphic symbols and class designation letters are based on ANSI Standard Y32.2-1975. Abbreviations are based on ANSI Y1.1-1972.

Logic symbology is based on ANSI/IEEE Std 91-1984 in terms of positive logic. Logic symbols depict the logic function performed and can differ from the manufacturer's data.

The tilde (~) preceding a signal name indicates that the signal performs its intended function when in the low state.

Other standards used in the preparation of diagrams by Tektronix, Inc are:

- Tektronix Standard 062-2476 Symbols and Practices for Schematic Drafting
- ANSI Y14.159-1971 Interconnection Diagrams
- ANSI Y32.16-1975 Reference Designations for Electronic Equipment
- MIL-HDBK-63038-1A Military Standard Technical Manual Writing Handbook

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 (μ F).

Resistors: Values are in Ohms (Ω).

Graphic Items and Special Symbols Used in This Manual

Each assembly in the instrument is assigned an assembly identifier (for example, MAIN or A5). The assembly identifier appears on the circuit board outline on the diagram (see Figure 9-1), in the title for the circuit board component location illustration, and in the lookup table for the schematic diagram and corresponding component locator illustration. The Replaceable Electrical Parts list is arranged by assemblies in numerical sequence; the components are listed by component number.

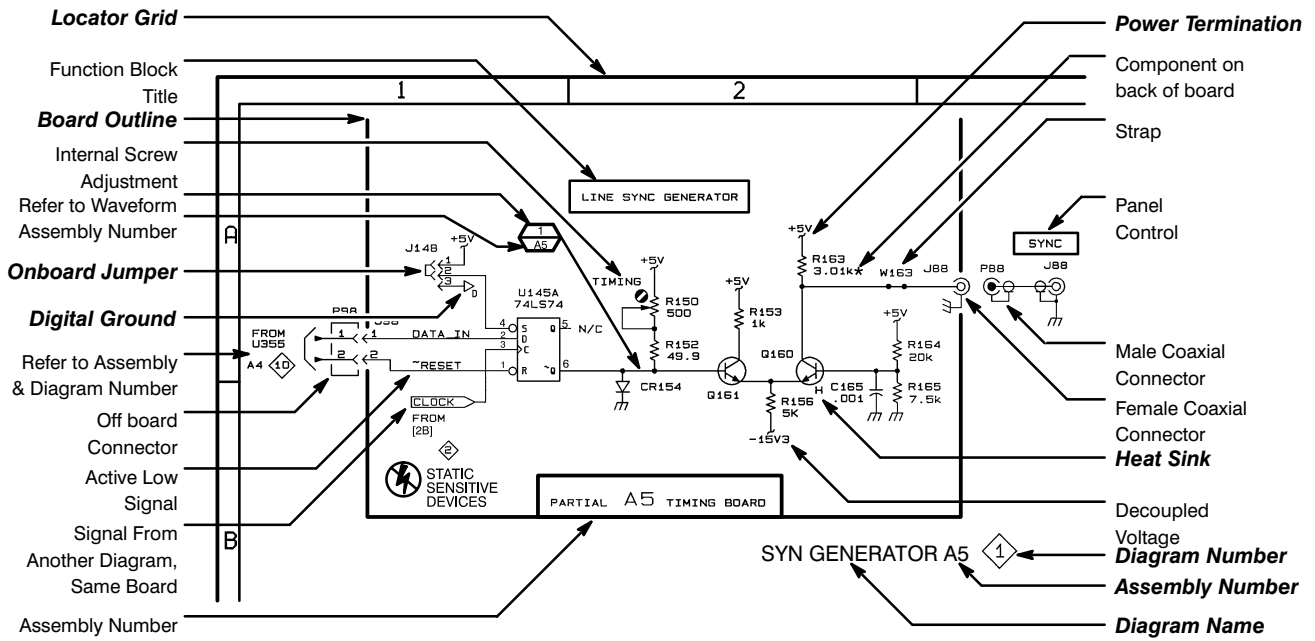


Figure 9-1: Graphic Items and Special Symbols Used in This Manual

Component Locator Diagrams

The schematic diagram and circuit board component location illustrations have grids. A lookup table is provided for ease of locating a component. The circuit board illustration only appears once; its lookup table lists the diagram number of all diagrams that the circuitry appears on.

Some of the circuit board component location illustrations are expanded and divided into several parts to make it easier for you to locate small components. To determine which part of the whole locator diagram you are looking at, refer to the small locator key positioned at the upper left of each circuit board component locator diagram, as shown in Figure 9-2. The gray block, within the larger circuit board outline, shows where that part fits in the whole locator diagram. Each part in the key is labeled with an identifying letter which appears in the figure titles under component locator diagrams.

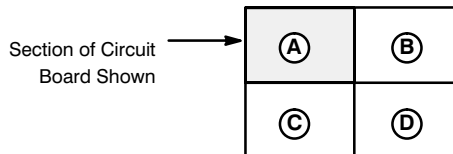
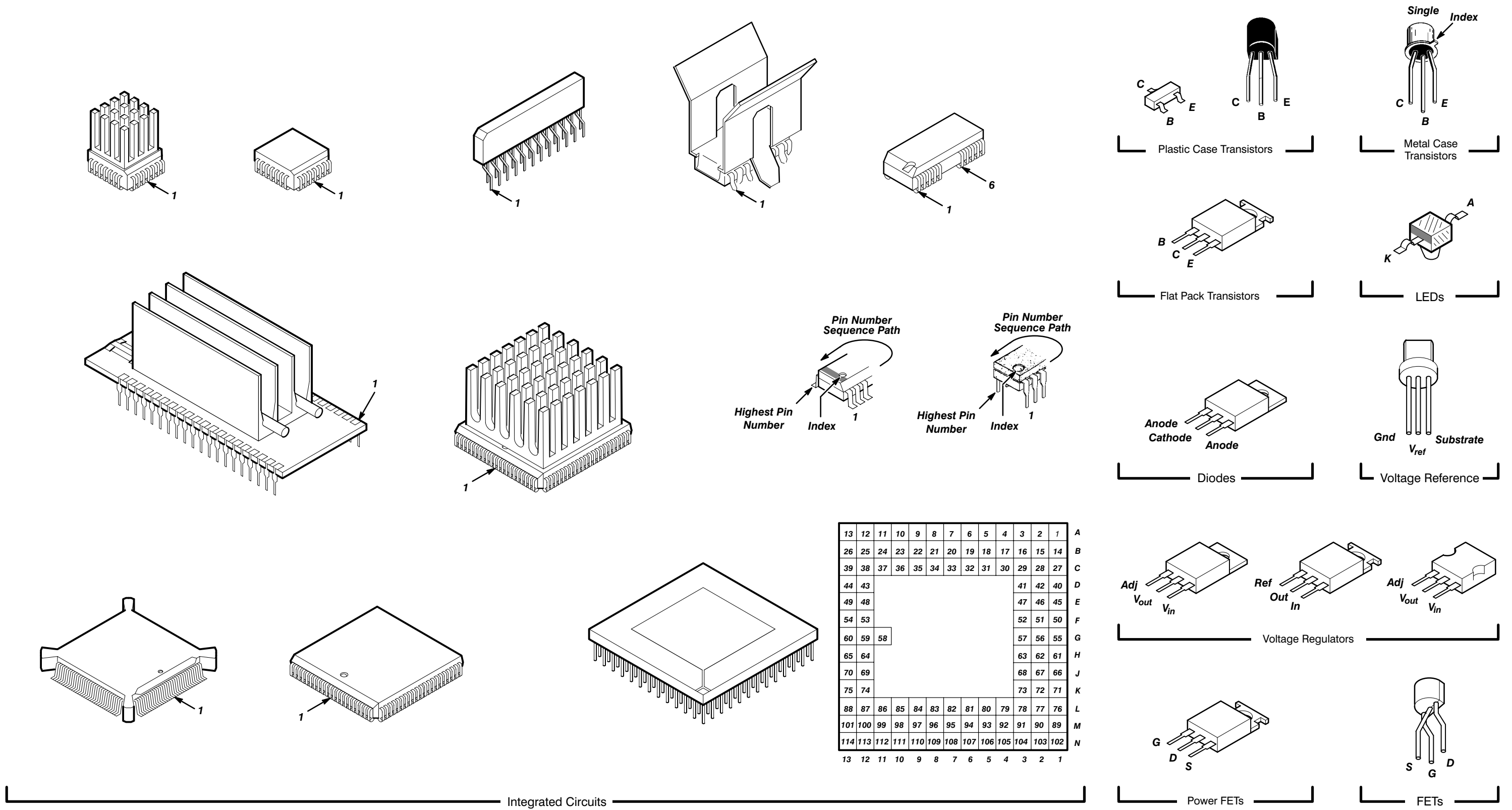


Figure 9-2: Circuit Board Component Locator Diagram Key



Lead configurations and case styles are typical, but may vary due to vendor changes or instrument modifications.

Figure 9-3: Semiconductor Lead Configurations

LOCATING COMPONENTS ON THE CIRCUIT BOARD OR SCHEMATIC DIAGRAM

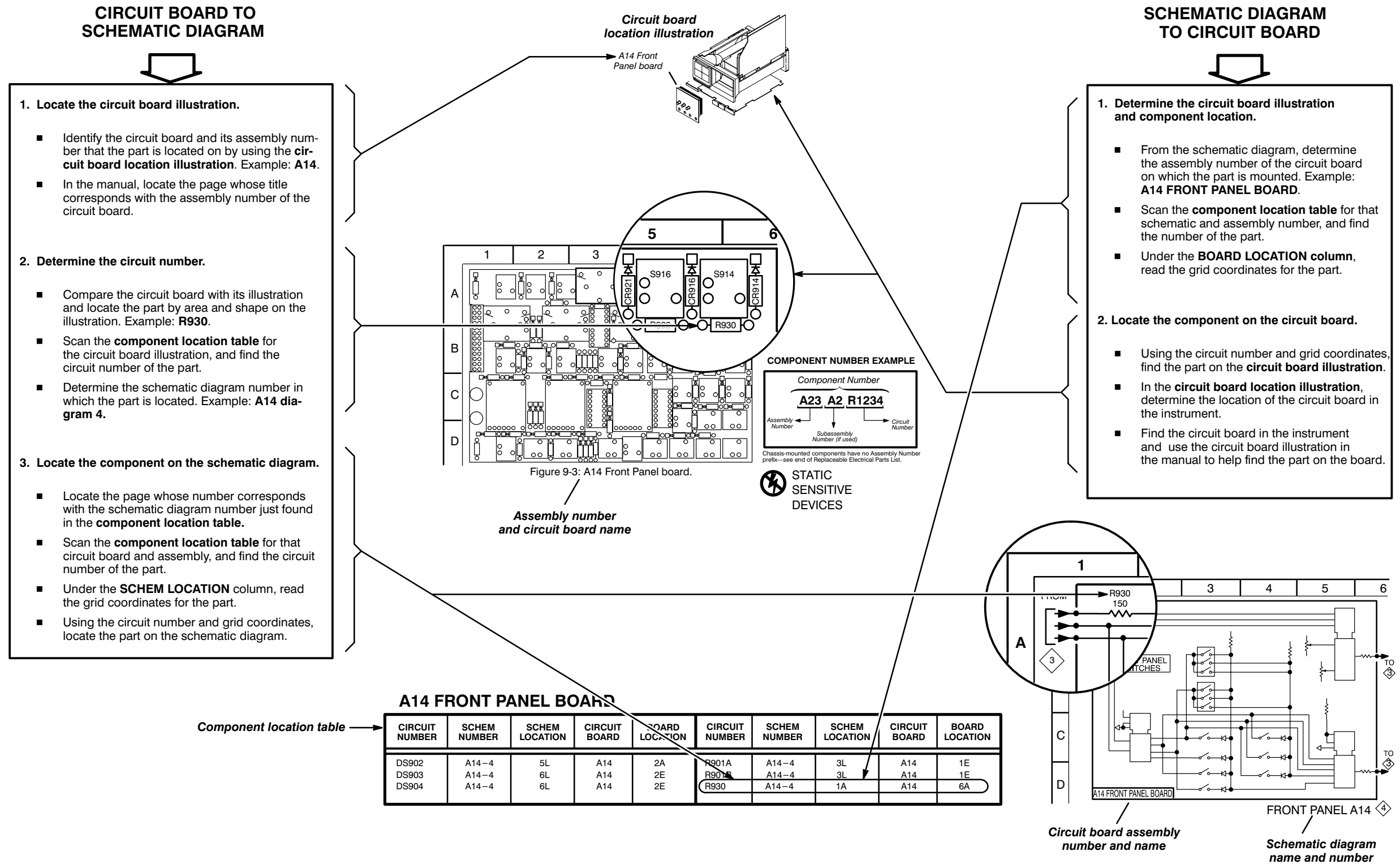
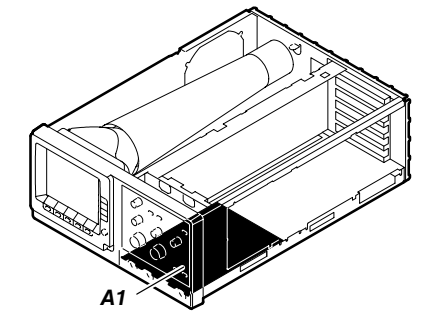
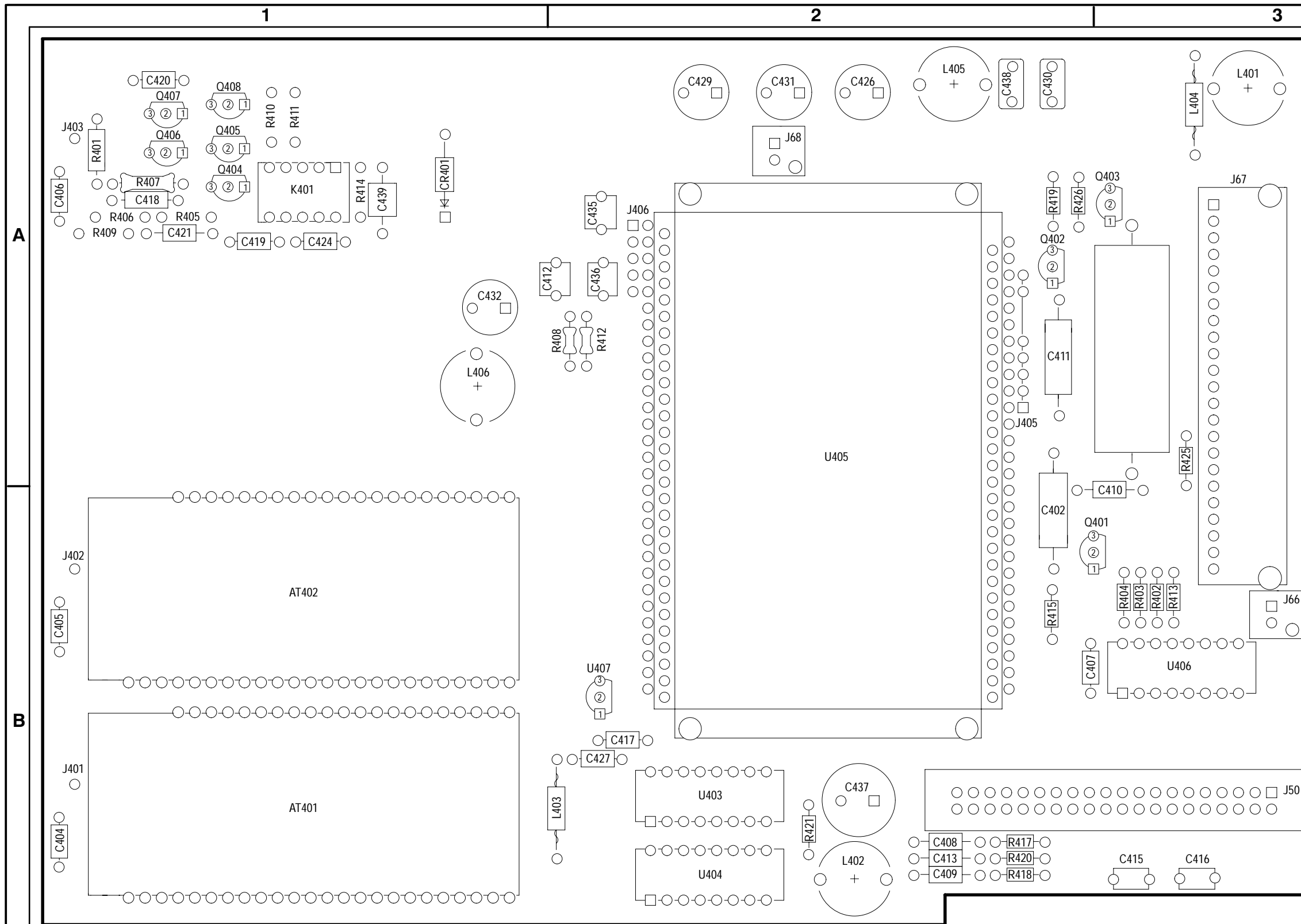


Figure 9-4: Locating Components on Circuit Board or Schematic Diagram

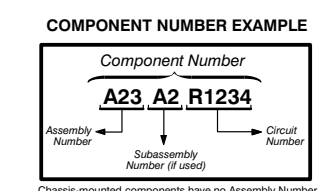
A1 Analog Component Locator

CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION
AT401	A1-2	4C	A1	1B	C427	A1-3	4D	A1	2B	J67	A1-3	1C	A1	3A	Q408	A1-1	4B	A1	1A	R426	A1-3	5C	A1	2A
AT402	A1-2	3A	A1	1B	C428	A1-3	4D	A1	2B	J68	A1-3	6A	A1	2A						R427	A1-3	2C	A1	2B
					C429	A1-3	3D	A1	2A	J401	A1-2	1C	A1	1B	R401	A1-1	2A	A1	1A	R428*	A1-3	3B	A1	3B
C402	A1-3	5C	A1	2B	C430	A1-3	2D	A1	2A	J402	A1-2	1B	A1	1B	R402	A1-3	2B	A1	3B	R429	A1-3	2C	A1	2B
C403	A1-3	6C	A1	3B	C431	A1-3	3D	A1	2A	J403	A1-1	1B	A1	1A	R403	A1-3	2B	A1	3B					
C404	A1-2	2C	A1	1B	C432	A1-3	2D	A1	1A	J405	A1-3	6A	A1	2B	R404	A1-3	3B	A1	3B	U403G	A1-1	4B	A1	2B
C405	A1-2	2B	A1	1B	C434	A1-3	2B	A1	3B	J406	A1-3	6B	A1	2A	R405	A1-1	3A	A1	1A	U403A	A1-2	5C	A1	2B
C406	A1-1	2C	A1	1A	C435	A1-3	3C	A1	2A						R406	A1-1	3A	A1	1A	U403B	A1-2	5C	A1	2B
C407	A1-3	5D	A1	2B	C436	A1-3	4C	A1	2A	K401	A1-1	5A	A1	1A	R407	A1-1	3B	A1	1A	U403C	A1-2	3C	A1	2B
C408	A1-2	2C	A1	2B	C437	A1-2	2D	A1	2B						R408	A1-3	3A	A1	2A	U403D	A1-2	4A	A1	2B
C409	A1-2	2B	A1	2C	C438	A1-3	4C	A1	2A	L401	A1-3	2D	A1	3A	R409	A1-1	3B	A1	1A	U403E	A1-2	5D	A1	2B
C410	A1-3	6B	A1	3B	C439	A1-1	4C	A1	1A	L402	A1-3	1D	A1	2B	R410	A1-1	4B	A1	1A	U403F	A1-2	4A	A1	2B
C411	A1-3	5B	A1	2A	C440	A1-3	5C	A1	2B	L403	A1-3	3D	A1	2B	R411	A1-1	4B	A1	1A	U404G	A1-1	4B	A1	2C
C412	A1-3	3A	A1	2A	C441	A1-3	5B	A1	2A	L404	A1-3	3D	A1	3A	R412	A1-3	3A	A1	2A	U404A	A1-2	5C	A1	2C
C413	A1-1	2C	A1	2B	C442	A1-3	6C	A1	2A	L405	A1-3	2D	A1	2A	R413	A1-3	3B	A1	3B	U404B	A1-2	5C	A1	2C
C415	A1-3	2B	A1	3C	C443	A1-3	6C	A1	3A	L406	A1-3	1D	A1	1A	R414	A1-1	4C	A1	1A	U404C	A1-2	3C	A1	2C
C416	A1-3	2B	A1	3C											R415	A1-3	3B	A1	2B	U404D	A1-2	4A	A1	2C
C417	A1-2	2D	A1	2B	CR401	A1-1	5B	A1	1A	Q401	A1-3	5C	A1	3B	R416	A1-3	2B	A1	3B	U404E	A1-2	4D	A1	2C
C418	A1-1	3A	A1	1A	CR402	A1-1	5B	A1	1A	Q402	A1-3	5B	A1	2A	R417	A1-2	1C	A1	2B	U404F	A1-2	4A	A1	2C
C419	A1-1	2C	A1	1A	CR403	A1-1	5C	A1	1A	Q403	A1-3	5C	A1	3A	R418	A1-2	1B	A1	2C	U405	A1-3	4A	A1	2B
C420	A1-1	2D	A1	1A	CR404	A1-1	5C	A1	1A	Q404	A1-1	3A	A1	1A	R419	A1-3	3C	A1	2A	U406	A1-3	2B	A1	3B
C421	A1-1	3B	A1	1A						Q405	A1-1	3B	A1	1A	R420	A1-1	3C	A1	2B	U407	A1-3	3A	A1	2B
C424	A1-1	5B	A1	1A	J50	A1-3	1A	A1	3B	Q406	A1-1	3A	A1	1A	R421	A1-2	2D	A1	2B					
C425	A1-3	3D	A1	3B	J66	A1-3	1C	A1	3B	Q407	A1-1	3B	A1	1A	R425	A1-3	2D	A1	3B	W401	A1-3	3D	A1	3A
C426	A1-3	3D	A1	2A																				

*Asterisks indicate components located on the back of the board.



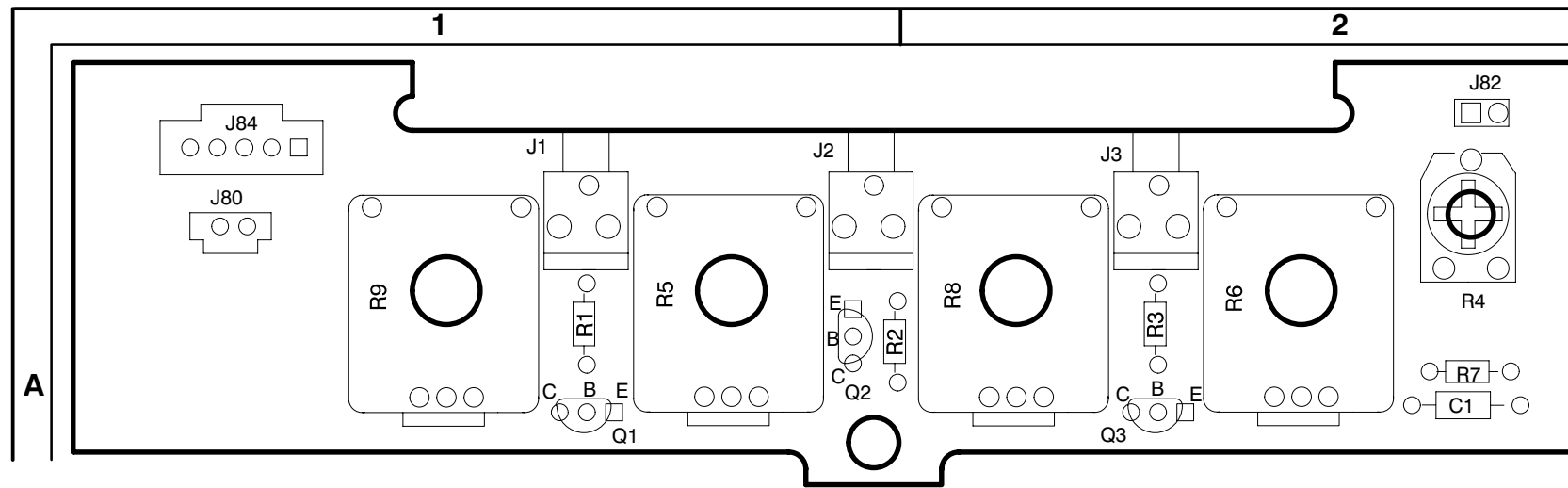
671-2219-09
389-1218-01
Q9A-1218-01



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

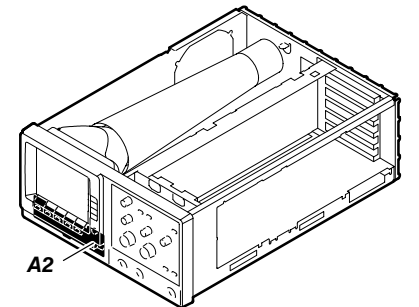
STATIC SENSITIVE DEVICES

Figure 9-5: A1 Analog Board



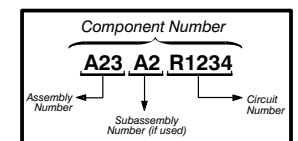
A2 Display Control Component Locator

CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION
C1	A2-1	2C	A2	2A	J82	A2-1	4C	A2	2A	Q2	A2-1	2A	A2	1A	R2	A2-1	2A	A2	1A	R6	A2-1	1C	A2	2A
J2	A2-1	2B	A2	1A	J84	A2-1	4B	A2	1A	Q3	A2-1	3A	A2	2A	R3	A2-1	3A	A2	2A	R7	A2-1	4C	A2	2A
J3	A2-1	3B	A2	2A	Q1	A2-1	2A	A2	1A	R1	A2-1	2A	A2	1A	R4	A2-1	1C	A2	2A	R8	A2-1	1D	A2	1A
J80	A2-1	4D	A2	1A											R5	A2-1	1B	A2	1A	R9	A2-1	1A	A2	1A



389-1221-00
671-2222-00

COMPONENT NUMBER EXAMPLE



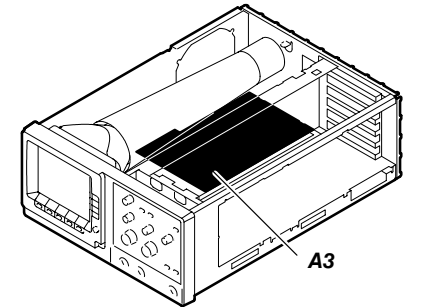
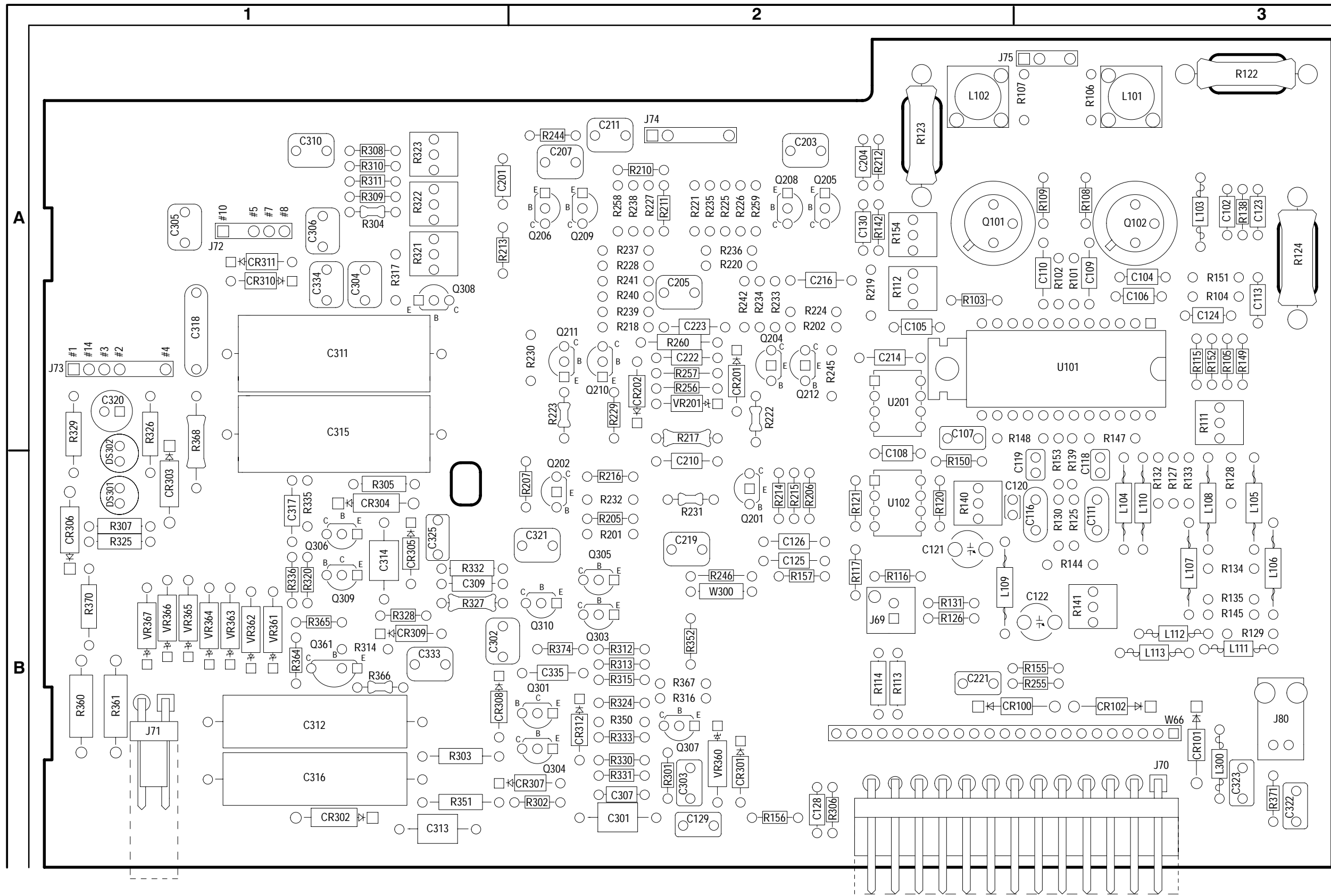
Chassis-mounted components have no Assembly Number prefix—see end of Replaceable Electrical Parts List.



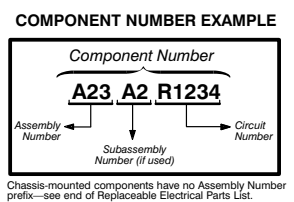
Figure 9-6: A2 Display Control Board

A3 Display Driver Component Locator

CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION
C102	A3-2	5B	A3	3A	C318	A3-4	4C	A3	1A	Q205	A3-3	4B	A3	2A	R150	A3-2	3D	A3	2B	R306	A3-4	4B	A3	2C
C104	A3-2	4A	A3	3A	C320	A3-4	6B	A3	1B	Q206	A3-3	4C	A3	2A	R151	A3-2	4B	A3	3A	R307	A3-4	5A	A3	1B
C105	A3-2	3C	A3	2A	C321	A3-4	1A	A3	2B	Q208	A3-3	4A	A3	2A	R152	A3-2	4C	A3	3B	R308	A3-4	4D	A3	1A
C106	A3-2	3D	A3	3A	C322	A3-4	1D	A3	3C	Q209	A3-3	4C	A3	2A	R153	A3-2	3B	A3	3B	R309	A3-4	4D	A3	1A
C107	A3-2	3D	A3	2B	C323	A3-4	1D	A3	3C	Q210	A3-3	3C	A3	2B	R154	A3-2	3B	A3	2A	R310	A3-4	3D	A3	1A
C108	A3-2	3D	A3	2B	C325	A3-4	3C	A3	1B	Q211	A3-3	3C	A3	2B	R155	A3-2	2C	A3	3B	R311	A3-4	4D	A3	1A
C109	A3-2	5A	A3	3A	C333	A3-4	3C	A3	1B	Q212	A3-3	3B	A3	2B	R156	A3-2	2C	A3	2C	R312	A3-4	1C	A3	2B
C110	A3-2	5B	A3	3A	C334	A3-4	1A	A3	1A	Q301	A3-4	3A	A3	2B	R157	A3-2	2D	A3	2B	R313	A3-4	1C	A3	2B
C111	A3-2	3A	A3	3B	C335	A3-4	2A	A3	2B	Q303	A3-4	1C	A3	2B	R201	A3-3	4D	A3	2B	R314	A3-4	4D	A3	1B
C112	A3-2	2A	A3	2B						Q304	A3-4	3B	A3	2B	R202	A3-3	5D	A3	2A	R315	A3-4	1C	A3	2B
C113	A3-2	4B	A3	3A	CR100	A3-2	2C	A3	2B	Q305	A3-4	1C	A3	2B	R205	A3-3	2C	A3	2B	R316	A3-4	1C	A3	2B
C116	A3-2	3B	A3	3B	CR101	A3-2	3D	A3	3B	Q306	A3-4	3C	A3	1B	R206	A3-3	2C	A3	2B	R317	A3-4	4A	A3	1A
C117	A3-2	2B	A3	2B	CR102	A3-2	2D	A3	3B	Q307	A3-4	2B	A3	2B	R207	A3-3	2C	A3	2B	R320	A3-4	3C	A3	1B
C118	A3-2	3A	A3	3B	CR201	A3-3	3B	A3	2B	Q308	A3-4	4A	A3	1A	R210	A3-3	4D	A3	2A	R321	A3-4	3A	A3	1A
C119	A3-2	3B	A3	3B	CR202	A3-3	3C	A3	2B	Q309	A3-4	3C	A3	1B	R211	A3-3	4A	A3	2A	R322	A3-4	4D	A3	1A
C120	A3-2	3A	A3	2B	CR301	A3-4	2B	A3	2C	Q310	A3-4	2C	A3	2B	R212	A3-3	4B	A3	2A	R323	A3-4	3D	A3	1A
C121	A3-2	2A	A3	2B	CR302	A3-4	4A	A3	1C	Q361	A3-4	5D	A3	1B	R213	A3-3	4C	A3	1A	R324	A3-4	2A	A3	2B
C122	A3-2	2A	A3	3B	CR303	A3-4	5A	A3	1B						R214	A3-3	2B	A3	2B	R325	A3-4	4A	A3	1B
C123	A3-2	5A	A3	3A	CR304	A3-4	4A	A3	1B	R101	A3-2	5A	A3	3A	R215	A3-3	2B	A3	2B	R326	A3-4	5B	A3	1B
C124	A3-2	4C	A3	3A	CR305	A3-4	3C	A3	1B	R102	A3-2	5B	A3	3A	R216	A3-3	2B	A3	2B	R327	A3-4	3C	A3	1B
C125	A3-2	1B	A3	2B	CR306	A3-4	5A	A3	1B	R103	A3-2	4C	A3	2A	R217	A3-3	3A	A3	2B	R328	A3-4	2C	A3	1B
C126	A3-2	1B	A3	2B	CR307	A3-4	3B	A3	2C	R104	A3-2	4C	A3	3A	R218	A3-3	3C	A3	2A	R329	A3-4	5A	A3	1B
C128	A3-2	2C	A3	2C	CR308	A3-4	3A	A3	1B	R105	A3-2	4B	A3	3B	R219	A3-3	5D	A3	2A	R330	A3-4	2A	A3	2B
C129	A3-2	3C	A3	2C	CR309	A3-4	3C	A3	1B	R106	A3-2	6A	A3	3A	R220	A3-3	4B	A3	2A	R331	A3-4	2A	A3	2B
C130	A3-2	5B	A3	2A	CR310	A3-4	4C	A3	1A	R107	A3-2	6B	A3	3A	R221	A3-3	4B	A3	2A	R332	A3-4	2C	A3	1B
C131	A3-2	6B	A3	3A	CR311	A3-4	4C	A3	1A	R108	A3-2	5A	A3	3A	R222	A3-3	2B	A3	2B	R333	A3-4	3A	A3	2B
C132	A3-2	6A	A3	3A	CR312	A3-4	3A	A3	2B	R109	A3-2	5B	A3	3A	R223	A3-3	2C	A3	2B	R335	A3-4	3C	A3	1B
C201	A3-3	4C	A3	1A						R111	A3-2	3B	A3	3B	R224	A3-3	3A	A3	2A	R336	A3-4	4C	A3	1B
C203	A3-3	4A	A3	2A	DS301	A3-4	5A	A3	1B	R112	A3-2	4C	A3	2A	R225	A3-3	4A	A3	2A	R350	A3-4	2A	A3	2B
C204	A3-3	4B	A3	2A	DS302	A3-4	5A	A3	1B	R113	A3-2	2B	A3	2B	R226	A3-3	5B	A3	2A	R351	A3-4	4A	A3	1C
C205	A3-3	4B	A3	2A						R114	A3-2	2B	A3	2B	R227	A3-3	5C	A3	2A	R352	A3-4	1A	A3	2B
C206	A3-3	3B	A3	2B	J69	A3-2	1A	A3	2B	R115	A3-2	4B	A3	3B	R228	A3-3	4C	A3	2A	R360	A3-4	5B	A3	1B
C207	A3-3	4C	A3	2A	J70	A3-2	1C	A3	2C	R116	A3-2	1B	A3	2B	R229	A3-3	3B	A3	2B	R361	A3-4	5B	A3	1B
C210	A3-3	2B	A3	2B	J71	A3-4	1B	A3	1B	R117	A3-2	1B	A3	2B	R230	A3-3	3D	A3	2B	R364	A3-4	4D	A3	1B
C211	A3-3	1C	A3	2A	J72	A3-4	6D	A3	1A	R120	A3-2	1B	A3	2B	R231	A3-3	2B	A3	2B	R365	A3-4	4D	A3	1B
C213	A3-3	3D	A3	2A	J73	A3-4	6B	A3	1B	R121	A3-2	1B	A3	2B	R232	A3-3	2C	A3	2B	R366	A3-4	5D	A3	1B
C214	A3-3	4D	A3	2B	J74	A3-3	6B	A3	2A	R122	A3-2	5A	A3	3A	R233	A3-3	3A	A3	2A	R367	A3-4	1C	A3	2B
C216	A3-3	3A	A3	2A	J75	A3-2	6A	A3	3A	R123	A3-2	5B	A3	2A	R234	A3-3	3A	A3	2A	R368	A3-4	5B	A3	1B
C217	A3-3	3D	A3	1B	J80	A3-4	1D	A3	3B	R124	A3-2	6A	A3	3A	R235	A3-3	4A	A3	2A	R370	A3-4	6C	A3	1B
C218	A3-3	3A	A3	2A						R125	A3-2	3A	A3	3B	R236	A3-3	4A	A3	2A	R371	A3-4	4D	A3	3C
C219	A3-3	1A	A3	2B	L101	A3-2	5A	A3	3A	R126	A3-2	2A	A3	2B	R237	A3-3	4C	A3	2A	R374	A3-4	2C	A3	2B
C221	A3-3	1D	A3	2B	L102	A3-2	5B	A3	2A	R127	A3-2	2A	A3	3B	R238	A3-3	4C	A3	2A					
C222	A3-3	3C	A3	2B	L103	A3-2	4A	A3	3A	R128	A3-2	3A	A3	3B	R239	A3-3	3D	A3	2A	U101	A3-2	4A	A3	3B
C223	A3-3	3B	A3	2A	L104	A3-2	2A	A3	3B	R129	A3-2	4A	A3	3B	R240	A3-3	3D	A3	2A	U102A	A3-2	1B	A3	2B
C301	A3-4	2A	A3	2C	L105	A3-2	3A	A3	3B	R130	A3-2	3B	A3	3B	R241	A3-3	4D	A3	2A	U102B	A3-2	1B	A3	2B
C302	A3-4	3A	A3	2B	L106	A3-2	3A	A3	3B	R131	A3-2	2B	A3	2B	R242	A3-3	4A	A3	2A	U201A	A3-3	2D	A3	2B
C303	A3-4	3B	A3	2C	L107	A3-2	3B	A3	3B	R132	A3-2	2B	A3	3B	R244	A3-3	1C	A3	2A	U201B	A3-3	2D	A3	2B
C304	A3-4	4A	A3	1A	L108	A3-2	3B	A3	3B	R133	A3-2	3A	A3	3B	R245	A3-3	3A	A3	2B					
C305	A3-4	3D	A3	1A	L109	A3-2	2A	A3	2B	R134	A3-2	3A	A3	3B	R246	A3-4	1A	A3	2B	VR201	A3-3	3B	A3	2B
C306	A3-4	4D	A3	1A	L110	A3-2	2B	A3	3B	R135	A3-2	4A	A3	3B	R255	A3-3	1D	A3	3B	VR360	A3-4	3B	A3	2B
C307	A3-4	3B	A3	2C	L111	A3-2	4A	A3	3B	R138	A3-2	5A	A3	3A	R256	A3-3	3C	A3	2B	VR361	A3-4	5C	A3	1B
C309	A3-4	3C	A3	1B	L112	A3-2	4B	A3	3B	R139	A3-2	3A	A3	3B	R257	A3-3	3C	A3	2B	VR362	A3-4	5C	A3	1B
C310	A3-4	5D	A3	1A	L113	A3-2	4A	A3	3B	R140	A3-2	2A	A3	2B	R258	A3-3	4C	A3	2A	VR363	A3-4	5C	A3	1B
C311	A3-4	5B	A3	1B	L300	A3-4	1D	A3	3B	R141	A3-2	2A	A3	3B	R259	A3-3	4B	A3	2A	VR364	A3-4	5C	A3	1B
C312	A3-4	4A	A3	1B						R142	A3-2	5B	A3	2A	R260	A3-3	3C	A3	2B	VR365	A3-4	5C	A3	1B
C313	A3-4	4A	A3	1C	Q101	A3-2	5B	A3	2A	R144	A3-2	2A	A3	3B	R301	A3-4	2A	A3	2C	VR366	A3-4	5C	A3	1B
C314	A3-4	3C	A3	1B	Q102	A3-2	5A	A3	3A	R145	A3-2	4A	A3	3B	R302	A3-4	3B	A3	2C	VR367	A3-4	5B	A3	1B
C315	A3-4	5B	A3	1B	Q201	A3-3	2B	A3	2B	R147	A3-2	4C	A3	3B	R303	A3-4	4A	A3	1B					
C316	A3-4	4A	A3	1B	Q202	A3-3	2C	A3	2B	R148	A3-2	4C	A3	2B	R304	A3-4	3B	A3	1A	W66	A3-2	1D	A3	3B
C317	A3-4	3C	A3	1B	Q204	A3-3	3B	A3	2B	R149	A3-2	3D	A3	3B	R305	A3-4	4A	A3	1B	W300	A3-4	1B	A3	2B



671-2904-02
389-1222-01
Q9A-1222-01



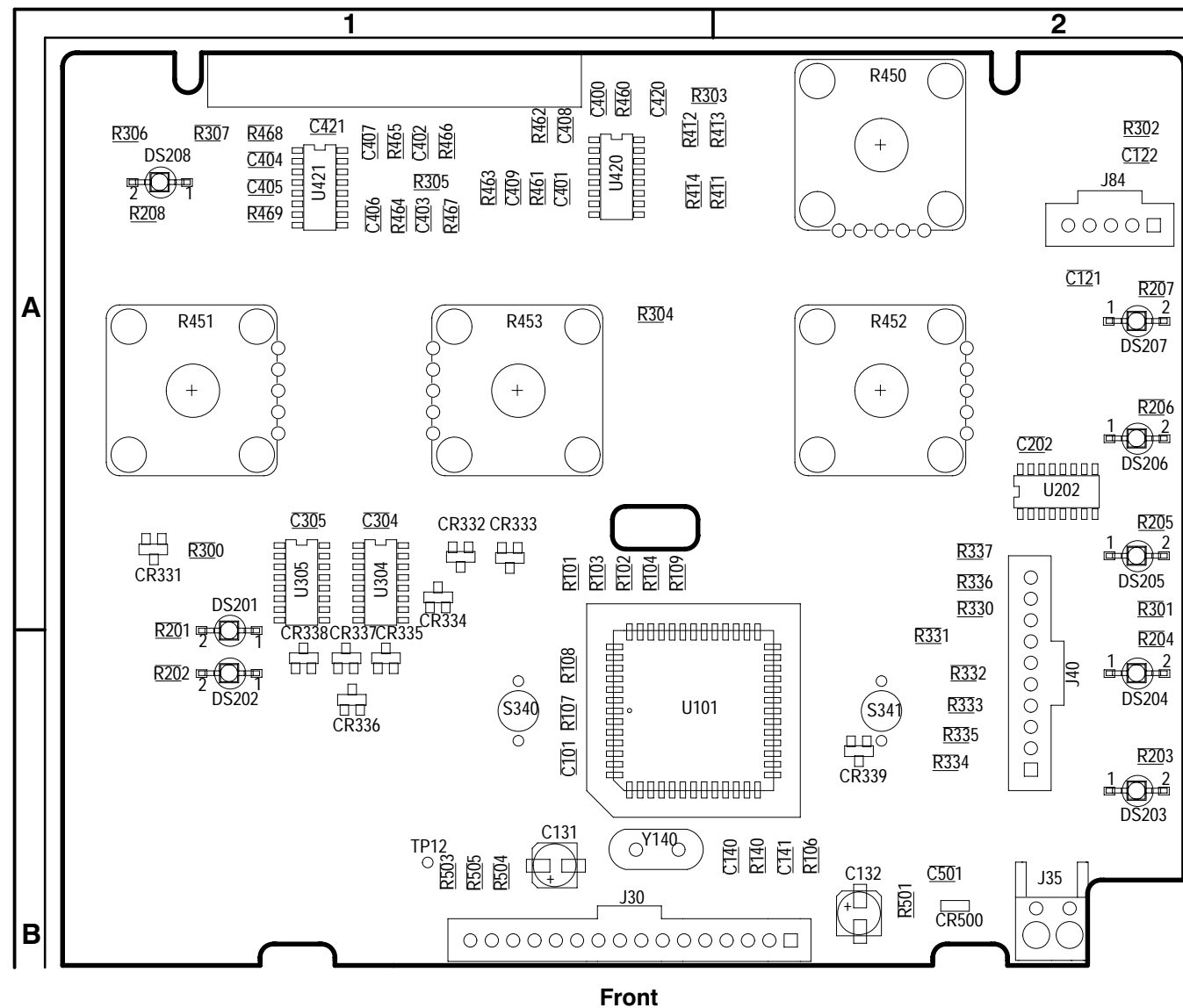
STATIC SENSITIVE DEVICES

Figure 9-7: A3 Display Driver Board

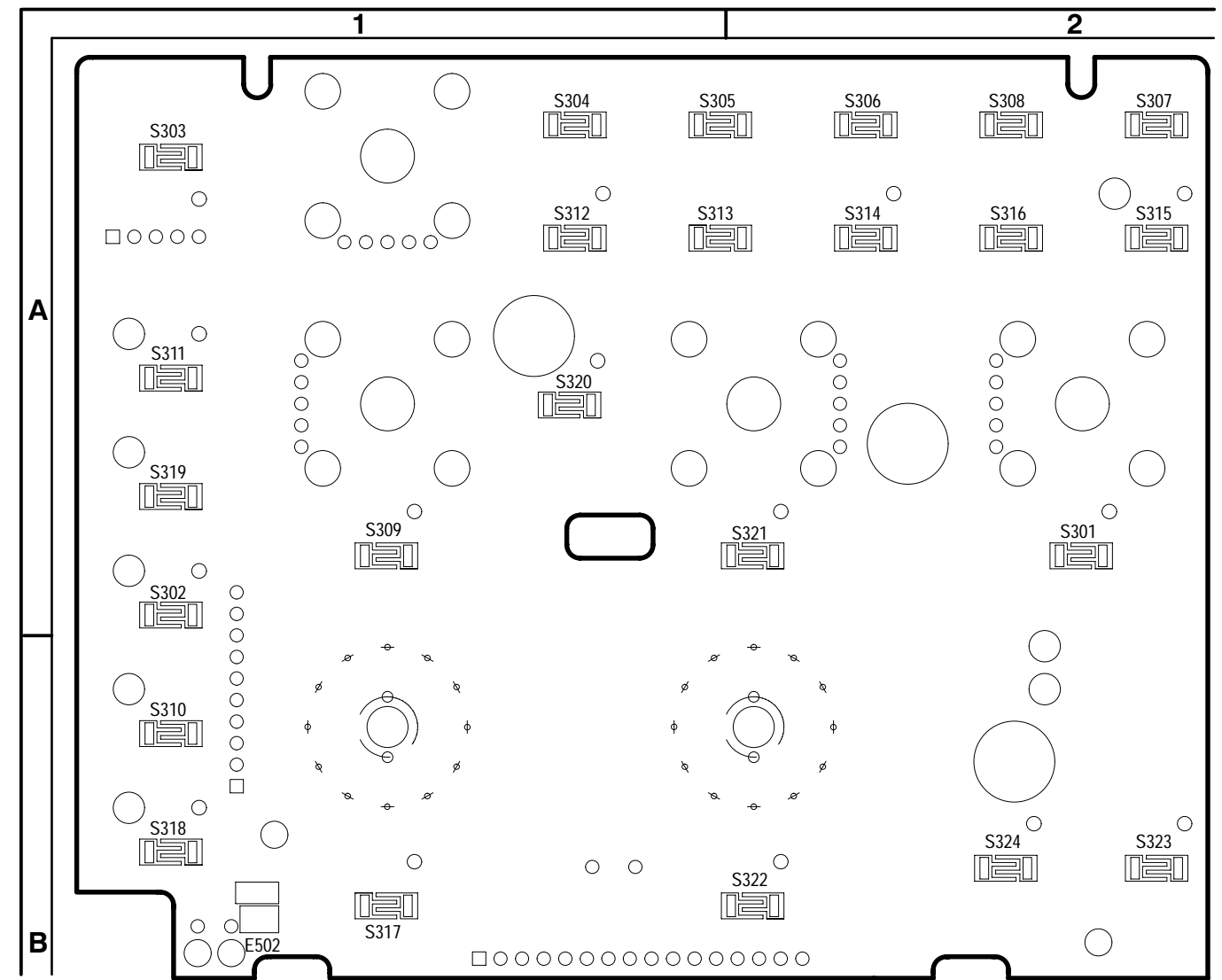
A4 Front-Panel Component Locator

CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION
C101	A4-1	3D	A4	1B	CR500A	A4-1	5C	A4	2B	J84C	A4-1	3D	A4	2A	R333	A4-4	5C	A4	2B	S306*	A4-4	3A	A4	2A
C121	A4-1	2D	A4	2A	CR500B	A4-1	5C	A4	2B	J84E	A4-1	3D	A4	2A	R334	A4-4	5C	A4	2B	S307*	A4-4	3A	A4	2A
C122	A4-1	2D	A4	2A						J84B	A4-2	1A	A4	2A	R335	A4-4	5C	A4	2B	S308*	A4-4	2A	A4	2A
C131	A4-1	1C	A4	1B	DS201	A4-3	3A	A4	1B	J84D	A4-2	1A	A4	2A	R336	A4-4	5C	A4	2B	S309*	A4-4	6A	A4	1A
C132	A4-1	2C	A4	2B	DS202	A4-3	4A	A4	1B						R337	A4-4	5C	A4	2A	S310*	A4-4	5A	A4	1B
C140	A4-1	3C	A4	2B	DS203	A4-3	4A	A4	2B	R101	A4-1	5B	A4	1B	R411	A4-2	4A	A4	1A	S311*	A4-4	5A	A4	1A
C141	A4-1	3C	A4	2B	DS204	A4-3	4A	A4	2B	R102	A4-1	5B	A4	1B	R412	A4-2	4A	A4	1A	S312*	A4-4	4A	A4	1A
C202	A4-4	2D	A4	2A	DS205	A4-3	5A	A4	2B	R103	A4-1	5B	A4	1B	R413	A4-2	5A	A4	2A	S313*	A4-4	6B	A4	1A
C304	A4-4	3D	A4	1A	DS206	A4-3	5A	A4	2A	R104	A4-1	4B	A4	1B	R414	A4-2	5A	A4	1A	S314*	A4-4	5B	A4	2A
C305	A4-4	3D	A4	1A	DS207	A4-3	5A	A4	2A	R106	A4-1	6C	A4	2B	R450	A4-2	2B	A4	2A	S315*	A4-4	5B	A4	2A
C400	A4-2	2B	A4	1A	DS208	A4-3	6A	A4	1A	R107	A4-1	6C	A4	1B	R451	A4-2	2C	A4	1A	S316*	A4-4	4B	A4	2A
C401	A4-2	2B	A4	1A						R108	A4-1	4C	A4	1B	R452	A4-2	3C	A4	2A	S317*	A4-4	6B	A4	1B
C402	A4-2	3C	A4	1A	E502	A4-1	6C	A4	1B	R109	A4-1	4B	A4	1B	R453	A4-2	4C	A4	1A	S318*	A4-4	5B	A4	1B
C403	A4-2	3C	A4	1A						R140	A4-1	3C	A4	2B	R460	A4-2	3B	A4	1A	S319*	A4-4	5B	A4	1A
C404	A4-2	4C	A4	1A	J30A	A4-1	1C	A4	1B	R201	A4-3	3A	A4	1B	R461	A4-2	4B	A4	1A	S320*	A4-4	4B	A4	1A
C405	A4-2	4C	A4	1A	J30B	A4-1	1C	A4	1B	R202	A4-3	4A	A4	1B	R462	A4-2	4B	A4	1A	S321*	A4-4	6B	A4	2A
C406	A4-2	2C	A4	1A	J30C	A4-1	1C	A4	1B	R203	A4-3	4A	A4	2B	R463	A4-2	4B	A4	1A	S322*	A4-4	5B	A4	2B
C407	A4-2	3C	A4	1A	J30D	A4-1	6B	A4	1B	R204	A4-3	4A	A4	2B	R464	A4-2	4B	A4	1A	S323*	A4-4	5B	A4	2B
C408	A4-2	3B	A4	1A	J30E	A4-1	6C	A4	1B	R205	A4-3	5A	A4	2A	R465	A4-2	4B	A4	1A	S324*	A4-4	4B	A4	2B
C409	A4-2	3B	A4	1A	J30F	A4-1	6C	A4	1B	R206	A4-3	5A	A4	2A	R466	A4-2	4B	A4	1A	S340*	A4-4	4C	A4	1B
C420	A4-1	4D	A4	1A	J30G	A4-2	1A	A4	1B	R207	A4-3	5A	A4	2A	R467	A4-2	4B	A4	1A	S341*	A4-4	4C	A4	2B
C421	A4-1	4D	A4	1A	J30H	A4-2	1A	A4	1B	R208	A4-3	6A	A4	1A	R468	A4-2	4B	A4	1A					
C501	A4-1	5C	A4	2B	J35	A4-1	6C	A4	2B	R300	A4-4	6A	A4	1A	R469	A4-2	4B	A4	1A	TP12	A4-1	4C	A4	1B
					J40A	A4-1	6D	A4	2B	R301	A4-4	5A	A4	2B	R501	A4-1	5C	A4	2B					
CR331A	A4-4	2A	A4	1A	J40C	A4-4	6C	A4	2B	R302	A4-4	5A	A4	2A	R503	A4-1	4C	A4	1B	U101	A4-1	3B	A4	1B
CR332A	A4-4	2B	A4	1A	J40D	A4-4	6C	A4	2B	R303	A4-4	4A	A4	1A	R504	A4-1	4D	A4	1B	U202	A4-3	3A	A4	2A
CR333A	A4-4	2B	A4	1A	J40E	A4-4	6C	A4	2B	R304	A4-4	4A	A4	1A	R505	A4-1	4D	A4	1B	U304	A4-4	2B	A4	1A
CR334A	A4-4	3C	A4	1B	J40F	A4-4	6C	A4	2B	R305	A4-4	3A	A4	1A						U305	A4-4	2D	A4	1A
CR335A	A4-4	3C	A4	1B	J40G	A4-4	6C	A4	2B	R306	A4-4	3A	A4	1A	S301*	A4-4	6A	A4	2A	U420	A4-2	5A	A4	1A
CR336A	A4-4	3C	A4	1B	J40H	A4-4	6B	A4	2B	R307	A4-4	2A	A4	1A	S302*	A4-4	5A	A4	1B	U421	A4-2	5B	A4	1A
CR337A	A4-4	3C	A4	1B	J40I	A4-4	6C	A4	2B	R330	A4-4	5B	A4	2B	S303*	A4-4	5A	A4	1A					
CR338A	A4-4	3C	A4	1B	J40J	A4-4	6C	A4	2B	R331	A4-4	5C	A4	2B	S304*	A4-4	4A	A4	1A	Y140	A4-1	3C	A4	1B
CR339A	A4-4	3D	A4	2B	J84A	A4-1	3D	A4	2A	R332	A4-4	5C	A4	2B	S305*	A4-4	4A	A4	1A					

*Asterisks indicate components located on the back of the board.



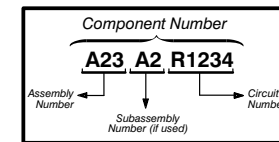
Front



Back

389-1687-00
671-2911-00
Q9A-1687-00

COMPONENT NUMBER EXAMPLE



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

STATIC SENSITIVE DEVICES

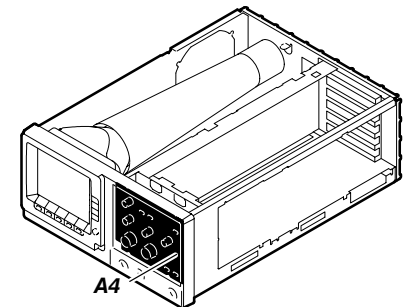
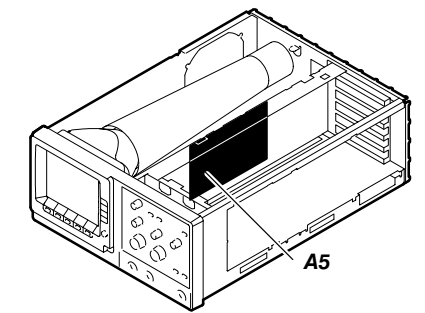
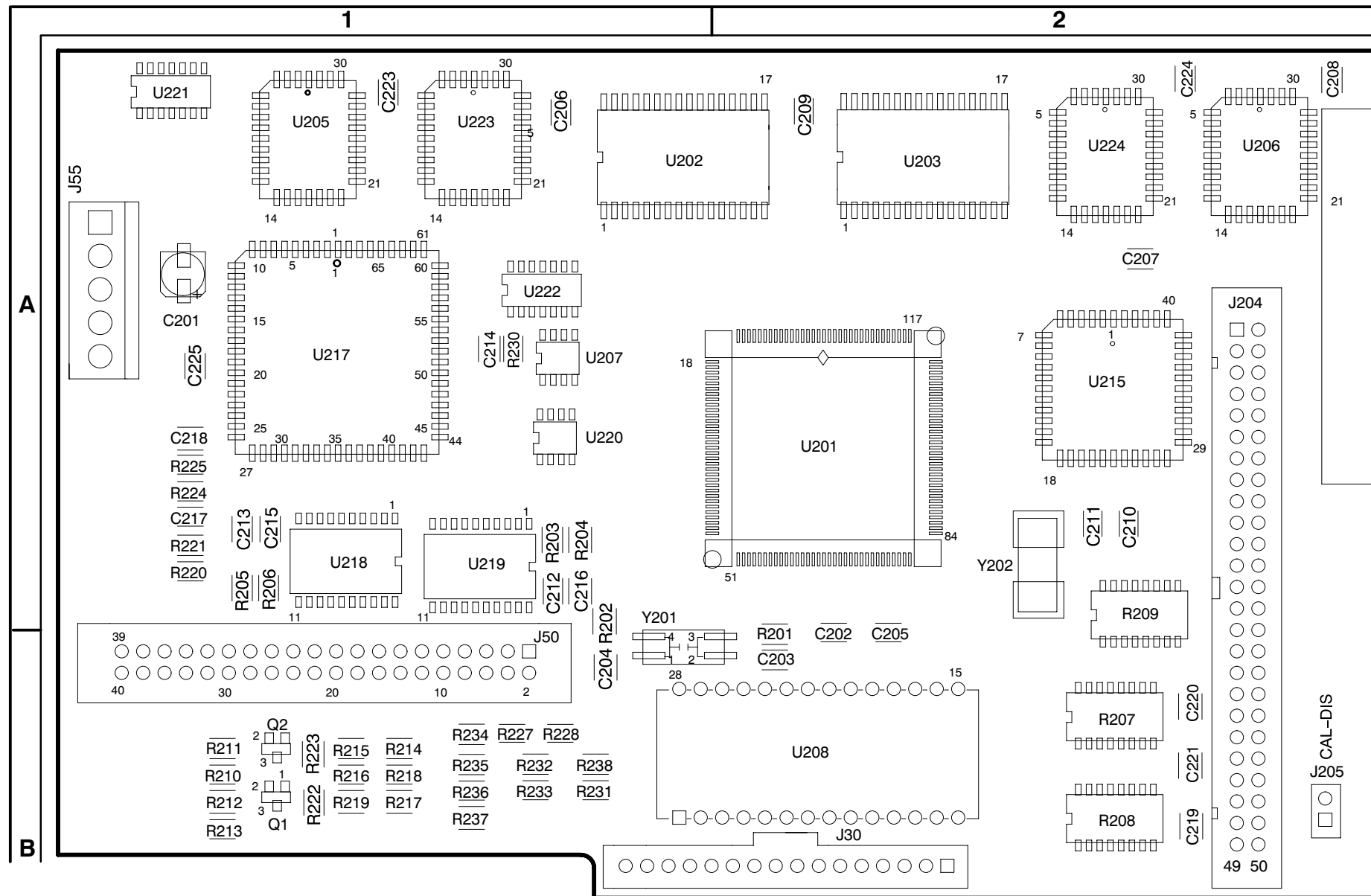


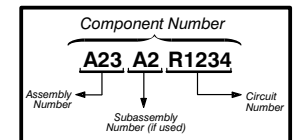
Figure 9-8: A4 Front Panel Board

CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION	CIRCUIT NUMBER	SCHEM NUMBER	SCHEM LOCATION	BOARD NUMBER	BOARD LOCATION
C201	A5-1	1A	A5	1A	C220	A5-1	5C	A5	2B	R206	A5-4	5B	A5	1A	R224	A5-4	4D	A5	1A	U206	A5-2	4B	A5	2A
C202	A5-1	2C	A5	2A	C221	A5-1	2C	A5	2B	R207	A5-1	2A	A5	2B	R225	A5-4	4D	A5	1A	U207	A5-1	1C	A5	1A
C203	A5-1	2C	A5	2B	C223	A5-2	6B	A5	1A	R208	A5-1	1B	A5	2B	R227	A5-4	6A	A5	1B	U208	A5-1	5A	A5	2B
C204	A5-1	2B	A5	1B	C224	A5-2	6C	A5	2A	R209	A5-3	2A	A5	2A	R228	A5-4	6A	A5	1B	U215	A5-3	3A	A5	2A
C205	A5-1	2A	A5	2A	C225	A5-4	3A	A5	1A	R210	A5-1	1D	A5	1B	R230	A5-2	2A	A5	1A	U217	A5-4	2A	A5	1A
C206	A5-2	2D	A5	1A						R211	A5-1	1D	A5	1B	R231	A5-1	5C	A5	1B	U218	A5-4	5C	A5	1A
C207	A5-2	4C	A5	2A	J30	A5-1	5D	A5	2B	R212	A5-1	1D	A5	1B	R232	A5-1	5C	A5	1B	U219	A5-4	5A	A5	1A
C208	A5-2	2B	A5	2A	J50	A5-1	6C	A5	1B	R213	A5-1	1D	A5	1B	R233	A5-1	5C	A5	1B	U220	A5-4	4B	A5	1A
C209	A5-2	4B	A5	2A	J55	A5-1	1C	A5	1A	R214	A5-1	3D	A5	1B	R234	A5-1	5C	A5	1B	U221A	A5-2	1A	A5	1A
C210	A5-3	2C	A5	2A	J204	A5-1	6A	A5	2A	R215	A5-1	3D	A5	1B	R235	A5-1	5C	A5	1B	U221B	A5-2	2A	A5	1A
C211	A5-3	2C	A5	2A						R216	A5-1	3D	A5	1B	R236	A5-1	5D	A5	1B	U221C	A5-2	2A	A5	1A
C212	A5-4	5B	A5	1A	Q1	A5-1	1D	A5	1B	R217	A5-1	2D	A5	1B	R237	A5-1	5D	A5	1B	U222A	A5-2	2A	A5	1A
C213	A5-4	5D	A5	1A	Q2	A5-1	2D	A5	1B	R218	A5-1	2D	A5	1B	R238	A5-1	5C	A5	1B	U222B	A5-2	2A	A5	1A
C214	A5-4	2A	A5	1A						R219	A5-1	2D	A5	1B						U223	A5-2	5B	A5	1A
C215	A5-4	5B	A5	1A	R201	A5-1	2C	A5	2A	R220	A5-1	1D	A5	1A	U201	A5-1	3A	A5	2A	U224	A5-2	5C	A5	2A
C216	A5-4	6B	A5	1A	R202	A5-1	2B	A5	1A	R221	A5-1	1D	A5	1A	U202	A5-2	3C	A5	1A					
C217	A5-4	4D	A5	1A	R203	A5-4	5B	A5	1A	R222	A5-1	2D	A5	1B	U203	A5-2	4C	A5	2A	Y201	A5-1	2C	A5	1A
C218	A5-4	4D	A5	1A	R204	A5-4	5B	A5	1A	R223	A5-1	2D	A5	1B	U205	A5-2	3B	A5	1A	Y202	A5-3	2C	A5	2A
C219	A5-1	2C	A5	2B	R205	A5-4	5D	A5	1A															



389-1220-02
671-2221-04
Q9A-1220-02

COMPONENT NUMBER EXAMPLE



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



Figure 9-9: A5 Processor Board

A63 Power Supply Component Locator

CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION	CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION	CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION	CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION	CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION	CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION	CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION	CIRCUIT NUMBER	BOARD LOCATION	SCHEM LOCATION
C1	B1	2C4	C28	A2	3D3	CR1	B3	4C2	CR3	A3	4D2	Q2	B2	3C6	R18	A1	2C3	R33	B2	3D5	R8	B4	2B5
C10	B3	2B5	C29	A2	3C5	CR10	A1	2C5	CR4	A3	4B2	Q3	B2	3C6	R19	A2	3B2	R34	B2	3C5	R9	A1	2C3
C11	A2	3B3	C3	A1	2C4	CR11	A3	4A2	CR5	A3	4B2	Q4	A2	3B5	R2	A2	3C1	R37	B2	3B4	R90	A4	4C4
C12	A2	3D2	C30	B2	3B4	CR12	A1	2C5	CR6	A3	4B2	Q5	B2	3C3	R20	A2	3B2	R38	A2	3B5	RT1	A1	2B3
C13	A3	4D4	C31	A4	4C3	CR13	A3	4A2	CR7	A3	4A2	Q6	A2	3B2	R21	A2	3B4	R39	A2	3C1	S1	B4	2C4
C14	A2	3B5	C32	A2	4D3	CR14	A1	2C5	CR8	A3	4A2	Q7	A2	3B4	R22	A2	3A1	R4	A2	3C1	T1	B4	2A5
C15	A2	2C6	C33	A3	4D3	CR15	A2	3C3	CR9	A1	2C5	Q8	A2	3B4	R23	A2	3B5	R40	A2	3B4	T2	A2	3B3
C16	B2	3D3	C34	A4	4C3	CR16	B1	3C3	DS1	A3	4D4	Q9	A2	3C3	R24	A2	3A2	R41	A2	3C1	T8	A3	4A1
C18	A3	4B2	C35	B3	4C3	CR17	A3	4A2	E1	B2	3C3	Q60	A3	4B3	R25	A2	3C3	R42	A2	3C1	T9	B2	3C5
C19	A4	4B3	C36	A3	4C2	CR18	B2	3C5	L1	A4	4A3	R1	A3	4D3	R26	B2	3C5	R43	A2	3B4	U1	A2	3C2
C2	A2	3C1	C37	B3	4C3	CR19	B2	3C5	L2	A3	4B3	R10	A2	3C1	R27	A2	3D3	R44	A3	4A4	U2	A3	4D3
C20	A3	4B3	C4	B1	2C3	CR2	B3	4C2	L3	A4	4C3	R11	A1	2C2	R28	A2	3C3	R45	A2	3C1	VR1	A2	3B2
C22	A4	4A3	C5	A3	4D4	CR20	A2	3A3	L5	B1	2C3	R12	A2	3C1	R29	B2	3C5	R46	A2	3C4	VR2	A2	3B5
C23	A2	3B1	C6	A1	2C3	CR21	A3	4C2	L6	A1	2B3	R13	A2	3B2	R3	B1	2B4	R5	B1	2B3	VR3	A2	3D3
C24	B3	4A3	C7	A2	3C2	CR22	A3	4C2	L7	B3	4C3	R14	A3	4D4	R30	B2	3B4	R6	B1	2C3	VR60	A3	4C3
C25	B2	3C5	C8	B1	2C5	CR23	A3	4B2	P55	?	4B6	R15	A2	3B2	R31	A2	3C3	R60	A3	4C3	W1	A1	2B2
C26	A3	4C2	C9	B1	3B3	CR24	B3	4C3	Q1	A2	3D3	R16	B4	2B5	R32	B2	3C6	R7	B3	2B5	W2	A1	2C2
C27	A4	4B3	C90	A3	4C5	CR25	B2	3D5	Q10	A2	3B2	R17	A2	3C1									

*Asterisks indicate components located on the back of the board.

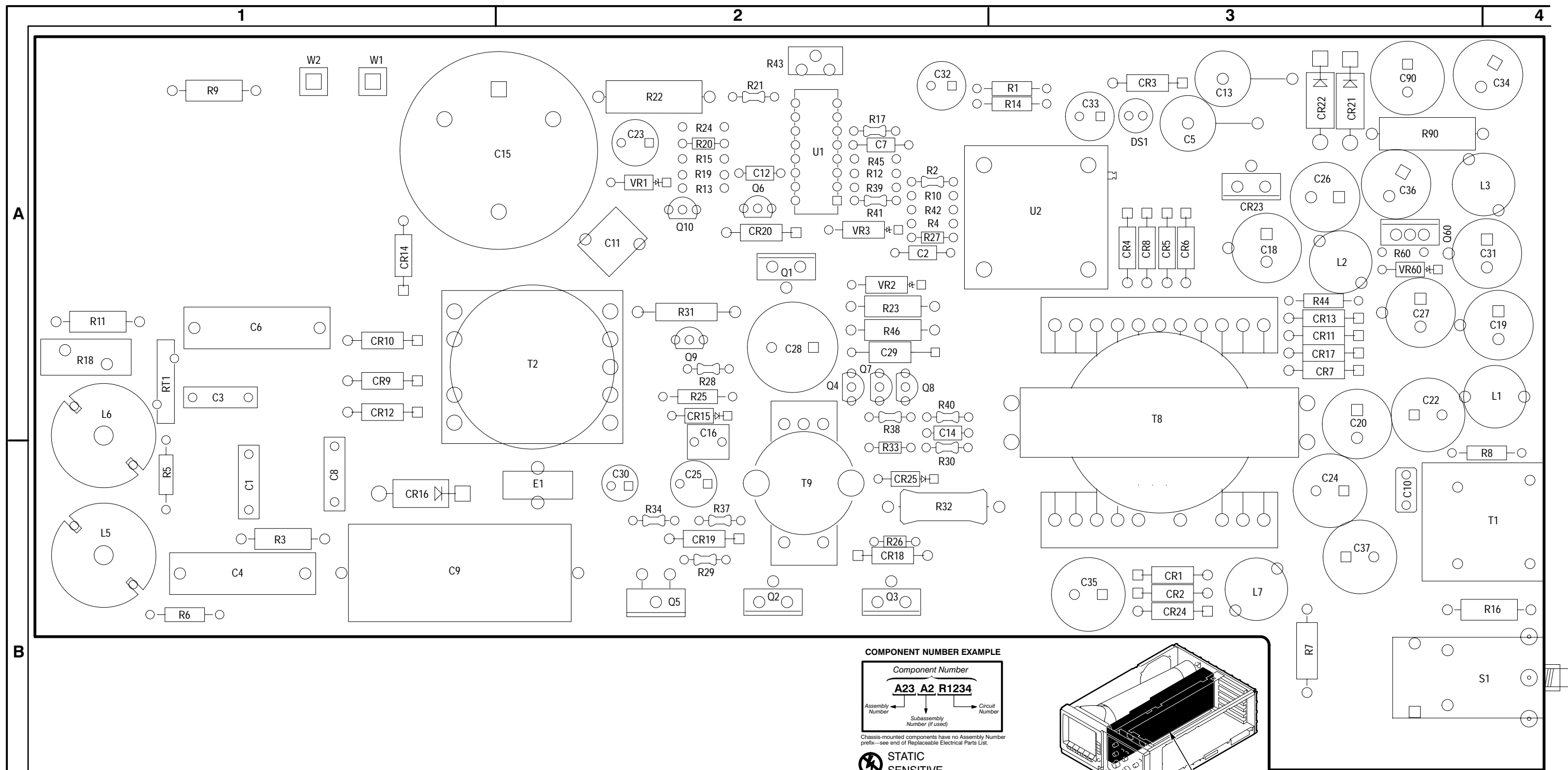
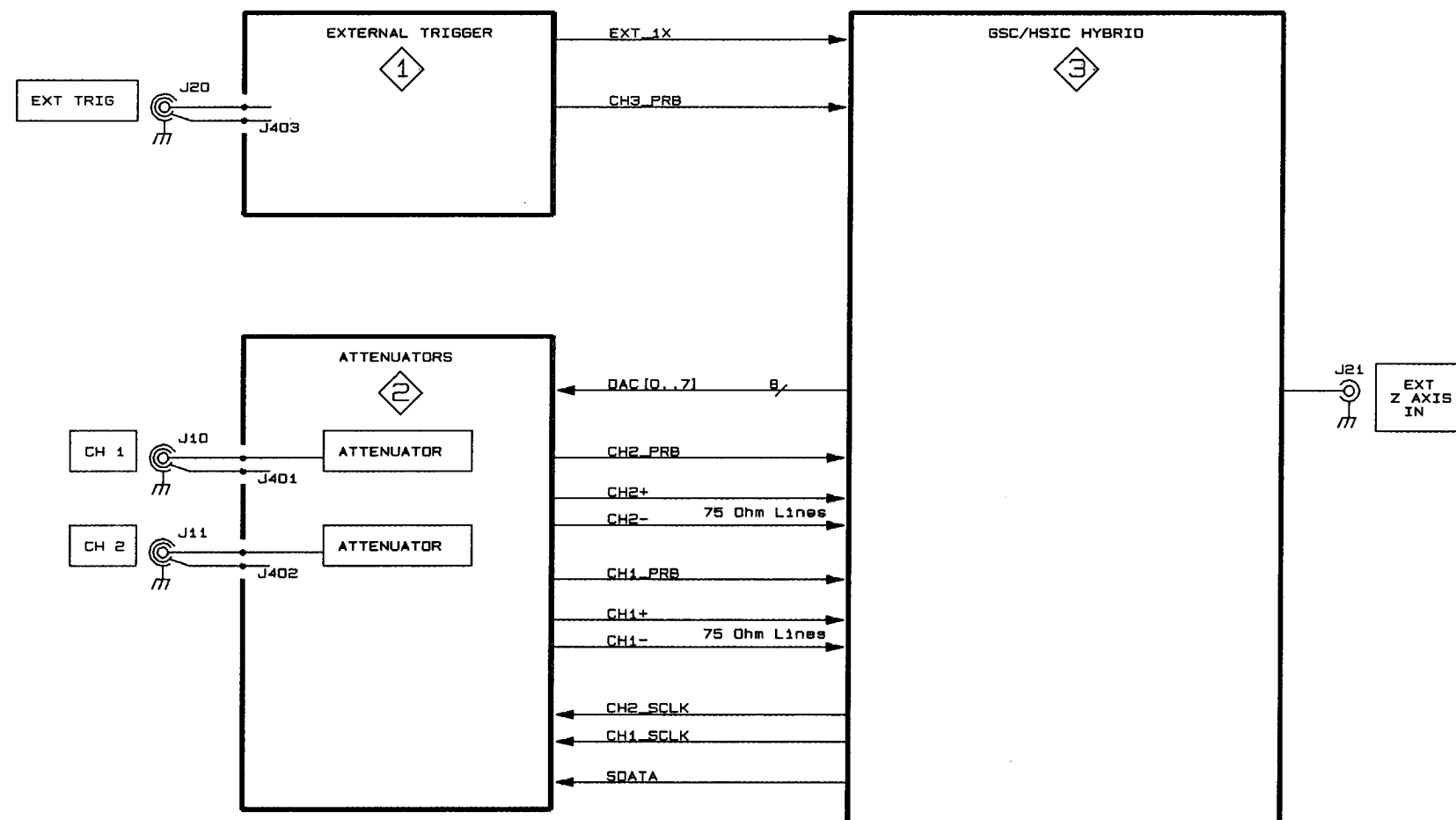
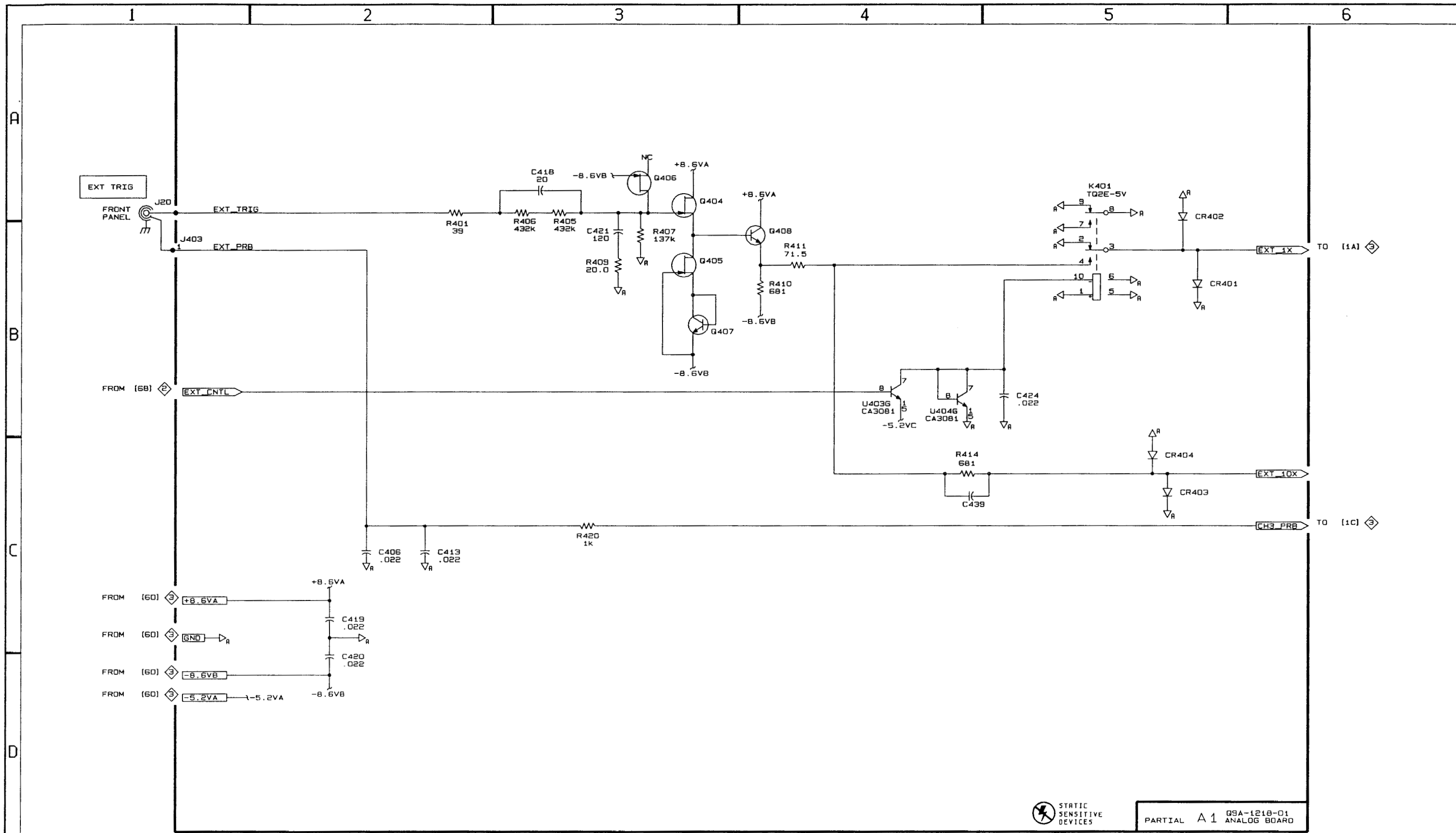
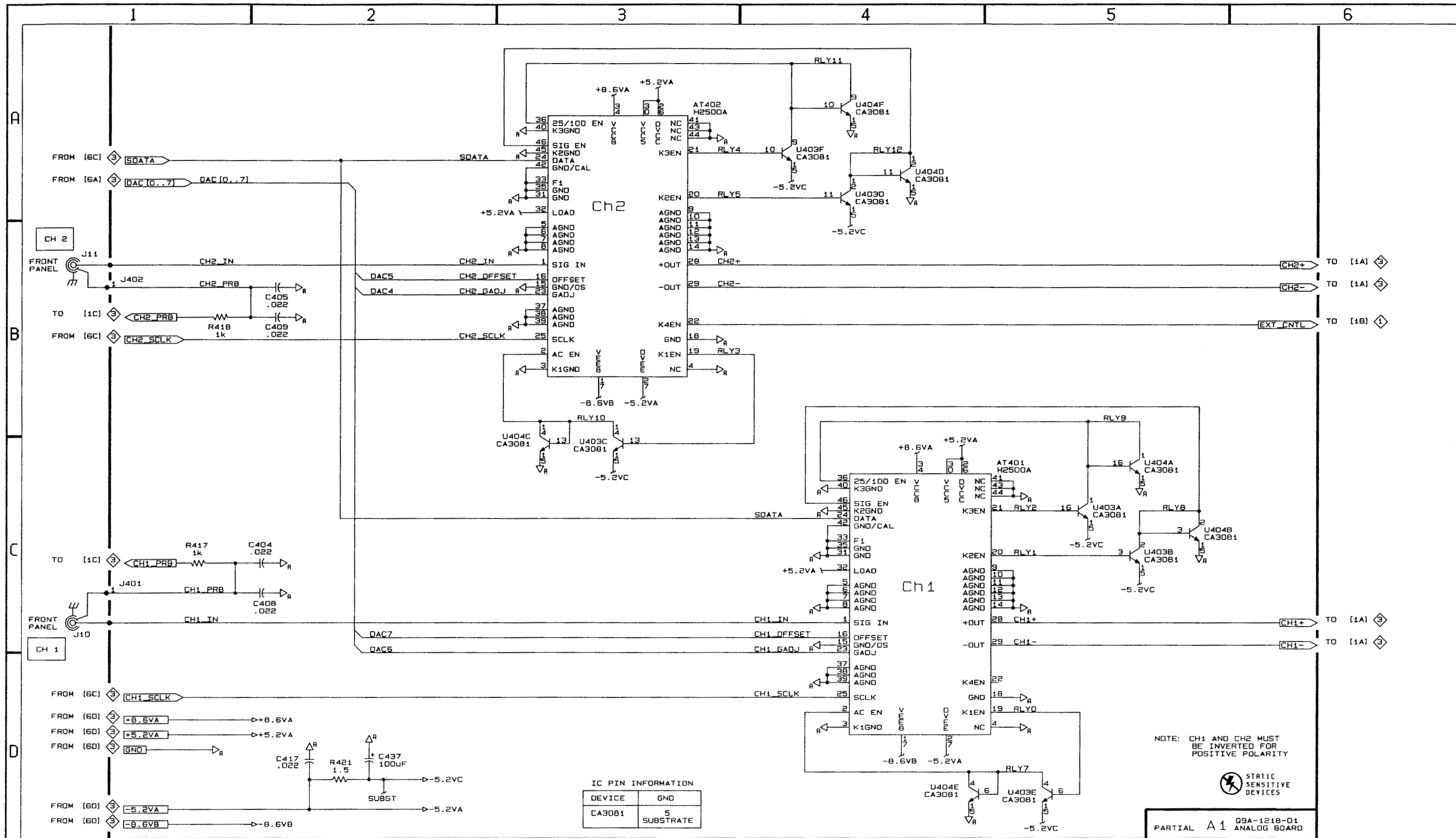


Figure 9-10: A63 Power Supply





PARTIAL A1 Q9A-1218-01 ANALOG BOARD



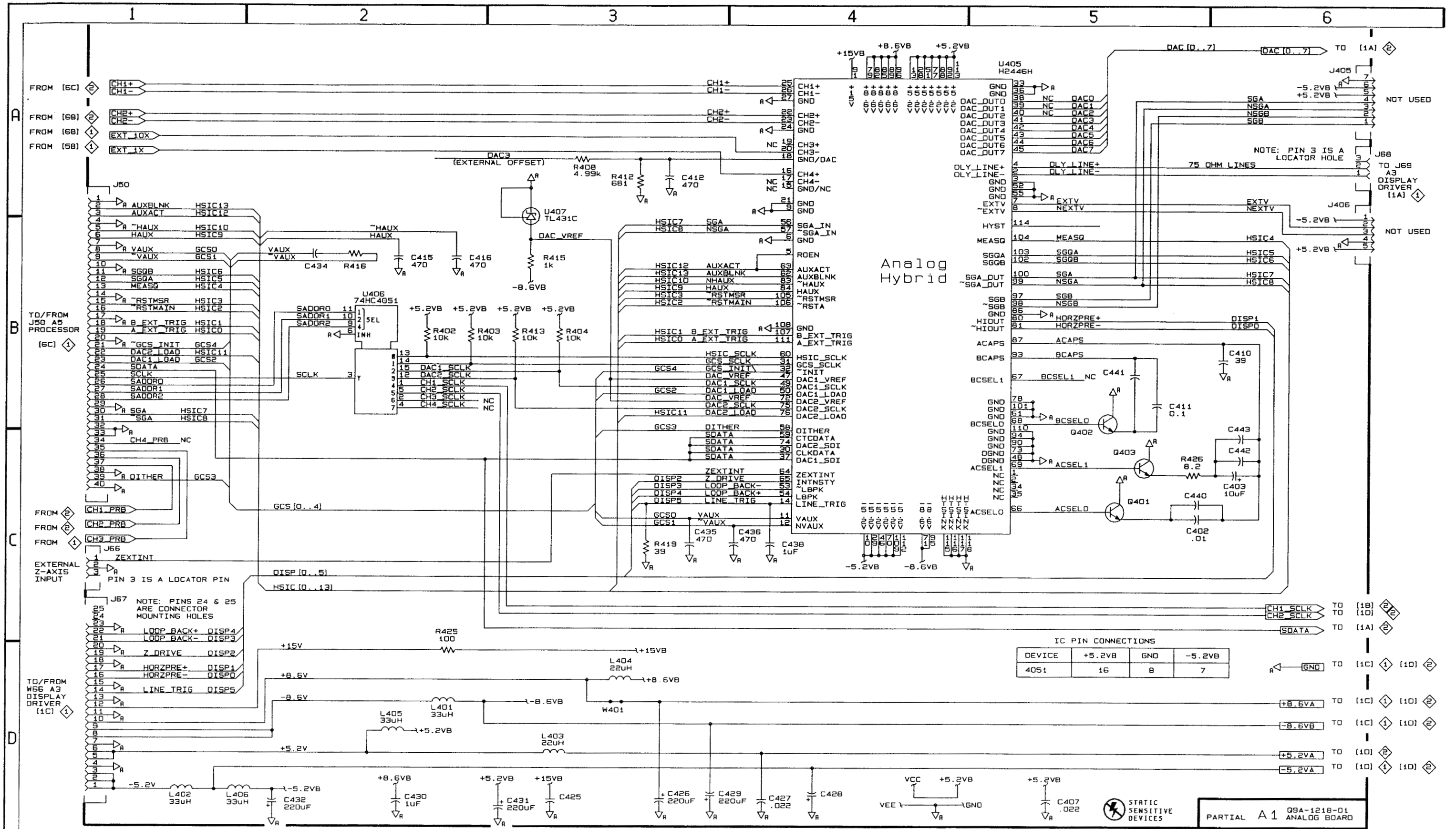
IC PIN INFORMATION

DEVICE	GND
CA3081	5 SUBSTRATE

NOTE: CH1 AND CH2 MUST BE INVERTED FOR POSITIVE POLARITY



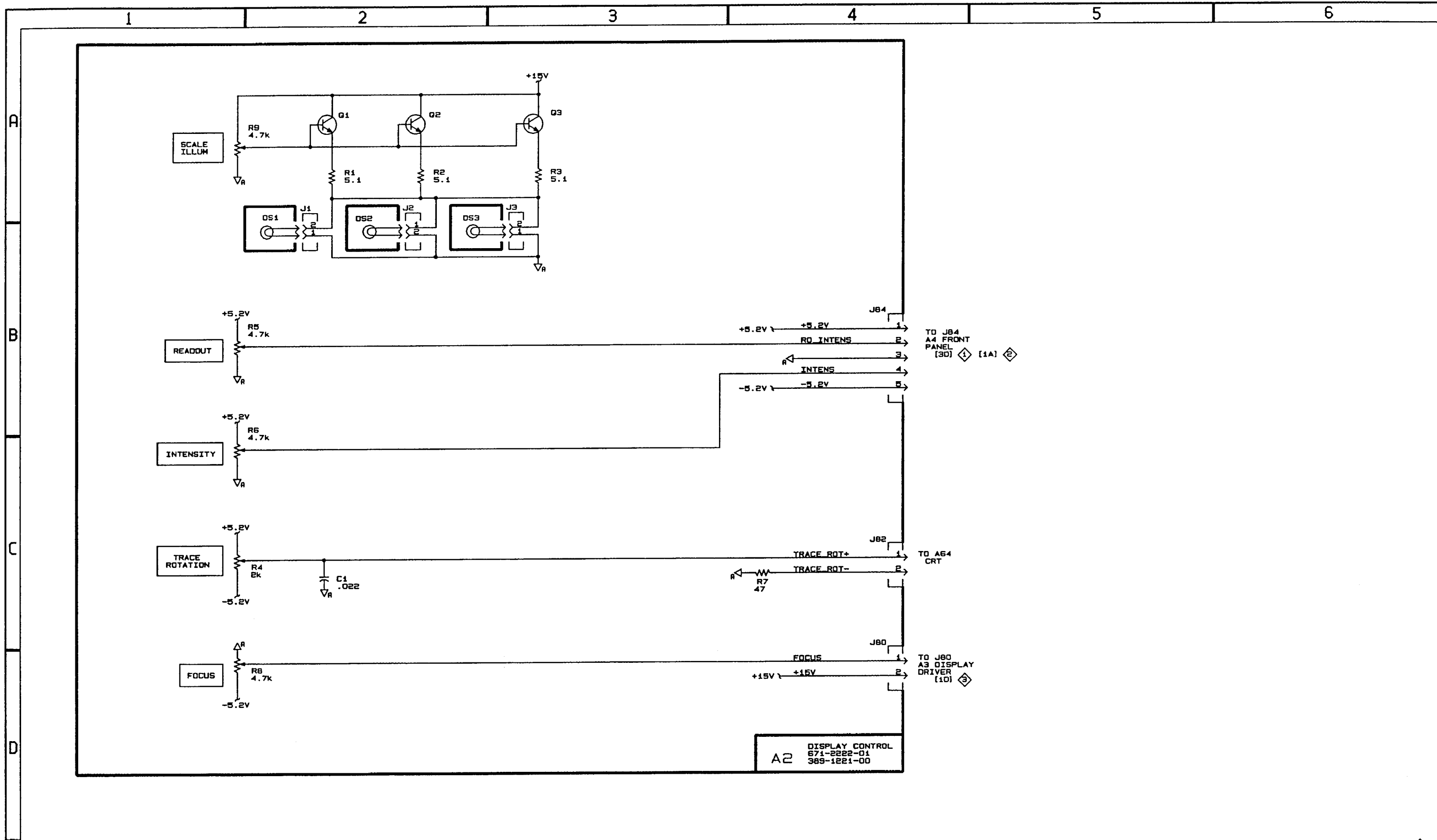
PARTIAL A1 Q9A-1218-01 ANALOG BOARD



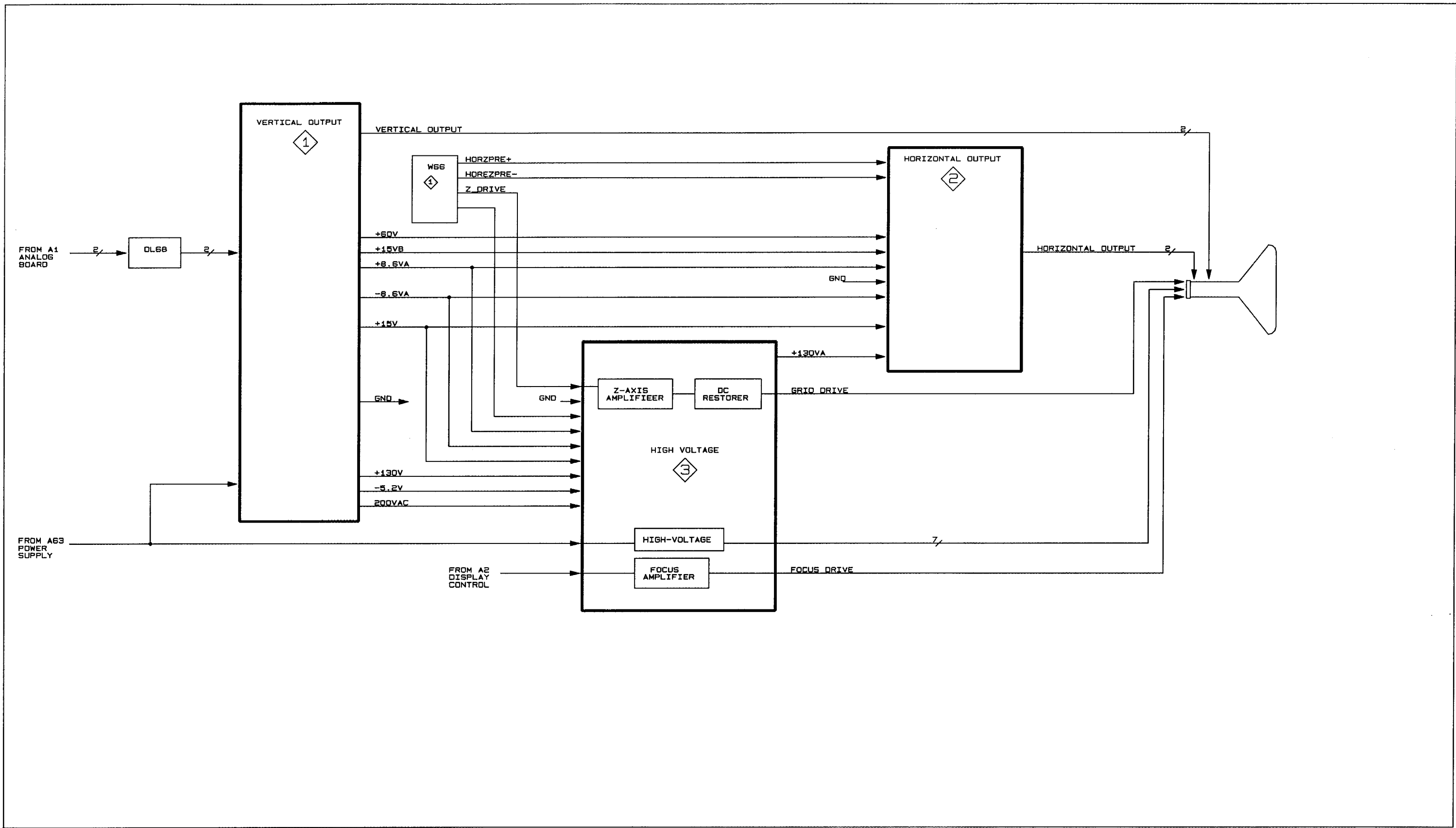
Analog Hybrid


IC PIN CONNECTIONS

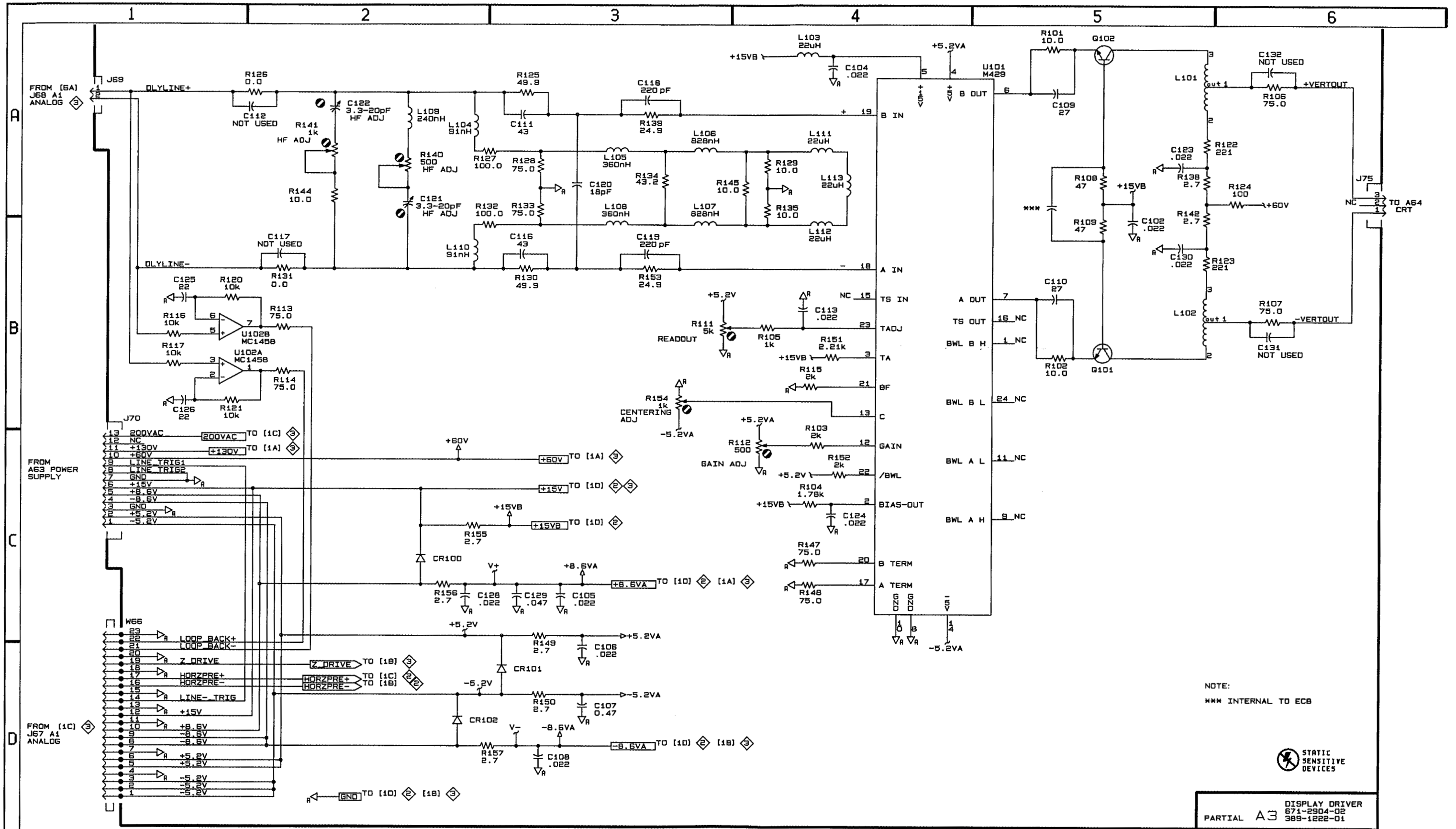
DEVICE	+5.2VB	GND	-5.2VB
4051	16	8	7



A2 DISPLAY CONTROL
671-2222-01
389-1221-00



DISPLAY DRIVER BLOCK DIAGRAM A3 

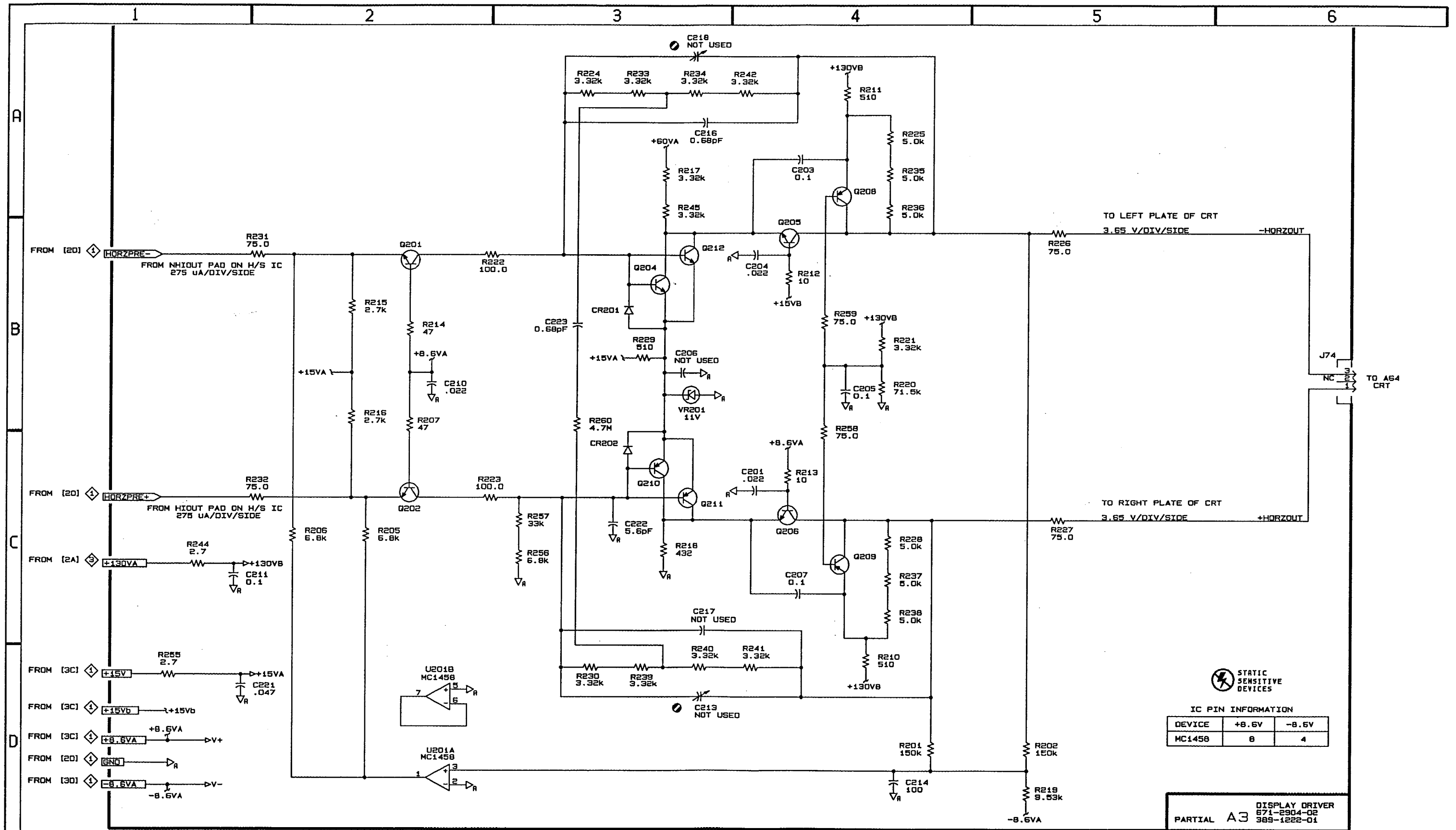


TAS 465

8012562 & ABOVE

VERTICAL OUTPUT A3 ①

DISPLAY DRIVER
671-2904-02
389-1222-01

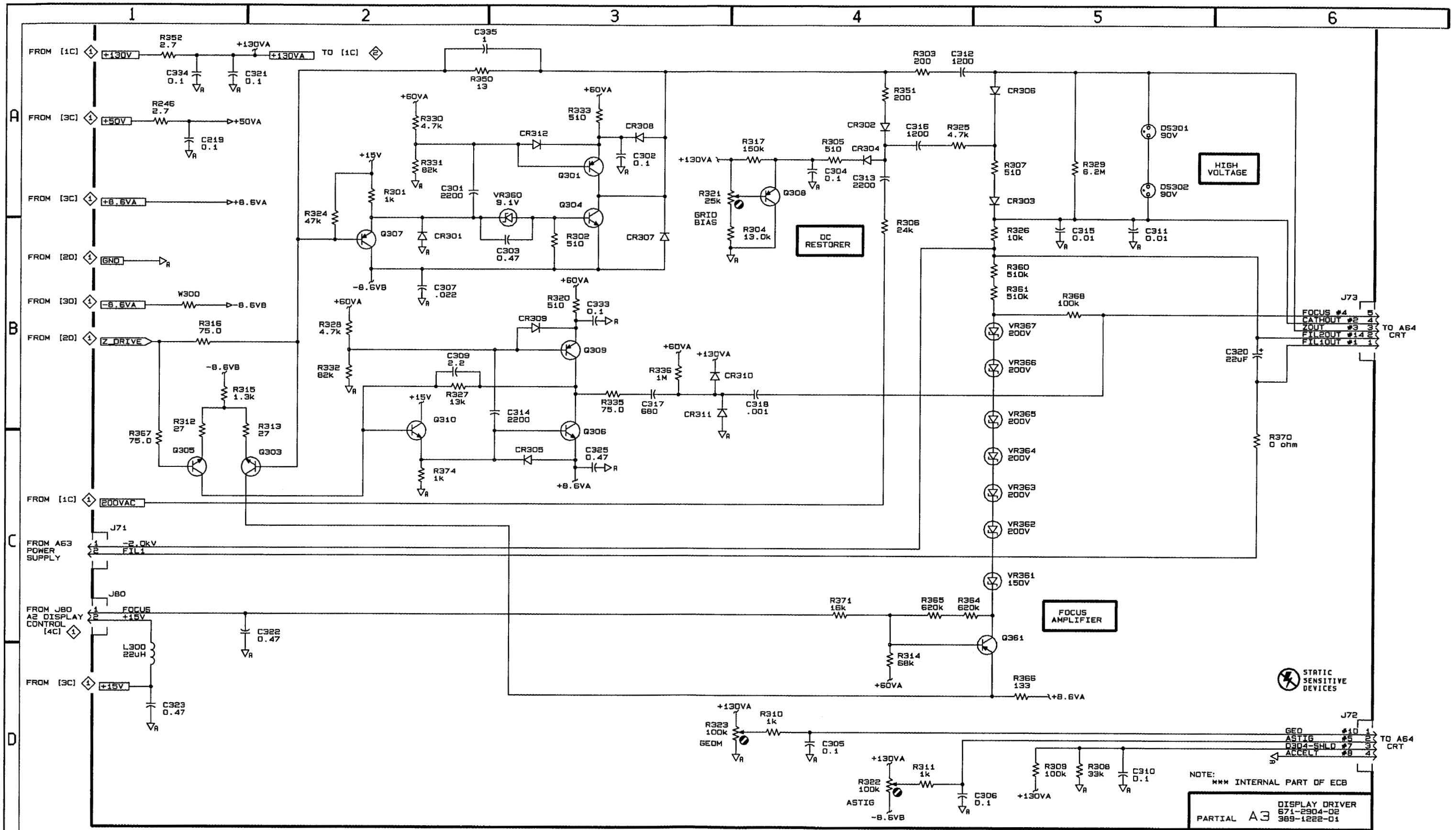


STATIC SENSITIVE DEVICES

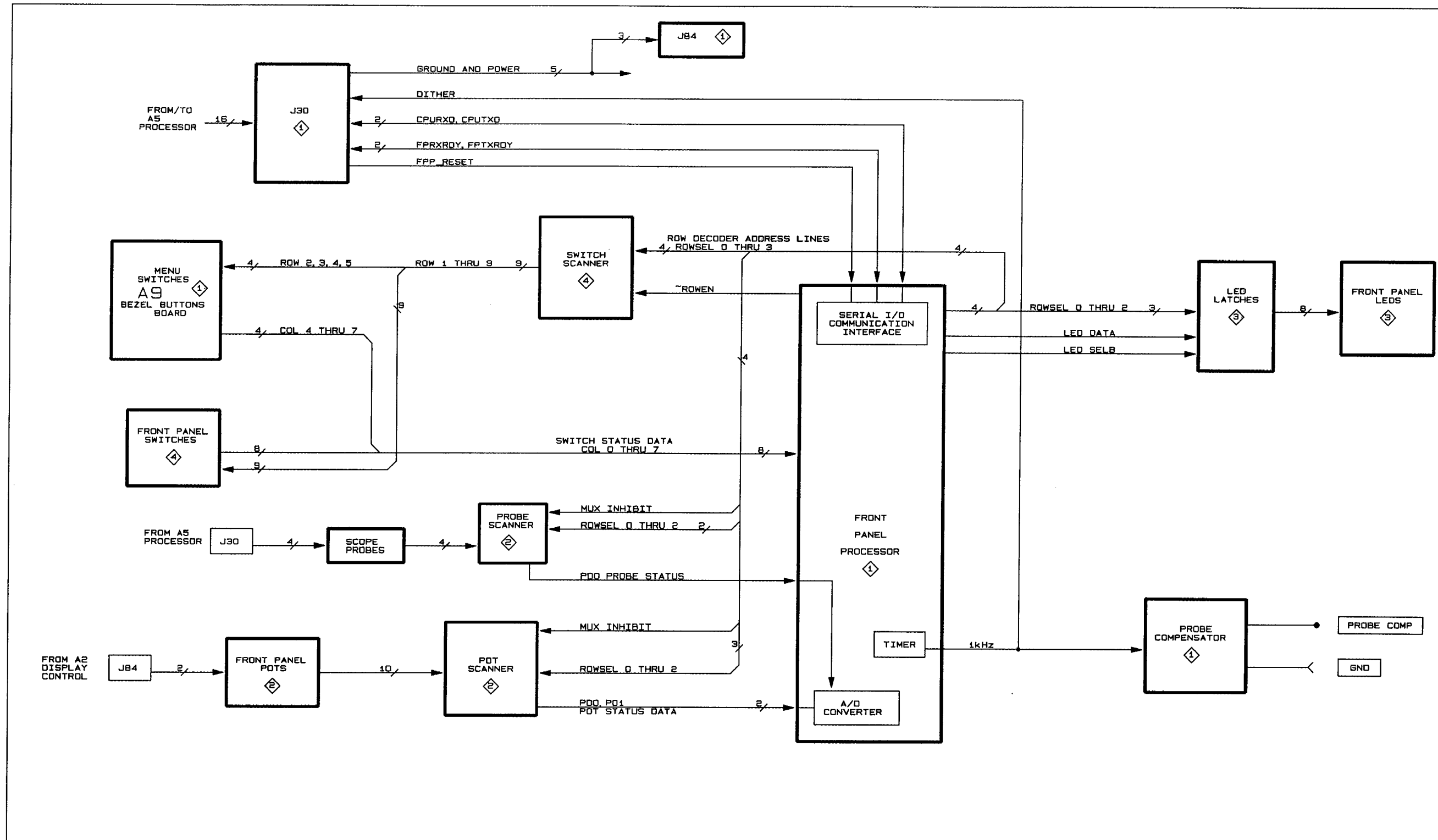
IC PIN INFORMATION

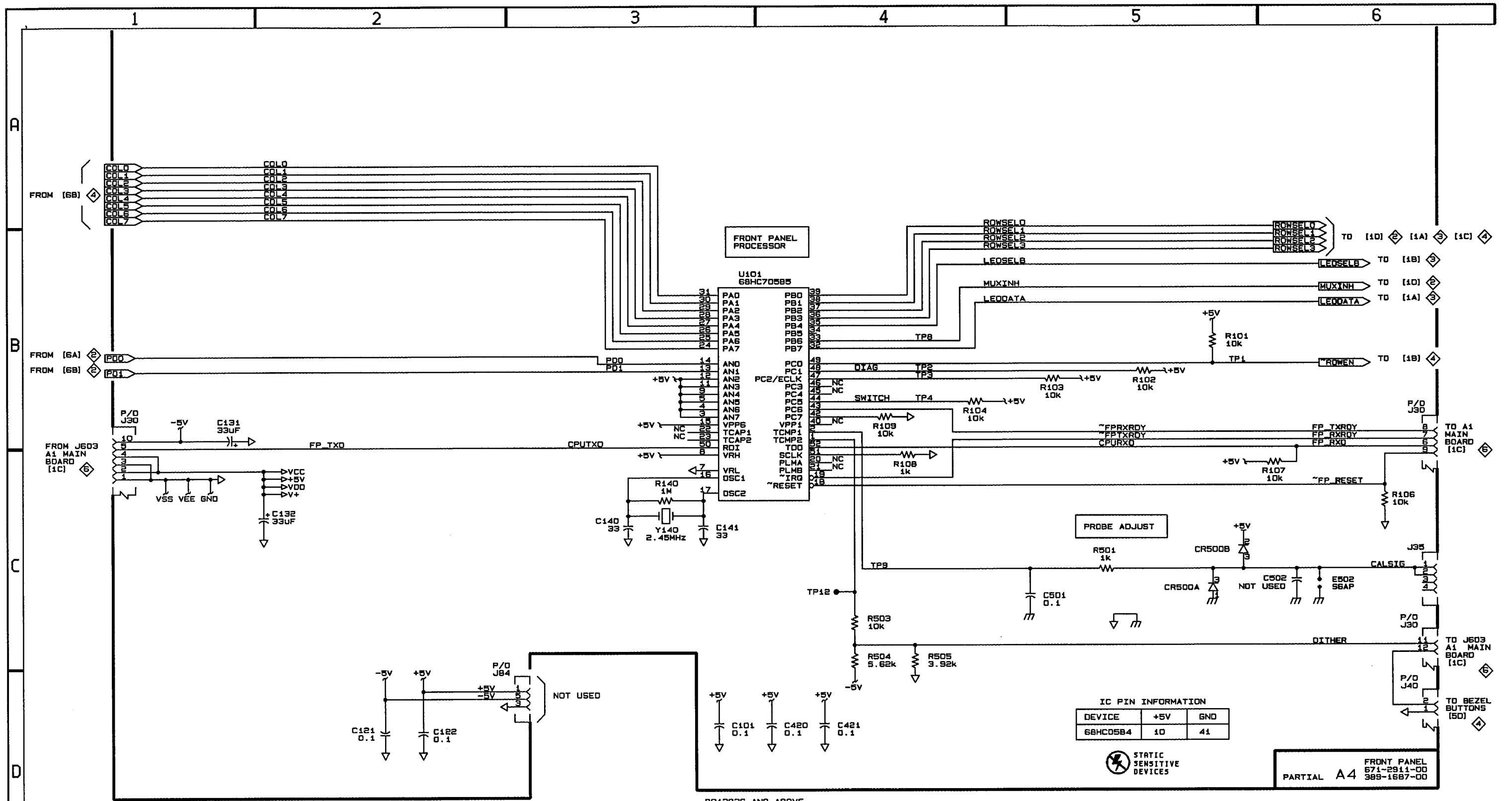
DEVICE	+8.6V	-8.6V
MC1458	8	4

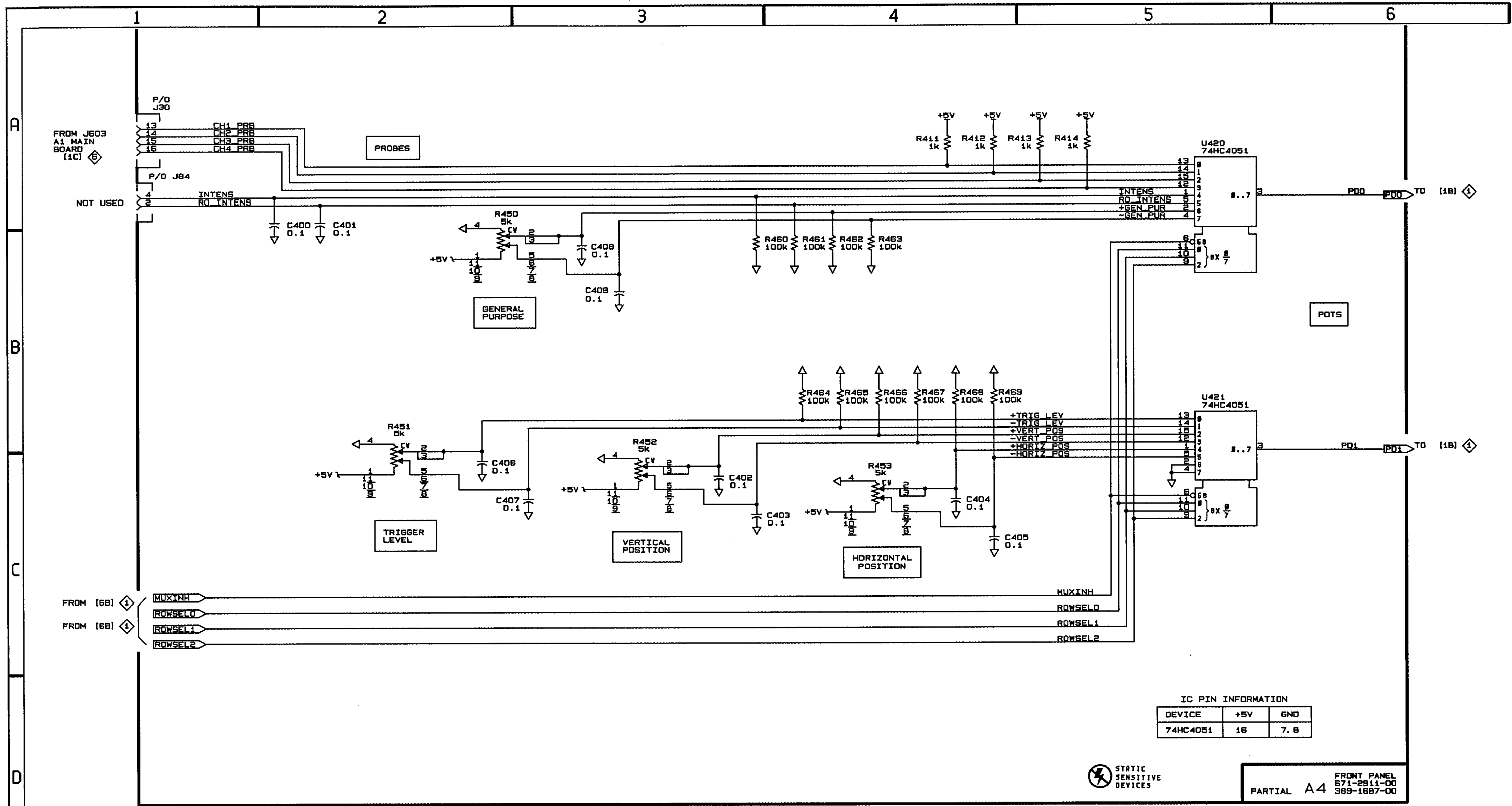
PARTIAL A3 DISPLAY DRIVER
671-2904-02
989-1222-01

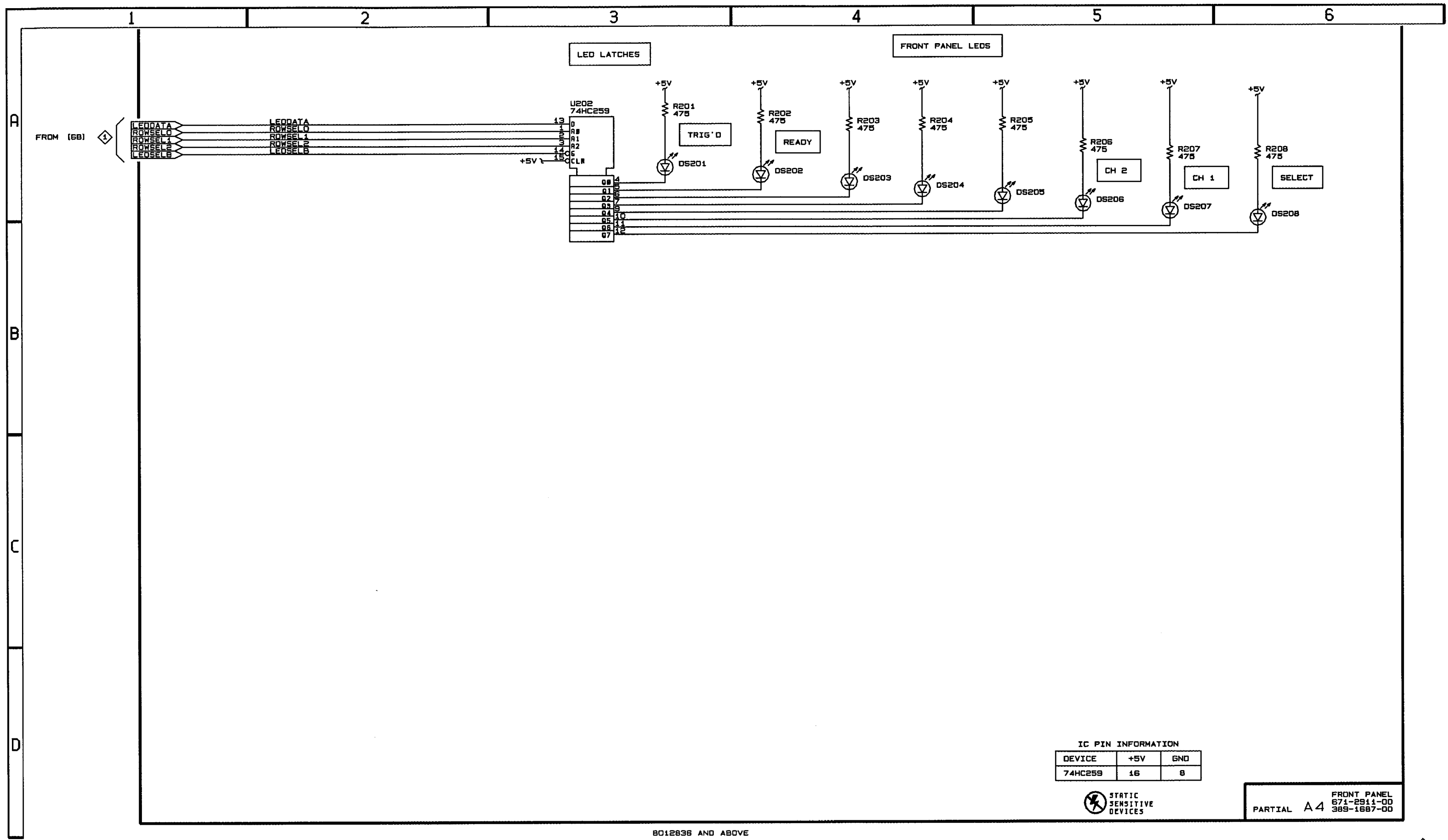


NOTE: *** INTERNAL PART OF ECB
 DISPLAY DRIVER
 671-2904-02
 PARTIAL A3
 389-1222-01









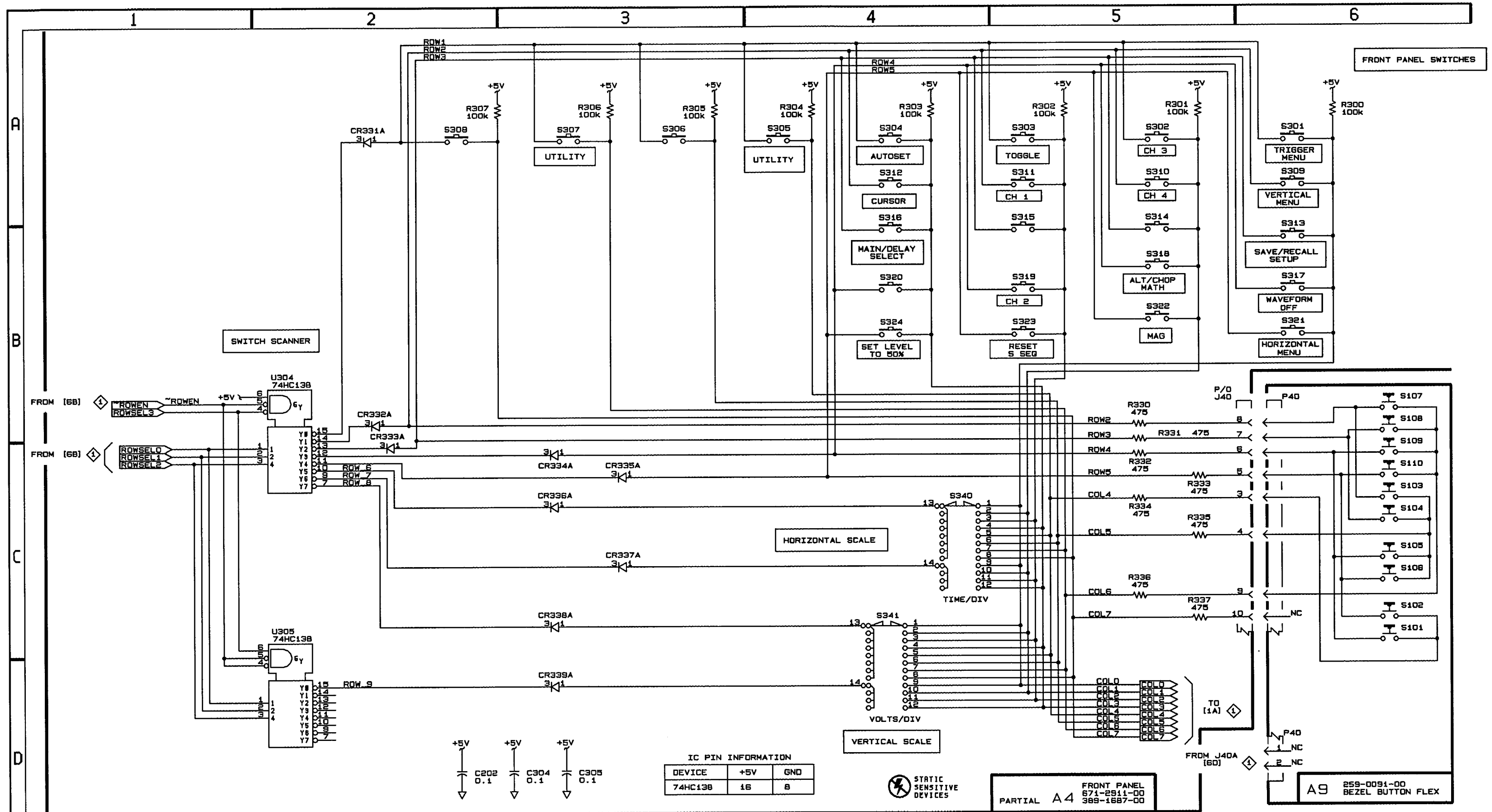
IC PIN INFORMATION

DEVICE	+5V	GND
74HC259	16	8

⚡ STATIC SENSITIVE DEVICES

FRONT PANEL
671-2911-00
389-1687-00
PARTIAL A4

8012836 AND ABOVE



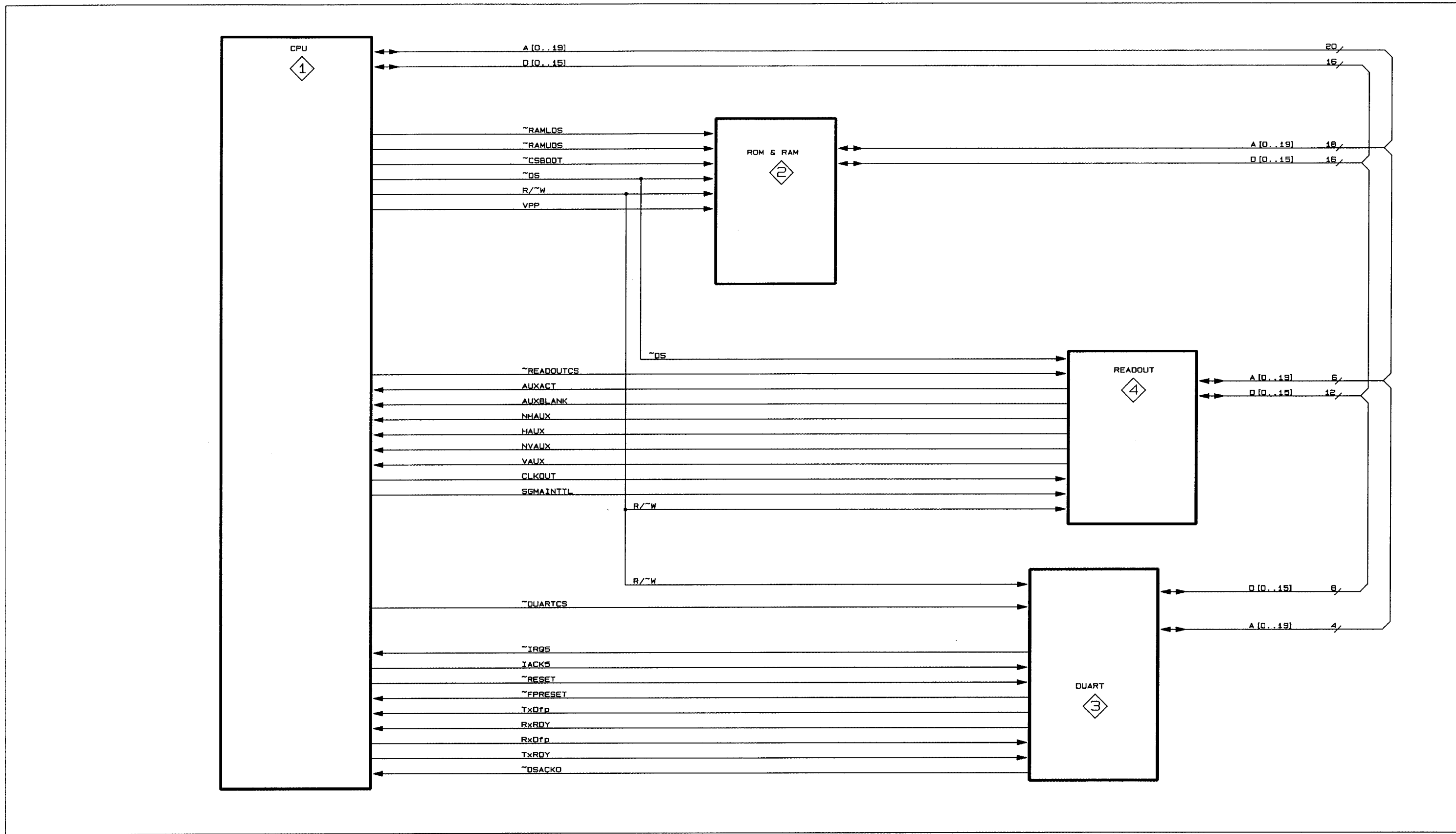
IC PIN INFORMATION

DEVICE	+5V	GND
74HC138	16	8

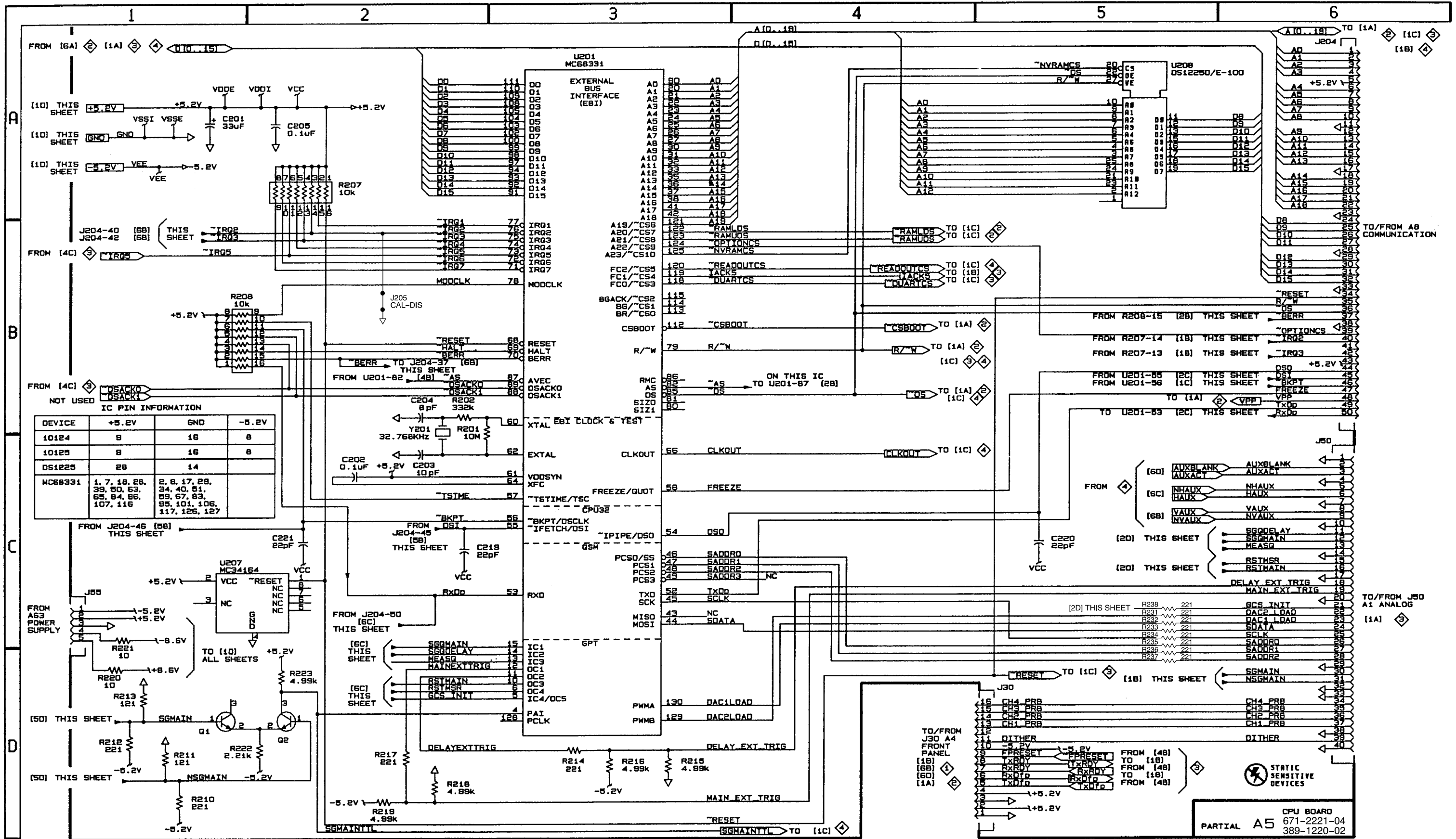
PARTIAL A4 FRONT PANEL
671-2911-00
389-1687-00

A9 259-0091-00
BEZEL BUTTON FLEX

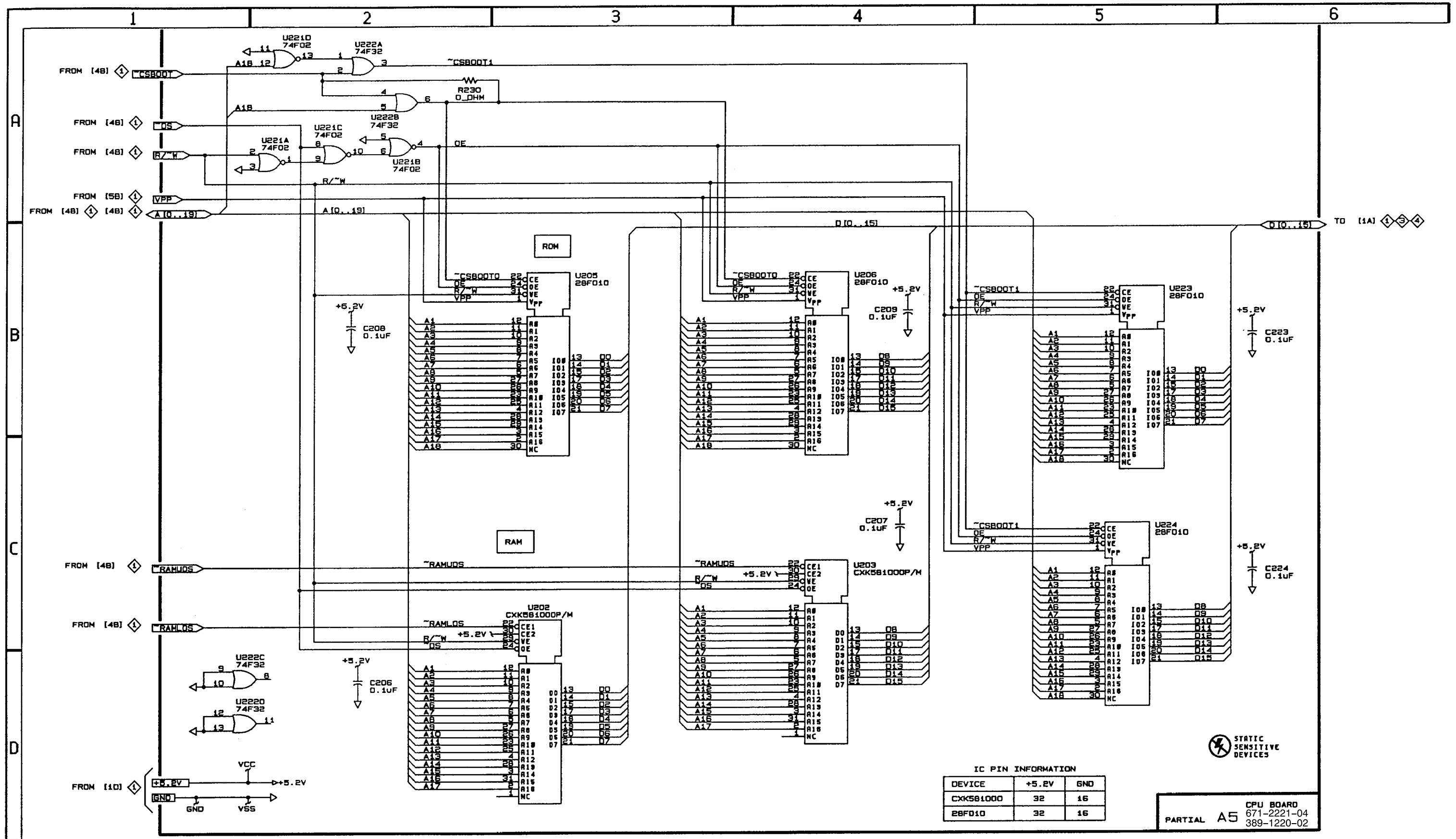
8012836 AND ABOVE



CPU BLOCK DIAGRAM DETAILED




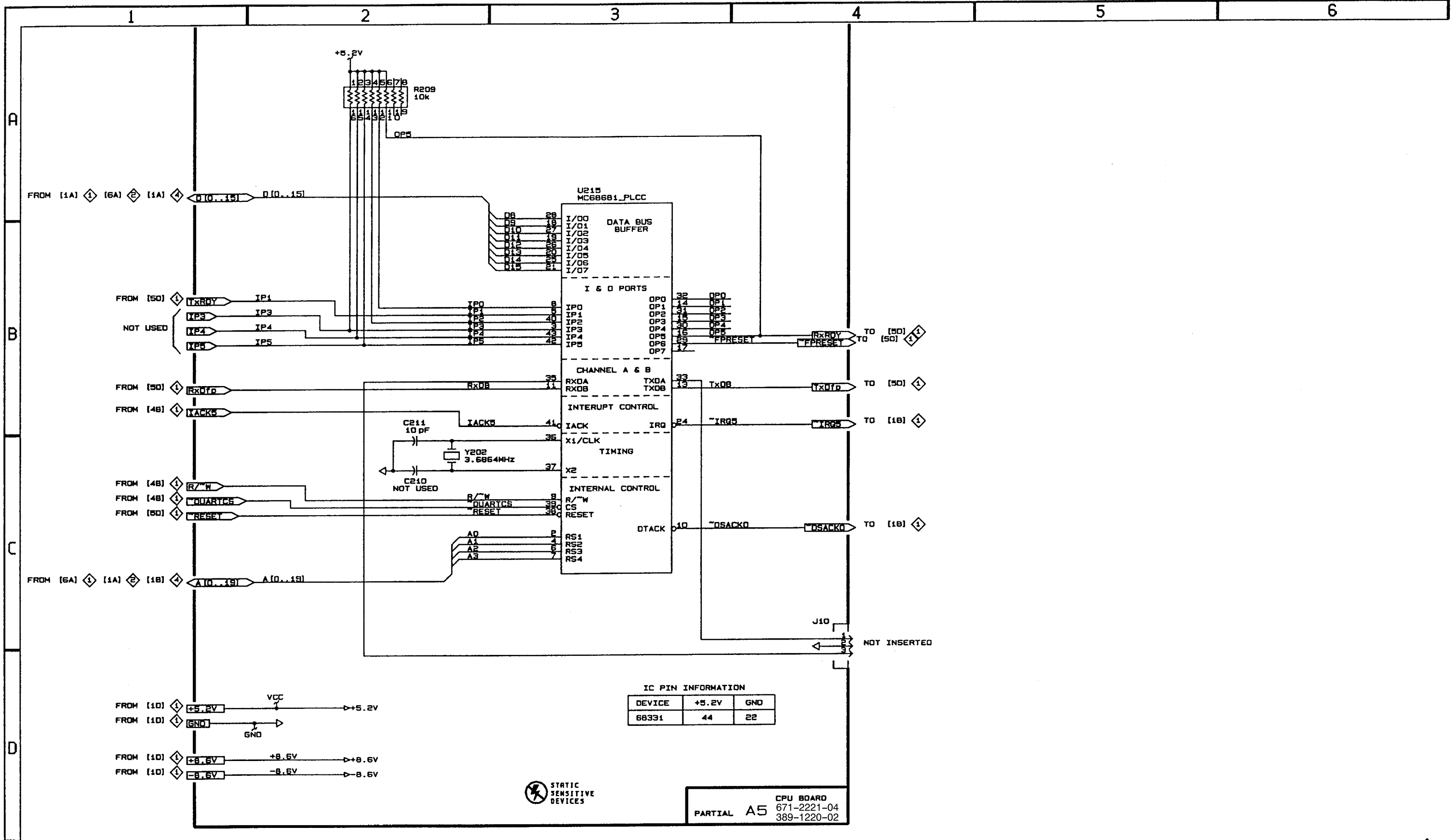
PARTIAL A5 CPU BOARD
671-2221-04
389-1220-02



IC PIN INFORMATION

DEVICE	+5.2V	GND
CXK581000	32	16
28F010	32	16


STATIC SENSITIVE DEVICES
 CPU BOARD
 671-2221-04
 PARTIAL A5 389-1220-02

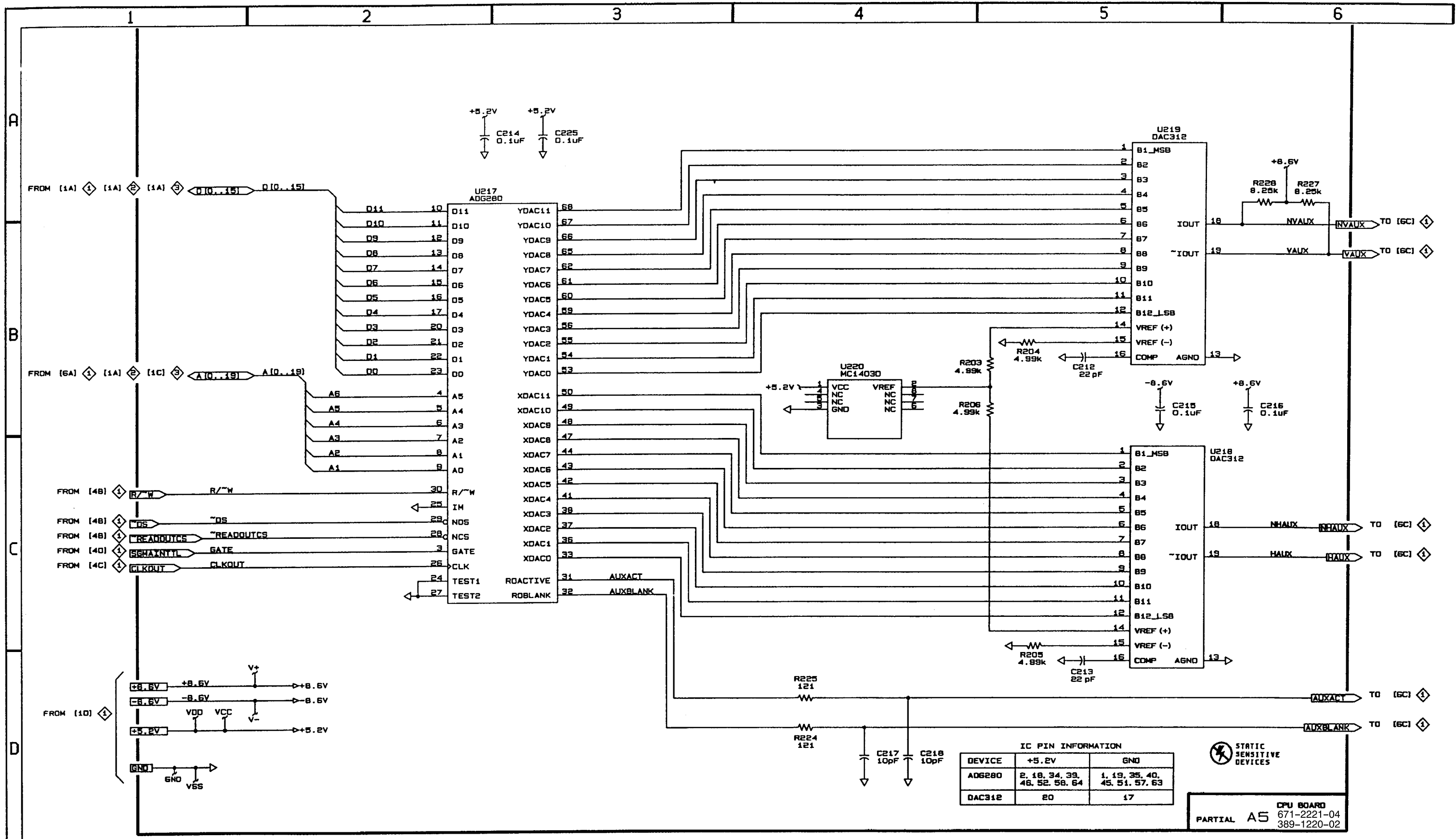


IC PIN INFORMATION

DEVICE	+5.2V	GND
68331	44	22



PARTIAL A5 CPU BOARD
671-2221-04
389-1220-02

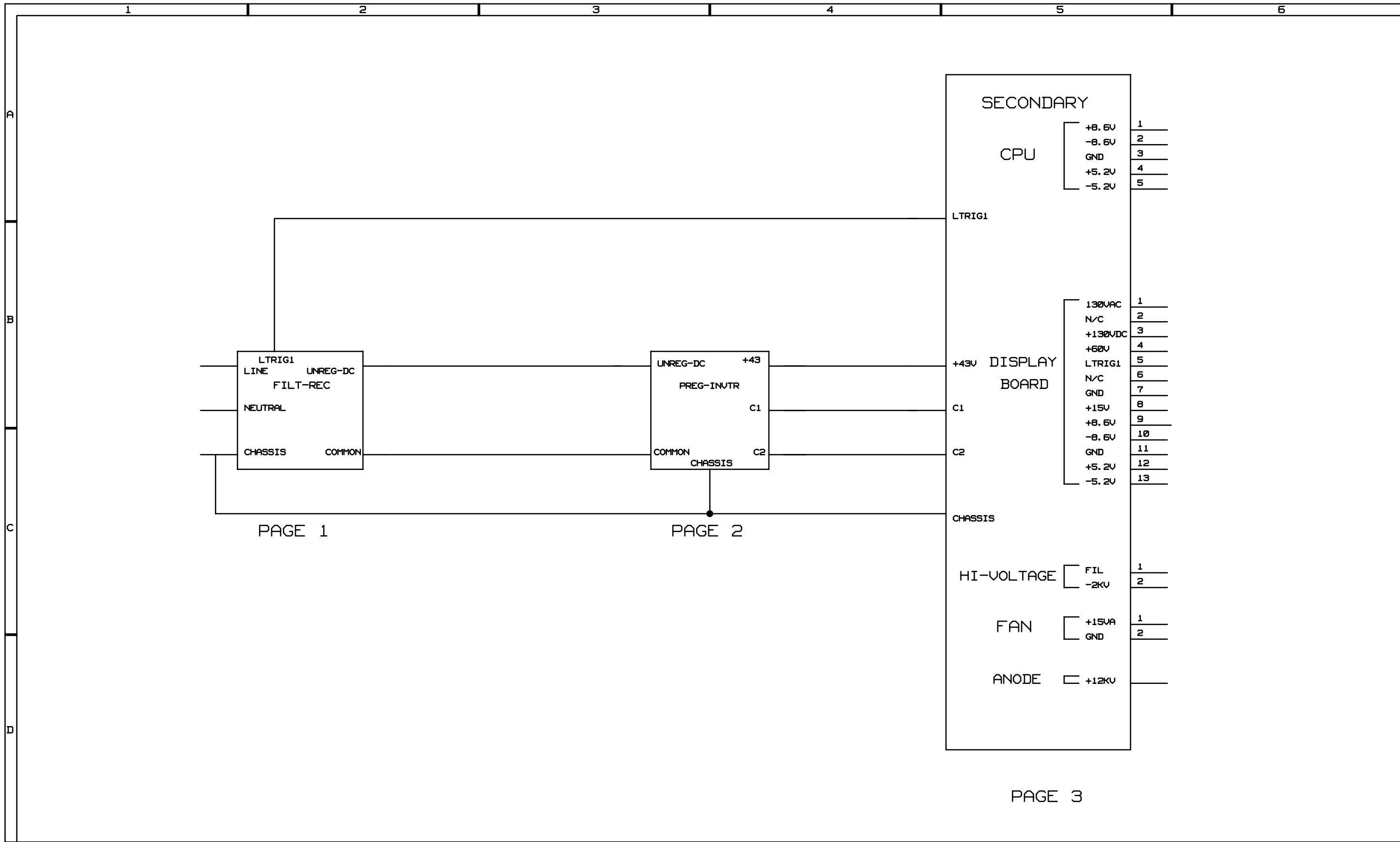


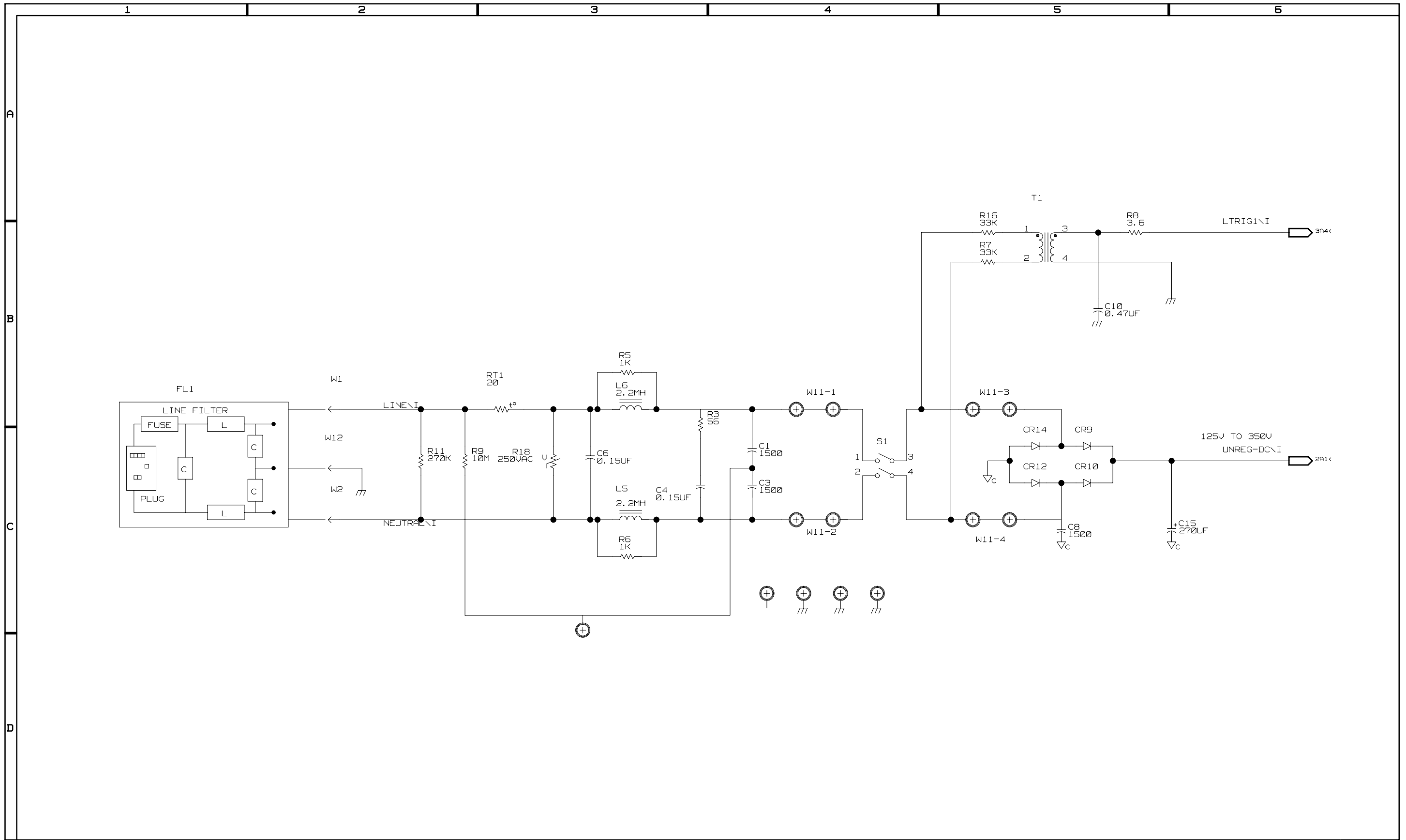
IC PIN INFORMATION

DEVICE	+5.2V	GND
ADG280	2, 18, 34, 39, 48, 52, 58, 64	1, 19, 35, 40, 45, 51, 57, 63
DAC312	20	17

STATIC SENSITIVE DEVICES

CPU BOARD
671-2221-04
PARTIAL A5 389-1220-02





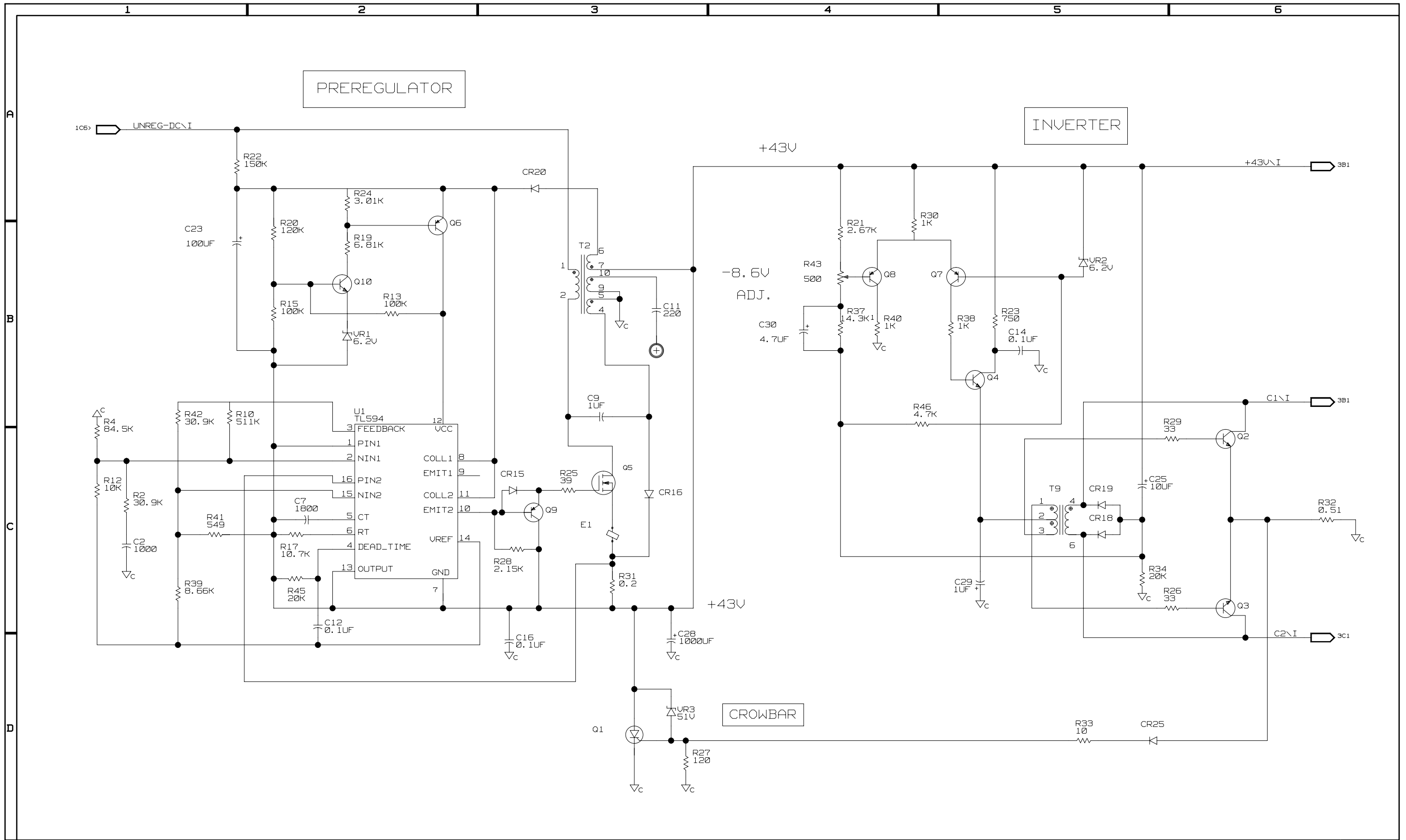
TAS400

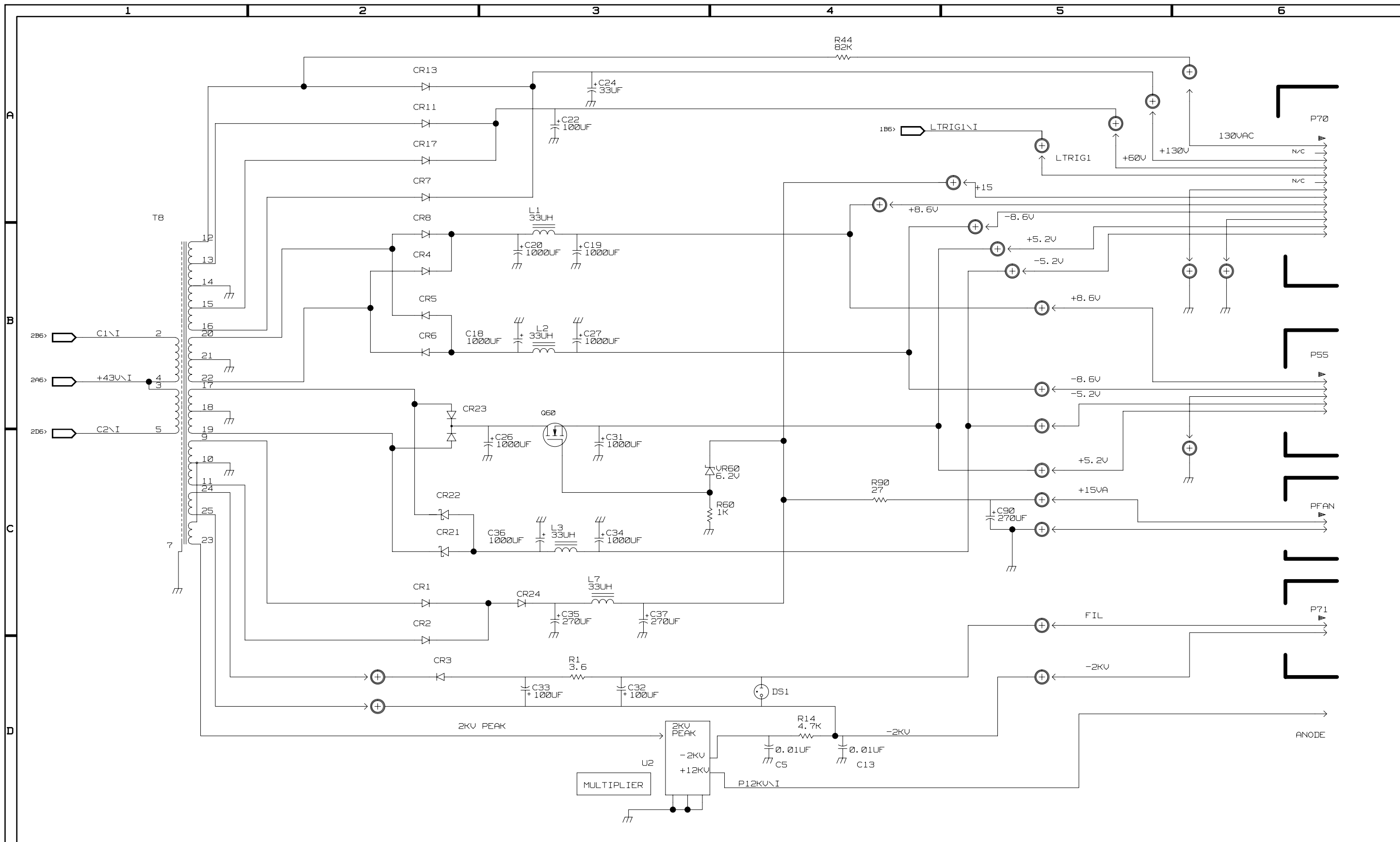
BOARD_NAME:: POWER SUPPLY
671-3240-XX

B020000 & ABOVE

INPUT_FILTER A63

1
OF: 4





TAS400

BOARD_NAME:: POWER SUPPLY
 671-3240-XX
 389-1904-XX
 B02000 & ABOVE

SECONDARY A63

Replaceable Mechanical Parts

This section contains a list of the components that are replaceable for the TAS 465 Analog Oscilloscope. As described below, use this list to identify and order replacement parts. There is a separate Replaceable Parts List for each instrument.

Parts Ordering Information

Replacement parts are available from or through your local Tektronix, Inc., service center or representative.

Changes to Tektronix instruments are sometimes made to accommodate improved components as they become available and to give you the benefit of the latest circuit improvements. Therefore, when ordering parts, it is important to include the following information in your order:

- Part number
- Instrument type or model number
- Instrument serial number
- Instrument modification number, if applicable

If a part you order has been replaced with a different or improved part, your local Tektronix service center or representative will contact you concerning any change in the part number.

Using the Replaceable Parts List

The tabular information in the Replaceable Parts List is arranged for quick retrieval. Understanding the structure and features of the list will help you find the all the information you need for ordering replacement parts.

Item Names

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

Indentation System

This parts list is indented to show the relationship between items. The following example is of the indentation system used in the Description column:

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>Name & Description</i>
					<i>Assembly and/or Component</i>
					<i>Attaching parts for Assembly and/or Component</i>
					<i>(END ATTACHING PARTS)</i>
					<i>Detail Part of Assembly and/or Component</i>
					<i>Attaching parts for Detail Part</i>
					<i>(END ATTACHING PARTS)</i>
					<i>Parts of Detail Part</i>
					<i>Attaching parts for Parts of Detail Part</i>
					<i>(END ATTACHING PARTS)</i>

Attaching parts always appear at the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. Attaching parts must be purchased separately, unless otherwise specified.

Abbreviations

Abbreviations conform to American National Standards Institute (ANSI) standard Y1.1

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
S3109	FELLER	72 VERONICA AVE UNIT 4	SUMMERSET NJ 08873
S4246	JAPAN SERVO CO LTD	7 KANDA MITOSHIRO-CHO CHIYODA-KU	TOKYO JAPAN
TK0860	LABEL GRAPHICS	6700 SW BRADBURY CT	PORTLAND OR 97224
TK1149	ALMAN INC	97 THORNWOOD RD	STAMFORD CT 06903-2617
TK1159	IMPROVED PRODUCTS	3400 OLYMPIC STREET	SPRINGFIELD OR 97477
TK1163	POLYCAST INC	9898 SW TIGARD ST	TIGARD OR 97223
TK1326	NORTHWEST FOURSIDE INC	18224 SW 100TH CT	TUALATIN OR 97062
TK1908	PLASTIC MOLDED PRODUCTS	4336 SO ADAMS	TACOMA WA 98409
TK1918	SHIN-ETSU POLYMER AMERICA INC	1181 NORTH 4TH ST	SAN JOSE CA 95112
TK1935	ACCRA-FAB INC	11007 NE 37TH CIRCLE	VANCOUVER WA 98682
TK2045	ITW CHRONOMATIC	4126 N NASHVILLE AVE	CHIGAGO IL 60634
TK2280	ESCORT INSTRUMENTS CORP	2-FL NO 37 POA HSIN RD PO BOX 3-20 MUCHA	TAIPEI TAIWAN ROC 00080
TK2432	UNION ELECTRIC	15/F #1, FU-SHING N. ROAD	TAIPEI, TAIWAN ROC
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK WAY SUITE #2	VANCOUVER WA 98601
TK6056	ASTEK USA	2880 SAN TOMES EXPRESSWAY SUITE 200	SANTA CLARA CA 95051
OJR05	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999
OJ7N9	MCX INC	30608 SAN ANTONIO ST	HAYWARD CA 94544
OJ9P9	GEROME MFG CO INC	PO BOX 737	NEWBERG OR 97132
OKBZ5	MORELLIS Q & D PLASTICS	1812 16TH AVE	FOREST GROVE OR 97116
OKB00	SCHRAMM PLASTIC FABRICATIORS	7885 SW HUNZIKER	TIGARD OR 97223
OKB01	STAUFFER SUPPLY	810 SE SHERMAN	PORTLAND OR 97214
05469	BEARINGS INC	3634 EUCLID P O BOX 6925	CLEVELAND OH 44101
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
13103	THERMALLOY CO INC	2021 W VALLEY VIEW LN PO BOX 810839	DALLAS TX 75381
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131
30817	INSTRUMENT SPECIALTIES CO INC	EXIT 53 RT 80 BOX A	DELAWARE WATER GAP PA 18327
52152	MINNESOTA MINING AND MFG CO INDUSTRIAL SPECIALTIES DIV	3M CENTER	ST PAUL MN 55144-0001
55335	JKL COMPONENTS CORP	13343 PAXTON STREET	PACOIMA CA 91331
70903	COOPER BELDEN ELECTRONICS WIRE AND CABLE SUB OF COOPER INDUSTRIES INC		
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
75915	LITTELFUSE INC SUB TRACOR INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001

Replaceable Mechanical Parts

Fig. & Index No.	Tektronix Part No.	Serial No.		Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont				
10-1-1	390-1106-01			1	CABINET,OSC:ALUMINUM	TK1935	ORDER BY DESC
-2	367-0356-01			1	HANDLE,CARRYING:13.855,SST,	0JR05	ORDER BY DESC
-3	212-0144-00			2	SCREW,TPG,TF:8-16 X 0.562 L,PLASTI,SPCL HD	0KB01	ORDER BY DESC
-4	348-0659-00			2	FOOT,CABINET:BLACK POLYURETHANE	0JR05	ORDER BY DESC
-5	-----			1	CABINET,OSC:ALUMINUM (NOT REPL, ORDER 390-1106-XX)		
-6	211-0730-00			1	SCR,ASSEM WSHR:6-32 X 0.375,PNH,STL CD PL	0KB01	ORDER BY DESC
-7	334-8836-00			1	MARKER,IDENT:MKD REAR COVER SUPPLY INFO	80009	334883600
-8	159-0277-00			1	FUSE,CARTRIDGE:5 X 20MM,3A,250V,5 SEC (STANDARD)	75915	235003
	-----			1	FUSE,CARTRIDGE:METRIC,3.1A,250V,FAST (OPTIONS A1,A2,A3,A4,A5)		
-9	211-0691-00			4	SCREW,MACHINE:6-32 X 0.625,PNH,STL	0KB01	ORDER BY DESC
-10	334-8494-00			1	MARKER,IDENT:MKD	80009	334849400
-11	200-3971-01			1	COVER,REAR:W/FEET AND LABELS	TK1163	200-3971-01
-12	161-0230-01			1	CABLE ASSY,PWR,;3,18 AWG,92 L,SVT,TAN (STANDARD ACCESSORY)	TK2432	ORDER BY DESC
-13	343-1213-00			1	CLAMP,PWR CORD:POLYMIDE (STANDARD ACCESSORY)	TK1163	ORDER BY DESC

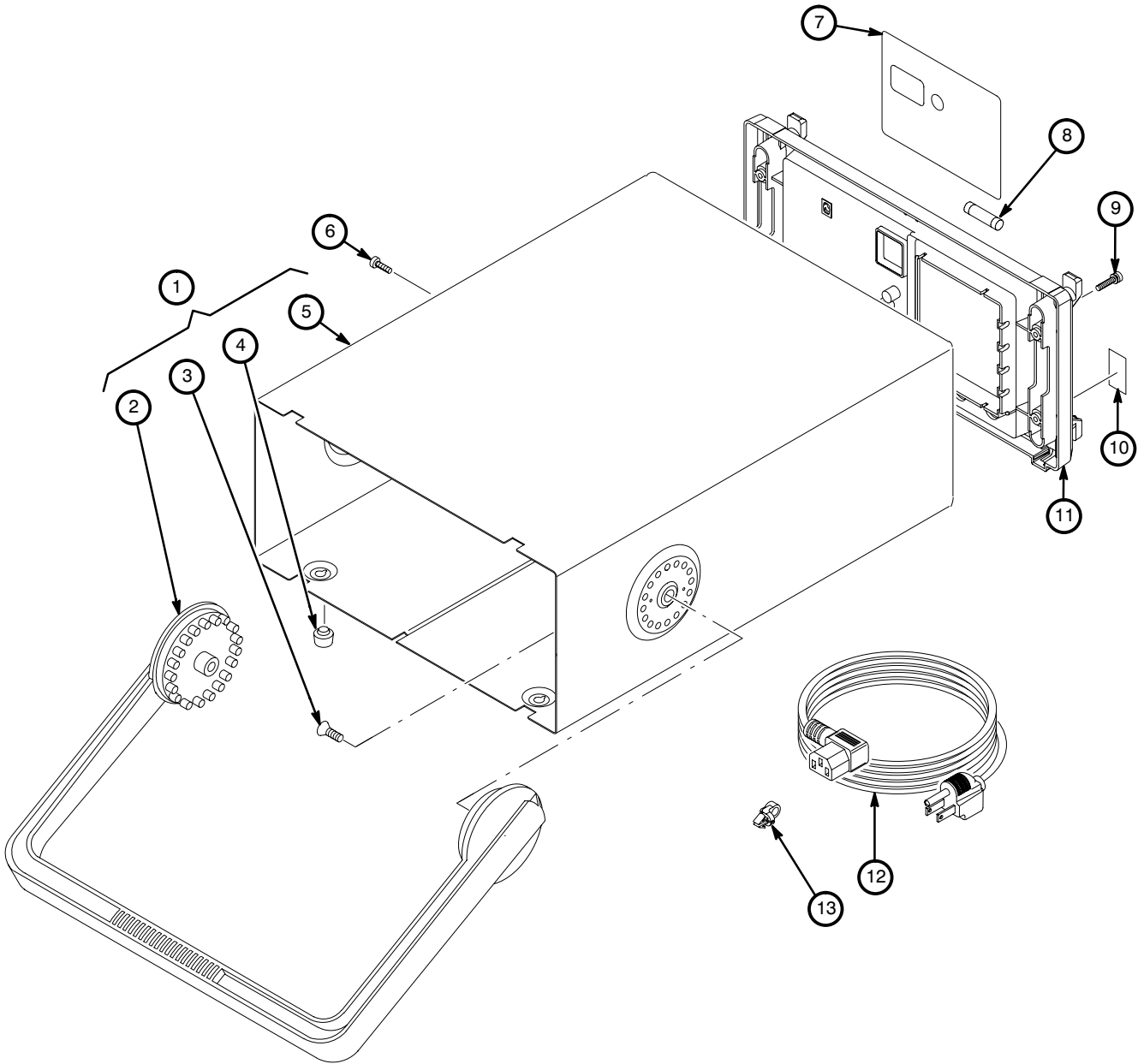


Figure 10-1: Cabinet and Rear

Replaceable Mechanical Parts

Fig. & Index No.	Tektronix Part No.	Serial No.		Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont				
10-2-1	200-3232-01			1	COVER,FRONT:ASB	TK1908	ORDER BY DESC
-2	334-8204-00			1	MARKER,IDENT:MKD INST NOMENCLATURE	80009	334820400
-3	101-0135-00			1	TRIM.DECORATIVE:	80009	101013500
-4	378-0199-03			1	FILTER,LT,CRT:BLUE,3.415 X 4.105 X 0.030THK	0KB00	378019903
-5	260-2561-00			1	SWITCH,PB:BEZEL	80009	260256100
-6	-----			1	FLEX CIRCUIT:BEZEL (SEE A9 REPL)		
-7	-----			1	CIRCUIT BD ASSY:FRONT PANEL (SEE A4 REPL)		
-8	260-2538-00			1	SWITCH SET:IMPLICIT	TK1918	ORDER BY DESC
-9	214-1126-01			2	SPRING,FLAT:0.7 X 0.125,CU BE GOLD CLR	80009	214112601
-10	214-0274-00			2	BALL,BEARING:0.125 DIA,SST,GRADE 100	05469	ORDER BY DESC
-11	105-1031-00			2	ACTUATOR SW AS:12 POSITION	TK2045	ORDER BY DESC
-12	131-5341-00			1	CONTACT,ELEC:ESD,CU-BE ALLOY	TK1326	ORDER BY DESC
-13	366-2163-00			16	PUSH BUTTON:IVORY GRAY,OVAL	80009	366216300
-14	-----			1	CIRCUIT BD ASSY:FRONT PANEL MODULE (SEE A62 REPL)	80009	672136200
-15	380-0990-00			1	HOUSING,FR PNL:	80009	380099000
-16	333-3960-00			1	PANEL,FRONT:PLASTIC,Q1,Q1/2	80009	333396000
-17	384-1689-01			6	SHAFT EXTENDER:ACETAL	80009	384168901
-18	366-2111-00			3	KNOB:SMALL,FLUTED	TK1163	ORDER BY DESC
-19	131-5142-00			1	CONTACT,ELEC:PROBE ADJUST	TK1935	ORDER BY DESC
-20	366-2113-00			3	KNOB:MEDIUM,DETENTED	TK1163	ORDER BY DESC
-21	366-2164-00			10	PUSH BUTTON:SMOKE TAN	80009	366216400

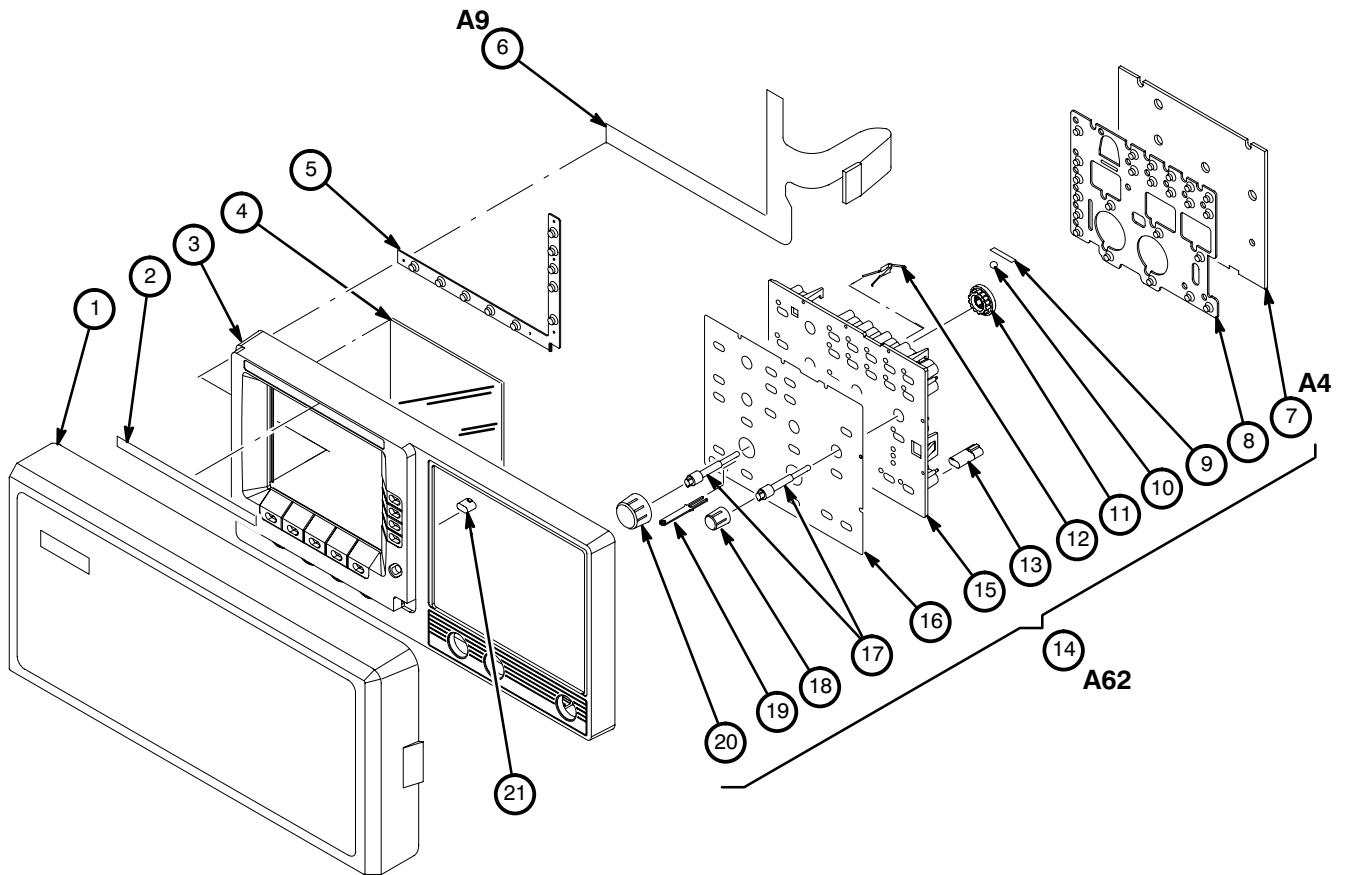


Figure 10-2: Front Panel Assembly

Replaceable Mechanical Parts

Fig. & Index No.	Tektronix Part No.	Serial No.		Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
		Effective	Dscont				
10-3-1	337-2926-03			1	SHLD,IMPLOSION:4.44 X 3.67 X 0.06,CLEAR	TK1159	ORDER BY DESC
-2	407-4130-01			1	BRACKET,CRT:FRONT	80009	407413001
-3	348-1474-00			1	GASKET; DUST SEAL	80009	348147400
-4	348-0660-00			4	CUSHION,CRT:POLYURETHANE	80009	348066000
-5	-----			1	ELECTRON TUBE:CRT (SEE A64 REPL)		
-6	344-0347-00			1	CLIP,ELECTRICAL:ANODE,0.72OD,NYLON	80009	344034700
-7	386-4443-00			1	SUPPORT,SHIELD:CRT,FRONT,PLASTIC	80009	386444300
-8	-----			1	LEAD,ELECTRICAL:DESCRETE,SDI/IDC,2,22 AWG (SEE P75 REPL)		
-9	-----			1	LEAD,ELECTRICAL:DESCRETE,SDI/IDC,2,22 AWG (SEE P74 REPL)		
-10	334-1951-00			1	MARKER,IDENT:MKD WARNING,CRT VOLTAGES	TK0860	ORDER BY DESC
-11	334-1379-00			1	MARKER,IDENT:MKD HI VACUUM	07416	ORDER BY DESC
-12	337-3487-00			1	SHIELD,ELEC:CRT,STL	0J9P9	337348700
-13	426-2426-00			1	FRAME,FAN MTG:POLYCARBONATE	TK1163	426-2426-00
-14	-----			1	FAN,TUBEAXIAL:12V,1.72W,42 CFM (SEE B90 REPL)		
-15	200-0616-02			1	COVER,CRT SKT:1.78 DIA X 0.2 D,WHITEPOLY	80009	200061602
-16	-----			1	CA ASSY,SP:DESCETE,SDI,9,26 AWG,7.4L (SEE P76 REPL)		
-17	131-5546-00			1	CONN,CONTACT:STATIC	80009	131554600
-18	407-4129-00			1	BRACKET,REAR:REAR OUT	80009	407412900
-19	213-0882-00			17	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL	0KB01	ORDER BY DESC
-20	-----			1	POWER SUPPLY:LOW POWER VERSION (SEE A63 REPL)		
-21	343-0549-00			1	STRAP,TIEDOWN,E:0.098W X 4.0L	TK1499	HW-047
-22	-----			1	CA ASSY RF:DESCRETE,SDI/RFD,22 AWG,8.625 L (SEE J21 REPL)		
-23	407-4196-00			1	BRACKET,STD:ALUMINUM	80009	407419600
-24	441-1982-00			1	CHASSIS ASSY:ALUMINUM	80009	441198200
-25	348-0150-00			1	GROMMET,PLASTIC:DK GRAY,U-SHAPE,0.66 ID	0KBZ5	ORDER BY DESC
-26	384-1370-00			1	EXTENSION SHAFT:4.68 L,MOLDED PLASTIC	0JR05	ORDER BY DESC
-27	366-2168-00			1	PUSH BUTTON:ON/OFF	80009	366216800
-28	351-0914-00			1	GUIDE,LIGHT:GRATICULE	80009	351091400
-29	384-1689-01			4	SHAFT EXTENDER:ACETAL	80009	384168901
-30	366-2169-00			4	KNOB:THUMBWHEEL	80009	366216900

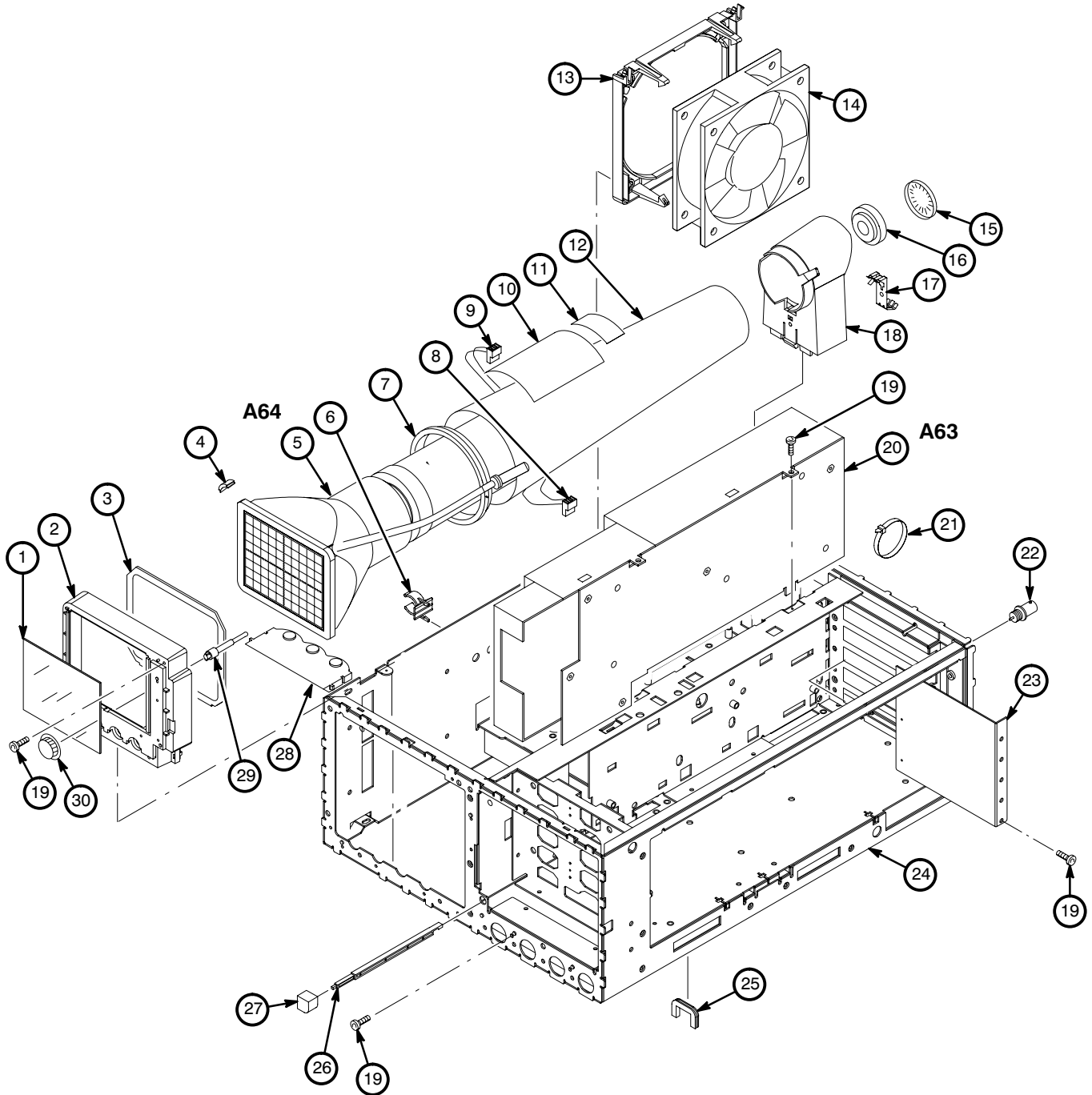


Figure 10-3: Chassis

Replaceable Mechanical Parts

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
10-4-1	-----			2	LAMP,INCAND:14V,0.08A,WEDGE BASE,T1.75 (SEE A2DS1,DS2 REPL)		
-2	196-3405-00			1	LEAD,ELECTRICAL:4.0L,W/AMPRING TERMINAL	80009	196340500
-3	210-0457-00			1	NUT,PL,ASSEM WA:6.32 X 0.312,STL CD PL	OKB01	ORDER BY DESC
-4	334-8543-00			1	MARKER,IDENT:0.500 IN DIA BLANK MYLAR	80009	334854300
-5	213-0882-00			7	SCREW,TPG,TR:6-32 X 0.437 TAPTITE,PNH,STL	OKB01	ORDER BY DESC
-6	-----			1	CIRCUIT BD ASSY:CPU (SEE A5 REPL)		
-7	-----			1	DELAY LINE,ELEC:VERTICAL (SEE DL68 REPL)		
-8	-----			1	CA ASSY,SP:FLAT FLEX,FLX,23,26 AWG,6.5L (SEE A3W66 REPL)		
-9	342-0960-00			1	INSULATOR,SHEET:POLYCARBONATE	80009	342096000
-10	337-3880-00			1	SHIELD,ELEC:PLASTIC,HIGHT VOLTAGE	80009	337388000
-11	334-0286-00			2	LABEL:MKD ASMZ80 OPT 1C	80009	334028600
-12	-----			1	CIRCUIT BD ASSY:DISPLAY DRIVER (SEE A3 REPL)		
-13	342-0324-00			2	INSULATOR,DISK:TRANSISTOR,NYLON	13103	7717-5N
-14	214-2593-00			2	HEAT SINK,XSTR:TO-5,AL	13103	2257B
-15	337-3904-00			1	SHIELD,ELEC:CIRCUIT BOARD,TSA465	TK1326	337-3904-00
-16	386-0048-00			2	SUPPORT,CHASSIS:BRASS W/NICKLE PLATING	80009	386004800
-17	407-4131-00			1	BRACKET,ATTEN:BNC,BRASS	80009	407413100
-18	337-3713-01			1	SHIELD,ELEC:ATTENUATOR	TK1935	337-3713-01
-19	-----			4	CONN,RF JACK:BNC,50 OHM,FEMALE,STR (SEE A1J10,11,20,21 REPL)		
-20	210-1039-00			3	WASHER,LOCK:0.521 ID,INT,0.025 THK,SST	OKB01	1224-02-00-0541
-21	220-0497-00			3	NUT,PLAIN,HEX:0.5-28 X 0.562 HEX,BRS CD PL	73743	ORDER BY DESC
-22	-----			1	CIRCUIT BD ASSY:ANALOG (SEE A1 REPL)		
-23	343-0775-00			1	CABLE,CLAMP:RIBBON,1.0 X 1.0,GRAY POLY	52152	3484-1000
-24	-----			1	CA ASSY,SP:FLAT FLEX,;FLX,16,26 AWG,13.7 L (SEE P30 REPL)		
-25	-----			1	CA ASSY,SP:RIBBON,;IDC,40,28 AWG,3.5 L,2X2 (SEE P50 REPL)		
-26	-----			1	CA ASSY,SP:FLAT FLEX,;FLX,2,26 AWG,7.65 L (SEE P80 REPL)		
-27	-----			1	CA ASSY,SP:FLAT FLEX,;FLX,5,26 AWG,8.7 L (SEE P84 REPL)		
-28	-----			1	CIRCUIT BD ASSY:DISPLAY CONTROL (SEE A2 REPL)		

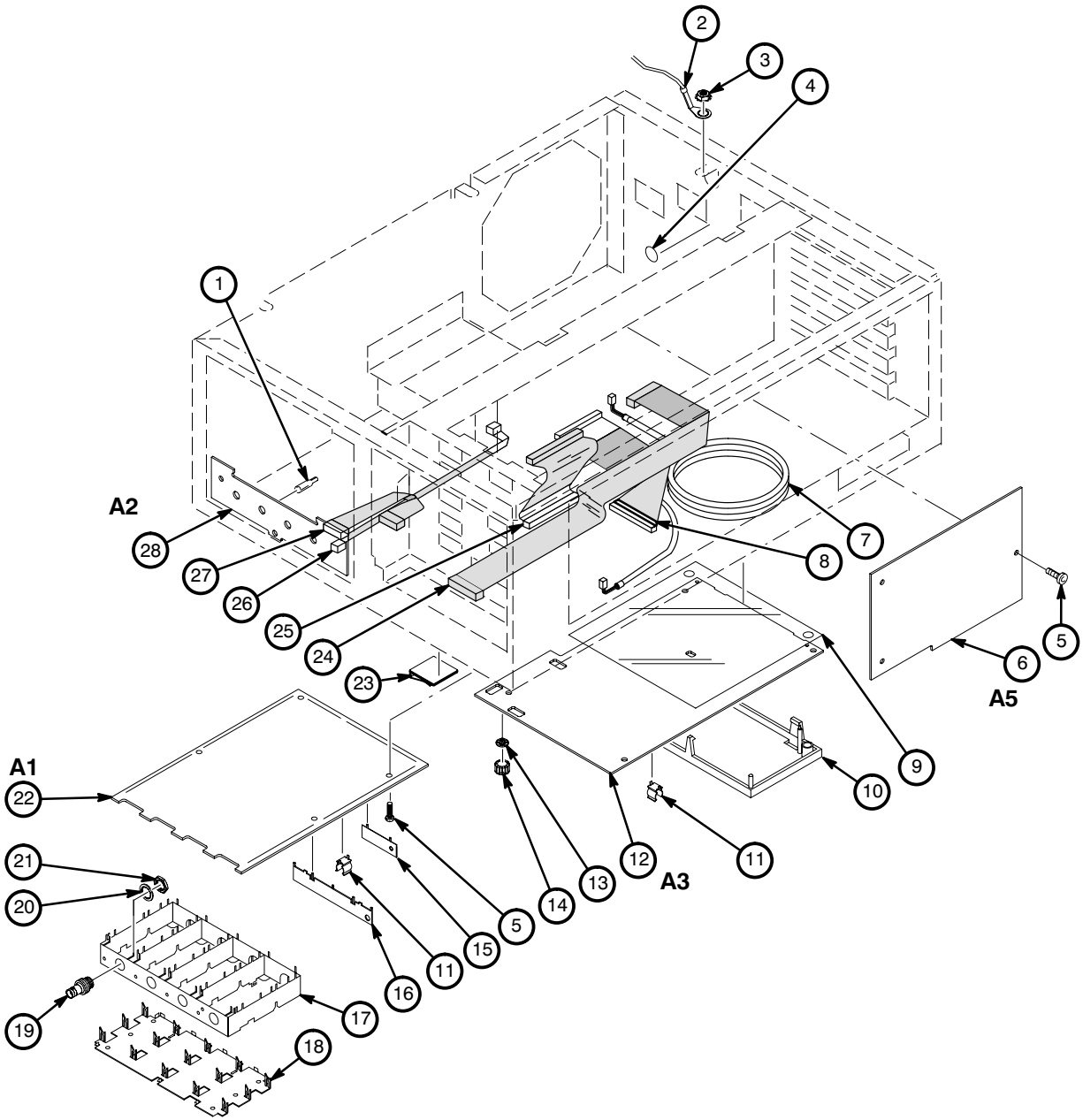


Figure 10-4: Circuit Boards

Replaceable Mechanical Parts

Fig. & Index No.	Tektronix Part No.	Serial No. Effective Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
STANDARD ACCESSORIES						
10-5-1	161-0104-05		1	CABLE ASSY,PWR,;3,18 AWG,240V,98.0 L (OPTION A3-AUSTRALIAN)	S3109	SAA/3-OD3CCFC3X
5-2	161-0104-06		1	CABLE ASSY,PWR,;3 X 0.75MM SQ,220V,98.0 L (OPTION A1-EUROPEAN)	S3109	VIIGSOPO-HO5VVF
5-3	161-0104-07		1	CABLE ASSY,PWR,;3,1.0MM SQ,240 VOLT,2.5 M (OPTION A2-UNITED KINGDOM)	S3109	ORDER BY DESC
5-4	161-0104-08		1	CABLE ASSY,PWR,;3,18 AWG,98 L,SVT,GREY/BLK (OPTION A4-NORTH AMERICAN)	70903	ORDER BY DESC
5-5	161-0167-00		1	CABLE ASSY,PWR,;3.0 X 0.75,6A,240V,2.5M L (OPTION A5-SWITZERLAND)	S3109	ORDER BY DESC
-----			1	CABLE ASSY,PWR,;3,18 AWG,92 L,SVT,TAN (STANDARD, SEE FIGURE 10-1-15)		
-----			1	ACCESSORY PKG:(2)P6109B 2M PROBES W/ACC		
	070-8522-XX		1	MANUAL,TECH:TAS455,TAS465 REF	80009	0708522XX
	070-8523-XX		1	MANUAL,TECH:INSTRUCTION,MODULE LEVEL	80009	0708523XX
	070-8690-XX		1	MANUAL,TECH:USER,XYZS OF OSCILLOSCOPE	80009	0708690XX
-----			1	FUSE,CARTRIDGE:5 X 20MM,3A,250V,5 SEC (SEE FIGURE 10-1-9)		
-----			1	FUSE,CARTRIDGE:METRIC,1.5A,250V,FAST (OPTIONS A1, A2, A3, A4, A5) (SEE FIG. 10-1-10)		
-----			1	CLAMP,PWR CORD:POLYIMIDE (SEE FIGURE 10-1-16)		
OPTIONAL ACCESSORIES						
	003-1472-00		1	HAND TOOL:CLAMP,DETENT SPRING	80009	003147200
	003-1473-00		1	HAND TOOL:SPRING INSERTION	80009	003147300
	070-8524-XX		1	MANUAL,TECH:SERVICE,COMPONENT LEVEL	80009	0708524XX
	016-1154-00		1	HOOD ASSEMBLY:2KDSO	80009	016115400
	016-1166-00		1	RACK MOUNT KIT:TAS SERIES	80009	016116600

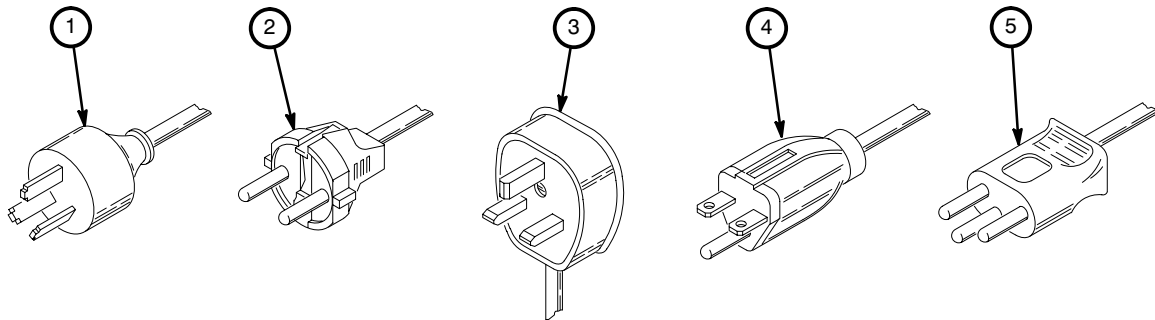


Figure 10-5: Accessories