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Service Reference

THE 11403A

DIGITIZING OSCILLOSCOPE

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TEK **Service Reference**

Part No. 070-8194-00
Product Group 47

THE 11403A

DIGITIZING OSCILLOSCOPE

WARNING

The following 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 the Safety Summary prior to performing any service.

Please check for CHANGE INFORMATION at the rear of this manual.

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Instrument Serial Numbers

Each instrument manufactured by Tektronix has a serial number on a panel insert or tag, or stamped on the chassis. The first letter in the serial number designates the country of manufacture. The last five digits of the serial number are assigned sequentially and are unique to each instrument. Those manufactured in the United States have six unique digits. The country of manufacture is identified as follows:

B010000	Tektronix, Inc., Beaverton, Oregon, USA
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

Instruments manufactured for Tektronix by external vendors outside the United States are assigned a two digit alpha code to identify the country of manufacture (e.g., JP for Japan, HK for Hong Kong, etc.).

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

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General Information

The *11403A Digitizing Oscilloscope Service Reference* is designed for use by qualified service personnel. It contains information necessary to check, troubleshoot, and maintain the 11403A Digitizing Oscilloscope.

Troubleshooting is primarily based on internal diagnostics. These diagnostics isolate problems to the field replaceable unit (FRU) level. If the diagnostics can not detect a defective FRU, then this defective FRU can be isolated using other troubleshooting methods. Once the faulty FRU is identified, use the instructions provided in this manual to remove and replace this FRU. Removing and immediately replacing the faulty FRU allows you to minimize the time your 11403A is not operational. Section 5, Replaceable Parts, provides a complete list of the FRUs in this instrument.

If you have never operated the 11403A Digitizing Oscilloscope, please read the *11403A Tutorial* to become familiar with the basic functions of the instrument.

This section gives information about safety, installing and removing plug-in units, applying power, proper environmental conditions, shipping, and instrument options.

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Safety Summary

This general safety information is directed to operators and service personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms in Manuals

CAUTION statements in manuals identify conditions or practices that could result in damage to the equipment or other property.

WARNING statements in manuals identify conditions or practices that could result in personal injury or loss of life.

Terms on Equipment

CAUTION on equipment means a personal injury hazard not immediately accessible as one reads the marking, or a hazard to property including the equipment itself.

DANGER on equipment means a personal injury hazard immediately accessible as one reads the marking.

Symbols in Manuals



Static Sensitive Devices

Symbols on Equipment



DANGER
High Voltage



Protective
ground (earth)
terminal



ATTENTION
Refer to
manual

Power Source

This instrument is 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, by way of the grounding conductor in the power cord, is essential for safe operation.

Grounding the Product

The 11403A is grounded through the grounding conductor in the power cord. To avoid electric shock, plug the power cord into a properly wired receptacle before connecting it to the 11403A input or output terminal. A protective-ground connection, by way of the grounding conductor in the power cord, is essential for safe operation.

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Danger Arising from Loss of Ground

Upon loss of the protective-ground connection, all accessible conductive parts (including knobs and controls that may appear to be insulating) can render an electrical shock.

Do Not Operate in Explosive Atmospheres

To avoid explosion, do not operate this instrument in an atmosphere of explosive gasses.

Do Not Service Alone

Do not perform internal service or adjustment of this instrument 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 instrument. To avoid personal injury, do not touch exposed connections and components while the power is on.

Disconnect the power before removing protective panels, soldering, or replacing components.

CRT Handling

Use care when handling a CRT. Breakage of the CRT causes a high-velocity scattering of glass fragments (implosion). Protective clothing and safety glasses should be worn. Avoid striking the CRT on any object which might cause it to crack or implode. When storing a CRT, place it in a protective carton or set it face down in a protected location on a smooth surface with a soft mat under the faceplate.

Use the Proper Fuse

To avoid fire hazard, use only a fuse which is identical in type, voltage rating, and current rating to the fuse specified in Section 5, Replaceable Parts.

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Installing and Removing a Plug-in Unit

To install a plug-in unit in a 11403A (see Fig. 1-1):

1. Set the ON/STANDBY switch to STANDBY to prevent damage to the instrument.
2. Align the grooves in the top and bottom of the plug-in unit with the guides in the instrument's plug-in compartment.

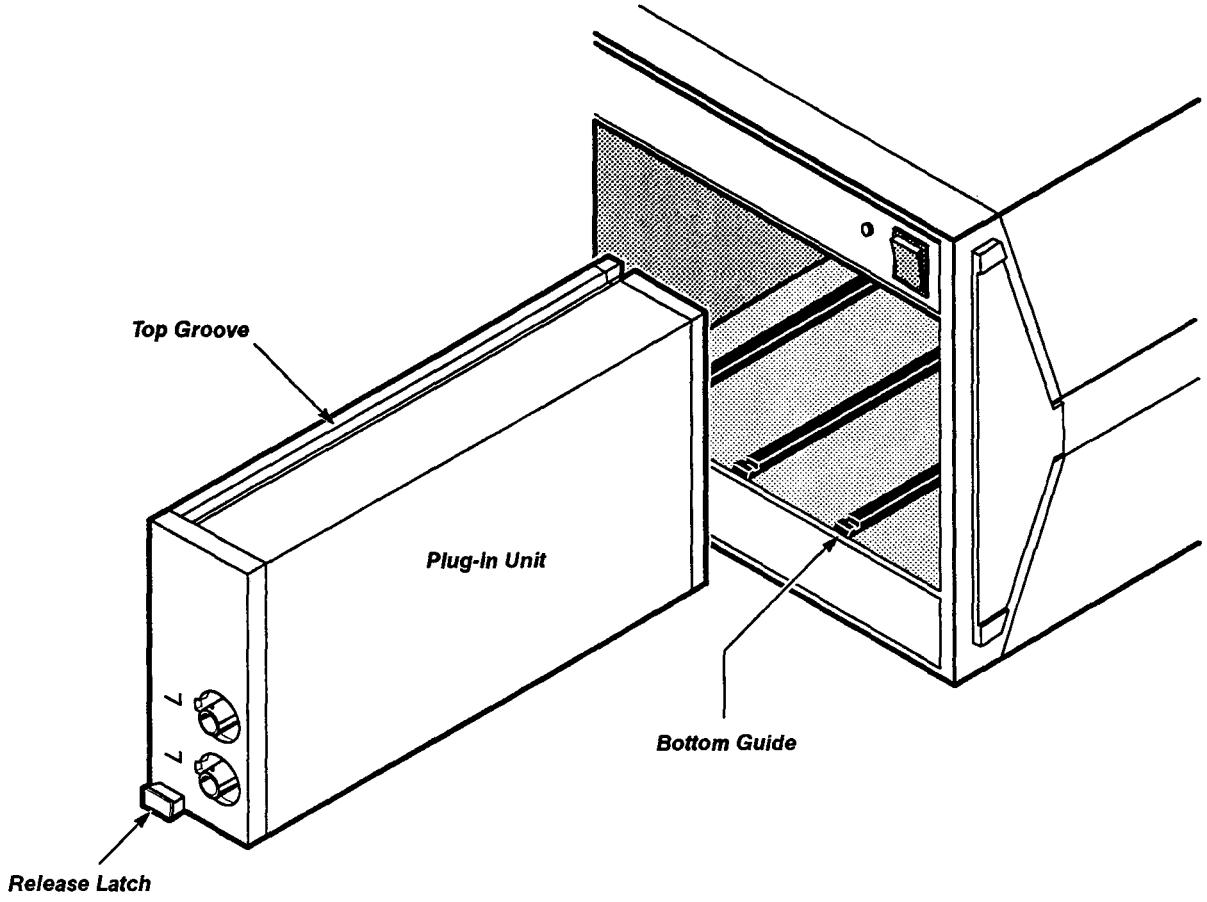


Figure 1-1 *— Installing the Plug-in Unit into a 11403A*

3. Insert the plug-in unit until the front panel of the plug-in unit is flush with the front panel of the 11403A.

CAUTION

Never install or remove a plug-in unit when the ON/STANDBY switch is ON.

To remove the plug-in unit:

1. Set the ON/STANDBY switch to STANDBY to prevent damage.
2. Pull the release latch to disengage the plug-in unit.
3. Remove the plug-in unit from the plug-in compartment.

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Power Information

The rear panel LINE VOLTAGE SELECTOR allows you to select either a 115 V or 230 V (48 to 440 Hz) nominal supply source. Both 115 V and 230 V operation use the 6 A, 250 V line fuse.

AC Power Source and Connection

The 11403A operates from a single-phase power source. It has a three-wire power cord and two-pole, three-terminal grounding type plug. The voltage to ground (earth) from either pole of the power source must not exceed the maximum-rated operating voltage of 250 V.

WARNING

Before making connection to the power source, ensure that the LINE VOLTAGE SELECTOR is set to match the voltage of the power source, and has a suitable two-pole, three-terminal grounding-type plug.

Grounding

This instrument is safety Class 1 equipment (IEC designation). All accessible conductive parts are directly connected through the grounding conductor of the power cord to the grounded (earthing) contact of the power plug.

WARNING

The power input plug must be inserted only in a mating receptacle with a grounding contact where earth ground has been verified by a qualified service person. Do not defeat the grounding connection. Any interruption of the grounding connection can create an electrical shock hazard.

For electric shock protection, the grounding connection must be made before making a connection to the instrument input or output terminals.

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Power Cord Information

A power cord with appropriate plug configuration is supplied with each 11403A. Table 1-1, Power-Cord Conductor Identification, gives the color-coding of the conductors in the power cord. If you require a power cord other than the one supplied, refer to Table 1-2, Power Cord and Plug Identification.

Table 1-1 – Power-Cord Conductor Identification

Conductor	Typical Color	Alternate Color
Ungrounded (Line)	Brown	Black
Grounded (Neutral)	Light Blue	White
Grounded (Earthing)	Green/Yellow	Green

Memory Backup Power

A self-contained power source in the 11403A allows it to retain volatile memory if the AC power source is lost. This power source provides the memory backup power that enables the 11403A to store the last-selected front panel button and CRT touch panel settings. Waveforms stored in memory may also be retained. A second self-contained power source also supplies power to the IC that generates time/date parameters, and records instrument on time and number of power-on sequences.

The self-contained power sources have a nominal shelf life of about five years (depending on the amount of memory installed). Partial or total loss of stored settings at power-on may indicate that one or both power sources need replacement.

Operating Environment

The following environmental requirements are provided to ensure proper operation and long instrument life.

Operating Temperature

The 11403A can be operated where the ambient air temperature is between 0° and +50°C and can be stored in ambient temperatures from –40° to +75°C. After storage at temperatures outside the operating limits, allow the chassis to reach safe operating temperature before applying power.

Enhanced Accuracy is available after a 20-minute warmup period. After entering Enhanced Accuracy, the 11403A reverts to normal accuracy if the internal temperature changes more than ±5°C.

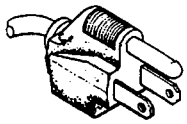
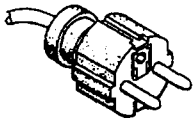
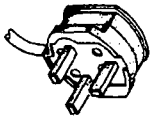
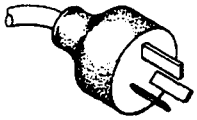
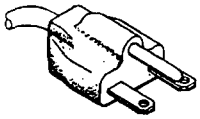
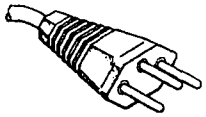
Ventilation Requirements

A fan draws air in through the 11403A's side panels and blows it through the rear of the instrument. To ensure proper cooling, allow at least two inches clearance on both sides and at the rear of the 11403A. The instrument's top and bottom do not require ventilation clearance.

CAUTION *If air flow is restricted, the power supply may temporarily shut down.*

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Table 1-2 *— Power Cord and Plug Identification*

Plug Configuration	Usage (Max Rating)	Reference Standards & Certification	Option #
	North American 125 V/6 A	[1]ANSI C73.11 [2]NEMA 5-15-P [3]IEC 83 [10]UL [11]CSA	Standard
	European 220 V/6 A	[3]ICE 83 [4]CEE (7), II, IV, VII [8]VDE [9]SEMKO	A1
	United Kingdom 240 V/6 A	[3]IEC 83 [5]BSI 1363	A2
	Australian 240 V/6 A	[6]AS C112 [12]ETSA	A3
	North American 250 V/10 A	[1]ANSI C73.20 [2]NEMA 6-15-P [3]IEC 83 [10]UL [11]CSA	A4
	Switzerland 240 V/6 A	[7]SEV	A5

[1]*ANSI—American National Standards Institute*
[2]*NEMA—National Electrical Manufacturers' Association*
[3]*IEC—International Electrotechnical Commission*
[4]*CEE—International Commission on Rules for the Approval of Electrical Equipment*
[5]*BSI—British Standards Institute*
[6]*AS—Standards Association of Australia*
[7]*SEV—Schweizevischer Elektrotechischer Verein*
[8]*VDE—Verband Deutscher Elektrotechniker*
[9]*SEMKO—Swedish Institute for Testing and Approval of Electrical Equipment*
[10]*UL—Underwriters Laboratories*
[11]*CSA—Canadian Standards Association*
[12]*ETSA—Electricity Trust of South Australia*

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Packaging for Shipment

If you are shipping the 11403A by commercial transportation, use the original carton and packaging material.

If you are shipping the 11403A to a Tektronix service center for service or repair, attach a tag that shows the following:

- Owner (with address)
- Name of contact person
- Complete description of instrument type and serial number
- If possible, furnish complete system firmware versions as displayed in the **Ident** pop-up menu selected from the UTILITY major menu
- A description of the service required

If the original packaging is unfit for use or not available, then package the 11403A as follows:

☐ Step 1: Obtain a corrugated cardboard shipping carton with a 375-pound test strength and having inside dimensions at least six inches greater than the instrument's dimensions. (This allows for cushioning.)

☐ Step 2: Wrap the instrument with polyethylene sheeting or equivalent material to protect the finish.

☐ Step 3: To cushion the 11403A on all sides tightly pack dunnage or urethane foam between the carton and the instrument, allowing three inches on each side.

☐ Step 4: Seal the carton with shipping tape or with an industrial stapler.

☐ Step 5: Mark the address of your local Tektronix service center and your return address on the carton in one or more prominent locations.

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Instrument Options

Your 11403A may be equipped with one or more instrument options. A brief description of each available option is given in the following discussion. Option information is also incorporated into the appropriate sections of the manual. Refer to Contents at the beginning of this manual for the location of option information. For further information and prices of instrument options, see your *Tektronix Products Catalog* or contact your local Tektronix service center.

Option 1C—adds eight BNC connectors to the front and rear panels so that signals to and from the rear panel can be routed to and from the front panel. This option can be added at any time.

Option 1R—adds slide rails and rackmounting hardware to convert the benchtop instrument to a standard 19-inch rackmount version. This option can be added at any time.

Option 1S—adds a statistical database package that makes direct jitter and noise measurements on incoming signals, then builds a database to provide histograms and other special color-graded displays.

Option 2D—adds 768 kilobytes of nonvolatile memory to expand the memory for stored waveforms and settings. This option can be added at any time.

Option 4D—increases the GPIB transfer speed up to ten times. Improves the overall throughput of the oscilloscope; especially the transmission of waveform and measurement data. This option can be added at any time.

Option A1—replaces the standard power cord with the Universal European 220 V power cord.

Option A2—replaces the standard power cord with the United Kingdom 240 V power cord.

Option A3—replaces the standard power cord with the Australian 240 V power cord.

Option A4—replaces the standard power cord with the North American 250 V power cord.

Option A5—replaces the standard power cord with the Switzerland 240 V power cord.

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Checks and Adjustments

This section contains procedures to examine measurement limits, check electrical specifications, and to manually set all internal adjustments. Each procedure provides a logical sequence of check and adjustment steps, and is intended to return the 11403A Digitizing Oscilloscope to specified operation following repair, or as a part of a routine maintenance program. To functionally test the instrument, perform the procedures having a "yes" indication in the Functional Test column of Table 2-1, Measurement Limits, Specifications, Adjustments and Functional Tests.

Refer to the *11403A Digitizing Oscilloscope User Reference* for more information about advertised specifications and operation. The beginning of each procedure lists or describes the specifications or measurement limits. The setup for each procedure provides information about configuring and connecting test equipment. Refer to Table 2-2, Test Equipment, for more information about the test equipment used in these setups.

Table 2-1 *— Measurement Limits, Specifications, Adjustments, and Functional Tests*

Procedure and Description	**Measurement Limits *(Examine)***	**Specifications *(Check)***	**Adjustments *(Adjust)***	**Functional Test**
Procedure 1 Power-On Diagnostics	none	none	none	yes
Procedure 2 Extended Diagnostics	none	none	none	yes
Procedure 3 Power Supply	none	none	none	no
Voltage Supply	+4.85 V to +5.25 V	none	none	
Voltage Reference	+5.15 V to +5.25 V	none	R800 +5.2 V REF for +5.20 V	
Regulator Reference	+9.95 V to +10.05 V	none	R830 +10 V REF for +10.00 V	
Procedure 4 Display				
Cutoff	visible		A8 CRT Driver board SCREEN adjustment on transformer until display appears	no
Convergence	primary colors are not separated in the white grid		CONVERGENCE, R210, for optimum convergence of red, green, and blue.	

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Table 2-1 — Measurement Limits, Specifications, Adjustments, and Functional Tests (Cont.)

Procedure and Description	Measurement Limits *(Examine)*	Specifications *(Check)*	Adjustments *(Adjust)*	Functional Test
Procedure 4 Display (Cont.)				
Focus	focused grid pattern		A8 CRT Driver board FOCUS adjustment on transformer for optimum focus on white grid pattern.	
Vertical Size and Position	align with tic marks		VERT SIZE, L321, and VERT POS, R311, for optimum alignment	
Horizontal Size, Linearity and Position	align with tic marks and optimum appearance		H-SIZE, R501, H-LIN, R502, and H-POS, R500, for optimum alignment and linearity	
Gray Scale	white at the top of the display and gray at the bottom, and the right side of the display is cut off		A8 CRT Driver board SCREEN adjustment on transformer; RED, R200;GREEN, R201, and BLUE; R203, are adjusted for cutoff and color balance	
Color Impurity	no severe color impurities in red, green, and blue display		Cycle power on and off	
Procedure 5 Enhanced Accuracy		successful execution	none	yes
Procedure 6 Calibration Output Accuracy				yes
Probe Calibration Output Voltage Accuracy		±0.06% (or ±6 mV)	R1576 offset for −10.000 V ±0.002 V R1582 gain for +9.9951 V ±0.002 V	
Attenuator Ratios and Calibrator DAC Linearity	attenuator ratios within ±0.04%; calibrator DAC linearity within ±0.75 of LSB		none	
Procedure 7 Probe Compensation Voltage				no
Output Voltage Accuracy	6.0 V ±0.18 V		none	

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Table 2-1 — Measurement Limits, Specifications, Adjustments, and Functional Tests (Cont.)

Procedure and Description	Measurement Limits *(Examine)*	Specifications *(Check)*	Adjustments *(Adjust)*	Functional Test
Procedure 8 Acquisition				no
10 MHz Signal Amplitude	≥1.0 V p-p		10 MHz, C217, for maximum signal amplitude (must be ≥0.8 V p-p)	
Phase Lock Loop	+6.0 V ±1.0 V		VCO, C500, for 6.0 V ±0.3 V	
Procedure 8 Acquisition (Cont.)				no
Differential Amplifier V+	10.500 V ±10 mV		Diff Amp V +, R666, for 10.500 V	
Procedure 9 Vertical Input Offset	±0.2 div		none	no
Procedure 10a Sampler and Digitizer Performance Verification Procedure	8.000 U ±0.080 U		none	no
Procedure 10b Sampler and Digitizer Functional Test Procedure	refer to Table 2-4m Vertical Accuracy Error Limits, for the measurement limits for this procedure		none	yes
Procedure 11 ADC Linearity		≤1% (2 LSBs)	none	no
Procedure 12 Equivalent Time Step Response				no
Rise Time	≤300 ps		none	
Aberrations	≤5% p-p within the first 20 ns after the step; ≤1% peak-to-peak after first 20 ns from the step		none	
Procedure 13a Bandwidth Performance Verification Procedure	≥82.3% of the reference amplitude at 1 GHz		none	no
Procedure 13b Bandwidth Functional Test Procedure	≥70.7% of the reference amplitude at the maximum bandwidth		none	yes
Procedure 14 ADC RMS Noise		≤10 mV (60 dB of full scale)	none	no
Procedure 15 Trigger Sensitivity at 1 GHz		triggered with 1.5 div (1.5 U) at 1 GHz	none	no

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Table 2-1 — Measurement Limits, Specifications, Adjustments, and Functional Tests (Cont.)

Procedure and Description	Measurement Limits *(Examine)*	Specifications *(Check)*	Adjustments *(Adjust)*	Functional Test
Procedure 16 Trigger Enhancement	delay limit is 330 ps ±70 ps		C212 to eliminate spiking (collisions)	no
Procedure 17a Time Base Performance Verification Procedure				no
Time Base Accuracy		±(0.002% +100 ps)	none	
Window Position Accuracy		±(0.002% +100 ps)		
Procedure 17b Time Base Functional Test Procedure	±(0.002% + 100 ps)		none	yes
Procedure 18 Events Window Position Accuracy		150 MHz maximum event frequency	none	no
Procedure 19 Input/Output				
Real Time Clock	1,000,000 µs ±5 µs		C510 REAL TIME CLOCK for 1,000,000 µs	no
Temperature Sensor Voltage Reference	+6.500 V ±5 mV		R112 TEMP SENSOR VOLTAGE REF for +6.500 V	
Procedure 20 Triggering	Trigger-Level DC Accuracy within 2.0% of full scale (20 LSBs)		none	yes
		DC Noise-Reject Coupled of 1.2 divisions or less from DC to 50 MHz	none	
		AC Coupled of 0.5 divisions from 60 Hz to 50 MHz, increasing to 1.5 divisions at 1 GHz	none	
		DC Coupled of 0.5 divisions from DC to 50 MHz, increasing to 1.5 divisions at 1 GHz	none	
	HF Reject Coupled functional		none	
	LF Reject Coupled functional		none	

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Test Equipment

The test equipment in Table 2-2 contains suggested test equipment for use in this manual. The Functional Test column of Table 2-2 indicates, with a check mark (✓), the test equipment that is recommended if you are performing a functional test. Procedure steps are based on the test equipment examples given, but other equipment with similar specifications may be substituted. Test results, setup information, and related connectors and adapters may be altered by the use of different equipment.

***Table 2-2** — Test Equipment*

Description	Minimum Specification	Examples of Recommended Test Equipment	Functional Test
Function Generator	50 Hz to 3 MHz, Variable offset, Amplitude variable from 0 to 10 V, Sine Wave and Square Wave output	TEKTRONIX FG 503 3 MHz Function Generator with a TM 500 Series Power Module	✓
High Frequency Sine Wave Generator	250 MHz to 1000 MHz, Variable amplitude, 6 MHz reference	TEKTRONIX SG 504 Leveled Sine Wave Generator with a TM 500 Series Power Module	✓
Medium Frequency Sine Wave Generator	250 kHz to 250 MHz, Variable amplitude, 50 kHz reference	TEKTRONIX SG 503 Leveled Sine Wave Generator with a TM 500 Series Power Module	✓
Time Mark Generator	1 ns through 5 s markers in a 1-2-5 sequence, at least 5 parts in 10^7 accuracy	TEKTRONIX TG 501 Time Mark Generator with a TM 500 Series Power Module	✓
Calibration Generator	5 V output amplitude, accuracy within 0.23%	TEKTRONIX PG 506 Calibration Generator with a TM 500 Series Power Module	✓
Frequency Counter	1 part in 10^6 accuracy	TEKTRONIX DC 603A Universal Counter/Timer with a TM 500 Series Power Module	
Test Oscilloscope	$\geq$80 MHz bandwidth	TEKTRONIX SC 504 Oscilloscope	
Logic Probe		TEKTRONIX P6401 Logic Probe	
Probe, 10X	Probe capacitance of $\leq$12 pF, DC to 150 MHz, 10X, w/ground lead	TEKTRONIX P6134	
Plug-in Amplifier	11000 Series	TEKTRONIX 11000 Series plug-in Amplifier	✓

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***Table 2-2** — Test Equipment (Cont.)*

Description	Minimum Specification	Examples of Recommended Test Equipment	Functional Test
Test Terminal	Any GPIB (IEEE-1978) controller, or ASCII terminal equipped with an RS-232-C port. Requires compatible RS-232-C serial interface cable	Compaq Portable II PC with terminal emulation software	
Digital Multimeter	≤0.005% accuracy	Fluke 8842A Digital Multimeter	✓
Signal Standardizer	Tektronix Calibration Fixture with Interface connector modified for 11000 Series use	Tektronix Part 067-0587-10 Signal Standardizer	
Coaxial Cable, 50 Ω	50 Ω, 36-inch, male BNC connectors	Tektronix Part 012-0482-00	✓
Adapters	BNC Female to Alligator Clips	Tektronix Part 013-0076-00	
	Probe tip to ground	Tektronix Part 013-0085-00	
Attenuator, 5X (2 required)	Impedance, 50 Ω; one male and female BNC connector	Tektronix Part 011-0060-02	✓
Power Supplies Troubleshooting Fixture		TEKTRONIX 067-1264-00 Extended Diagnostics 11000 Series Power Supplies troubleshooting fixture	
External Loopback Connector	RS-232-C connector	Tektronix Part 013-0198-00	
Alignment Tool (plastic hex)	Plastic hex	Tektronix Part 003-0301-00	
Term Conn Link (Plastic Short Circuit Jumper)	short circuit jumper	Tektronix Part 131-0993-00	
Alignment Tool (insulated slot)	Insulated slot	Tektronix Part 003-0675-01	
Alignment Tool (square-tip)	Square-Tip	Tektronix Part 003-1400-00	
Magnetic Screwdriver	Holder for Torx tips	Tektronix Part 003-0293-00	
Torx Screwdriver Tips	#10 tip	Tektronix Part 003-0814-00	
	#15 tip	Tektronix Part 003-0966-00	
	#20 tip	Tektronix Part 003-0866-00	

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***Table 2-2** — Test Equipment (Cont.)*

Description	Minimum Specification	Examples of Recommended Test Equipment	Functional Test
Shorting Strap	Two alligator clips on a short pigtail conductor		
Integrated Circuit Extracting Tools	IC Extraction Pliers	General Tool P/N 8212566-1 or equivalent	
	IC Insertion-Extraction Pliers 28-pin type	General Tool P/N U505BG or equivalent	
Circuit Board Removal Tools	Straight-slot screwdriver, large		
	Torx screwdriver. T-7, T-8, T-10, T-15, T-20, T-25		
	Allen (Hex) Wrench, $^{1}/_{16}$-inch		
	Nutdrivers, $^{3}/_{16}$", $^{1}/_{4}$", $^{7}/_{16}$"		
	Needle-nose pliers		

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Using These Procedures

Each procedure begins with a setup illustration that shows the necessary test equipment and connections. Refer to Table 2-2, Test Equipment, for an example of the equipment for each procedure.

Note: *Each procedure that requires you to access test points or adjustment locations in the 11403A assumes that the top and bottom covers were previously removed. If you are performing a functional test, it is not necessary to remove the covers.*

Conventions in this Manual

These procedures use the following conventions:

- CAPITAL letters within the body of text identify front panel controls, indicators, test points, adjustment locations, and connectors on the instrument (for example, MEASURE) and plug-in unit.
- **Bold** letters identify menu labels and display messages.
- Initial Capital letters identify connectors, controls, and indicators (for example, Position) on associated test equipment.

In some steps, the first word is italicized to identify a step that contains a performance verification and/or an adjustment instruction. For example, if *Check* is the first word in the title of a step, an electrical specification is checked. If *Adjust* appears in the title, the step involves an electrical adjustment. If *Examine* is the first word in the title, the step concerns measurement limits that are used as calibration guides; these limits are not to be interpreted as electrical specifications.

Menu Selections and Measurement Techniques

Details on measurement techniques and instructions for making menu selections are generally not included in this manual. Comprehensive descriptions of menus and instrument features are located in the *11403A Digitizing Oscilloscope User Reference*.

Warm-up

For the first 20 minutes after power-on, the 11403A is in either **Warmup** or **New configuration-partial enhanced accuracy occurring** mode, depending on whether or not a plug-in unit has been added or removed since the last Enhanced Accuracy procedure. In either case, the instrument is fully operational but its accuracy is not specified.

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In many of the setup illustrations, a signal standardizer or a plug-in amplifier is shown installed in the 11403A just to keep the signal standardizer or plug-in amplifier at operating temperature. If you are performing a functional test, you should replace the signal standardizer with a plug-in amplifier in the left plug-in compartment of the instrument for Procedure 5, Enhanced Accuracy and Procedure 6, Calibration Output Accuracy.

Tutorial Manual

The tutorial manual, the *11403A Digitizing Oscilloscope Tutorial,* is strongly recommended to familiarize the first-time user with 11403A controls and features.

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Procedure 1 Power-On Diagnostics

Perform this procedure within the ambient temperature range of +18° and +28°C, to ensure proper oscilloscope operation.

CAUTION

Applying a voltage outside the range printed on a plug-in amplifier can result in damage. Static electricity is also a hazard.

Test Equipment Required

11000 Series plug-in amplifier or signal standardizer.

Setup to Power-On Diagnostics

☐ Step 1: With the 11403A's front panel ON/STANDBY switch set to STANDBY, remove the instrument's top and bottom covers.

☐ Step 2: With the rear panel PRINCIPAL POWER SWITCH set to OFF, connect the instrument to a suitable power source.

☐ Step 3: Install a signal standardizer (or an amplifier if you are performing a functional test) in the 11403A's left plug-in compartment.

☐ Step 4: Set the PRINCIPAL POWER SWITCH to ON and then the ON/STANDBY switch to ON.

When the instrument is first installed, the PRINCIPAL POWER SWITCH should be set to the ON position and remain in this position. Thereafter, use the ON/STANDBY switch to perform all power switching.

☐ Step 5: Power on the following test equipment so that it is warmed up with the 11403A to be tested (a complete list of test equipment is shown in Table 2-2):

- Digital multimeter
- Function generator
- Calibration generator
- Frequency counter
- Medium frequency sine wave generator
- High frequency sine wave generator
- Time mark generator
- Test oscilloscope

Procedure to Power-On Diagnostics

Each time the ON/STANDBY switch is set to ON, the 11403A performs power-on diagnostics on its microprocessor subsystems and Self-Test diagnostics on all of its major circuits.

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CAUTION

Turning the 11403A power off during probe calibration, Enhanced Accuracy, or Extended Diagnostics may result in some internal data being corrupted. This may cause mainframe and plug-in diagnostic errors to occur at the next power up. These diagnostic errors will occur until you successfully operate the instrument in Enhanced Accuracy mode.

When power-on diagnostics begin, the messages **Diagnostics in Progress** and **Comm Test in Progress** are displayed on the screen. Diagnostic routines are then performed on each of the instrument's microprocessor subsystems: Display, Executive, and Digitizer. Then, the communication between these subsystems is tested. If the 11403A is being powered-on from cold, the diagnostics may be complete before the CRT is warmed-up sufficiently (that is before the CRT is able) to display these messages.

The start of Self-Test diagnostics indicates successful completion of power-on diagnostics. The message, **Dsy Kernel Failure**, or a beep and illuminated menu button indicators indicates a failure in power-on diagnostics.

Self-Test Diagnostics

When Self-Test diagnostics begin, the message **Self-Test in Progress** is displayed. Flashing and pattern changes on the display indicate test progress. Return to normal operation indicates successful completion of the Self-Test diagnostics. Any failures cause the 11403A to execute the remaining tests, and then display the **EXTENDED DIAGNOSTIC** menu structure. Record the displayed error codes for the failed circuit block(s), and then refer to Diagnostic Troubleshooting in Section 3.

Front panel controls are active during the Self-Test diagnostics sequence and any disturbance will cause a test failure. If such a failure occurs, the 11403A will automatically enter the Extended Diagnostic mode and display the **EXTENDED DIAGNOSTIC** menu structure. Touch the **Exit** selector twice to remove the menu and resume normal operation. However, if the diagnostics detect a fatal Digitizer fault, exiting this menu structure and returning to normal operation will not be possible.

Self-Tests diagnostics verify the following circuits:

- Executive Control
- Front Panel
- Internal I/O
- External I/O
- Subsystem Communication
- Display Control
- Video Generator
- Digitizer Control
- Timebases
- Points Acquisition
- Triggers

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- Points/Address Generator
- Left plug-in amplifier compartment (if installed)
- Center plug-in amplifier compartment (if installed)
- Right plug-in amplifier compartment (if installed)

Completion of Power-On Diagnostics

When the graticule is displayed and the front panel settings in effect at the last power-off are restored, the 11403A has passed power-on diagnostics.

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Procedure 2 Extended Diagnostics

The Extended Diagnostics perform more extensive testing than the Self-Test diagnostics. Extended Diagnostics is designed as a troubleshooting aid for service personnel.

Test Equipment Required

Same equipment as Procedure 1.

Setup to Invoke Extended Diagnostics

No change from previous settings.

Procedure to Invoke Extended Diagnostics

Perform the following steps to enter the **EXTENDED DIAGNOSTICS** menu structure and execute the indicated tests.

- ☐ Step 1: Press the UTILITY button, and then **Page to Utility 2**.
- ☐ Step 2: Touch **Extended Diagnostics**, and then **Extended Diagnostic** in the **Verify Selection** pop-up menu.
- ☐ Step 3: Touch **All** and then **Run** to start the tests.
- ☐ Step 4: Ensure that all tests have executed and have a **Pass** status.
- ☐ Step 5: Touch the following selectors in order:

  Block

  External I/O

  Area

  GPIB

  Routine

- ☐ Step 6: Touch **Intrpt Reset** and then **Run** to start the test.
- ☐ Step 7: Touch **Reset Status** and then **Run** to start the test.
- ☐ Step 8: Touch **Data Lines** and then **Run** to start the test.
- ☐ Step 9: Touch **Interrupt** and then **Run** to start the test.
- ☐ Step 10: Ensure that all four tests executed and passed.
- ☐ Step 11: Touch **Exit** twice to leave the **EXTENDED DIAGNOSTICS** menu structure.

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Procedure 3 Power Supply

This procedure shows the setup and lists the steps required to examine the measured voltage supply, and to examine/adjust the voltage reference and the regulator reference (see Fig. 2-1, 2-2, and 2-3).

Test Equipment Required

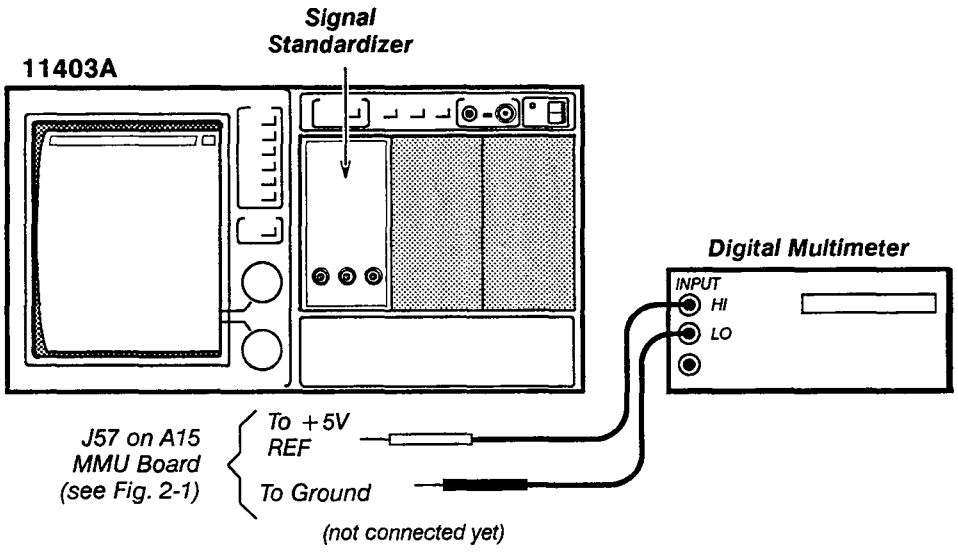
Digital multimeter, shorting strap, alignment tools, magnetic screwdriver, and circuit board removal tools (see Table 2-2 for a detailed tool list).

Measurement Limits

The measurement limits for this procedure are as follows:

- the measured voltage supply must be within the limits of +4.85 V and +5.25 V
- the voltage reference must be within +5.15 V and +5.25 V
- the regulator reference must be within +9.95 V and +10.05 V

Setup to Examine the Voltage Supply



Procedure to Examine the Voltage Supply

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A
ON/STANDBY ..... ON
Digital multimeter
Mode ..... DC Voltage
Signal standardizer ..... not used in this procedure

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☐ Step 2: Disconnect connector J57 on the A15 MMU board. Note the position of the multi-pin connector's index triangle to ensure that the connector can be correctly replaced.

☐ Step 3: Connect the digital multimeter to the J57 connector as indicated in the setup illustration (be careful not to touch the pins together).

☐ Step 4: *Examine* that the digital multimeter reads within the limits of +4.85 V and +5.25 V.

STOP

DO NOT attempt to optimize the following adjustment settings if the reading is within the stated limits. Proceed to Procedure 4, Display.

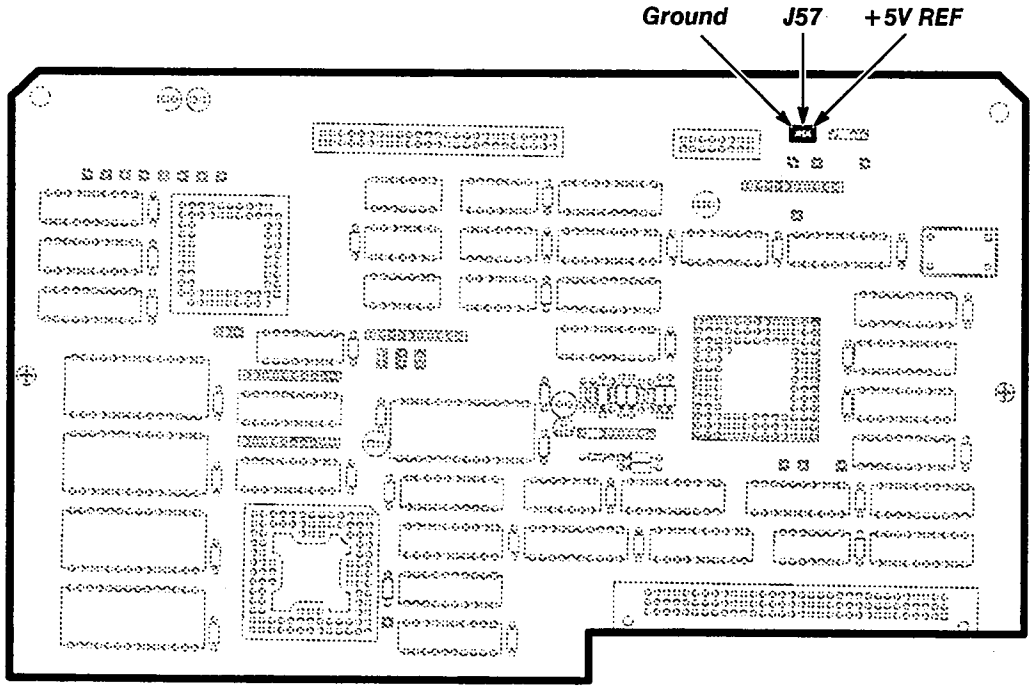
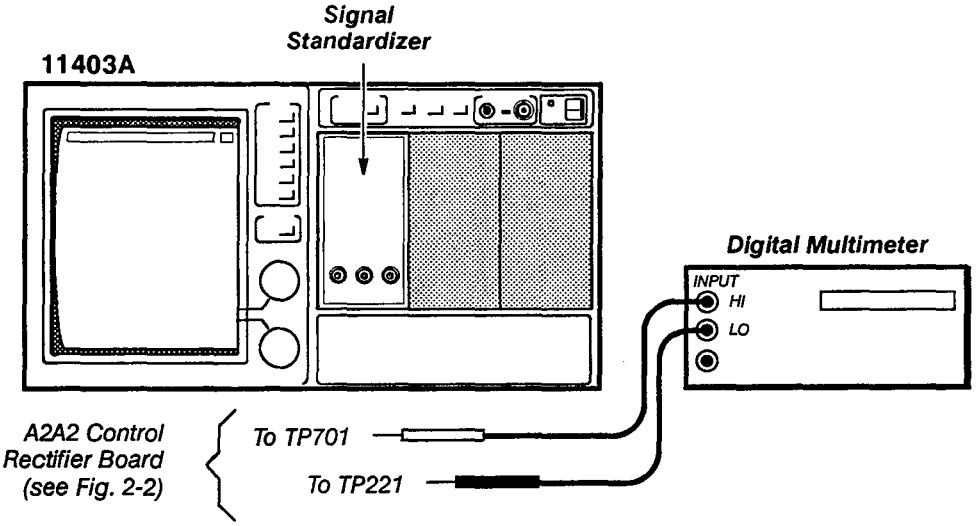


Figure 2-1 *— A15 MMU Board Test Point Locations*

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Setup to Examine/Adjust the Voltage Reference



Procedure to Examine/Adjust the Voltage Reference

☐ Step 1: Perform the following settings in the order listed:

11403A:

a. Set the front panel ON/STANDBY switch to STANDBY and the rear panel PRINCIPAL POWER SWITCH to OFF. Disconnect the 11403A from the power source.

b. Remove the Power Supply module from the mainframe following the steps listed in Power Supply Module Removal/Replacement in Section 3.

c. Create a short between test points TP830 and TP831 on the A2A2 Control Rectifier board using a shorting strap.

d. Connect the instrument Power Supply module to a suitable line power source.

e. Set the PRINCIPAL POWER SWITCH to ON.

Digital multimeter

Mode ..... DC Voltage

☐ Step 2: *Examine* that the digital multimeter reads +5.20 V, within the limits of +5.15 and +5.25 V.

STOP

DO NOT attempt to adjust the following adjustment setting, if the reading is within the stated limits. Proceed to Step 4.

WARNING

Use extreme caution when performing the following adjustment.

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- ☐ Step 3: *Adjust* +5.2 V REF adjustment R800 on the A2A2 Control Rectifier board for +5.20 V.
- ☐ Step 4: Set the PRINCIPAL POWER SWITCH to OFF.
- ☐ Step 5: Remove the digital multimeter leads from the test points.
- ☐ Step 6: Disconnect the 11403A from the power source.
- ☐ Step 7: Remove all test leads and the shorting strap.
- ☐ Step 8: Replace the Power Supply module following the procedure listed under Power Supply Module Removal/Replacement in Section 3.
- ☐ Step 9: Set the PRINCIPAL POWER SWITCH to ON.

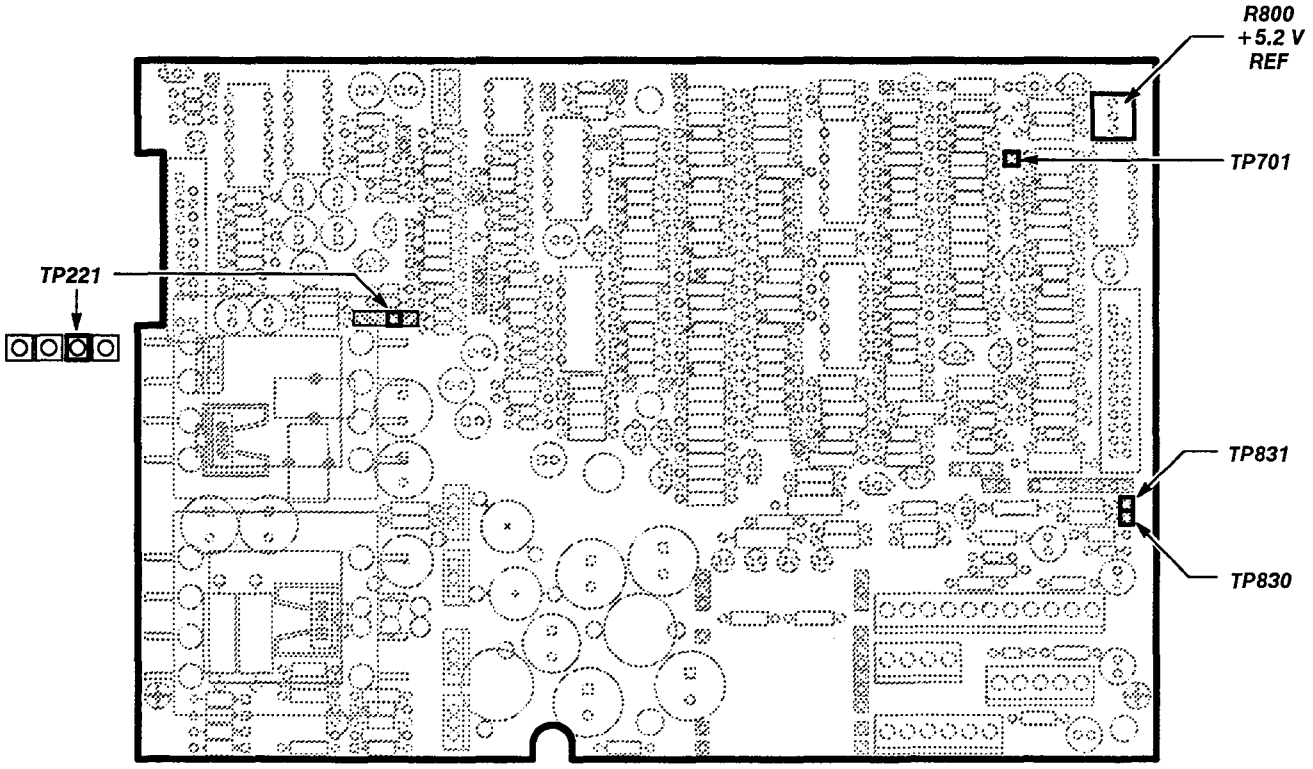
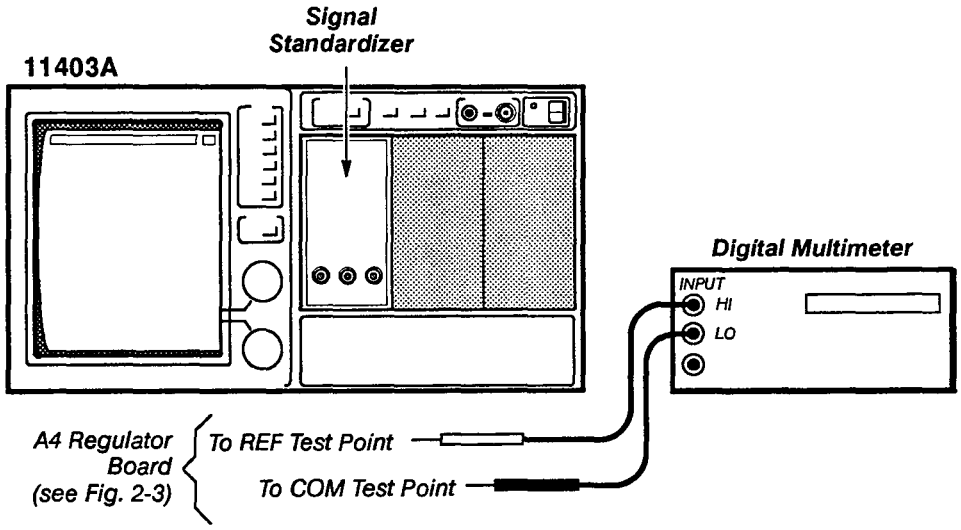


***Figure 2-2** — A2A2 Control Rectifier Board Test Point and Adjustment Locations*

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Setup to Examine/Adjust the Regulator Reference



Procedure to Examine/Adjust the Regulator Reference

☐ Step 1: Attach meter leads to the test points on the A4 Regulator board.

☐ Step 2: Set the ON/STANDBY switch to ON.

☐ Step 3: Perform the following settings in the order listed:

11403A ..... no settings required
Digital multimeter
Mode ..... DC Voltage
Signal standardizer ..... not used in this procedure

☐ Step 4: *Examine* that the digital multimeter reads +10.00 V, within the limits of +9.95 V and +10.05 V.

STOP

DO NOT attempt to adjust the following adjustment, R830, if the reading is within the stated limits. Proceed to Step 4.

WARNING

Use extreme caution when making the following adjustment due to the dangerous potentials present. Access the test points from the right side of the 11403A.

☐ Step 5: *Adjust* +10 V REF adjustment R830 on the A4 Regulator board for +10.00 V.

☐ Step 6: Set the ON/STANDBY switch to STANDBY.

☐ Step 7: Remove the test leads.

☐ Step 8: Set the ON/STANDBY switch to ON.

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☐ Step 9: Repeat Procedure 1, Power-On Diagnostics.

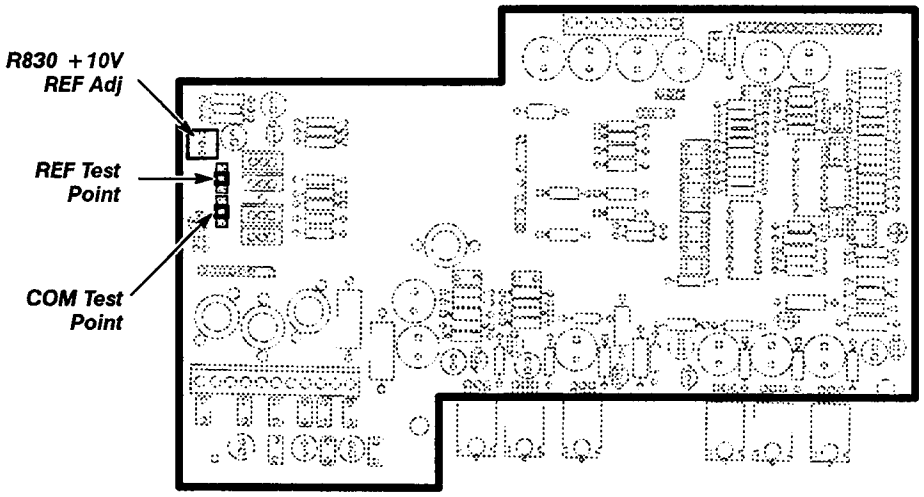


Figure 2-3 *— A4 Regulator Board Test Point and Adjustment Locations*

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Procedure 4 Display

This procedure shows the setup and lists the steps required to examine/adjust the A7 CRT Socket board and the A8 CRT Driver board (see Fig. 2-4 and 2-5).

Test Equipment Required

Magnetic screwdriver and alignment tools.



The adjustments in this procedure only affect the visual aspects of the CRT display and you should only perform these adjustments when the CRT, A7 CRT Socket board or A8 CRT Driver board components are replaced. These adjustments do not affect 11403A accuracy since all measurements are made on the acquired data, not the displayed data. Unless alignment or brightness difficulties are apparent, proceed to Procedure 5, Enhanced Accuracy.

For all *Examine* steps in this procedure, if the display parameter examined is within the stated limits, then do not perform the *Adjust* step following that *Examine* step. Instead, proceed to the step following the *Adjust* step.

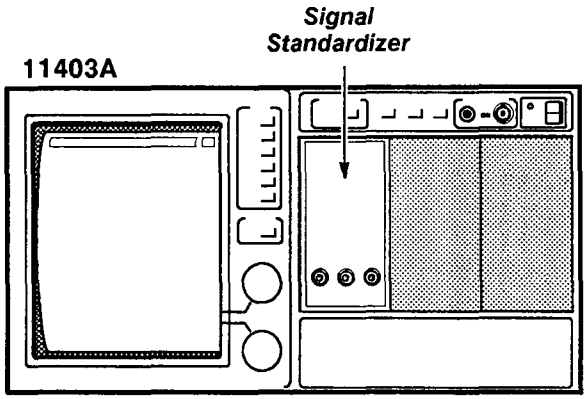
Measurement Limits

The measurement limits are set on the CRT as follows:

- The display must be visible (not cut off).
- The red, green, and blue traces must not be separated.
- Focus is adjusted for minimum line width.
- Vertical size is adjusted to align the corners of the grid pattern with the tic marks on the edges of the front panel bezel.
- Horizontal size is adjusted to align the corners of the grid pattern with the tic marks on the top and bottom edges of the front panel bezel, and the horizontal linearity is adjusted for uniform grid box length.
- Horizontal linearity is adjusted for optimum appearance using internally generated grid pattern.
- Red, green, and blue colors must have optimum white to gray scale linearity.
- **Red Display**, **Green Display**, and **Blue Display** in Extended Diagnostics must not contain severe color impurities.

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Setup to Examine/Adjust the Display



Procedure to Examine/Adjust the Display

WARNING

Use extreme caution when performing the following adjustment.

☐ Step 1: Perform the following settings in the order listed:

11403A
ON/STANDBY ..... STANDBY
Signal standardizer ..... not used in this procedure

☐ Step 2: Remove the three screws that secure the CRT cover, and then remove the cover.

☐ Step 3: Remove the two screws that secure the cover that shields the A7 CRT Socket board (CRT Socket board cover).

☐ Step 4: Set the ON/STANDBY switch to ON.

☐ Step 5: *Examine* that the display is visible.

☐ Step 6: If the display is not visible, *adjust* the SCREEN adjustment (located on the transformer mounted to the A8 CRT Driver board) clockwise until the display appears.

☐ Step 7: Press the UTILITY button, and then touch **Page to Utility 2 Menu**.

☐ Step 8: Touch **Extended Diagnostic** and then **Extended Diagnostic** in the **Verify Selection** pop-up menu.

☐ Step 9: Touch **Block** and then **Front Panel**.

☐ Step 10: Touch **Area** and then **Test Pattern**.

☐ Step 11: Touch **Routine** and then **White Grid**.

☐ Step 12: Touch **Run** in the UTILITY major menu.

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Note: *The mainframe should be in its normal position. If the instrument is on its side, the red screen colors displayed will not be aligned correctly.*

☐ Step 13: *Examine* that the primary colors (red, green, and blue) are not separated in the white grid pattern.

WARNING

Do not touch the back side of the A7 CRT Socket board. Due to dangerous voltage levels, use extreme caution when performing the following adjustment.

☐ Step 14: *Adjust* the CONVERGENCE adjustment, R210, on the A7 CRT Socket board for the optimum vertical convergence of the red, green, and blue colors.

☐ Step 15: *Examine* that the grid pattern is focused.

☐ Step 16: *Adjust* the Focus adjustment, located on the transformer mounted on the A8 CRT Driver board, for the optimum focus of the white grid pattern.

☐ Step 17: *Examine* that the grid is aligned with the top and bottom tic marks along the inside vertical edge of the front panel bezel. To eliminate any parallax error, look directly ahead at the CRT, and then align the top of the grid with the top vertical tic mark and the bottom of the grid with the bottom tic mark.

☐ Step 18: *Adjust* VERT SIZE, L321, and VERT POS, R311, adjustments on the A8 CRT Driver board to align the grid with the tic marks along the inside vertical edge of the front panel bezel.

☐ Step 19: *Examine* that the grid is aligned with the horizontal tic marks at the top and bottom of the front panel bezel and that the grid boxes are of uniform length throughout the grid pattern.

☐ Step 20: *Adjust* the H SIZE, R501, H LIN, R502, and H POS, R500, adjustments on the A8 CRT Driver board for optimum overall linearity and position. Use the horizontal tic marks at the top and bottom of the front panel bezel to properly aligned the grid.

☐ Step 21: H-SIZE, H-LIN, and H-POS adjustments interact, therefore you may need to repeat Steps 19 and 20 until H-SIZE, H-LIN, and H-POS are all optimally adjusted.

☐ Step 22: Touch **Exit** to return to the **EXTENDED DIAGNOSTIC** menu structure.

☐ Step 23: Touch **Gray Scale** in the **Routine** pop-up menu.

☐ Step 24: Touch **Run** in the **UTILITY** major menu.

☐ Step 25: *Examine* that the color scale is white at the top, gray at the bottom, and the background on the right side of the display is cut off (that is, the vertical raster lines are not visible on the right side of the display).

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STOP

If the gray scale meets the previous conditions, do not perform the adjustments in steps 25, 26, and 28. Proceed to Step 29.

☐ Step 26: *Adjust* the Red, R200, Green, R201, and Blue, R203, adjustments on the A7 CRT Socket board fully counterclockwise.

☐ Step 27: *Adjust* the SCREEN adjustment, located on the transformer that is mounted on the A8 CRT Driver board, so that the bottom block of the gray scale is visible but the background on the right side of the display is still cut off.

☐ Step 28: Note which color (red, green, or blue) appears more prominently in the display. DO NOT adjust this color in the following step.

☐ Step 29: *Adjust* the RED, R200, GREEN, R201, or BLUE, R203, adjustments on the A7 CRT Socket board for a pure white to gray scale display. Only adjust the colors that appear not to be prominent. For example, if the display appears to be more red, then adjust the GREEN and BLUE adjustments.

Note: *The SCREEN adjustment may have to be adjusted slightly if any of the colors are adjusted. If the vertical raster lines are visible in the background, then adjust the SCREEN adjustment so that the background is just cut off, but the bottom gray box is still visible.*

☐ Step 30: Touch **Exit** to return to the **EXTENDED DIAGNOSTIC** menu structure.

☐ Step 31: Touch **Red Display**, and then **Run**.

☐ Step 32: *Examine* the red display for any severe color impurities.

☐ Step 33: Touch **Exit** to return to the EXTENDED DIAGNOSTICS menu structure.

☐ Step 34: Touch **Green Display** and then **Run**.

☐ Step 35: *Examine* the green display for any severe color impurities.

☐ Step 36: Touch **Exit** to return to the **EXTENDED DIAGNOSTIC** menu structure.

☐ Step 37: Touch **Blue Display** and then **Run**.

☐ Step 38: *Examine* the blue display for any severe color impurities.

☐ Step 39: If any of the color displays (that is, the **Red Display**, **Green Display**, or **Blue Display**) showed severe color impurities, then perform the following to restore the color purity:

- Ensure that the 11403A environment is free of all external magnetic fields. For example, a magnetic screwdriver in the near proximity of the instrument could cause color impurities on the screen.
- Set the ON/STANDBY switch to STANDBY.
- Set the ON/STANDBY switch to ON.

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- *Examine* the color displays again, and verify that the color impurities are removed.

Note: *When the 11403A is moved in the earth's magnetic field, color impurities will appear on the display. This is normal. To remove the impurity, repeat step 38.*

☐ Step 40: Set the ON/STANDBY switch to STANDBY.

☐ Step 41: Replace the CRT Socket board cover and the CRT cover.

☐ Step 42: Set the ON/STANDBY switch to ON.

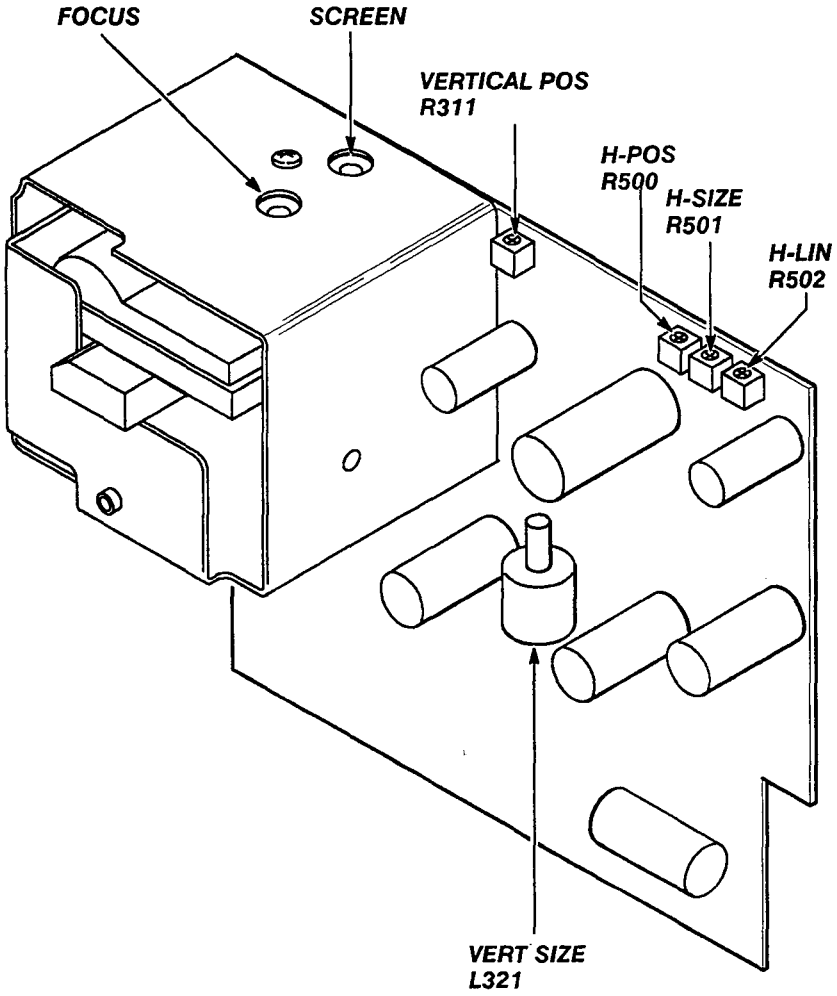


Figure 2-4 *— A8 CRT Driver Board Adjustment Locations*

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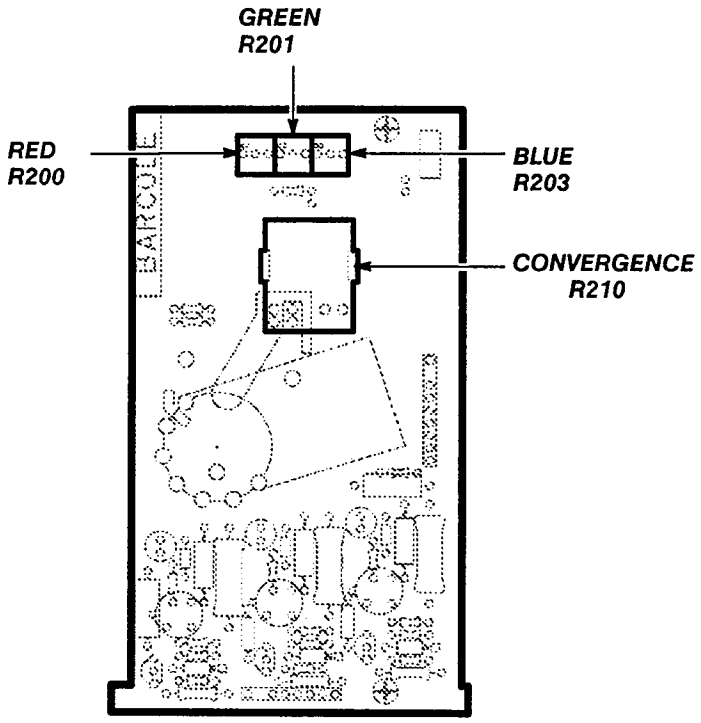


Figure 2-5 *— A7 CRT Socket Board Adjustment Locations*

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Procedure 5 Enhanced Accuracy

When displayed, the Enhanced Accuracy symbol (**EA**) indicates that the 11403A Digitizing Oscilloscope is at its highest accuracy state. The instrument saves the time of calibration and ambient temperature for use in maintaining the Enhanced Accuracy state.

For more information about the Enhanced Accuracy state, refer to the *11403A Digitizing Oscilloscope User Reference*.

To verify the DC measurement accuracy of the 11403A in its Enhanced Accuracy state, apply and monitor test voltages, and then compare these test voltages with the measurements performed on the screen.

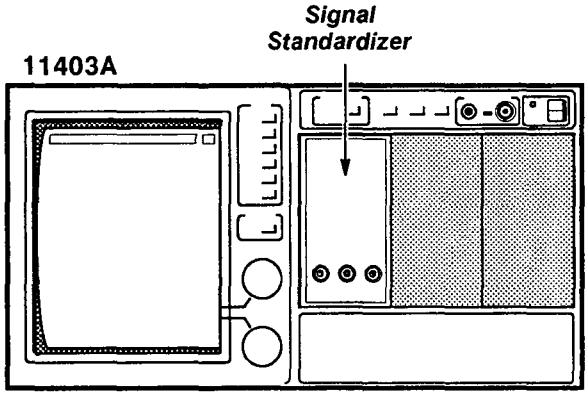
Test Equipment Required

No test equipment is required for this procedure.

Specification

When invoked, Enhanced Accuracy must pass.

Setup to Check the Enhanced Accuracy State



Procedure to Check the Enhanced Accuracy State

☐ Step 1: Perform the following settings in the order listed:

11403A ..... no settings required
Signal standardizer ..... not used in this procedure

☐ Step 2: Twenty minutes after power-on, the 11403A can attempt to achieve the Enhanced Accuracy state. Press the ENHANCED ACCURACY button. The prompt **Press ENHANCED ACCURACY again to confirm request** will appear at the top of the display.

☐ Step 3: Press the ENHANCED ACCURACY button again. Attaining the Enhanced Accuracy state requires a couple of minutes.

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CAUTION

Turning instrument power off during this process may result in some loss of the nonvolatile RAM data. This could cause diagnostic errors at the next power-on and affect normal instrument operation in unpredictable ways.

☐ Step 4: *Check* for the following messages:

- **Enhanced Accuracy in Progress Please Leave Instrument on Until Complete** indicating that the 11403A is attempting to attain the Enhanced Accuracy state.
- **Enhanced Accuracy completed and passed** indicating that the Enhanced Accuracy state has been attained. The **EA** indicator also appears on the display when the Enhanced Accuracy state is achieved.

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Procedure 6 Calibration Output Accuracy

This procedure shows the setup and lists the steps required to check the probe calibration output voltage, and to examine the attenuator ratios and calibrator (DAC) linearity (see Fig. 2-6).

Test Equipment Required

Digital multimeter, alignment tools, circuit board removal tools.

Specification

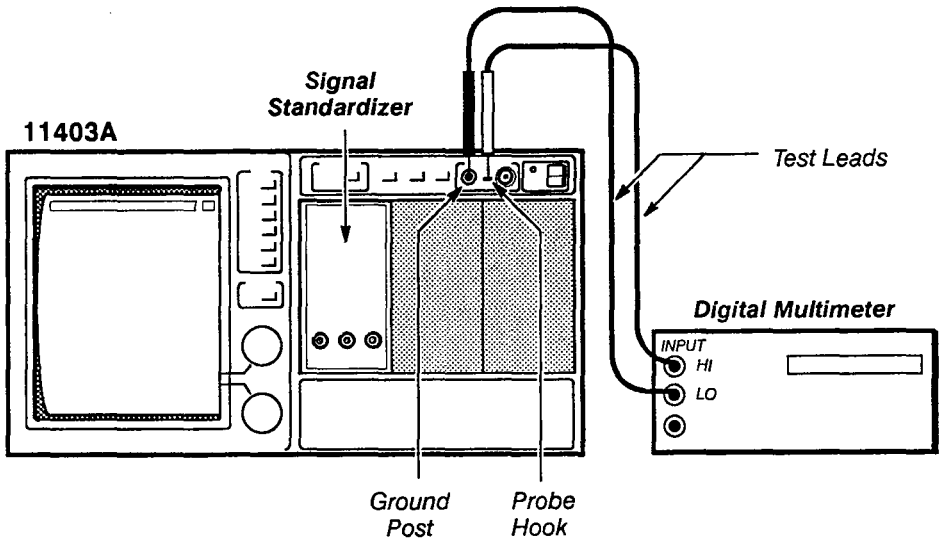
Probe calibration output voltage accuracy ±0.06% (or ±6 mV).

Measurement Limits

The measurement limits for this procedure are as follows:

- Attenuator Ratios ±0.04%.
- Calibrator Digital-to-Analog Converter (DAC) Linearity of ±0.75 LSB.

Setup to Check/Adjust the Probe Calibration Output Voltage Accuracy



Procedure to Check/Adjust the Probe Calibration Output Voltage Accuracy

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A
UTILITY button ..... press
Page to Utility 2 Menu ..... touch
Extended Diagnostic ..... touch
Verify Selection pop-up menu ..... **Extended Diagnostic**

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Subsys pop-up menu ..... **Digitizer**
Block pop-up menu ..... **Points Acq**
Area pop-up menu ..... **FP Cal Refs**
Routine pop-up menu ..... **FP -10.0000 V**

☐ Step 2: Touch **Run** in the **UTILITY** major menu.

Digital multimeter
Set to measure ..... 10.0000 V DC
Signal standardizer ..... not used in this procedure

☐ Step 3: *Check* that the Digital multimeter reads within the limits of −10.0060 V and −9.9940 V.



DO NOT attempt to optimize the following adjustment setting if the digital multimeter reading is within the stated limits or if you are performing a functional test. Proceed to Step 4.

To gain access to the A5 Acquisition board adjustment locations, remove the nine Torx drive screws on the A5 Acquisition board. Then, pivot and lock the A5 Acquisition board in the extended position. Refer to FRU Board Assembly Removal, A5 Acquisition Board, in Section 3 of this manual, for the location of these Torx drive screws.

☐ Step 4: *Adjust* the OFFSET adjustment R1576 on the A5 Acquisition board for −10.000 V, within the limits of −9.998 V and −10.002 V.

☐ Step 5: Touch **Exit**.

☐ Step 6: Touch **FP +9.9951 V** in the **Routine** pop-up menu and then **Run** at the bottom of the screen.

☐ Step 7: *Check* the digital multimeter for +9.9951 V, within the limits of +9.9891 V and +10.0011 V.



DO NOT attempt to optimize the following adjustment setting if the digital multimeter reading is within the stated limits or if you are performing a functional test. Proceed to Step 8.

☐ Step 8: *Adjust* the GAIN adjustment R1582 on the A5 Acquisition board for +9.9951 V, within the limits of +9.9931 V and +9.9971 V.

☐ Step 9: Touch **Exit**.

☐ Step 10: Touch **Exit** twice to clear the EXTENDED DIAGNOSTICS menu.

☐ Step 11: If any adjustments were performed, perform the ENHANCED ACCURACY procedure (refer to Procedure 5, Enhanced Accuracy).

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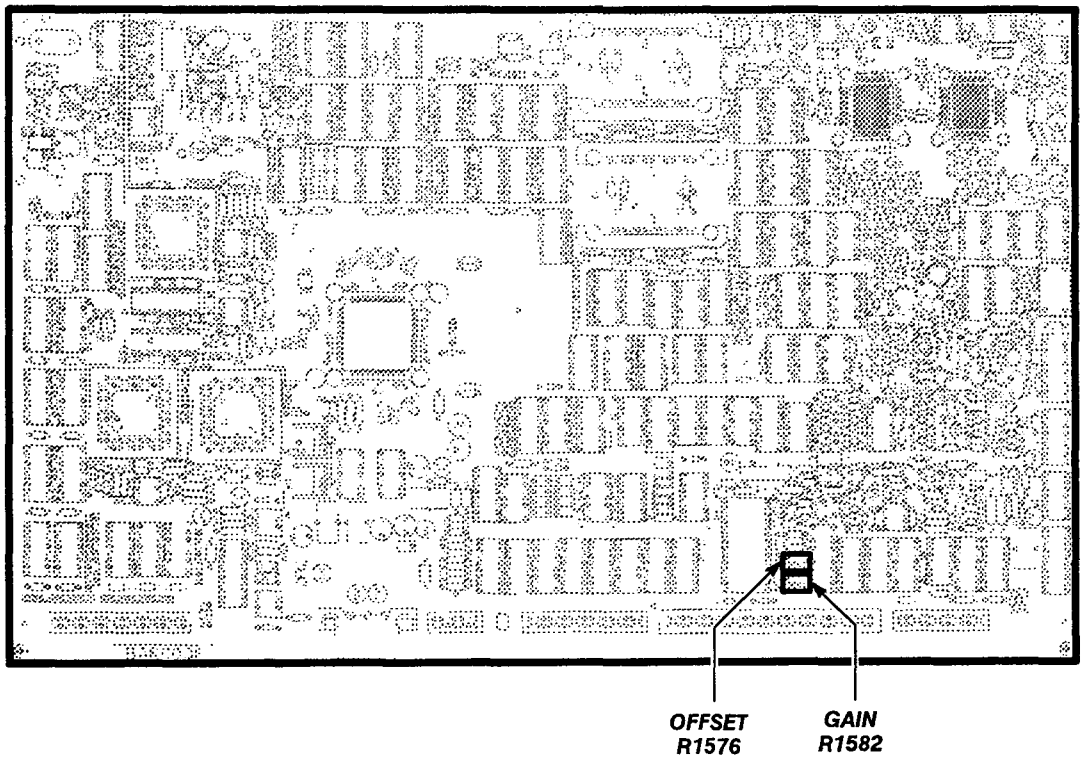
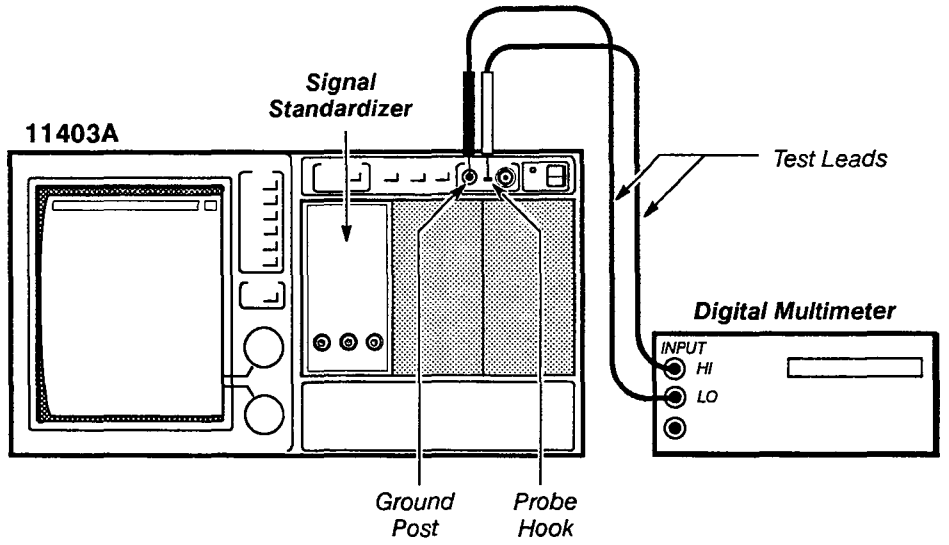


Figure 2-6 *— A5 Acquisition Board Adjustment Locations*

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Setup to Examine the Attenuator Ratios and Calibrator DAC Linearity



Procedure to Examine the Attenuator Ratios and Calibrator DAC Linearity

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A
- UTILITY button ..... press
  - **Page to Utility 2 Menu** ..... touch
  - **Extended Diagnostic** ..... touch
  - **Verify Selection** pop-up menu ..... **Extended Diagnostic**
    - **Subsys** pop-up menu ..... **Digitizer**
    - **Block** pop-up menu ..... **Points Acq**
    - **Area** pop-up menu ..... **FP Cal Refs**
    - **Routine** pop-up menu ..... **FP –10.0000 V**
      ..... **Run**

Digital multimeter
- Mode ..... DC Voltage

Signal standardizer ..... not used in this procedure

☐ Step 2: Record the negative voltage reading from the digital multimeter as V_2 for later use.

☐ Step 3: Touch **Exit.**

☐ Step 4: Touch **FP +9.9951 V** in the **Routine** pop-up menu.

☐ Step 5: Touch **Run** at the bottom of the screen, and then record the voltage reading from the digital multimeter as V_5 for later use.

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☐ Step 6: Add the absolute value of the voltage recorded in Step 2 (V_2) to the absolute value recorded in Step 5 (V_5). Record this voltage as V_6 for later use.

☐ Step 7: Touch **Exit**.

☐ Step 8: Touch **FP -5.0000 V** (when performing successive tests, refer to Table 2-3 for the correct selector for repetitions 2, 3, and 4) in the **Routine** pop-up menu.

☐ Step 9: Touch **Run** at the bottom of the screen.

Note: *If your digital multimeter does not have an offset feature, then record the absolute value of the measured voltages in steps 9 and 13. Then, add these values and multiply the result by 2 (when performing successive tests, refer to the Step 14 Multiplier in Table 2-3 for the correct multiplier for repititions 2, 3, and 4). Record this value as V_{14} for later use.*

☐ Step 10: Push the offset button on the digital multimeter.

☐ Step 11: Touch **Exit**.

☐ Step 12: Touch **FP +4.9976 V** (when performing successive tests, refer to Table 2-3 for the correct selector for repetitions 2, 3, and 4) in the **Routine** pop-up menu.

☐ Step 13: Touch **Run** at the bottom of the screen.

☐ Step 14: Record the voltage reading on the digital multimeter, and then multiply this reading by 2 (when performing successive tests, refer to the Step 14 Multiplier in Table 2-3 for the correct multiplier for repetitions 2, 3, and 4). Record this voltage as V_{14} for later use.

☐ Step 15: *Examine* that the difference between the voltages recorded in Step 6 (V_6) and Step 14 (V_{14}) is $\leq \pm 0.008$ V ($\pm 0.04\%$).

☐ Step 16: Push the offset button on the digital multimeter so that the offset is turned off.

☐ Step 17: Repeat Steps 7 through 16 three times (repetitions 2, 3, and 4 in Table 2-3, respectively) using the selectors and multipliers supplied in Table 2-3 for Steps 8, 12, and 14.

Table 2-3 *— Voltages for Examining Attenuator Ratios*

Repetition	Step 8 Selector	Step 12 Selector	Step 14 Multiplier	Recorded Voltages (V_{14})
2	FP -2.5000 V	FP +2.4988 V	multiply by 4	_____
3	FP -1.000 V	FP +999.51 mV	multiply by 10	_____
4	FP -100.00 mV	FP +99.951 mV	multiply by 100	_____

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☐ Step 18: Touch **Exit**.

☐ Step 19: Touch **FP 0.0000 V** in the **Routine** pop-up menu.

☐ Step 20: Touch **Run** at the bottom of the screen.

☐ Step 21: Record the voltage reading on the digital multimeter as V_{21}.

☐ Step 22: *Examine* that

$$\left(\left(\frac{V_2 + V_5 + 4.9mV}{2}\right) - V_{21}\right)$$

is within the limits of ±3.7 mV (±0.75 LSBs).

☐ Step 23: Touch **Exit** once to leave the routine.

☐ Step 24: Continue to the next procedure, or touch **Exit** twice to leave the **EXTENDED DIAGNOSTIC** menu structure.

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Procedure 7 Probe Compensation Voltage

This procedure shows the setup and lists the procedure to examine the probe compensation voltage.

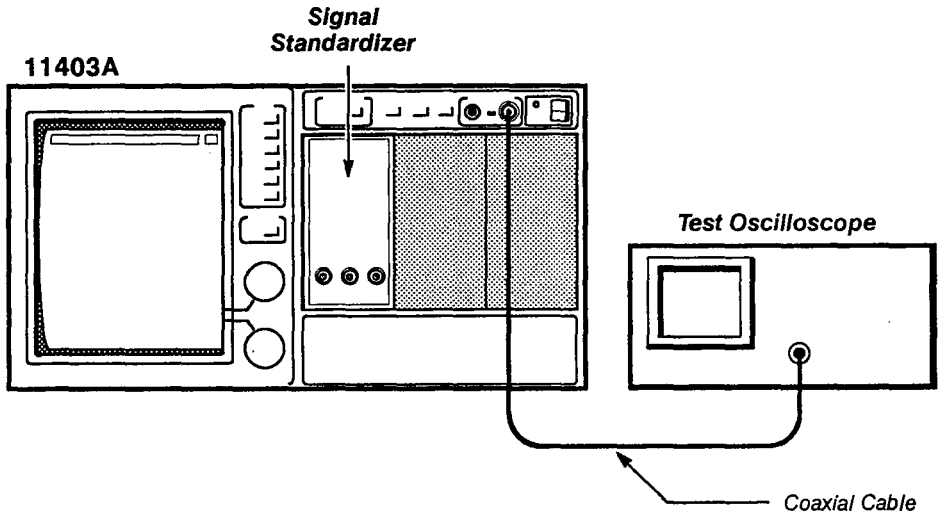
Test Equipment Required

Test oscilloscope, 50 Ω coaxial cable.

Measurement Limit

Probe compensation output voltage is 6.0 V, ±0.18 V (±3%) into a 1 MΩ load

Setup to Examine the Probe Compensation Voltage



Procedure to Examine the Probe Compensation Voltage

☐ Step 1: First **Initialize** the 11403A settings, then perform the following in the order listed:

11403A

UTILITY button ..... press
Page to Utility 2 Menu ..... touch
Extended Diagnostics ..... touch
Verify Selection pop-up menu ..... **Extended Diagnostic**
Subsys pop-up menu ..... **Digitizer**
Block pop-up menu ..... **Points Acq**
Area pop-up menu ..... **FP Cal Refs**
Routine pop-up menu ..... **FP 1 kHz**
..... **Run**

Test oscilloscope ..... Set controls to measure a 6 V p-p square wave signal

Signal standardizer ..... not used in this part

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☐ Step 2: *Examine* the test oscilloscope display for a 6 V peak-to-peak square wave, within the limits of 5.820 V and 6.180 V.

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Procedure 8 Acquisition

This procedure shows the setup and lists the steps required to examine/adjust the 10 MHz peak-to-peak signal amplitude, the phase lock loop voltage, the differential amplifier voltage, and the difference amplifier step response (see Fig. 2-7, 2-8, and 2-9).

Test Equipment Required

Test oscilloscope, digital multimeter, 10X probe, magnetic screwdriver, and alignment tools.

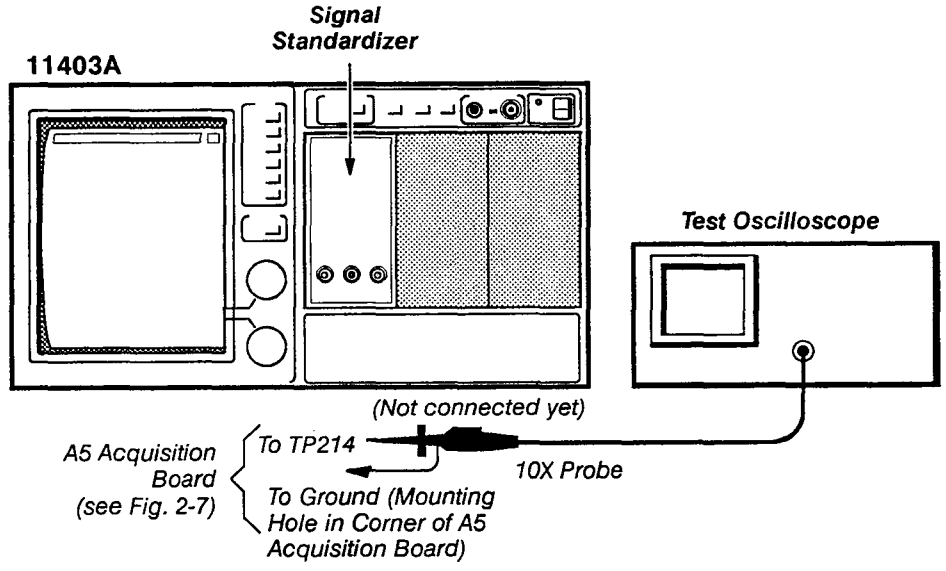
Measurement Limits

The measurement limits for this procedure are as follows:

- 10 MHz signal amplitude $\geq$1.0 V p-p
- Phase lock loop +6.0 V, ±1.0 V
- Differential amplifier V +10.500 V, ±10 mV

Static Sensitive Devices

Setup to Examine/Adjust the 10 MHz Signal Amplitude



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Procedure to Examine/Adjust the 10 MHz Signal Amplitude

☐ Step 1: Perform the following settings in the order listed:

11403A:

a. Set the ON/STANDBY switch to STANDBY.

b. Set the instrument on its right side.

c. Remove the nine Torx drive screws on the A5 Acquisition board (located on the bottom of the instrument). Unlock the A5 Acquisition board from its present position. (Refer to FRU Board Assembly Removal, A5 Acquisition Board, in Section 3 of this manual, for the location of the Torx drive screws to remove.)

d. Pivot and lock the A5 Acquisition board in the extended position.

e. Connect the 10X probe to the test points indicated in the setup illustration.

f. Set the ON/STANDBY switch to ON.

Test oscilloscope
- Vertical Sensitivity (at probe tip) . . . . . 500 mV/division
- Horizontal time/div . . . . . 50 ns/division
- Triggering . . . . . Internal

Signal standardizer . . . . . not used in this procedure

☐ Step 2: *Examine* that the amplitude of the waveform on the test oscilloscope is at least 1 V peak-to-peak.



DO NOT attempt to optimize the following adjustment setting, if the signal amplitude is within the stated limits. Proceed to Step 4.

☐ Step 3: *Adjust* the 10 MHz adjustment, C217, for maximum signal amplitude (0.8 V peak-to-peak minimum acceptable amplitude for this adjustment). Rotate the adjustment slowly to allow the circuit to settle to its final value.

☐ Step 4: Remove the 10X probe.

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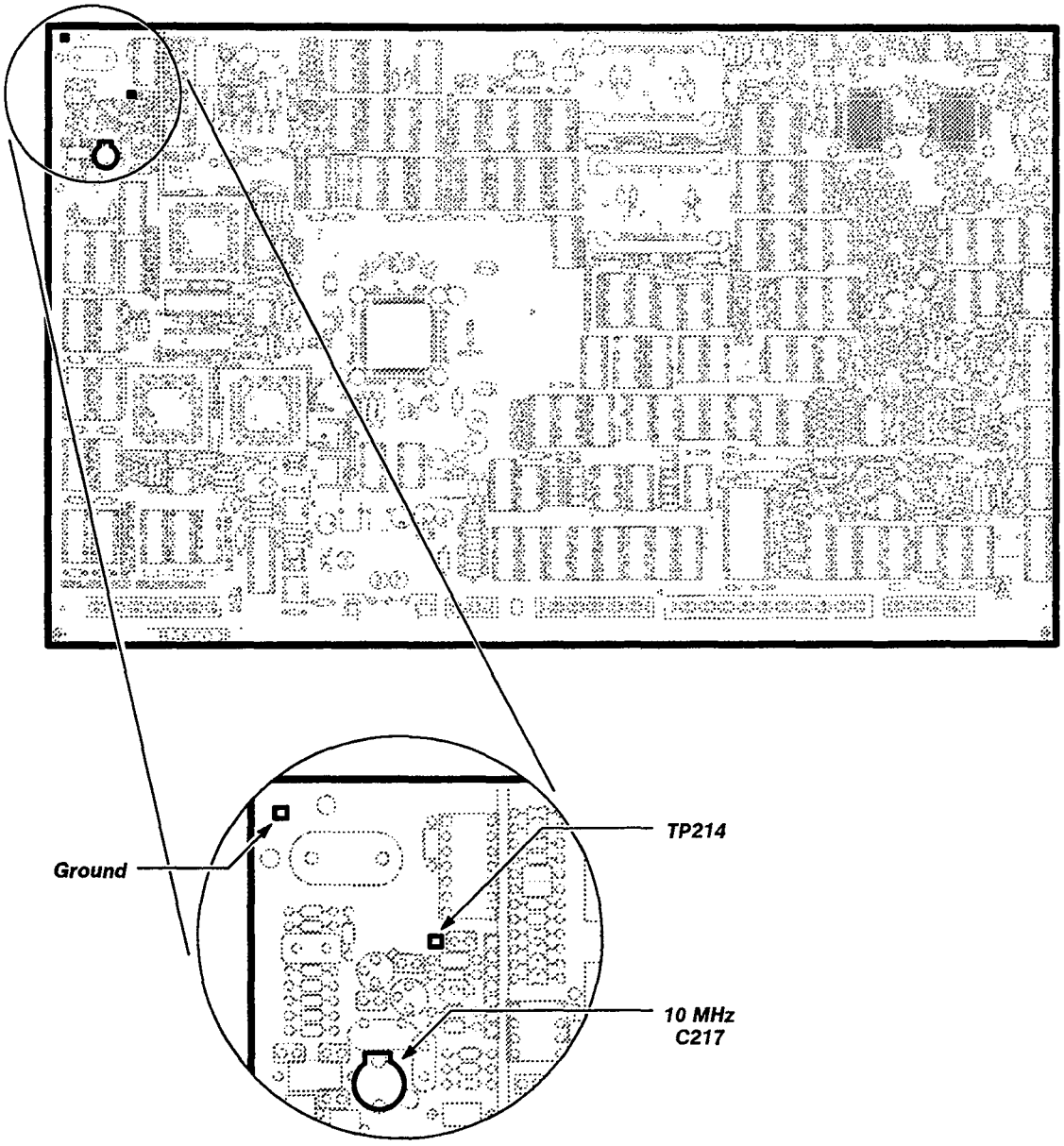
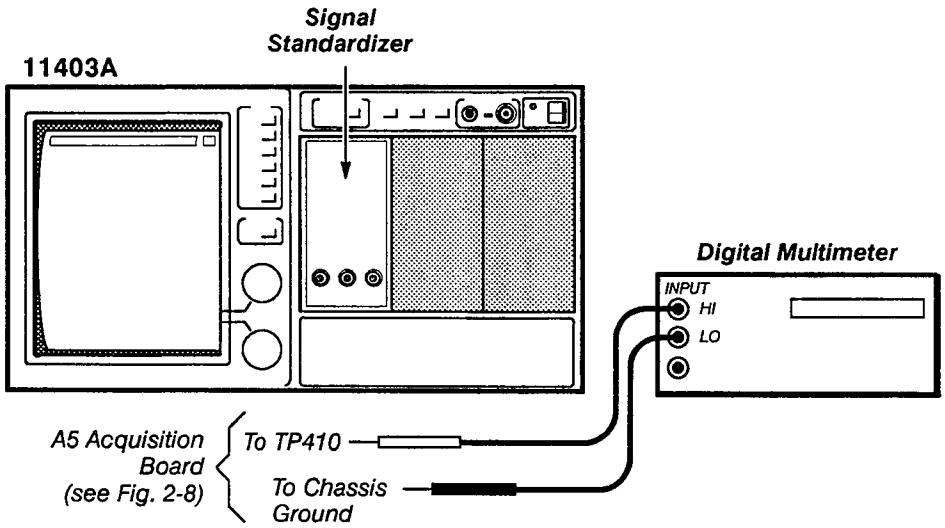


Figure 2-7 *— A5 Acquisition board (10 MHz) Test Point and Adjustment Locations*

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Setup to Examine/Adjust the Phase Lock Loop



Procedure to Examine/Adjust the Phase Lock Loop

☐ Step 1: Perform the following settings in the order listed:

11403A ..... no setting changes required
Digital multimeter
Mode ..... DC Voltage
Signal standardizer ..... not used in this procedure

☐ Step 2: *Examine* that the digital multimeter (DMM) reads within the limits of +7.0 V and +5.0 V.

STOP

DO NOT attempt to optimize the following adjustment setting if the reading is within the stated limits. The adjustment is sensitive and has a wide range. Proceed to Step 4.

☐ Step 3: *Adjust* the VCO adjustment, C500, for +6.0 V, ±0.3 V.

☐ Step 4: Remove the DMM leads.

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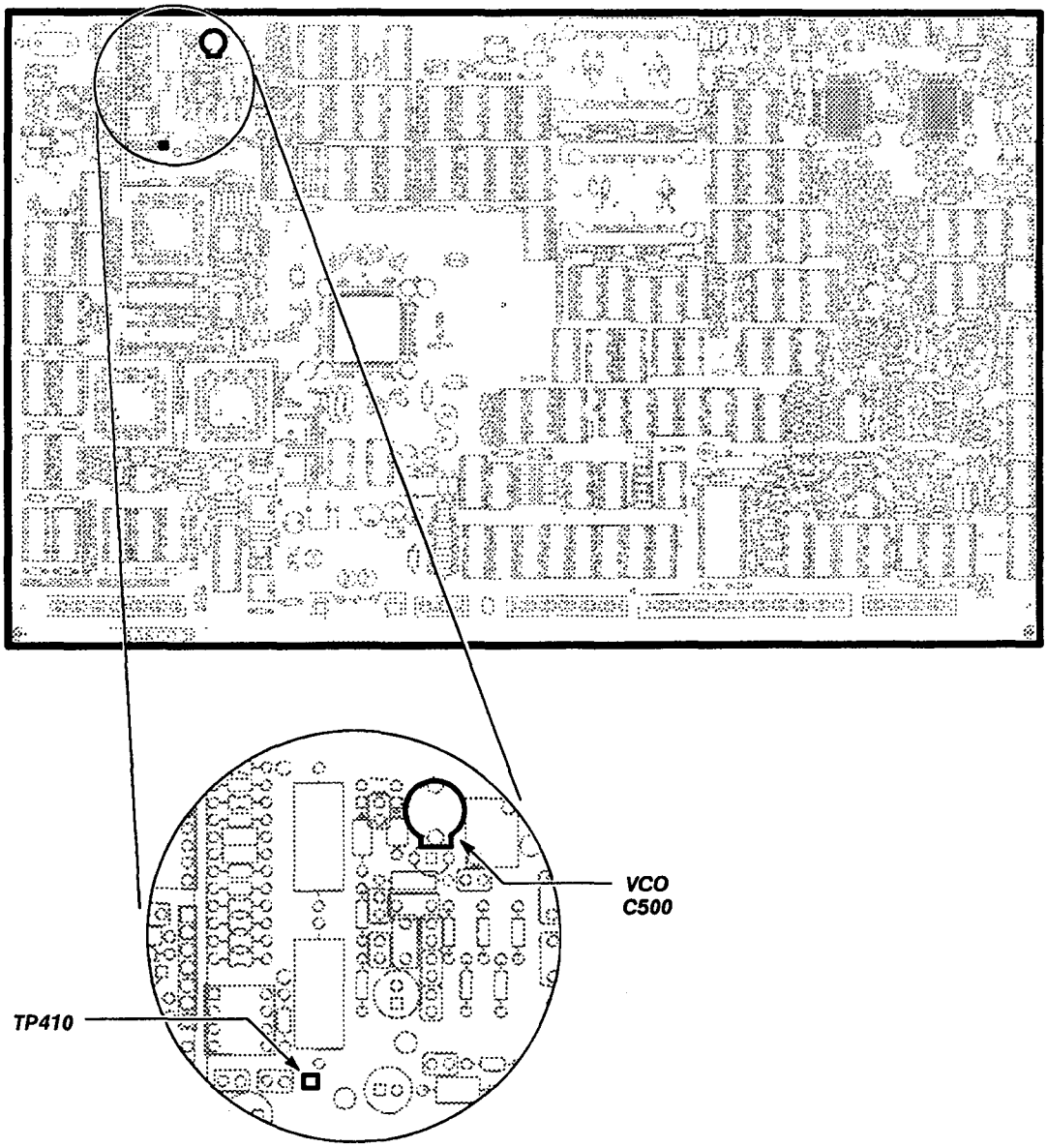
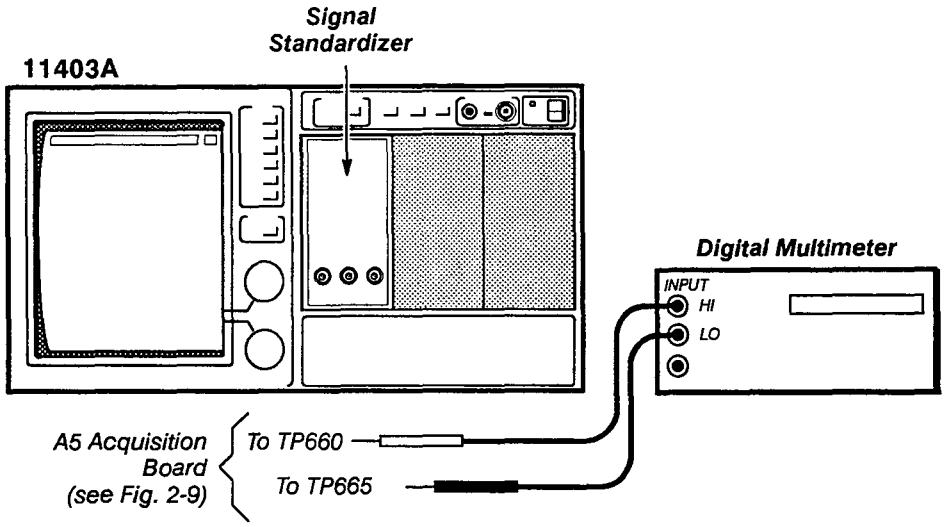


Figure 2-8 *— A5 Acquisition board (VCO) Test Point and Adjustment Locations*

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Setup to Examine/Adjust the Differential Amplifier V+



Procedure to Examine/Adjust the Differential Amplifier V+

☐ Step 1: Perform the following settings in the order listed:

11403A ..... no setting changes required
Digital multimeter
Mode ..... DC Voltage
Signal standardizer ..... not used in this procedure

☐ Step 2: *Examine* that the digital multimeter (DMM) reads within the limits of 10.510 V and 10.490 V.

STOP

DO NOT attempt to optimize the following adjustment setting,if the reading is within the stated limits. Proceed to Step 4.

☐ Step 3: *Adjust* the Diff Amp V+ adjustment, R666, for 10.500 V.

☐ Step 4: Remove the DMM leads.

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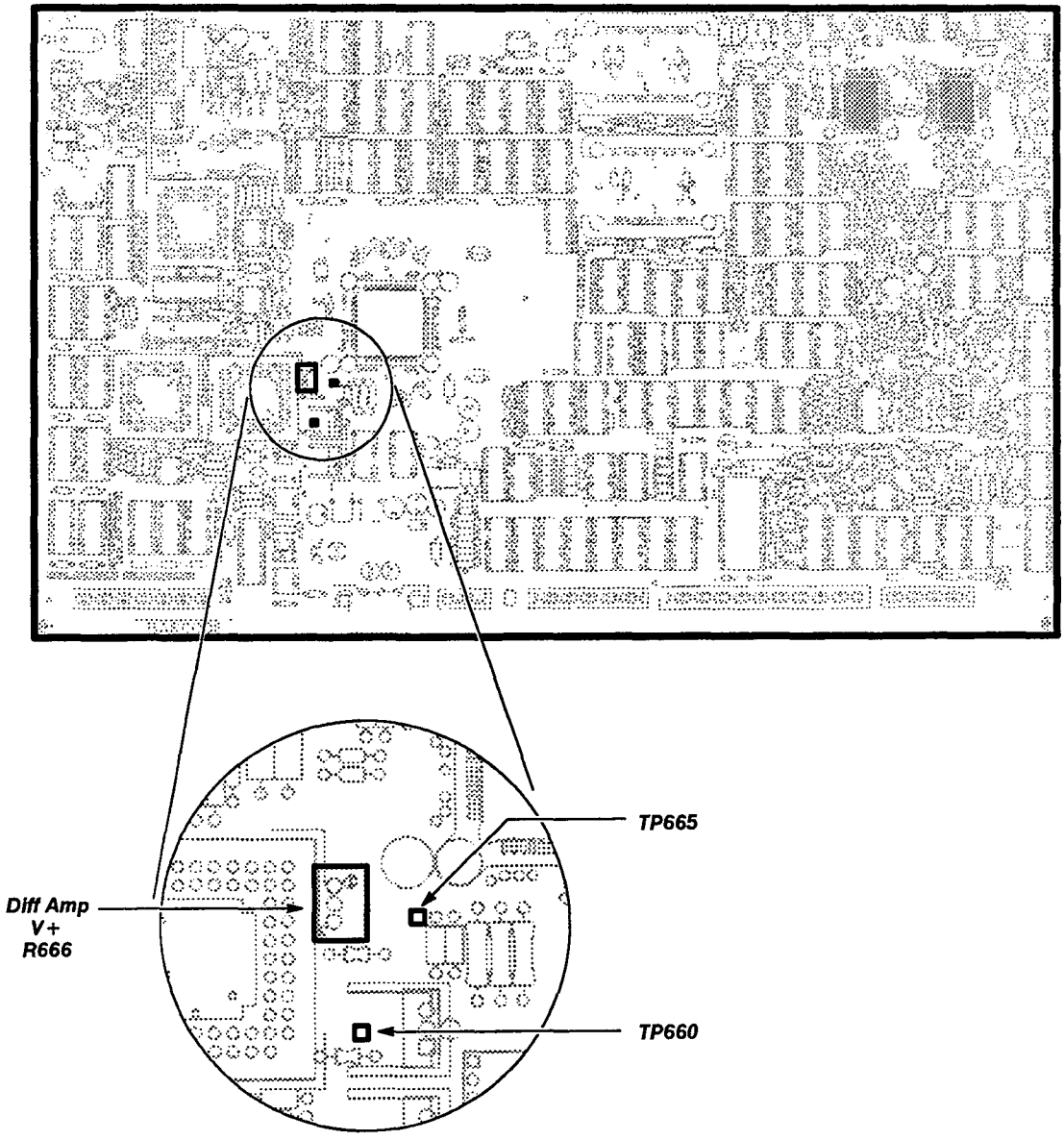


Figure 2-9 *— A5 Acquisition board (Diff Amp V+) Test Point and Adjustment Locations*

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Procedure 9 Vertical Input Offset

This procedure shows the setup and lists the steps required to examine the vertical input offset.

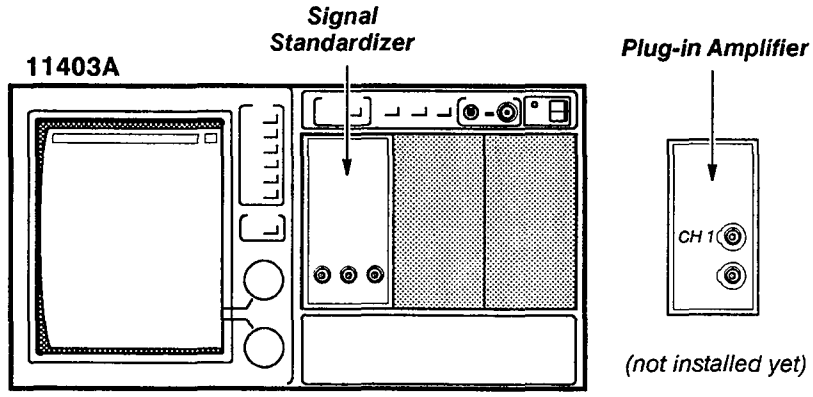
Test Equipment Required

A plug-in amplifier is the only test equipment required for this procedure.

Measurement Limit

Vertical input offset must be within ±0.2 division.

Setup to Examine the Vertical Input Offset



Procedure to Examine the Vertical Input Offset

☐ Step 1: First **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A
- **Def Wfm** ..... touch
  - **L** ..... touch
  - **Enter Desc** ..... touch
- MEASURE button ..... press
  - **Measurements** ..... **Mean**
    - **Mean** ..... touch
    - **Data Interval** ..... **Whole Zone**

Signal standardizer
- Vert or Horiz ..... Com Mode

Plug-in amplifier ..... not used in this procedure unless setting the vertical input offset

☐ Step 2: *Examine* that the **Mean** readout on the screen is within ±200 mU (±0.2 divisions).

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☐ Step 3: Repeat Steps 1 and 2 for the Center and Right plug-in compartments. Do not move the signal standardizer to examine the Center and Right compartments. When performing the settings, simply substitute **C** or **R** for **L** in the **Vertical Description** pop-up menu (after you touch **Def Wfm**).



If the Checks for Left, Center, and Right plug-in compartments are within the stated limits, proceed to Procedure 10a, Sampler and Digitizer.

Procedure to Set Vertical Input Offset

☐ Step 4: Set the ON/STANDBY switch to STANDBY.

☐ Step 5: Install a plug-in amplifier in the left compartment.

☐ Step 6: Set the ON/STANDBY switch to ON. Ignore any plug-in unit diagnostic errors that may be displayed on the screen.

☐ Step 7: Notice that the messages **Enhanced Accuracy in Progress, Please Leave Instrument on Until Complete** and **New configuration - partial enhanced accuracy occurring** appear on the screen. Proceed to Step 8 when the message **Enhanced Accuracy completed and passed** appears on the screen (you do not have to wait 20 minutes).

☐ Step 8: Repeat Steps 4 through 7 for the Center and Right plug-in compartments. (Move the amplifier to the appropriate compartment to set the vertical input offset.)

☐ Step 9: Remove the amplifier, and repeat the setup and procedure to examine the vertical input offset.

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Procedure 10a Sampler and Digitizer Performance Verification Procedure

In this procedure, the gain is checked using the signal standardizer as a signal source. The delta voltage between the 1st and 9th steps is measured with the cursors function (see Fig. 2-10).

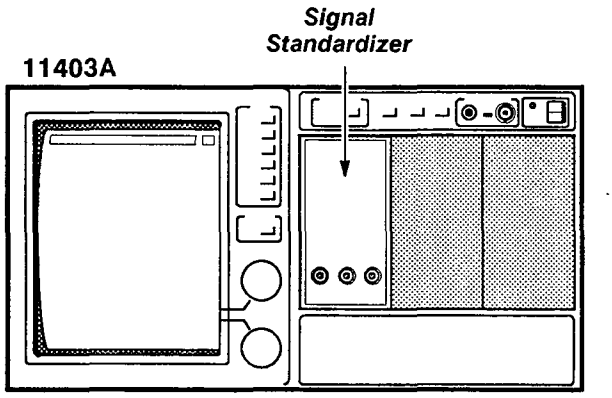
Test Equipment Required

A signal standardizer is the only test equipment required for this procedure.

Measurement Limit

Vertical input sensitivity accuracy must be within 1% when checked with a signal standardizer referenced to 8 divisions.

Setup to Examine the Sampler Gain



Procedure to Examine the Sampler Gain

☐ Step 1: First **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A

Def Wfm ..... touch
L ..... touch
Enter Desc ..... touch
Main Size ..... 2 ms/div
Acquire Desc ..... touch
Average N ..... **On**
TRIGGER button ..... press
Time Holdoff ..... 15.5 ms
(set knob resolution to Medium for final setting)

Signal standardizer

Test ..... Vert or Horiz Gain
Rate ..... 1 kHz

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The 11403A must be in the Enhanced Accuracy state to perform this procedure. If the **EA** symbol is not visible on the left side of the display, then press the ENHANCED ACCURACY button twice and check that the message, **Enhanced Accuracy in Progress, Please Leave Instrument on Until Complete** appears on the screen. When the message **Enhanced Accuracy completed and passed** appears, proceed to Step 2.

☐ Step 2: Set the signal standardizer Position control to center the waveform on the screen.

☐ Step 3: Touch the **Cursors** icon and position **Cursor 1** to the center of the first step and **Cursor 2** to the center of the last step (see Fig. 2-10).

☐ Step 4: *Examine* that the ΔV readout is within the limits of 7.920 U and 8.080 U.

☐ Step 5: Repeat this procedure for the Center and Right plug-in compartment and record the results. The trigger source must be selected for each plug-in compartment (that is, select **C** or **R** in the **Main Trigger Source Description** pop-up menu).



If any of the ΔV values are outside the limits stated in Step 4, then repeat the Enhanced Accuracy procedure (refer to Procedure 5) and then repeat Steps 2, 3, and 4 in this procedure. If the ΔV readout is within the stated limits, proceed to Procedure 11, Analog-to-Digital Converter Linearity.

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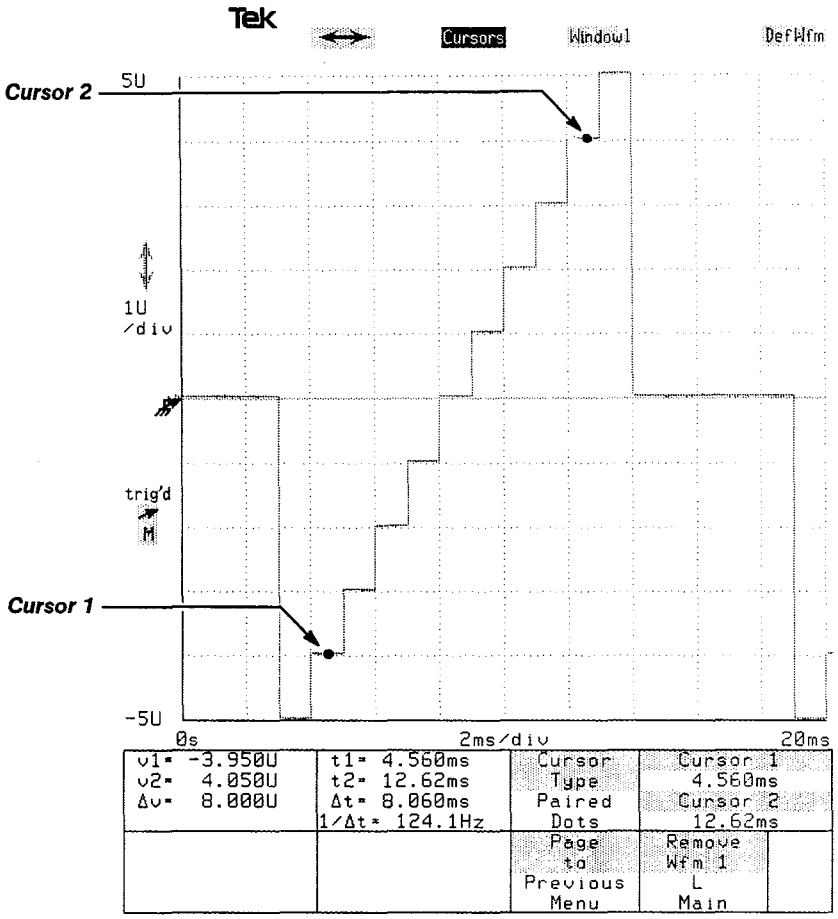


Figure 2-10 *— Cursor Placement on the Staircase Waveform*

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Procedure 10b Sampler and Digitizer Functional Test Procedure

This procedure shows the setup and lists the procedure to functionally test the vertical accuracy. You should only perform this procedure if you are performing a functional test. Otherwise, perform Procedure 10a, Sampler and Digitizer Performance Verification Procedure, and then proceed to Procedure 11, Analog-to-Digital Converter (ADC) Linearity.

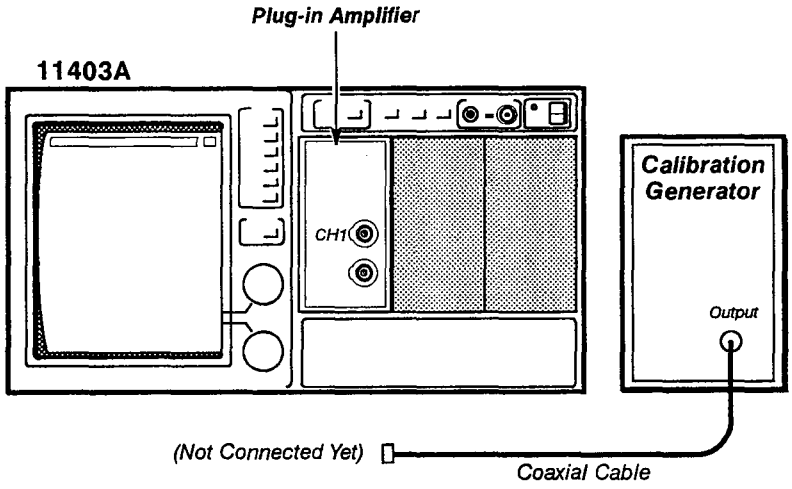
Test Equipment Required

Calibration generator, 50 Ω coaxial cable, 11000-Series plug-in amplifier.

Measurement Limits

Refer to Table 2-4, Vertical Accuracy Error Limits for the appropriate measurement limits in this procedure.

Setup to Examine the Vertical Accuracy



Procedure to Examine the Vertical Accuracy

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

Plug-in amplifier
- CH 1 display on/off ..... On

11403A
- TRIGGER
  - **Coupling** ..... **AC**
  - **Acquire Desc** ..... **Average N** to **On**
- MEASURE button ..... press
  - **Measurements** pop-up menu ..... **Mid, Peak-Peak**

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Calibration generator

Mode ..... Std Ampl

Amplitude ..... 5 V

☐ Step 2: *Examine* that the **Mid** measurement is equal to or less than the value listed in the DC Balance column of Table 2-4.

☐ Step 3: Connect the 5 V signal from the calibration generator to the CH 1 input connector.

Note: *If the plug-in amplifier has only a 50 Ω input impedance you must increase the calibration generator Amplitude to 10 V.*

☐ Step 4: Set the **Vert Offset:L1** to positive 2.5 V to center the waveform.

☐ Step 5: Touch the horizontal icon, and set the **Main Size** to 100 μs/div.

☐ Step 6: *Check* that the **Peak-Peak** measurement is 5 V, plus or minus the value listed in the ΔV DC Accuracy column of Table 2-4.

Table 2-4 *— Vertical Accuracy Error Limits*

Plug-in	ΔV DC Accuracy	DC Balance
11A32	57 mV	200 mV
11A33	55 mV	150 mV
11A34	57 mV	200 mV
11A52	50 mV	120 mV
11A71	65 mV	200 mV

Repeat this procedure for the Center and Right plug-in compartments.

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Procedure 11 Analog-to-Digital Converter (ADC) Linearity

This procedure checks ADC linearity using a two division signal placed at three positions on the screen.

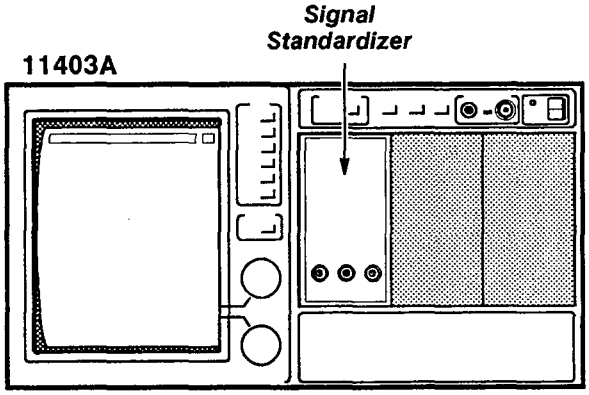
Test Equipment Required

A signal standardizer is the only test equipment required for this procedure.

Specification

ADC linearity—Compression or expansion of a center screen two-division signal positioned anywhere vertically within the graticule is ≤2 LSBs. (2 LSBs of 200 LSBs = 1%).

Setup to Check the ADC Linearity



Procedure to Check the ADC Linearity

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A

- **Def Wfm** ..... touch
  - **Avg(** ..... touch
  - **L** ..... touch
  - **)** ..... touch
  - **Enter Desc** ..... touch
- **Main Size** ..... 200 µs/div
- MEASURE button ..... press
  - **Measurements** ..... **Peak-Peak**
- Signal standardizer
  - Test ..... + Step Response
  - Rep Rate ..... 1 kHz

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☐ Step 2: Set the signal standardizer Position knob so that the top of the square wave is one division above the horizontal centerline.

☐ Step 3: Set the signal standardizer Amplitude so that the **Peak-Peak** reading is between 1.950 U and 2.050 U. Record this value as V_3 for later use.

Note: *Turn the **Main Pos** knob one click to restart the waveform averaging process. This accelerates the averaging process that occurs after you change the waveform amplitude or position.*

☐ Step 4: Set the signal standardizer Position knob so that the top of the square wave is four divisions above the horizontal centerline.

☐ Step 5: Wait ten seconds for the **Peak-Peak** reading to settle, then record the **Peak-Peak** reading as V_5.

☐ Step 6: Set the signal standardizer Position knob so that the top of the square wave is two divisions below the horizontal centerline.

☐ Step 7: Wait ten seconds for the **Peak-Peak** reading to settle, then record the **Peak-Peak** reading as V_7.

☐ Step 8: Check the following:

$V_5 - V_3$ is within ± 0.020U ($\pm 1\%$ of 2 divisions)
$V_7 - V_3$ is within ± 0.020U ($\pm 1\%$ of 2 divisions)

Repeat this procedure with the signal standardizer placed in the Center and Right plug-in compartments. You will need to define the corresponding waveform and trigger source for both the Center and Right plug-in compartments (that is, select **Avg(C)** or **Avg(R)** in the Vertical Description pop-up menu (after you touch **DefWfm**), and then select **C** or **R** in the **Main Trigger Source Description** pop-up menu).

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Procedure 12 Equivalent Time Step Response

This procedure examines rise time and aberrations using a signal standardizer. The 11403A's **Rise** and **Peak-Peak** measurement functions provide the specific value readout.

Test Equipment Required

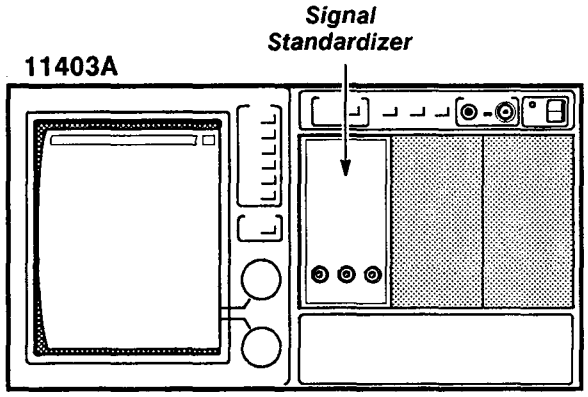
A signal standardizer is the only test equipment required for this procedure.

Measurement Limits

The measurement limits for this procedure are as follows:

- rise time must be ≤300 ps (this limit includes the rise time of the signal standardizer)
- aberrations must be ≤5% peak-to-peak within the first 20 ns after the step, and ≤1% after the first 20 ns from the step

Setup to Examine the Equivalent Time Step Response



Procedure to Examine the Equivalent Time Step Response

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A

Def Wfm ..... touch
L ..... touch
Enter Desc ..... touch
Acquire Description ..... touch
Average N ..... **On**
Main Size ..... 1 ns/div
Main Pos ..... 0 ns
MEASURE button ..... press

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Measurements ..... **Rise**
..... **Peak-Peak**
..... **Over Shoot**
..... **Under Shoot**
Signal standardizer
Test Vert or Horiz ..... + Step Response
Rep Rate ..... 1 MHz

☐ Step 2: Set the signal standardizer Position and Amplitude controls for a 6-division step centered on the screen.

☐ Step 3: *Examine* that the **Rise** (rise time) readout is ≤300 ps.

☐ Step 4: Set the **Main Size** to 5 ns/div.

☐ Step 5: Set the **Main Pos** to position the 50% amplitude of the step one division from the left-most edge of the screen.

☐ Step 6: Touch **Over Shoot** in the MEASURE major menu and then **Left Limit** in the **Over Shoot** pop-up menu.

☐ Step 7: Set the **Left Limit** readout to 0% and the **Right Limit** readout to 50%.

☐ Step 8: *Examine* that the **Over Shoot** and **Under Shoot** readings are ≤5.0%.

☐ Step 9: Set the Rep Rate on the signal standardizer to 100 kHz.

☐ Step 10: Set the **Main Size** to 50 ns/division.

☐ Step 11: Set the **Main Pos** control to position the step one division from the left side of the screen.

☐ Step 12: Touch **Peak-Peak** in the MEASURE major menu and then **Left Limit** in the **Peak-Peak** pop-up menu.

☐ Step 13: Set the **Left Limit** readout to 14%.

☐ Step 14: Set the **Right Limit** readout to 100%.

☐ Step 15: *Examine* that the **Peak-Peak** reading is ≤60 mU (1% of the step amplitude).

☐ Step 16: Repeat this procedure for the Center and Right plug-in compartments. The trigger source must be set for the appropriate plug-in compartment (that is, select **C** or **R** in the **Main Trigger Source Description** pop-up menu).

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Procedure 13a Bandwidth Performance Verification Procedure

A reference signal with a frequency of 6 MHz is set to an amplitude of six divisions. The frequency is increased to 1 GHz, and then the displayed amplitude is examined for at least 4.94 div.

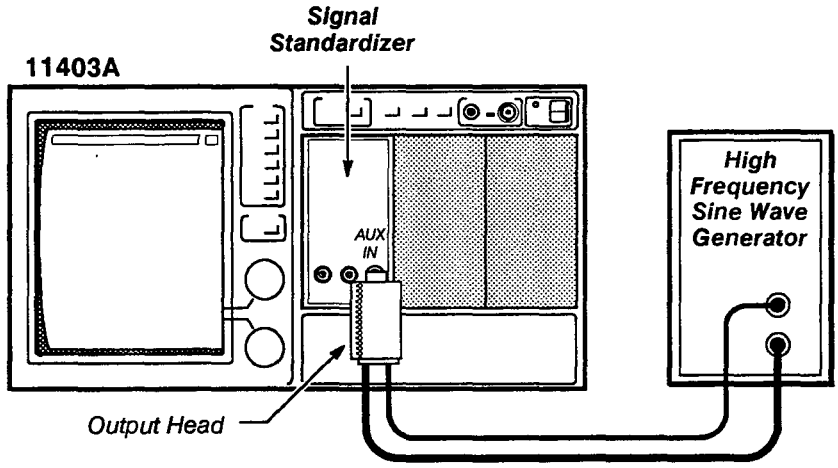
Test Equipment Required

A signal standardizer and a high-frequency sine-wave generator are required for this procedure.

Measurement Limit

The relative amplitude at 1 GHz must be ≥82.3% of the reference amplitude.

Setup to Examine the Bandwidth



Procedure to Examine the Bandwidth

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A
- **Def Wfm** ..... touch
  - **L** ..... touch
  - **Enter Desc** ..... touch
- MEASURE button ..... press
  - **Measurements** ..... **Peak-Peak**

Signal standardizer
- Test ..... Vert or Horiz Freq Resp

High frequency sine wave generator
- Frequency ..... 6 MHz (Ref)
- Amplitude ..... Set to turn on the signal standardizer CW Leveled light

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☐ Step 2: Use the signal standardizer Amplitude and Position control to obtain a centered display and a **Peak-Peak** reading of 6 U.

☐ Step 3: Set the high frequency sine wave generator to 1 GHz.

☐ Step 4: Verify that the signal standardizer's CW Leveled light is still on. If the light is not on, then increase the high frequency sine wave generator's amplitude until the light illuminates.

☐ Step 5: *Examine* that the **Peak-Peak** voltage readout on the screen is ≥4.94 U (82.3% of the reference amplitude).

☐ Step 6: Repeat this procedure for the Center and Right plug-in compartments. You must move the signal standardizer to the Center or Left plug-in compartment and also define the corresponding waveform (that is, substitute **C** or **R** for **L** in the **Horizontal Description** pop-up menu after you touch **Def Wfm**).

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Procedure 13b Bandwidth Functional Test Procedure

This procedure shows the setup and lists the steps required to functionally test the bandwidth of the 11403A. you should only perform this procedure if you are performing a functional test. Otherwise, perform Procedure 13a, Bandwidth Performance Verification Procedure, and then proceed to Procedure 14, Analog-to-Digital Converter (ADC) RMS Noise.

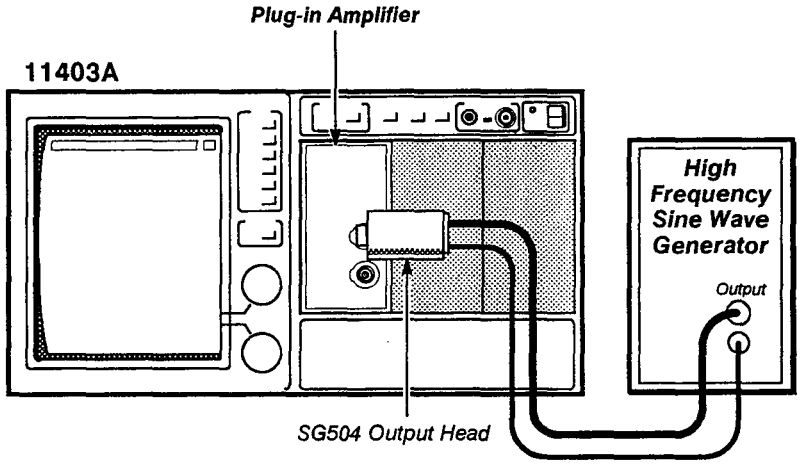
Test Equipment Required

A high-frequency sine-wave generator and a plug-in amplifier are required for this procedure.

Measurement Limit

The peak-to-peak amplitude of the sine wave, at the maximum bandwidth, must be ≥70.7% of the reference amplitude

Setup to Examine the Bandwidth



Procedure to Examine the Bandwidth

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

Plug-in amplifier
CH 1 display on/off ..... On
High frequency sine wave generator
Frequency ..... Ref
11403A
Impedance ..... **50 Ω**
Vert Size ..... 200 mV/div
Main Size ..... 100 ns/div
MEASURE button ..... press
Measurements pop-up menu ..... **Peak-Peak**

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☐ Step 2: Set the high frequency sine wave generator output for a 1.2 V **Peak-Peak** measurement.

☐ Step 3: Set the high frequency sine wave generator for variable-frequency output and the Frequency control to the maximum bandwidth frequency specified for the system under test. The **BW Limit** selector (press the WAVEFORM button) shows this upper limit for the plug-in unit under test.

☐ Step 4: Touch the horizontal icon, and then set the **Main Size** to 1 ns/division.

☐ Step 5: *Check* that the **Peak-Peak** measurement readout is at least 848 mV (70.7% of the **Peak-Peak** measurement in Step 2 of this procedure).

Repeat this procedure for the Center and Right plug-in compartments.

Note: *To avoid a 20-minute warmup period, set the ON/STANDBY switch to STANDBY, move the amplifier to an adjacent compartment, and then set the ON/STANDBY switch to ON within 15 seconds. If the power is off longer than 15 seconds, the 11403A will cool, and another 20-minute warmup will be required. If this occurs, wait 20 minutes with the power on and then perform the Enhanced Accuracy procedure (refer to Procedure 5, Enhanced Accuracy).*

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Procedure 14 Analog-to-Digital Converter (ADC) RMS Noise

In this procedure, the RMS measurement function measures the noise on the waveform from the plug-in compartment containing the signal standardizer.

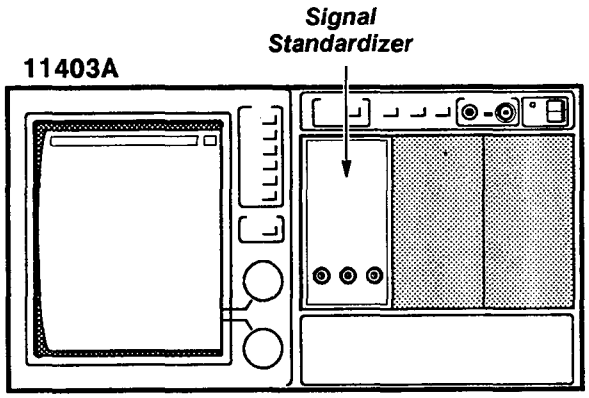
Test Equipment Required

A signal standardizer is the only test equipment required for this procedure.

Specification

ADC noise (relative to full scale) must be ≤60 dB.

Setup to Check the ADC RMS Noise



Procedure to Check the ADC RMS Noise

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

Signal standardizer
Test ..... Vert or Horiz Com Mode
11403A
Def Wfm ..... touch
L ..... touch
– ..... touch
Avg (..... touch
L ..... touch
) ..... touch
Enter Desc ..... touch
MEASURE button ..... press
Measurements ..... **RMS**
RMS ..... touch
Data Interval ..... **whole zone**

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☐ Step 2: *Check* that **RMS** readout on screen is ≤10 mU (60 dB of full scale).

☐ Step 3: Repeat this procedure for the Center and Right plug-in compartments. Do not move the signal standardizer to check the Center and Right compartments. When you are repeating the settings, substitute **C** or **R** for **L** in the **Vertical Description** pop-up menu (after you touch **Def Wfm**).

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Procedure 15 Trigger Sensitivity at 1 GHz

This procedure verifies trigger sensitivity using the specified output frequency and amplitude of a high-frequency sine wave generator applied to a signal standardizer, and checks for a screen-displayed trigger indicator.

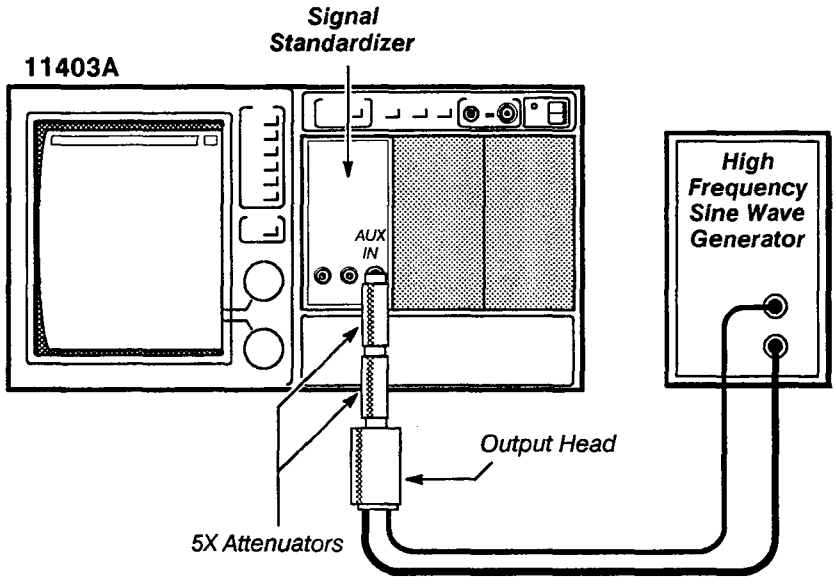
Test Equipment Required

High-frequency sine-wave generator, two 5X attenuators, and a signal standardizer.

Specification

Trigger Sensitivity – the display will trigger on a 0.5 division (0.5 U) signal from DC to 50 MHz, increasing to 1.5 division (1.5 U) at 1 GHz.

Setup to Check the Trigger Sensitivity at 1 GHz



Procedure to Check the Trigger Sensitivity at 1 GHz

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A
- **Def Wfm** ..... touch
- **L** ..... touch
- **Enter Desc** ..... touch
- MEASURE button ..... press
- **Measurements** ..... **Peak-Peak**

High frequency sine wave generator
- Frequency ..... 1 GHz

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Signal standardizer

Test Vert or Horiz ..... Freq Resp

Amplitude ..... fully clockwise

☐ Step 2: Set the high frequency sine wave generator output Amplitude control for a **Peak-Peak** readout of 1.5 U. (The CW Leveled light on the signal standardizer should be off.)

☐ Step 3: Set the signal standardizer Test to Trigger Freq Resp. Note that the signal will disappear at this time.

☐ Step 4: *Check* that the **not** display above the **trig'd** icon can be extinguished by rotating the signal standardizer Position control.

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Procedure 16 Trigger Enhancement

In this procedure, the operation of the A5A2 Trigger Enhancement board is examined and adjusted if necessary (see Fig. 2-11).

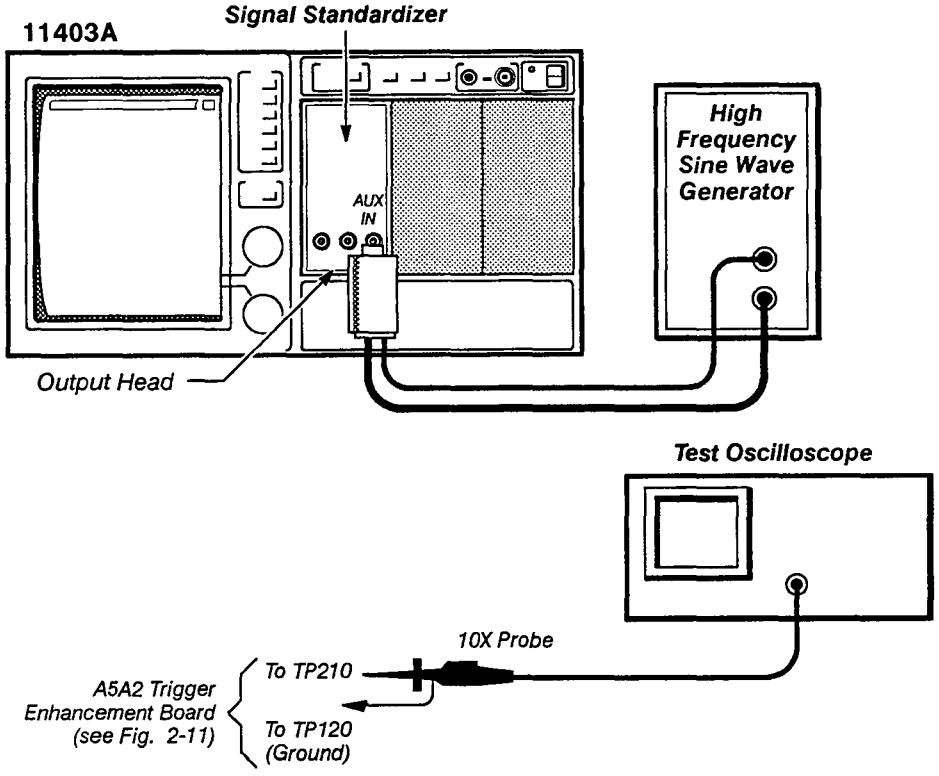
Test equipment required

Signal standardizer, high-frequency sine-wave generator, test oscilloscope, 10X probe, magnetic screwdriver, and alignment tools.

Measurement Limit

The delay limit must be within 330 ps ±70 ps

Setup to Examine/Adjust the A5A2 Trigger Enhancement Board



Procedure to Examine/Adjust the A5A2 Trigger Enhancement Board

To gain access to the A5A2 Trigger Enhancement board, remove the nine Torx drive screws on the A5 Acquisition board and unlock the A5 Acquisition board. Then, pivot and lock the A5 Acquisition board in the extended position. (Refer to FRU Board Assembly Removal, A5 Acquisition Board, in Section 3 of this manual, for the location of the Torx drive screws to remove.)

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Prior to performing this procedure, ensure that all of the test equipment is connected as shown in the setup, and that the 11403A is fully warmed up (powered-on for at least 20 minutes). Also, install a plastic short circuit jumper across pins 2 and 3 of the J2 jumper on the A5A2 Trigger Enhancement board (move the jumper from pins 1 and 2).

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed.

Signal standardizer
- Test ..... Vert or Horiz Aux In
- Amplitude ..... 9 o'clock position
- Position ..... 12 o'clock position

Test oscilloscope
- Vertical Sensitivity (at probe tip) ..... 500 mV/div
- Vertical Position (Offset) ..... set so that the waveform is centered
- Horizontal time/div ..... 50 ns/div
- Vertical Coupling ..... DC
- Triggering ..... Auto Trigger
- Trigger Level ..... set so that the display is not triggered (free run)

11403A
- **Def Wfm** ..... touch
  - **L** ..... touch
  - **Enter Desc** ..... touch
- **Main Size** ..... 50 ns/div
- WAVEFORM button ..... press
  - **Horizontal Desc** ..... touch
    - **Main Record Length** ..... **512 points**
    - **Window Record Length** ..... **512 points**

High frequency sine wave generator
- Frequency ..... approximately 900 MHz
- Amplitude ..... set for a 6-division waveform

☐ Step 2: Touch the **Window 1** icon at the top of the screen.

☐ Step 3: Set the **Window 1 Pos** knob to 400 ns.

☐ Step 4: Set the **Window 1 Size** knob to 500 ps/div.

☐ Step 5: Set the high frequency sine wave generator (fine resolution) Frequency knob to a setting that displays spikes on the sine wave, then maximize the number of spikes displayed.

☐ Step 6: Carefully set the high frequency sine wave generator's frequency (fine resolution) to obtain the most transitions on the test oscilloscope. The number of transitions is maximized when the intensity of the minimum and maximum levels are equal. Verify that spikes are still displayed on the 11403A screen.

☐ Step 7: Select the Window 1 **Cursors** icon.

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☐ Step 8: Touch **Cursor Type** and then **Vertical Bars** in the **Cursor Type** pop-up menu.

☐ Step 9: Touch **Cursor 1** and then **Fine** in the **Numeric Entry & Knob Res** pop-up menu.

☐ Step 10: Position **Cursor 1** to the first, rising, zero-crossing point on the sine wave. (It may be necessary to slightly readjust the sine wave generator's frequency, as described in Step 6.)

☐ Step 11: Rotate the high frequency sine wave generator (fine resolution) Frequency knob counter-clockwise (decreasing the frequency) through a null of the transitions on the test oscilloscope's waveform, then continue to rotate the knob counter-clockwise until the next maximum number of transitions is displayed.

☐ Step 12: Set the **Cursor 2** vertical bar to the zero crossing of the first rising edge of the sine wave to the right of **Cursor 1**.

☐ Step 13: *Examine* that the Δt readout on the screen is 330 ps ±70 ps.

STOP

DO NOT attempt to optimize the following adjustment setting if the reading is within the stated limits. Remove the short circuit jumper and 10X probe (return the jumper to pins 1 and 2 of the J2 jumper). Reinstall the A5 Acquisition board and proceed to Procedure 17a, Time Base Performance Verification Procedure.

☐ Step 14: Set the high frequency sine wave generator (fine resolution) Frequency knob to a setting that displays spikes on the 11403A's waveform, and then maximize the number of spikes displayed.(You can either increase or decrease the frequency to obtain this setting.)

☐ Step 15: Carefully set the high frequency sine wave generator's Frequency (fine resolution) to obtain the most transitions on the test oscilloscope. Verify that spikes are still displayed on the 11403A screen.

☐ Step 16: Position **Cursor 1** to the first rising zero crossing point of the sine wave.

☐ Step 17: Set **Cursor 2** to the right of **Cursor 1** to obtain a Δt readout on the screen of 330 ps.

☐ Step 18: Rotate the high frequency sine wave generator (fine resolution) Frequency knob counter-clockwise to align the rising edge of the sine wave to the zero crossing of **Cursor 2**.

☐ Step 19: *Adjust* C212 on the A5A2 Trigger Enhancement board slightly to obtain the most transitions on the test oscilloscope's waveform.

☐ Step 20: Repeat Steps 14, 15, 16, 11, 12 and 13 (in that order). If the limits stated in Step 13 are not met, then repeat Steps 14 through 20.

☐ Step 21: Move the short circuit jumper to its original position (to pins 1 and 2) on J2, and then remove the 10X probe from TP210 and TP120.

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☐ Step 22: Rotate the high frequency sine wave generator Frequency knob (fine resolution) through its entire frequency range, and observe that no spikes appear on the sine wave. Spikes may occur momentarily when you turn the knob; however, they should disappear when a constant frequency is established.

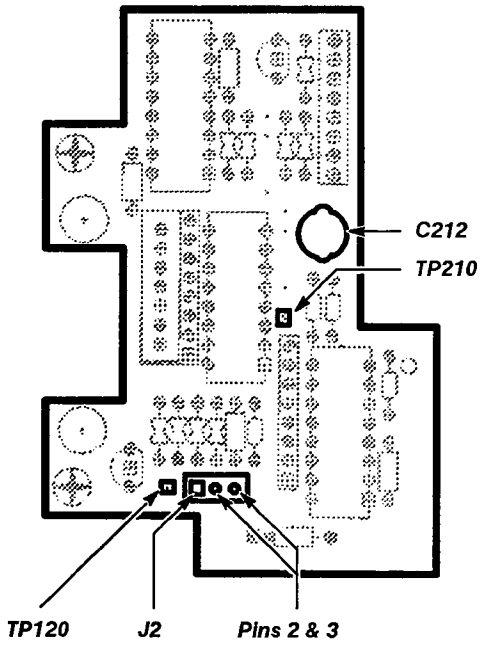


Figure 2-11 *— A5A2 Trigger Enhancement Board Test Point and Adjustment Locations*

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Procedure 17a Time Base Performance Verification

This procedure shows the setup and lists the steps required to check the horizontal timing accuracy.

Test Equipment Required

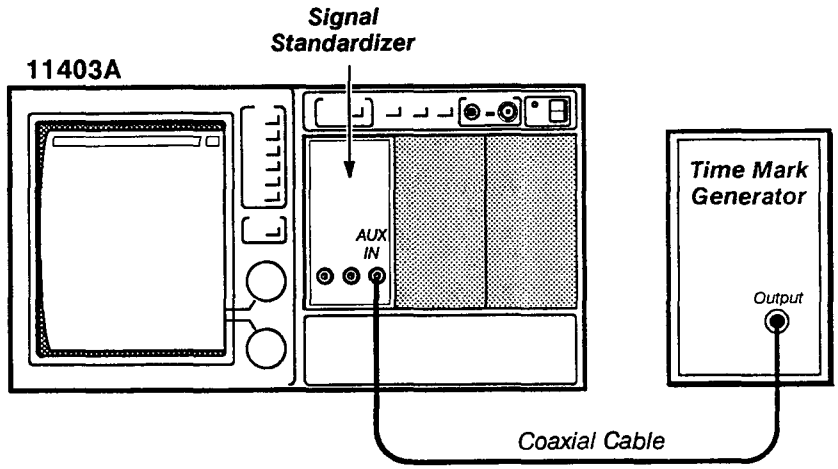
Time mark generator, 50 Ω coaxial cable, signal standardizer, high-frequency sine-wave generator.

Specifications

Time base accuracy must be within ±0.002% +100 ps of the measurement interval.

Trigger window position accuracy must be within ±0.002% +100 ps.

Setup to Check the Time Base Accuracy



Procedure to Check the Time Base Accuracy

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

11403A
- **Def Wfm** ..... touch
- **L** ..... touch
- **Enter Desc** ..... touch
- **Main Size** ..... 1 ns/div

Time mark generator
- Marker (Sec) ..... 5 ns

Signal standardizer
- Test ..... Vert or Horiz Freq Resp
- Amplitude ..... set for a 6 division display

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1 ns/Division Accuracy

☐ Step 2: Touch the **Trig'd** icon.

☐ Step 3: Set the **Trig Level** and **Time Holdoff** for a stable display.

☐ Step 4: Press the WAVEFORM button, and then touch **Acquire Desc.**

☐ Step 5: Set **Average N** to **On** in the **Acquire Desc** pop-up menu.

☐ Step 6: Press the MEASURE button, and then touch **Measurements.**

☐ Step 7: Touch **Period** in the **Measurements** pop-up menu.

☐ Step 8: *Check* that the **Period** result is 5 ns ±100 ps (0.002% of the measurement interval is negligible) .

☐ Step 9: Press WAVEFORM, and then touch **Acquire Desc.**

☐ Step 10: Set **Average N** to **Off** in the **Acquire Desc** pop-up menu.

5 µs/Division Accuracy

☐ Step 11: Touch the horizontal icon, and then set **Main Size** to 5 µs/division. Set **Main Pos** to 0 s. (Ignore the main waveform in the following steps, since it will appear to be unstable.)

☐ Step 12: Touch **Window 1.**

☐ Step 13: Set the **Window1 Pos** to 0 s.

☐ Step 14: To select the main waveform perform the following:

- touch **Page to All Wfms Menu**
- touch **I:L1 Main**
- touch **Page to Waveform Menu**

☐ Step 15: Touch **Window 2.**

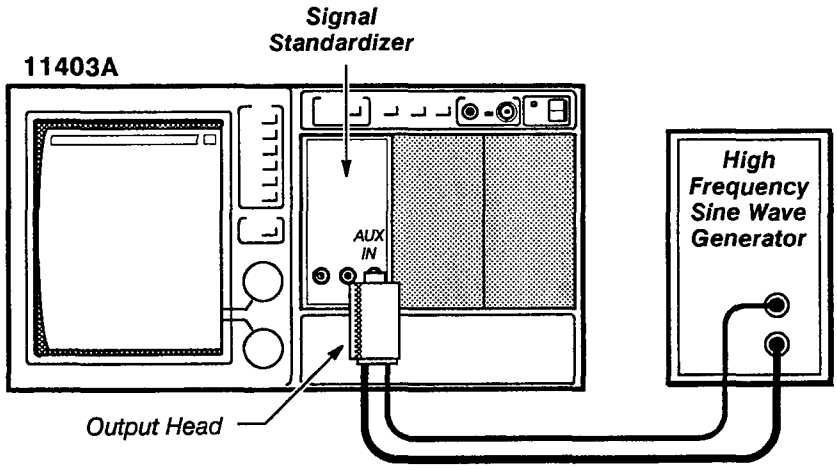
☐ Step 16: Set the **Window2 Pos** to 50 µs.

☐ Step 17: Set the **Window Size** to 1 ns/div.

☐ Step 18: *Check* that the horizontal positions of the two waveforms match within 1.1 ns (0.002% of 50 µs + 100ps). Touch the vertical icon, and then adjust the **Trace Sep** (separation) to reposition the window waveform so that the difference is easier to see.

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Setup to Check the Window Position Accuracy



Procedure to Check the Window Position Accuracy

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed.

11403A
- **Def Wfm** ..... touch
  - **L** ..... touch
  - **Enter Desc** ..... touch
- **Main Size** ..... 2 ns/div
- TRIGGER button ..... press
  - **Slope** ..... – (negative)

High frequency sine wave generator
- Frequency ..... 333 MHz (approximately)

Signal standardizer
- Test ..... Vert or Horiz Freq Resp

☐ Step 2: Set the high frequency (HF) sine wave generator and signal standardizer Amplitude controls for ≈6-division leveled signal centered on the screen. (The signal is leveled when the CW Leveled indicator on the signal standardizer is illuminated.)

☐ Step 3: If the display is unstable, then set the **Time Holdoff** for a stable display (use **Fine** resolution).

☐ Step 4: Press the WAVEFORM menu button, and then touch **Acquire Desc**.

☐ Step 5: Set the **Average N** to **On** in the **Acquire Description** pop-up menu.

☐ Step 6: Press the MEASURE button, and then touch **Measurements**.

☐ Step 7: Touch **Delay** in the **Measurements** pop-up menu and then **Delay** in the MEASURE major menu.

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☐ Step 8: Touch **Left Limit** in the **Delay** pop-up menu, and then touch **Delay** in the MEASURE major menu to remove the **Limit** pop-up menu.

☐ Step 9: Set the **Left Limit** knob to position the limit line on the signal's first negative peak.

☐ Step 10: Set the **Right Limit** knob to position the limit line on the signal's sixth positive peak (with an intensified zone of five complete cycles).

☐ Step 11: Set the HF sine wave generator frequency control for a **Delay** readout on the screen of 15 ns, within the limits of 14.99 ns and 15.01 ns.

☐ Step 12: Set the **Right Limit** knob to display an intensified zone of six complete cycles.

☐ Step 13: *Check* that the **Delay** readout on the screen is within the limits of 17.9 ns and 18.1 ns.

☐ Step 14: *Check* that the **Delay** readout for each **Right Limit** setting in the Set Right Limit Line to Display column is within the limits listed under the Check Delay Readout column of Table 2-5, Main Delay Readout.

Table 2-5 *– Main Delay Readout*

Set Right Limit Line to Display	Check Delay Readout
4 cycles	11.9 ns to 12.1 ns
3 cycles	8.9 ns to 9.1 ns
2 cycles	5.9 ns to 6.1 ns

☐ Step 15: Touch **Window 1**.

☐ Step 16: Set the **Window Size** knob to 2 ns/div.

☐ Step 17: Touch **Delay** in the MEASURE major menu, and then touch **Left Limit** in the **Delay** pop-up menu.

☐ Step 18: Touch **Delay** in the MEASURE major menu to remove the pop-up menu.

☐ Step 19: Set the **Left Limit** and **Right Limit** to display an intensified zone of six complete cycles.

☐ Step 20: *Check* that the **Delay** readout on the screen is within the limits of 17.9 ns and 18.1 ns.

☐ Step 21: *Check* the **Delay** readout as shown in Table 2-6, Window Delay Readout.

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Table 2-6 *— Window Delay Readout*

Set Right Limit Line to Display	Delay Readout Limits
5 cycles	14.9 ns to 15.1 ns
4 cycles	11.9 ns to 12.1 ns
3 cycles	8.9 ns to 9.1 ns
2 cycles	5.9 ns to 6.1 ns

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Procedure 17b Time Base Functional Test

This procedure shows the setup and lists the steps to functionally test the horizontal timing accuracy. You should only perform this procedure if you are performing a functional test. Otherwise, perform Procedure 17a, Time Base Performance Verification, and then proceed to Procedure 18, Events Window Position Accuracy.

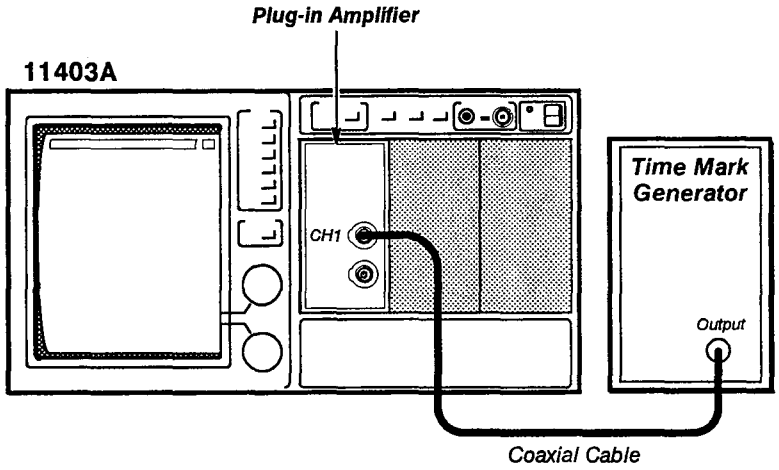
Test Equipment Required

Plug-in amplifier, time mark generator, and a 50 Ω coaxial cable.

Specification

Time Base accuracy must be within ±(0.002% + 100 ps).

Setup to Check the Time Base Accuracy



Procedure to Check the Time Base Accuracy

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

Time mark generator
- Marker (sec) ..... 5 ns

Plug-in amplifier
- CH 1 display on/off ..... on

11403A
- **Impedance** ..... **50** Ω
- **Vert Size: L1** ..... 200 mV/div
- **Vert Offset: L1** ..... 500 mV
- **Main Size** ..... 1 ns/div
- **Acquire Desc** ..... touch
- **Acquire Description** pop-up menu ..... **Average N** to **On**

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1 ns/Division Accuracy

☐ Step 2: Press the MEASURE button, and then touch **Measurements**.

☐ Step 3: Touch **Period** in the **Measurements** pop-up menu, then touch **Exit**.

☐ Step 4: *Check* that the **Period** reading is 5 ns ±100 ps (the 0.002% of the measurement interval is negligible).

☐ Step 5: Press the WAVEFORM button, and then touch **Acquire Desc**.

☐ Step 6: Set **Average N** to **Off** in the **Acquire Description** pop-up menu.

5 µs/Division Accuracy

☐ Step 7: Touch the horizontal icon, and then set **Main Size** to 5 µs/div. (Ignore the main waveform in the following steps, since it will appear unstable.)

☐ Step 8: Touch **Window 1**.

☐ Step 9: Set the **Window1 Pos** to 0 s.

☐ Step 10: To select the main waveform perform the following:

- touch **Page to All Wfms Menu**
- touch **1:L1 Main**
- touch **Page to Waveform Menu**

☐ Step 11: Touch **Window 2**.

☐ Step 12: Set the **Window2 Pos** to 50 µs.

☐ Step 13: Set the **Window Size** to 1 ns/div.

☐ Step 14: *Check* that the horizontal positions of the two waveforms match within 1.1 ns (0.002% of 50 µs + 100 ps). Touch the vertical icon, and then adjust the **Trace Sep** (separation) to reposition the window waveform so that the difference is easier to see.

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Procedure 18 Events Window Position Accuracy

In this procedure, triggering events on the screen are counted with relation to an equal number set by the events holdoff control knob.

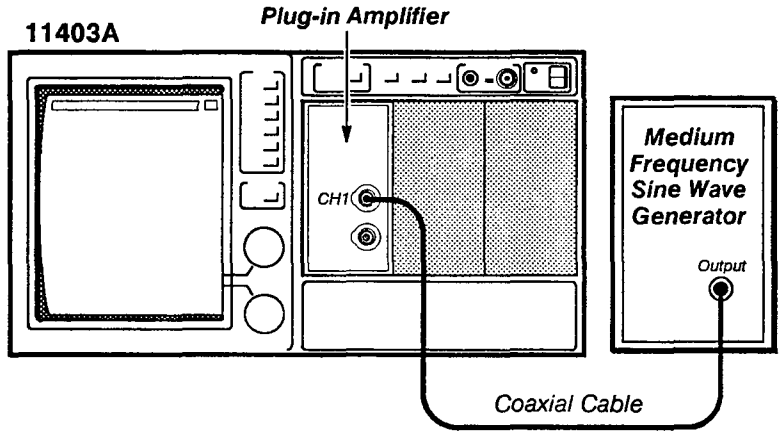
Test Equipment Required

Medium-frequency sine-wave generator, 50 Ω coaxial cable, and a plug-in amplifier.

Specification

Maximum window holdoff event frequency is 150 MHz.

Setup to Check the Events Window Position Accuracy



Procedure to Check the Events Window Position Accuracy

☐ Step 1: **Initialize** the 11403A settings, then perform the following settings in the order listed:

Plug-in Amplifier
- CH 1 display on/off ..... on

11403A
- **Vert Size: L1** ..... 500 mV/div
- **Main Size** ..... 10 ns/div

Medium frequency sine wave generator
- Frequency ..... 150 MHz
- Amplitude ..... Approx 6 div display

11403A
- **Window1** icon ..... touch
- TRIGGER button ..... press
- **Window Holdoff Md** pop-up menu ..... **Holdoff by Events Triggered from Window**

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☐ Step 2: Set the **Window1 Pos** knob to 0 s.

☐ Step 3: Touch the **W**(window) **trig'd** icon, and set the **Events Holdoff** knob to 1.

☐ Step 4: *Check* that the two trigger indicator arrows on the main waveform are one cycle apart.

☐ Step 5: Set the **Events Holdoff** knob to 2.

☐ Step 6: *Check* that the two trigger indicator arrows on the waveform are two cycles apart.

☐ Step 7: *Check* that the window trigger indicator arrow moves one additional cycle to the right for each increment of **Events Holdoff** (up to an **Events Holdoff** reading of 10).

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Procedure 19 Input/Output

This procedure measures the real time clock frequency with a frequency counter, and measures the temperature sensor voltage reference with a digital multimeter (see Figs. 2-12 and 2-13).

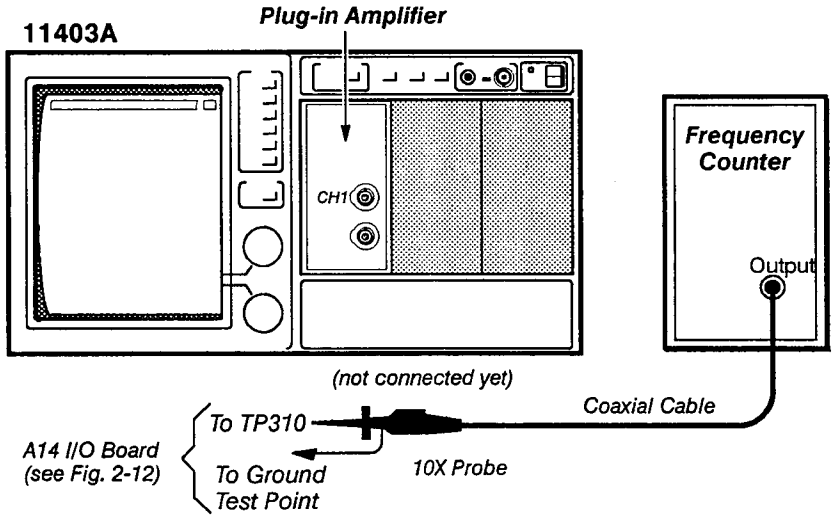
Test Equipment Required

Plug-in amplifier, frequency counter, 50 Ω coaxial cable, 10X probe, magnetic screwdriver, alignment tools, and a digital multimeter.

Measurement Limits

Real time clock 1,000,000 μs, ±5 μs
Temperature sensor voltage reference +6.500 V, ±5 mV.

Examine/Adjust the Real Time Clock



Procedure to Examine/Adjust the Real Time Clock

☐ Step 1: To perform this procedure, you will need to move the A14 I/O board into a position where it is easily accesible from the side of the 11403A. To do this, you will need to rearrange the boards in the 11403A card cage.

Before removing a board, detach all cables from the board. To simplify this process, replace all cables that do not cross the top of the card cage as soon as you insert a board in a slot. Perform the following steps in the order listed:

11403A

a. Set the front panel ON/STANDBY switch to STANDBY.

b. Remove the CRT cover from the 11403A.

c. Remove both of the plastic retaining strips from top of the card cage.

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d. Remove the A15 Memory Management Unit (MMU) board and place it in the slot second from the right (as viewed facing the CRT).

e. Remove the A18 Memory board and place it in the right-most slot.

f. Remove the A14 I/O board and place it in the slot previously occupied by the A18 Memory board (the second slot from the left).

g. Remove the A17 Executive Processor board and place it in the slot previously occupied by the A14 I/O board (the third slot from the left).

h. Connect the 10X probe to the test points indicated in the setup illustration.

i. Reconnect any remaining cables to their correct connectors. You may want to refer to the cabling diagram, Figure 4-2, to verify the connections.

j. Set the ON/STANDBY switch to ON.

Frequency counter
- Mode ..... Period
- Trigger ..... DC
- Slope ..... – (negative)
- Time Base ..... 1 MHz

Plug-in amplifier ..... not used in this procedure

☐ Step 2: Press the UTILITY button, and then touch **Page to Utility 2 Menu**.

☐ Step 3: Touch **Extended Diagnostics** in the UTILITY major menu, and then touch ~~**Extended Diagnostics**~~ in the ~~**Verify Selection**~~ pop-up menu.

☐ Step 4: Touch **Block** and then **Internal I/O** in the **Block** menu.

☐ Step 5: Touch **Area** and then **Realtime Clk** from the **Area** pop-up menu.

☐ Step 6: Touch **Routine** and then **Calibrate** in the **Routine** pop-up menu.

☐ Step 7: Touch **Run**.

☐ Step 8: *Examine* that the frequency counter reads within the limits of 1,000,005 µs and 999,995 µs.

STOP

DO NOT attempt to optimize the following adjustment setting if the period is within the stated limits. Proceed to the Examine/Adjust Temperature Sensor Voltage Reference procedure that follows.

☐ Step 9: *Adjust* the REAL TIME CLOCK adjustment C510 for 1,000,000 µs.

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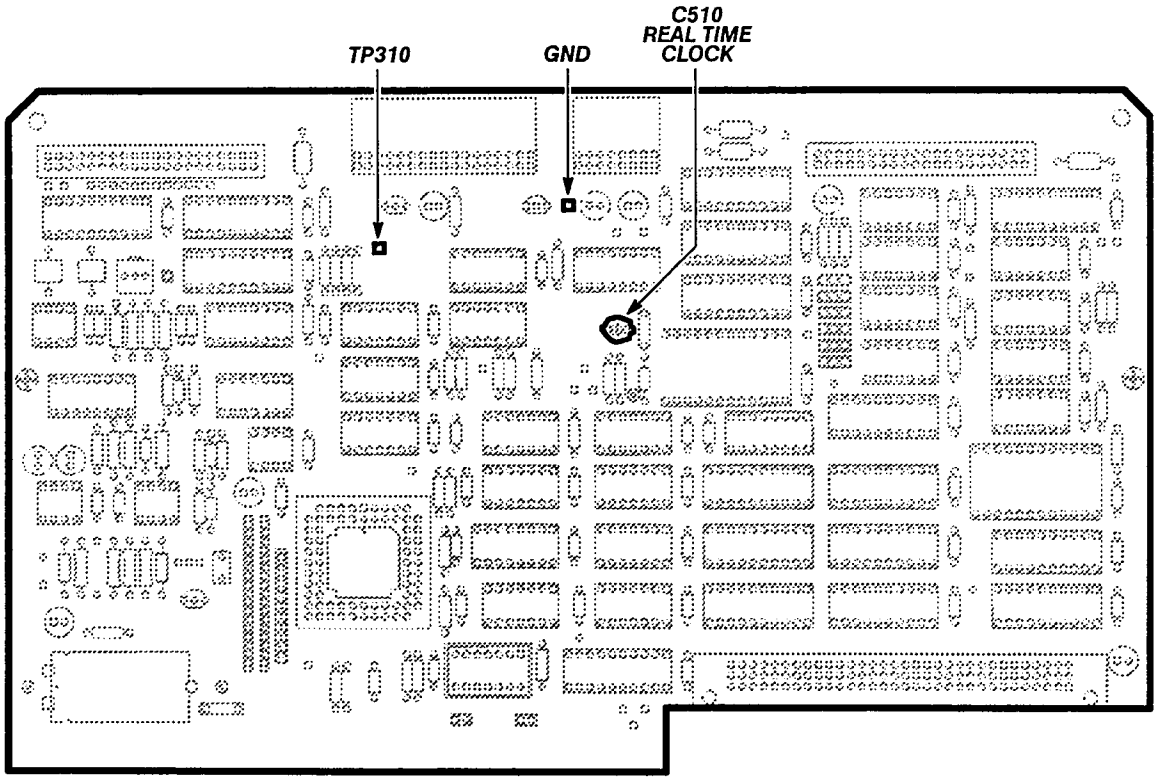
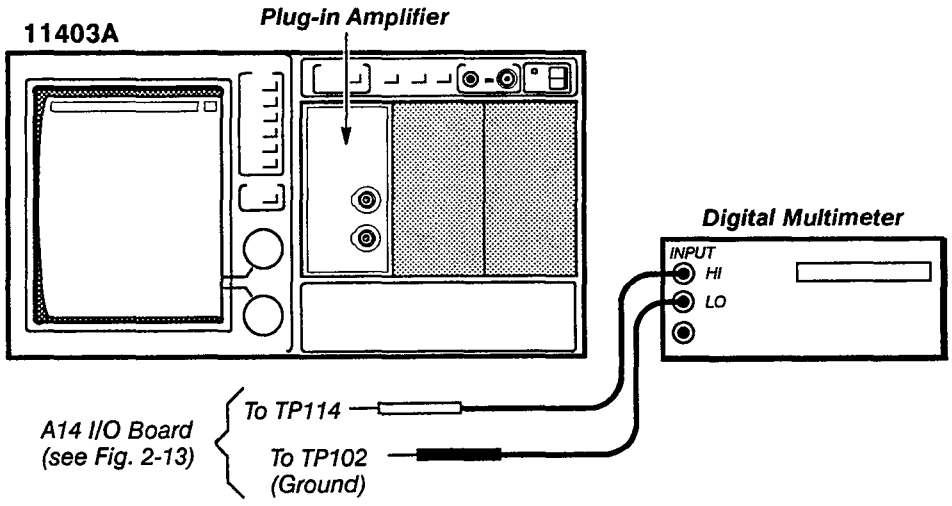


***Figure 2-12** — A14 I/O Board (Real Time Clock) Test Point and Adjustment Locations*

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Setup to Examine/Adjust the Temperature Sensor Voltage Reference



Procedure to Examine/Adjust the Temperature Sensor Voltage Reference

☐ Step 1: Perform the following in the order listed:

11403A ..... no setting changes required
Digital multimeter
Mode ..... DC
Plug-in amplifier ..... not used in this procedure

☐ Step 2: *Examine* that the digital multimeter reads within the limits +6.505 V and +6.495 V.

STOP

DO NOT attempt to optimize the following adjustment setting if the digital multimeter reading is within the stated limits. Proceed to Step 4.

☐ Step 3: *Adjust* TEMP SENSOR VOLTAGE REF adjustment R112 for +6.500 V.

☐ Step 4: Set the ON/STANDBY switch to STANDBY.

☐ Step 5: Move all boards to their original location and replace the plastic retaining strips. (Refer to the circuit board exploded view in Section 5 for the locations of the boards.)

☐ Step 6: Replace the CRT cover.

☐ Step 7: Set the ON/STANDBY to ON.

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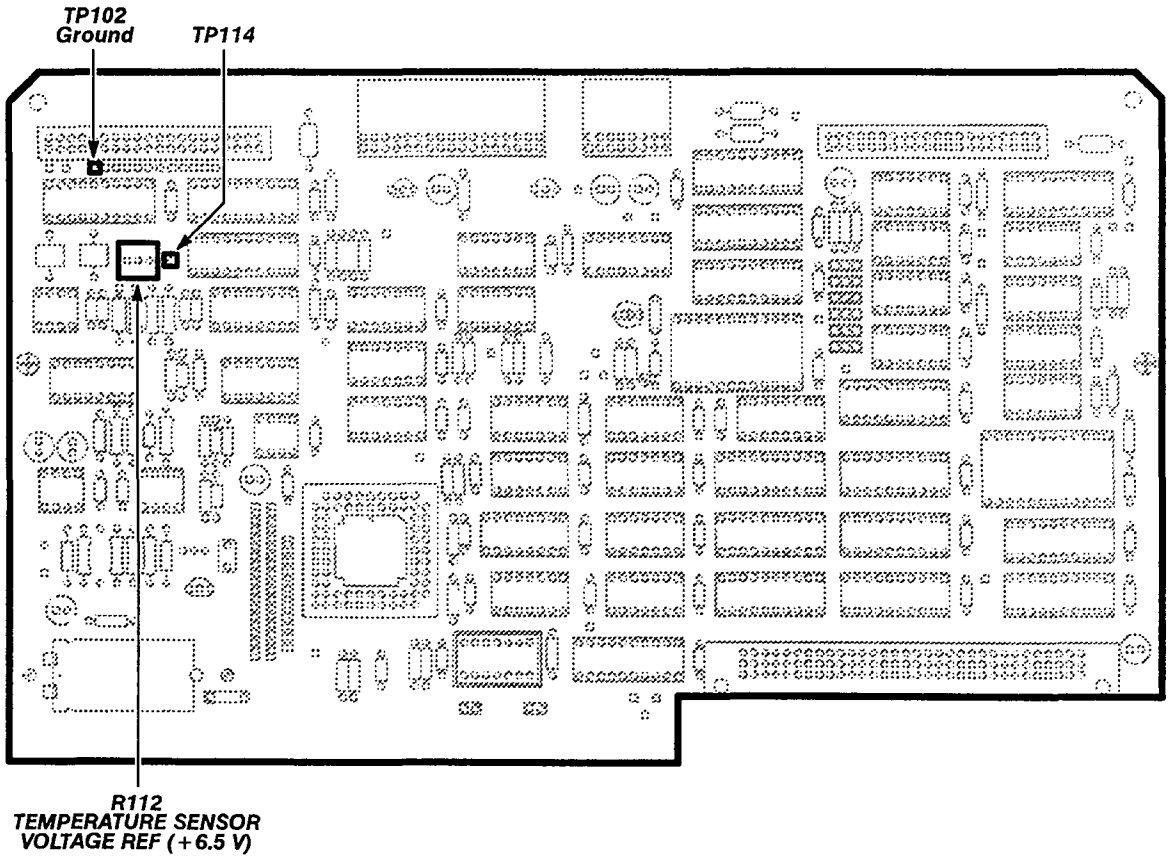


Figure 2-13 *— A14 I/O Board (Temperature Sensor) Test Point and Adjustment Locations*

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Procedure 20 Triggering

This procedure sets the trigger voltage to various values and checks it using the cursors readout on the screen.

Test Equipment Required

Plug-in amplifier, function generator, medium-frequency sine-wave generator, 50 Ω coaxial cable, and a 5X attenuator.

Specifications

The specifications for this procedure are as follows:

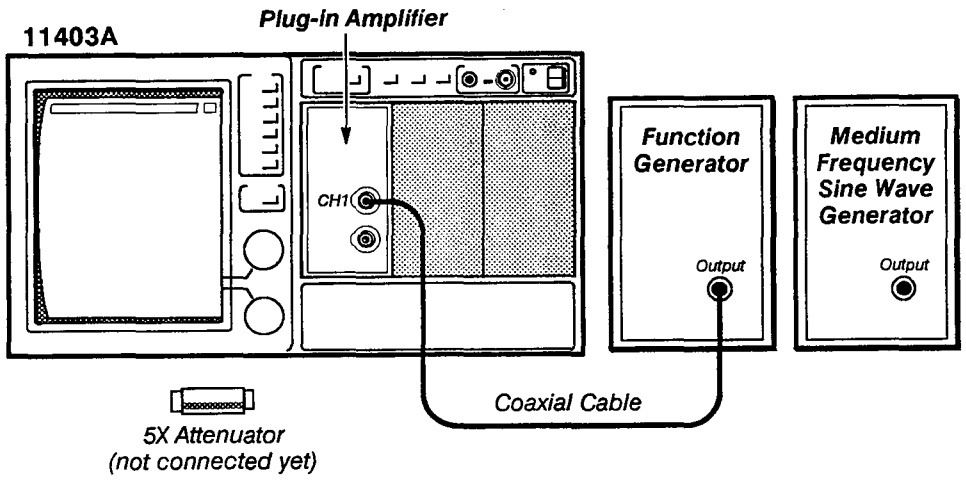
- DC noise-reject coupled must be 1.2 divisions or less from DC to 50 MHz.
- AC coupled must be 0.5 divisions from 60 Hz to 50 MHz.
- DC coupled must be 0.5 division from DC to 50 MHz, increasing to 1.5 divisions at 1 GHz.

Measurement Limits

The measurement limits for this procedure are as follows:

- Trigger-level DC accuracy within 2.0% of full scale (20 LSBs).
- DC HF reject coupled must be functional.
- AC LF reject coupled must be functional.

Setup to Check/Examine Triggering



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Procedure to Check/Examine Triggering

☐ Step 1: Perform the following items in the order listed:

a. First perform the Enhanced Accuracy procedure (refer to Procedure 5, Enhanced Accuracy).

b. **Initialize** the 11403A settings, then perform the following in the order listed:

Plug-in amplifier
CH 1 display on/off ..... on
11403A
Impedance ..... **50** Ω
Vert Size ..... 100 mV/div
Main Size ..... 100 µs/div
Main Pos ..... 0 s
MEASURE button ..... press
Measurements ..... **Peak-Peak**
STORE/RECALL button ..... press
Store Settings ..... **Store next FPS**
(note the front panel setting (FPS) number)
Function generator
Waveform ..... triangular
Frequency ..... 1 kHz
Amplitude ..... 10-division signal
11403A
Main Size ..... 50 µs/div
WAVEFORM button ..... press
Acquire Description ..... **Average N** to **On**
Cursors icon ..... touch
Trigger icon ..... touch
Trig Level ..... 400 mV
Medium frequency sine wave generator
Frequency ..... 50 MHz

Examine the Trigger Level DC Accuracy

☐ Step 2: *Check* that the cursor readout is V1 = 400 mV, ±20 mV (2.0% of full scale).

☐ Step 3: Set the **Trig Level** to −400 mV.

☐ Step 4: *Check* that the cursor readout is V1 = −400 mV, ±20 mV (2.0% of full scale).

☐ Step 5: Touch the horizontal icon, and then set the **Main Size** to 100 µs/div.

☐ Step 6: Touch **Window 1**, then set the **Window 1 Pos** to 0 s.

☐ Step 7: Press the TRIGGER button, and then set the **Window Holdoff Md** to **Holdoff by Time Triggered from Window**.

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☐ Step 8: Set **Trigger Select** to **Window**.

☐ Step 9: Select the **Cursors** label.

☐ Step 10: Select the **W**(window) **trig'd** icon, then set the window1 **Trigger Level** to 400 mV.

☐ Step 11: *Check* that the **Cursor** readout is V1 = 400 mV, ±20 mV (2.0% of full scale).

☐ Step 12: Set the window 1 **Trigger Level** to -400 mV.

☐ Step 13: *Check* that the **Cursor** readout is V1 = -400 mV, ±20 mV (2.0% of full scale).

Check the AC Coupled 50 MHz Sensitivity

☐ Step 14: Connect the medium frequency (MF) sine wave generator through a 5X attenuator to the CH 1 input connector.

☐ Step 15: Press the STORE/RECALL button, and then touch **Recall Setting**.

☐ Step 16: Touch **FPS**X, where X is the FPS number noted in the initial settings in step 1.

☐ Step 17: Press the TRIGGER button, and then set **Coupling** to **AC**.

☐ Step 18: Touch the horizontal icon, and then set the **Main Size** to 10 ns/div.

☐ Step 19: Press the MEASURE button, and then set the MF frequency sine wave generator output for a **Peak-Peak** measurement of 50 mV (0.5 divs).

☐ Step 20: Select the **trig'd** icon.

☐ Step 21: *Check* that you can adjust the **Trig Level** and achieve a stable display (use **Fine** resolution).

☐ Step 22: Select the **Window 1** icon.

☐ Step 23: Set **Window Size** to 10 ns/div.

☐ Step 24: Press the TRIGGER button, and then set the **Window Holdoff Md** to **Holdoff by Time Triggered from Window**.

☐ Step 25: Set **Trigger Select** to **Window**.

☐ Step 26: Touch the **W**(window) **trig'd** icon.

☐ Step 27: *Check* that you can adjust the window **Trig Level** and achieve a stable display.

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Check the DC Noise Reject

☐ Step 28: Press the MEASURE button, and then set the MF sine wave generator output for a **Peak-Peak** measurement of 120 mV (1.2 divisions).

☐ Step 29: Press the TRIGGER button, and then set the window trigger **Coupling** to **DC Noise Reject**.

☐ Step 30: *Check* that you can adjust the window **Trig Level** and achieve a stable display.

☐ Step 31: Set **Trigger Select** to **Main**.

☐ Step 32: Set the main trigger **Coupling** to **DC Noise Reject**.

☐ Step 33: *Check* that you can adjust the main **Trig Level** and achieve a stable display.

☐ Step 34: Disconnect the medium frequency (MF) sine wave generator from the CH1 input connector.

Check the DC Coupling

☐ Step 35: Connect a coaxial cable from the CH 1 input to the CALIBRATOR output connector of the 11403A (remove the 5X attenuator).

☐ Step 36: Select the UTILITY button.

☐ Step 37: Touch **Probes**, then select **L1** (this probe calibration deskews the system).

☐ Step 38: Press the STORE/RECALL button, and then touch **Recall Setting**.

☐ Step 39: Touch **FPS**X, where X is the FPS number noted in the initial settings.

☐ Step 40: Disconnect the CH 1 input from the CALIBRATOR output connector of the 11403A.

☐ Step 41: Connect the coaxial cable from the CH 1 input to the MF sine wave generator.

☐ Step 42: Set the MF sine wave generator output to its 50 kHz Reference frequency.

☐ Step 43: Press the MEASURE button, and then set the MF Sine Wave Generator Output Amplitude for a **Peak-Peak** measurement of 600 mV.

☐ Step 44: Touch the horizontal icon, and then set the **Main Size** to 2 μs/div.

☐ Step 45: Set the **Main Pos** to position the trigger indicator (arrow) to the center vertical graticule line (−10.2 μs readout).

☐ Step 46: *Examine* that the rising portion of the sine wave crosses the center of the screen, ±0.2 divisions.

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☐ Step 47: Touch the vertical icon, and then set the **Vert Offset** to move the waveform above and below its original position.

☐ Step 48: *Check* that the trigger indicator (arrow) remains at the same level, at the center of the screen.

☐ Step 49: Set the **Vert Offset** control for a 0 V readout.

Examine the DC HF Reject

☐ Step 50: Touch the TRIGGER button, and then set the **Coupling** to **DC HFReject**.

☐ Step 51: *Examine* that the waveform moved to the left of the trigger indicator (arrow); between 0.5 and 2.0 divisions.

Examine AC LF Reject

☐ Step 52: Set the trigger **Coupling** to **AC LF Reject**.

☐ Step 53: *Examine* that the trigger indicator (arrow) disappears and that the zero crossing of the positive-going edge of the waveform now appears between 0.5 and 2.0 divisions to the right of the center vertical graticule line.

Check AC Coupling

☐ Step 54: Set the trigger **Coupling** to **AC**.

☐ Step 55: Set the **Vert Offset** to any setting.

☐ Step 56: *Check* that the waveform remains triggered at the same point regardless of the **Vert Offset** setting.

Remove the Stored Setting

To remove the setting you stored in Step 1:

☐ Step 57: Press the STORE/RECALL button.

☐ Step 58: Select **Delete Setting** in the major menu area.

☐ Step 59: In the pop-up menu, select the **FPS**X, where X is the FPS number you noted in Step 1.

☐ Step 60: Select **Delete Selected Settings** in the pop-up menu.

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Maintenance

This section contains preventive maintenance procedures for the 11403A Digitizing Oscilloscope. If a failure occurs, this section also contains procedures for removing and replacing the instrument's circuit boards, modules, and other field replaceable units (FRUs).

Preventive Maintenance

Regularly maintaining the 11403A can keep it from malfunctioning and may improve its reliability. The operating environment determines the instrument's maintenance frequency. A convenient time for performing preventive maintenance is before making an electrical adjustment.

Removing the Cabinet Panel

WARNING

Dangerous potentials exist throughout the 11403A. If you operate this instrument with the covers removed, do not touch exposed connections or components. Some transistors have voltages present on their cases. Therefore, disconnect the power before cleaning the 11403A or replacing any parts.

The top and bottom cabinet covers (or panels) protect you from high voltages present in the 11403A. The covers also reduce electromagnetic interference radiation (EMI). If you must remove the instrument's covers, loosen the fasteners and lift the covers off. Otherwise, operate the 11403A with the covers in place to protect the interior from dust.

Cleaning the 11403A Digitizing Oscilloscope

The 11403A should be cleaned as often as operating conditions require. Dirt present in the instrument can cause overheating and component breakdown. If dirt accumulates on components, it will act as an insulating blanket and prevent efficient heat dissipation. Dirt also provides an electrical conduction path which may cause instrument failures. The cover panels reduce the amount of dust reaching the interior of the the 11403A. Therefore, keep these panels in place for safety and cooling.

CAUTION

Avoid using chemical cleaning agents that might damage plastic parts in this instrument. Use a nonresidue type of cleaner, preferably isopropyl alcohol or totally denatured ethyl alcohol. Before using any other type of cleaner, consult your local Tektronix service center or representative.

Exterior—Dust on the instrument's exterior can be removed with a soft cloth or small brush. The brush is also useful for removing the dirt on the front panel controls. After using the brush, remove any remaining dirt with a soft cloth dampened in a mild detergent and water solution. Don't use abrasive cleaners.

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CRT—Clean the CRT faceplate with a soft, lint-free cloth dampened with denatured alcohol.

Interior—Cleaning the interior of the 11403A should seldom be necessary. If you do need to clean the interior, blow off the dust with dry, low-velocity air (approximately 5 lb/in^2). Again, remove remaining dirt with a soft brush or a cloth dampened with a mild detergent and water solution. Use a cotton-tipped applicator for cleaning narrow spaces, or for cleaning more delicate circuit components. Use a water-dampened washcloth to remove any residue from the areas you have cleaned.

CAUTION

To prevent damage from electrical arcing, boards and components must be dry before applying power.

Ensure that you carefully examine the high-voltage circuits. Excessive dirt in these circuit areas may cause high-voltage arcing and result in improper instrument operation.

Visual Inspection

The 11403A should be inspected occasionally for defects; such as broken connections, improperly seated semiconductors, damaged or improperly installed boards, and heat-damaged parts. The corrective procedure for most visible defects is obvious; however, particular care must be taken if heat-damaged parts are found. Since overheating usually indicates other trouble, correcting the cause of the overheating is necessary to prevent the damage from recurring.

Periodic Electrical Adjustment

To ensure accurate measurements, check the 11403A's electrical adjustment after every 2,000 operating hours, or every 24 months if you use the instrument infrequently.

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Removal and Replacement Procedures

After performing diagnostics and troubleshooting procedures to locate faults, correcting the faults consists of replacing modules and boards to repair the 11403A. The following sections of this chapter contain the removal and replacement procedures. Diagnostics and troubleshooting procedures are in a separate chapter.

Power Supply Voltage Hazard

Use caution when working near any metal-faced components in the Power Supply module.

WARNING

All metal components (including any metal-faced components) in the Power Supply module should be considered hazardous; since the voltage potential of these components may be equivalent to the AC line voltage potential.

Always disconnect the line power cord before attempting any disassembly procedures.

An electric-shock hazard exists when the 11403A is not grounded. Do not remove the ground wire (green-yellow wire) connecting the Power Supply module chassis to the instrument.

Ordering Parts

When ordering replacement parts from Tektronix, Inc., include the following information:

- instrument type
- instrument serial number
- description of the part
- Tektronix part number

Static-Sensitive Device Classification

CAUTION

Static discharge can damage any semiconductor component in this instrument.

The 11403A contains electrical components that are susceptible to damage from static discharge. See Table 3-1 for the relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

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Table 3-1 *— Relative Susceptibility to Damage from Static Discharge*

Semiconductor Classes	Relative Susceptibility Levels[1]
MOS or CMOS microcircuits and discrete or linear microcircuits with MOS inputs (most sensitive)	100 to 500 V
ECL	200 to 500 V
Schottky signal diodes	250 V
Schottky TTL	500 V
High-frequency bipolar transistors	400 to 600 V
JFETs	600 to 800 V
Linear microcircuits	400 to 1000 V (est.)
Low-power Schottky TTL	900 V
TTL (least sensitive)	1200 V

[1]*Voltage discharged from a 100 pF capacitor through a resistance of 100 Ω.*

Observe the following precautions to avoid damaging components:

- Minimize handling of static-sensitive components.
- Transport and store static-sensitive components or assemblies in their original containers, anti-static tube rail, or conductive foam. Label any package that contains static-sensitive assemblies or components.
- Wear a wrist strap while handling these components to discharge the static voltage from your body. Perform servicing of these static-sensitive assemblies or components at a static-free work station (only qualified service personnel should service these components). We recommend using the static control mat. Refer to Table 2-2 for the part numbers of the wrist strap and static control mat.
- Clear the work station surface of any objects capable of generating or holding a static charge.
- Whenever possible, store the component leads in conductive foam or rails to keep these leads shorted together.
- Pick up components by the body, never by the leads.
- Do not slide the components over any surface.
- Avoid handling components in areas that have a floor or work-surface covering that can generate a static charge.

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Cables and Connectors

A cabling diagram (see Fig. 4-2) is provided to show the interconnecting cables between the various boards, modules, and assemblies. Use this diagram for a reference when you are removing and replacing cables on these units.

Interconnecting Pins—Two methods of interconnection are used to electrically connect a board with other boards and components. When the interconnection is made with a coaxial cable, a special end-lead connector plugs into a socket on the board. Other interconnections are made with a pin soldered into the board.

These interconnecting pins use two types of connectors. If the connector is mounted on a plug-on board, a special socket is soldered into the board. If the connector is on the end of a lead, an end-lead pin connector mates with the interconnecting pin. The following information provides the removal and replacement procedure for the various types of interconnecting methods.

Coaxial-type End Lead Connectors (Peltolas)—Color coding of wires may be helpful to connect a Peltola connector to its socket on a board. The wire insulation's color, or its colored stripe, is the same as the color represented by the last digit of the JXX component number. (for example, a green wire would connect to a J05 socket.) Other Peltola connectors may have labels which designate their JXX component number.

Multi-Pin Connectors—Multi-pin connectors are the pin connectors that connect the wires to interconnecting pins. These pin connectors are clamped to the ends of the associated leads, and some of these pin connectors are grouped together and mounted in a plastic holder. See Figure 3-1 for an example of a multi-pin connector.

Arrangement of Pins in Multi-Pin Connectors—Pin 1 on multi-pin connectors is designated with a triangle (or arrowhead). Pin 1 on a board is denoted by a triangle, dot, or square. Most board-mounted connectors have a square pad for pin 1.

Note: *Some multi-pin connectors are keyed by a gap between the pin 1 and 3 positions in the holder. A small plastic plug covers the pin 2 position on the end of the holder. There is a corresponding gap between pins 1 and 3 on the board.*

Align the plug, in the multi-pin holder, with the gap between the board pins. The connector is then ready to be installed.

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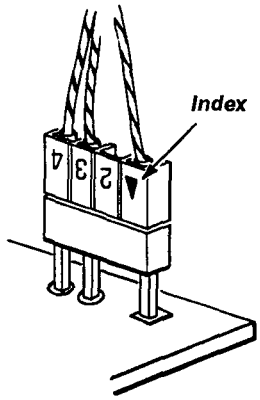


***Figure 3-1** — Multi-Pin Connector Orientation*

Many of the larger, multi-pin ribbon connectors have a red, blue, or other contrasting color line along one side of their attached wire cables. This line indicates the location of pins 1 and 2 and also the location of the corresponding triangle index mark on the connector.

Some of the gray ribbon cables may have the number of their connectors stamped on itself.

The ribbon connectors have two functions:

The first is to provide a strain release for the wire connections. The wire ribbon is wrapped around a bar in between the wire connections and the top of the connector; producing strain between the wires and the top of the connector, and thereby releasing most of the strain which would otherwise exist on the wire connections.

The second function of the ribbon connectors is to provide a pull-tab to ease disconnection. The pull-tab is attached inside the connector. When the tab is pulled, even pressure is applied across the connector. Then, the connector separates from its holder easily.

Note: *To remove these ribbon connectors, grasp the pull-tab (fastened into the connector, if there) and pull it loose from the holder.*

If there is not a pull-tab present in the connector, then grasp the ends of the connector, and pull the connector straight out from the connector socket.

Removing/Replacing FRUs

Table 3-2 is a convenient reference for finding connector and screw locations when removing and replacing field replaceable units (FRUs). The table's first column lists the FRU to be removed or replaced. The second column lists the figure(s) that you should reference for connector, screw, and index locations while you use the procedure to remove/replace this FRU.

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Table 3-2 *— FRU Removal/Replacement Figure Cross Reference*

FRU to be Removed/ Replaced	Figures to Reference During Removal		Page
Batteries	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-25	Removing/Replacing the A14 I/O Board	3-48
	Figure 3-28	Removing/Replacing the A18 Memory Board	3-53
Cathode Ray Tube (CRT)	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-4	Removing/Replacing the Cathode Ray Tube	3-17
	Figure 3-5	Removing/Replacing the CRT Torx Drive Screws	3-18
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-18	A9 Touch Panel Assembly Torx Drive Screws	3-38
Fan Motor	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-6	Removing the Power Supply Rear Plate, Fan Housing, and Rear Panel Connector Plate	3-21
Power Supply Module	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-6	Removing the Power Supply Rear Plate, Fan Housing, and Rear Panel Connector Plate	3-21
	Figure 3-7	A2A2 Control Rectifier Board Connector Locations	3-22
A1 Plug-in Interface board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-6	Removing the Power Supply Rear Plate, Fan Housing, and Rear Panel Connector Plate	3-21
	Figure 3-7	A2A2 Control Rectifier Board Connector Locations	3-22
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-9	Removing/Replacing the Plug-in Compartment Torx Head Screws	3-25
	Figure 3-10	Removing/Replacing the A1 Plug-in Interface Board	3-26
	Figure 3-11	Removing/Replacing the A4 Regulator Board	3-27
	Figure 3-12	Removing/Replacing the A5 Acquisition Board	3-28
	Figure 3-15	Removing/Replacing the A6 Time Base Board	3-33
A4 Regulator board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-6	Removing the Power Supply Rear Plate, Fan Housing, and Rear Panel Connector Plate	3-21
	Figure 3-7	A2A2 Control Rectifier Board Connector Locations	3-22
	Figure 3-11	Removing/Replacing the A4 Regulator Board	3-27
A5 Acquisition board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-12	Removing/Replacing the A5 Acquisition Board	3-28
A5A2 Trigger Enhancement board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-12	Removing/Replacing the A5 Acquisition Board	3-28
	Figure 3-13	Removing/Replacing the A5A2 Trigger Enhancement Board	3-30

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Table 3-2 *— FRU Removal/Replacement Figure Cross Reference (Cont.)*

FRU to be Removed/ Replaced	Figures to Reference During Removal		Page
A5A3 Strobe Drive board	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-12	Removing/Replacing the A5 Acquisition Board	3-28
	Figure 3-14	Removing/Replacing the A5A3 Strobe Drive Board	3-28
A6 Time Base board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-12	Removing/Replacing the A5 Acquisition Board	3-28
	Figure 3-15	Removing/Replacing the A6 Time Base Board	3-33
A7 CRT Socket Board and A8 CRT Driver board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-4	Removing/Replacing the Cathode Ray Tube	3-17
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-16	Removing/Replacing the A7 CRT Socket Board	3-36
	Figure 3-17	Removing/Replacing the A8 CRT Driver Board	3-37
	Figure 3-21	Removing/Replacing the A10 Front Panel Control Board Torx drive screws	3-41
	Figure 3-21	Removing/Replacing the A10 Front Panel Control Board	3-42
A9 Touch Panel Assembly	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-18	A9 Touch Panel Assembly Torx drive screws	3-38
	Figure 3-19	Removing and Replacing the A9 Torx Panel Assembly	3-39
	Figure 3-21	Removing/Replacing the A10 Front Panel Control Board	3-42
A10 Front Panel Control board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-20	Removing/Replacing the A10 Front Panel Control Board Torx drive screws	3-41
	Figure 3-21	Removing/Replacing the A10 Front Panel Control Board	3-42
A11 Front Panel Button board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-21	Removing/Replacing the A10 Front Panel Control Board Torx drive screws	3-41
	Figure 3-21	Removing/Replacing the A10 Front Panel Control Board	3-42
	Figure 3-22	Removing/Replacing the A11 Front Panel Button Board	3-43
A12 Rear Panel Assembly	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-6	Removing the Power Supply Rear Plate, Fan Housing, and Rear Panel Connector Plate	3-21
	Figure 3-23	Removing/Replacing the A12 Rear Panel Assembly	3-48
	Figure 3-25	Removing/Replacing the A14 I/O Board	3-48

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***Table 3-2** — FRU Removal/Replacement Figure Cross Reference (Cont.)*

FRU to be Removed/ Replaced	Figures to Reference During Removal		Page
A13 Mother board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-2	Field Replaceable Units (FRU) Locator	3-11
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-24	Removing/Replacing the A13 Mother Board	3-47
	Figure 3-25	Removing/Replacing the A14 I/O Board	3-48
	Figure 3-26	Removing/Replacing the A15 MMU Board	3-50
	Figure 3-27	Removing/Replacing the A17 Executive Processor Board	3-52
	Figure 3-28	Removing/Replacing the A18 Memory Board	3-53
A14 Input/Output (I/O) board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-25	Removing/Replacing the A14 I/O Board	3-48
A15 MMU board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-25	Removing/Replacing the A14 I/O Board	3-48
	Figure 3-26	Removing/Replacing the A15 MMU Board	3-50
A17 Executive Processor board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-27	Removing/Replacing the A17 Executive Processor Board	3-52
A18 Memory board	Figure 3-1	Multi-Pin Connector Orientation	3-6
	Figure 3-3	Removing/Replacing the CRT Cover	3-16
	Figure 3-8	Top View of the Card Cage	3-23
	Figure 3-27	Removing/Replacing the A17 Executive Processor Board	3-52
	Figure 3-28	Removing/Replacing the A18 Memory Board	3-53

Note: *In addition to the figures listed in Table 3-2, the exploded-view drawings in Section 5, Replaceable Parts, may be helpful in removing or disassembling individual FRUs or subassemblies. Also, Figure 3-2 and 3-30 are useful for determining the location of FRUs and FRU ICs.*

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The following FRU removal/replacement procedures assume that the top and/or bottom covers are removed from the 11403A. To loosen the cover fasteners, use a coin or a straight-slot screwdriver with a large-sized tip. Rotate the cover fasteners a quarter-turn counter-clockwise.

Whenever a specific area is mentioned (such as the right side), it is usually referenced to the front of the instrument. If another reference is intended, it will be stated (for example, viewing from the left side or viewing from the rear).

All connector names are labeled on the board and/or on the actual connector.

WARNING

To avoid electric-shock hazard and damage, always disconnect the instrument from its power source before removing or replacing FRUs.

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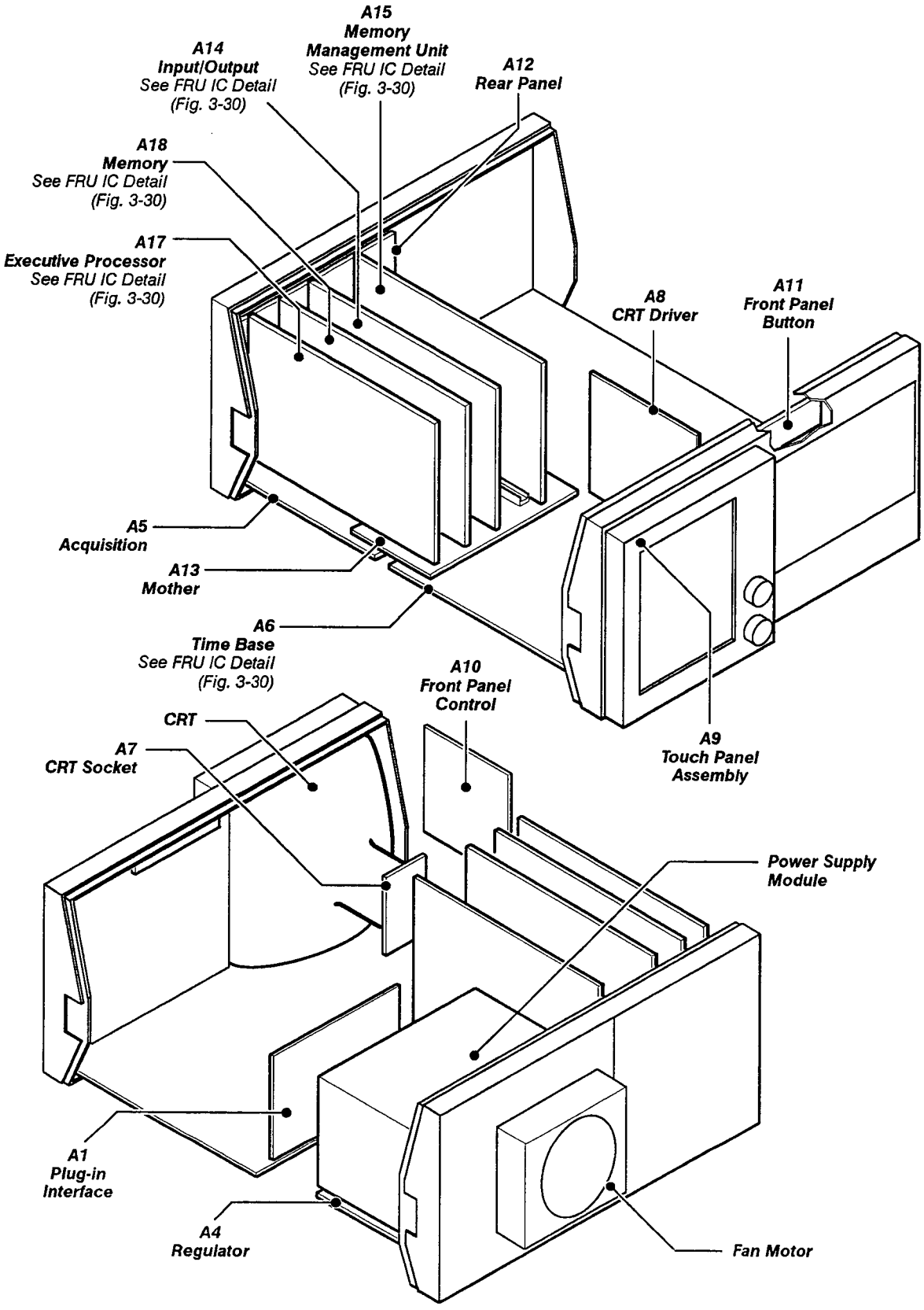


Figure 3-2 — *Locating Instrument Field Replaceable Units (FRU)*

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Locking the Front Panel ON/STANDBY Power Switch to ON

Some 11403A applications may require that the power remain on. To electrically lock the power on, use the following procedure:

- ☐ Step 1: Switch the rear panel PRINCIPAL POWER SWITCH to OFF.
- ☐ Step 2: Remove the AC power cable.
- ☐ Step 3: Position the instrument on its left (handle) side.
- ☐ Step 4: Remove the bottom cover.
- ☐ Step 5: Locate the A4 Regulator board.
- ☐ Step 6: Locate the J820 jumper on the A4 Regulator board (see Fig. 3-11).
- ☐ Step 7: Reposition the J820 jumper from its two outer (right side) pins to its two inner (left side) pins.
- ☐ Step 8: Replace the bottom cover and turn the 11403A upright.
- ☐ Step 9: Reconnect the AC power cable and switch the PRINCIPAL POWER SWITCH to ON.

  The power will now remain on regardless of the setting of the ON/STANDBY power switch.
- ☐ Step 10: To turn the power off while the ON/STANDBY power switch is disabled, use the PRINCIPAL POWER SWITCH.

To return the ON/STANDBY Power Switch to normal operation, perform the previous steps in reverse.

Disposing of Batteries and First Aid

The 11403A contains the following batteries on the following boards:

- one battery (BT130) on the A14 I/O board
- one battery (BT150) on the A18 Memory board

See Figures 3-25 and 3-28 for the location of these batteries.

WARNING

To avoid personal injury, observe proper procedures for the handling of lithium batteries. ***Improper handling may cause fire, explosion, or severe burns.*** *Do not recharge, crush, disassemble, heat the battery above 100°C (212°F), incinerate, or expose the contents to water.*

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Dispose of the Battery—according to local, state and federal regulations.

Note: *Typically, small quantities of batteries (less than 20) can be safely discarded along with ordinary garbage in a sanitary landfill.*

However, larger quantities must be sent by surface transport to a hazardous waste disposal facility. The batteries should be individually packaged to prevent shorting. Then, pack them into a sturdy container that is clearly labeled, ***Lithium Batteries—DO NOT OPEN****.*

Emergency and first aid information—for lithium batteries.

- **Manufacturer:** Panasonic
- **Battery Type:** Lithium Poly-Carbon monoflouride, BR 2/3 A
- **Solvent** (electrolyte): Gama Butyrlactone is of low toxicity. This solvent can cause some eye and respiratory irritation. According to the manufacturer, the solvent may be released during venting (out-gassing of battery material). Short circuiting (for more than a few seconds) or overheating the battery usually causes venting.
- **Solute:** LIBF4

Table 3-3 lists the actions to take if you come in contact with battery solvent.

Table 3-3 *— Emergency Procedures*

Contact	Do This:
Skin	Wash promptly with plenty of water.
Eyes	Flush immediately with plenty of water and use an emergency eye wash, if available. Report to a medical professional for treatment.
Inhalation	Leave the area and get fresh air. Report to a medical professional for treatment.
Ingestion	Non-toxic according to laboratory testing. However, report to a medical professional for advice.

In case of venting, clear the immediate area. Usually, venting will only last a few seconds.

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Removing and Replacing the Cathode Ray Tube (CRT)

WARNING

The cathode ray tube (CRT) may retain a dangerous electrical (16 kV) charge. Before removing the CRT, the anode must be fully discharged. Short the anode lead from the CRT to the chassis. Wait approximately ten minutes and again firmly short the anode lead to the chassis. Then, remove the CRT.

Use extreme care when handling the CRT. If the CRT breaks, the glass fragments scatter at a high velocity (implosion). Protective clothing and safety glasses should be worn. Avoid striking the CRT on any object which might cause it to crack or implode. When storing a CRT, place it in a protective carton. You may also place the CRT face down on a smooth surface in a protected location with the CRT faceplate on a soft mat.

See Figures 3-1, 3-2, 3-3, 3-4, 3-5, 3-8, and 3-18 for module, connector, screw, and index locations.

Remove the CRT as follows:

- ☐ Step 1: Remove the three Torx-head screws and the CRT cover.
- ☐ Step 1: Set the 11403A upside down.
- ☐ Step 2: Use a $^{1}/_{16}$-inch allen wrench to loosen the screws securing the two control knobs. Carefully remove the control knobs (don't lose the small allen screws inside the knobs).
- ☐ Step 3: Remove the two Torx drive screws on the bottom of the A9 Touch Panel Assembly.
- ☐ Step 4: Lift up on the bottom of the A9 Touch Panel Assembly and swing the assembly outward. The top of the A9 Touch Panel Assembly is held in place with two tabs that hook under the top of the chassis. Pull the assembly out until you can access the black ground wire that connects the A9 Touch Panel Assembly to the 11403A chassis.
- ☐ Step 5: Disconnect the quick-disconnect ground connector that connects the black ground wire to the instrument chassis.
- ☐ Step 6: Set the A9 Touch Panel Assembly aside. To avoid stressing the ribbon cable that is still connected to the A9 Touch Panel Assembly, and to keep the assembly from cluttering your workspace, place the A9 Touch Panel Assembly inside the plug-in compartments. Do not damage the A9 Touch Panel Assembly when placing it inside the plug-in compartments.
- ☐ Step 7: Carefully set the 11403A on its left side.
- ☐ Step 8: Remove the two plastic circuit board guides from the top of the card cage.
- ☐ Step 9: Remove the two Torx drive screws that secure the A7 CRT Socket board cover (use a short Torx drive screwdriver to remove the rear-most Torx drive screw).

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☐ Step 10: Remove the A7 CRT Socket board cover.

☐ Step 11: Slowly pull the A7 CRT Socket board towards the rear of the instrument to unplug the A7 CRT Socket board from the CRT.

Note: *When reattaching the A7 CRT Socket board to the CRT, align the pins of the CRT to the receptacles on the socket board and slowly push the pins into the receptacles.*

Do not force the connection into place; doing so can bend or break some of the pins. If the pins do not slide easily into the receptacles, pull the A7 CRT Socket board away from the CRT, and realign the A7 CRT Socket board to the CRT.

WARNING

The CRT anode voltage is 16 kV. Again, ground the anode lead from the CRT to the chassis to remove any stored charge remaining in the CRT. Wait approximately ten minutes, then ground the anode load to the chassis again.

☐ Step 12: Disconnect connector J54 from the A8 CRT Driver board. Note the position of the multi-pin connector's index triangle to ensure that you can correctly replace the connector.

☐ Step 13: Remove the four Torx drive screws that secure the CRT to the top of the chassis. Two of the screws are removed from the front of the front panel chassis, and two of the screws are removed from behind the front panel casting.

☐ Step 14: Remove the top CRT support bar. The CRT support bar is unattached once the four Torx drive screws securing the top of the CRT are removed.

☐ Step 15: Remove the four Torx drive screws that secure the CRT to the bottom of the chassis. Two of the screws are removed from the front of the front panel chassis and two of the screws are removed from behind the front panel casting.

☐ Step 16: Remove the bottom CRT support bar.

CAUTION

Once the four Torx drive screws are removed from the bottom of the CRT, the CRT is unattached. Use care not to damage the CRT while it is loose.

☐ Step 17: Slowly pull the CRT out of the front panel chassis.

To replace the CRT, perform the previous steps in reverse.

CAUTION

When replacing the two control knobs, do not overtighten the two allen set screws.

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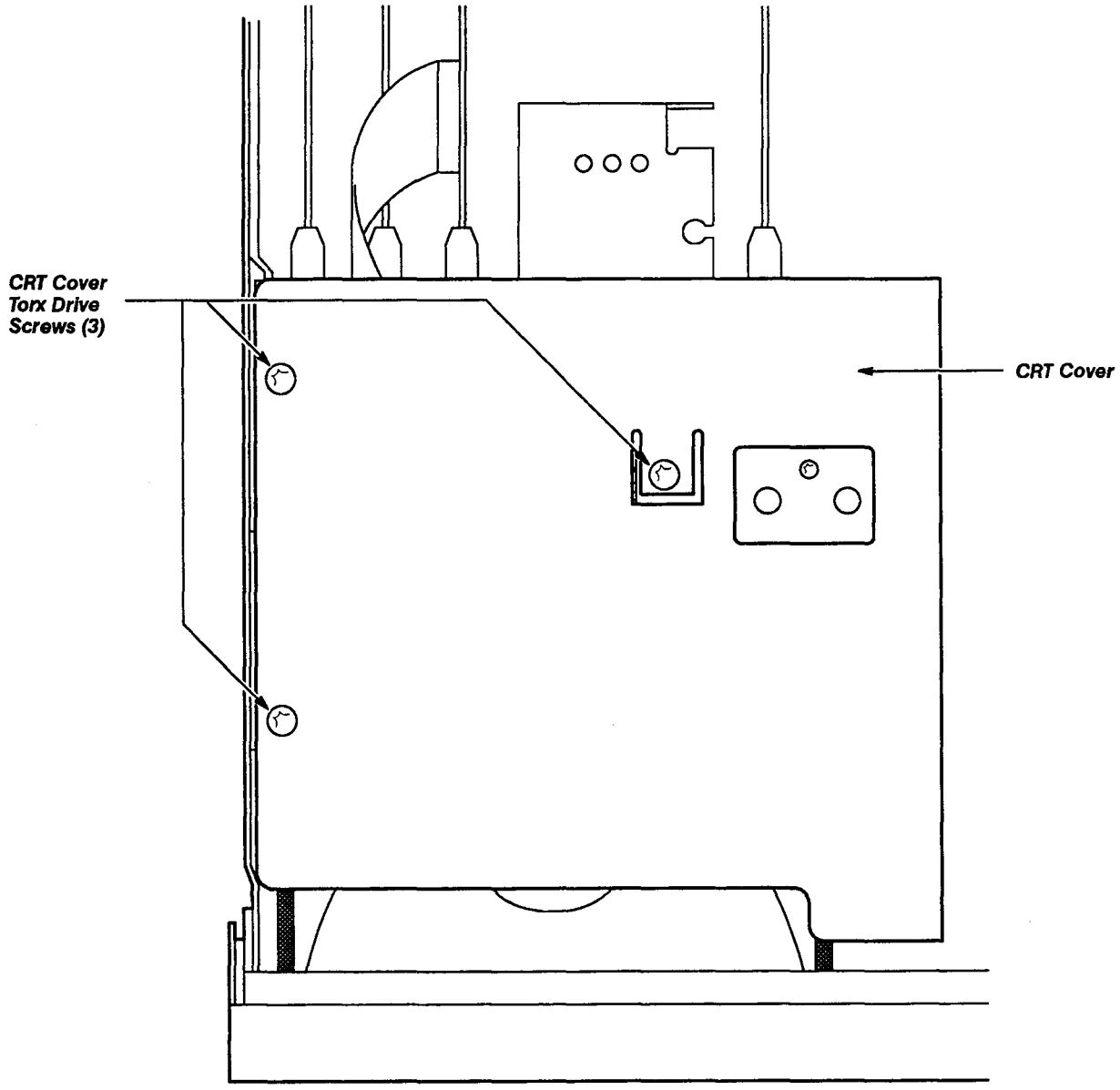


Figure 3-3 *— Removing/Replacing the CRT Cover*

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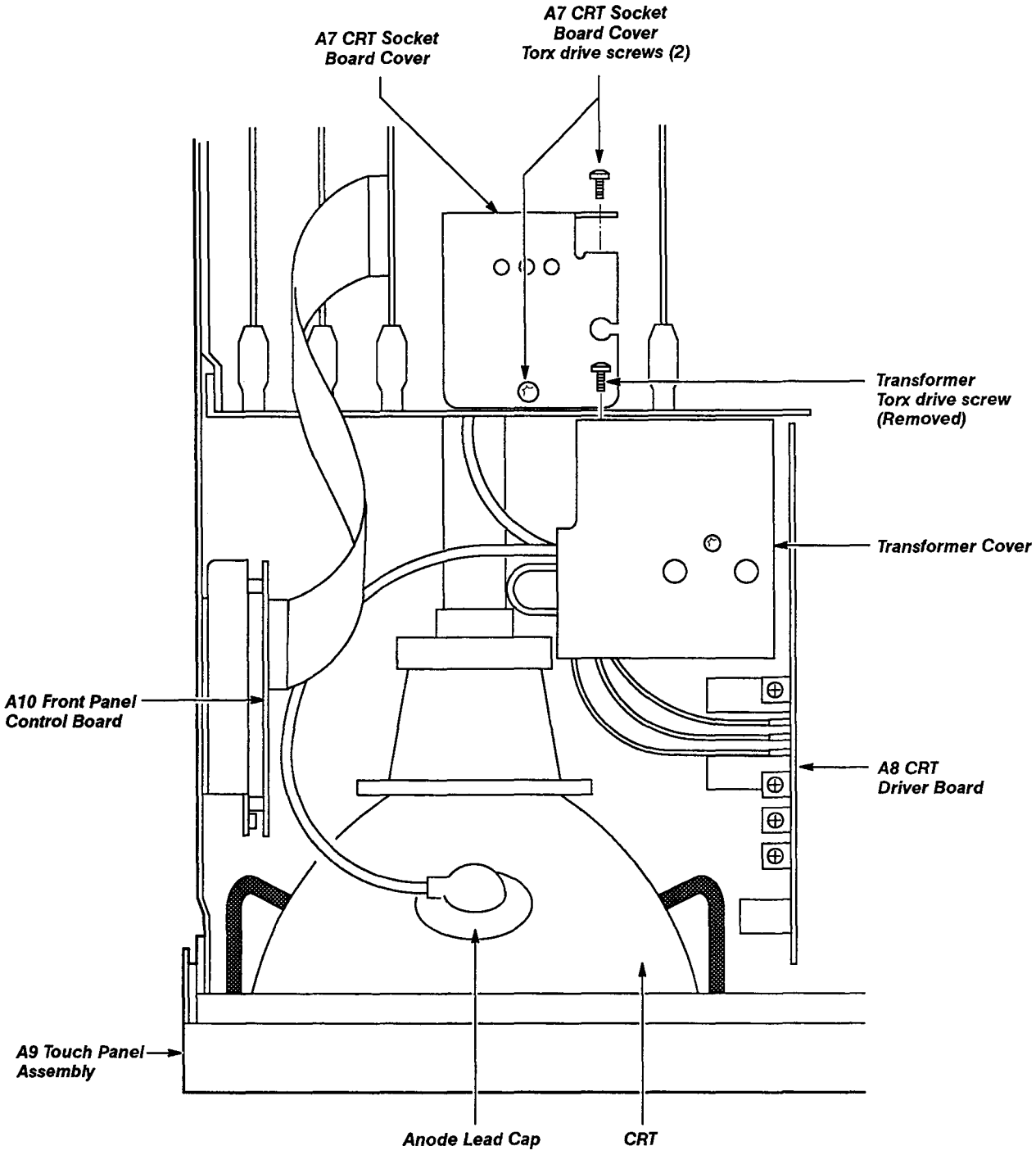


Figure 3-4 *— The Cathode Ray Tube in the Instrument Chassis*

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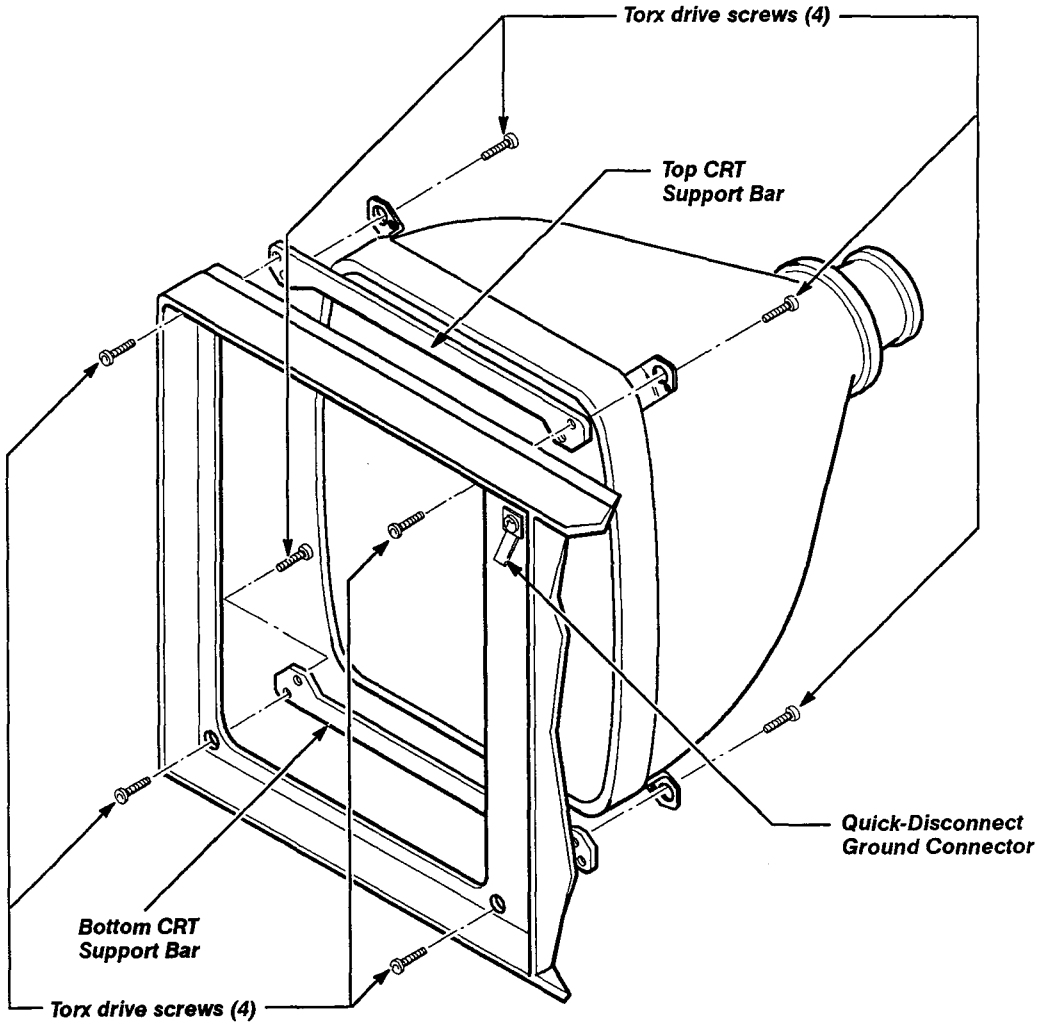


***Figure 3-5** — Removing/Replacing the CRT's Torx Drive Screws*

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Removing and Replacing the Fan Motor

See Figures 3-2 and 3-6 for module and screw locations.

Remove and replace the fan motor using these steps:

- ☐ Step 1: Using a pencil or piece of tape, mark the top of the fan motor housing for positioning during reassembly.
- ☐ Step 2: Remove the four screws securing the housing to the rear of the 11403A (support the housing as you remove the last screws).
- ☐ Step 3: Separate the grill and housing from the motor.
- ☐ Step 4: Remove the two wires at their motor connections. Note that the red wire is plus (+) and the brown is minus (–).
- ☐ Step 5: Remove the fan motor.

Note: *Observe the position in which the motor was mounted. Be sure that the motor is remounted in its original position, or the fan wires may not reach.*

To replace the fan motor, perform the previous steps in reverse and note the following additional points:

- use the location mark from Step 1 to determine the original position of the motor housing
- tighten the screws securely
- remove the mark from the top of the housing
- ensure that no wires contact the fan blades

CAUTION *Be careful not to pinch the wires under the fan housing.*

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Removing and Replacing the Power Supply Module

The Power Supply module slides out of the rear of the instrument for maintenance and troubleshooting. It may also be removed to gain better access to the A1 Plug-in Interface or the A4 Regulator boards.

See Figures 3-1, 3-2, 3-6, and 3-7 for module, connector, screw, and index locations.

Use the following steps to remove and replace the Power Supply:

☐ Step 1: Turn the 11403A on its left side (as viewed facing the rear panel). The Power Supply module will now be at the bottom.

☐ Step 2: Remove the eight Torx drive screws that secure the power supply module.

☐ Step 3: Carefully pull the Power Supply module partially out of the instrument (don't stretch taut or bind the wires attached to the A2A2 Control Rectifier board).

CAUTION *Pulling the Power Supply module more than part way out may damage connector pins.*

☐ Step 4: Disconnect connectors J62, J63, J64, J65, J66, J70 and J81 from the A2A2 Control Rectifier board. Note the position of the multi-pin connector's index triangles to ensure correctly replacing these connectors.

☐ Step 5: Remove the chassis ground (green-yellow) wire connected from the chassis to the Power Supply module.

☐ Step 6: Remove the Power Supply module.

To replace the Power Supply module, perform the previous steps in reverse.

Note: *Align the metal guides on top of the Power Supply module with the grooves inside the upper portion of the opening.*

Be careful not to pinch any wires or interconnecting cables while installing the Power Supply module.

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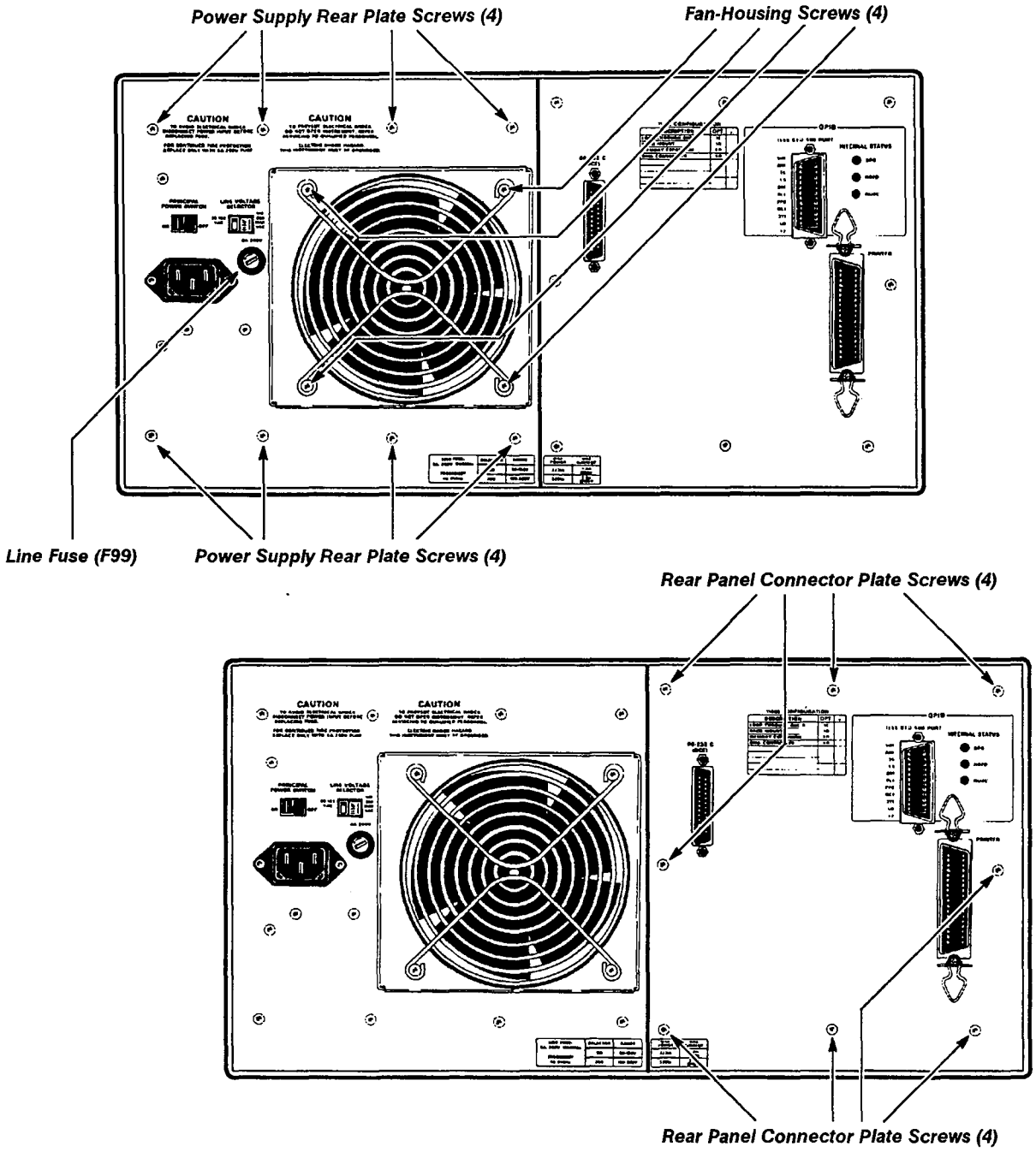


Figure 3-6 — *Removing the Power Supply Rear Plate, Fan Housing, and Rear Panel Connector Plate*

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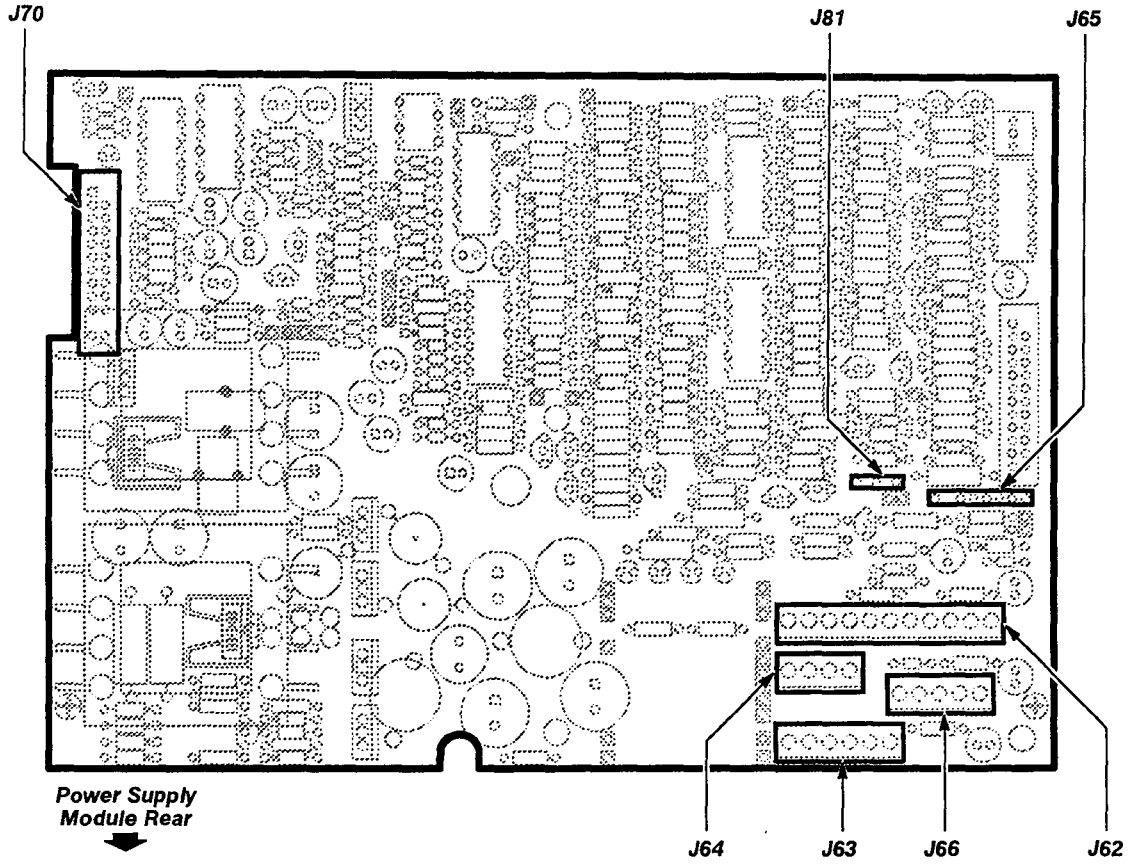


Figure 3-7 *— A2A2 Control Rectifier Board Connector Locations*

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Removing and Replacing Board and Assembly FRUs

This section contains the procedures for removing and replacing field-replaceable board and assmebly units. Most pin connectors in the chassis are for electrically connecting chassis-mounted components with other boards. Most boards or assemblies in the 11403A Digitizing Oscilloscope are mounted on the chassis. However, these four boards plug onto the top of the A13 Mother board (see Fig. 3-8 for the location of these boards in the card cage):

- A14 Input/Output (I/O)
- A15 Memory Management Unit (MMU)
- A17 Executive Processor (EXP)
- A18 Memory

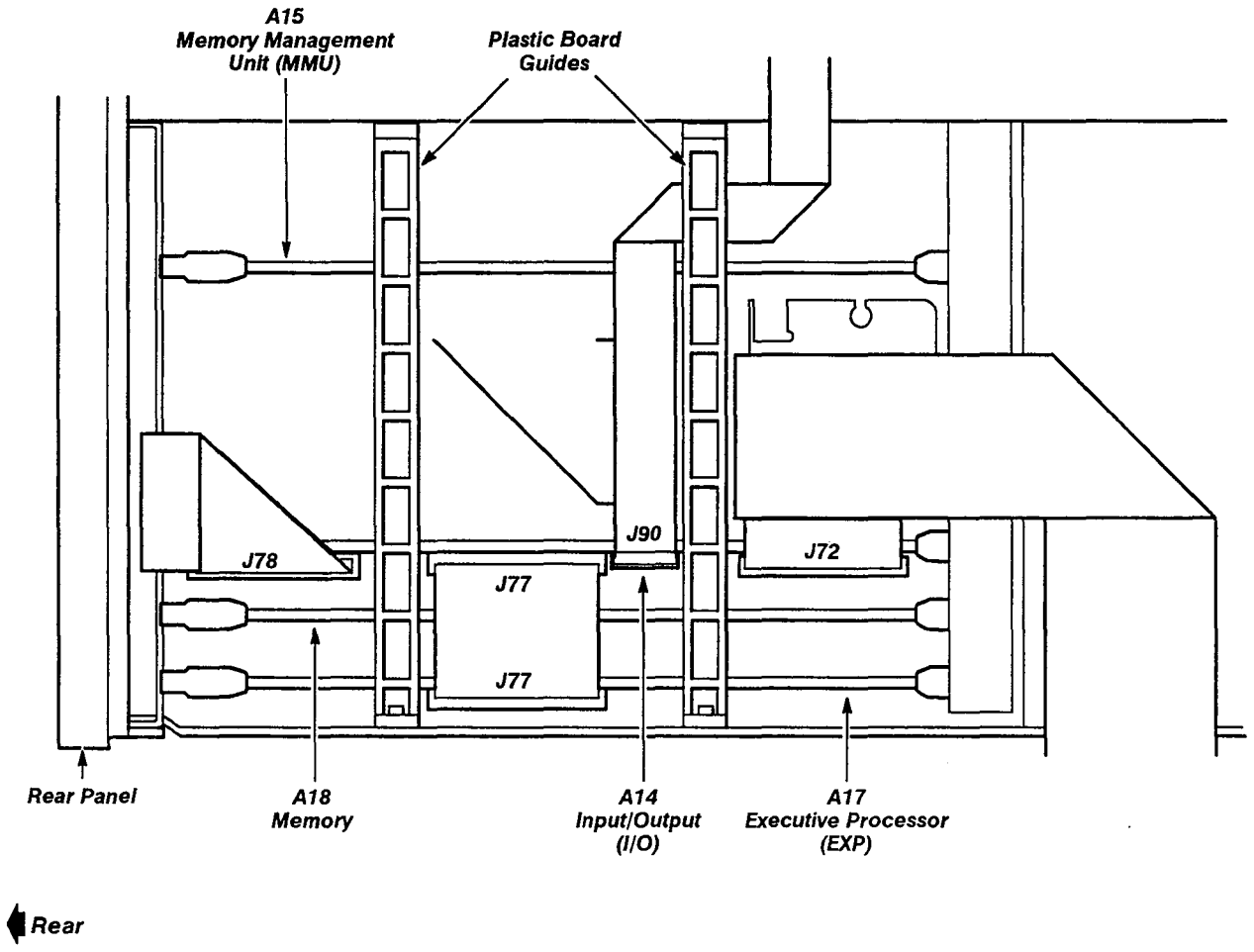


Figure 3-8 *— Top View of the Card Cage*

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Feed-through connectors join the plug-on boards to the A13 Mother board.

CAUTION

After removing a board from the 11403A, place it on a grounded antistatic surface. This will minimize the chance of static charge damage to the integrated circuits and/or related circuitry.

Some components mounted on a board must be retained for use with the new assembly. These components would include interconnecting plugs, support posts, and some wiring.

Removing and Replacing the A1 Plug-in Interface Board—See Figures 3-1, 3-2, 3-6, 3-7, 3-8, 3-9, 3-10, 3-11, 3-12, and 3-15 for board, connector, screw, and index locations.

☐ Step 1: Remove the nine Torx drive screws securing the three interface connector receptacles to the chassis.

☐ Step 2: Partially remove the Power Supply module (but don't disconnect connectors J70 and J81 from the A2A2 Control Rectifier board.

Note: *The chassis ground (green-yellow) wire may be removed from the Power Supply module for this operation only.*

Record the positions of all connectors for correct replacement.

Set the 11403A in the upright position (if it is on its side).

☐ Step 3: Disconnect connectors J57 and J60 from the A4 Regulator board.

☐ Step 4: Remove the two Torx drive screws from the metal heat sink at the rear of the A4 Regulator board.

Note: *The A4 Regulator board is now unfastened from the chassis, but still connected to the A1 Plug-in Interface board.*

☐ Step 5: Pull the A4 Regulator board toward the rear to carefully disconnect the J95 and J96 interconnecting pins from the A1 Plug-in Interface board.

☐ Step 6: Remove the A4 Regulator board.

☐ Step 7: Disconnect connector J90 from the A14 I/O board.

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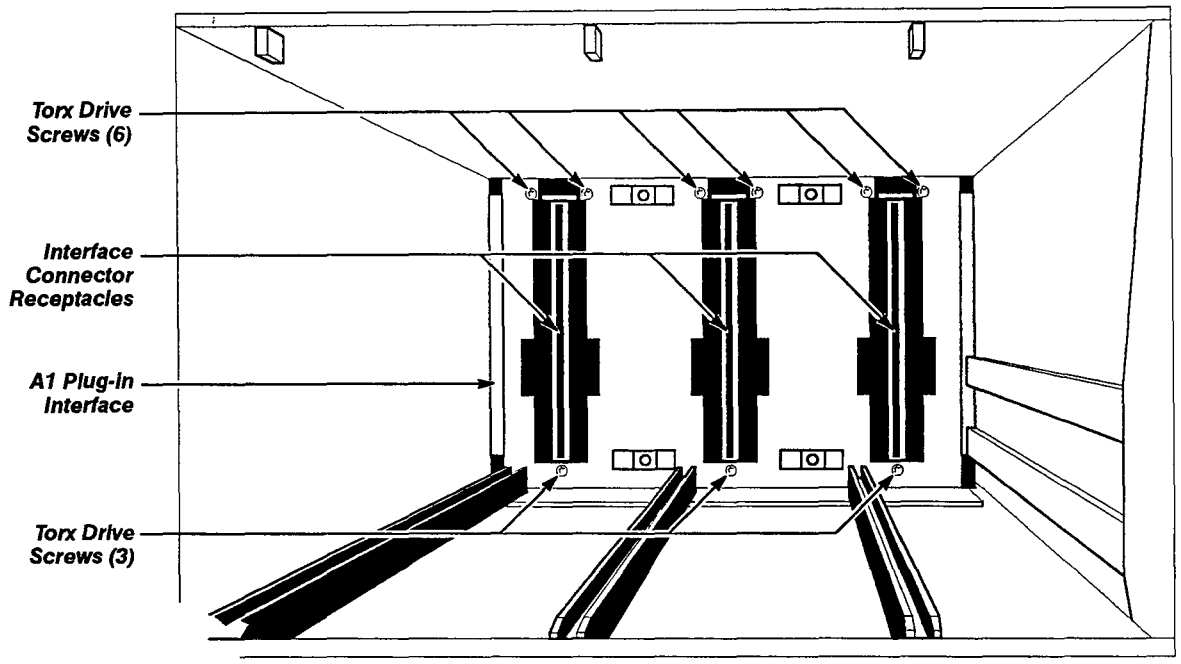


Figure 3-9 *— Removing/Replacing the Plug-in Compartment Torx Drive Screws*

☐ Step 8: Remove the A5 Acquisition board.

☐ Step 9: Disconnect connector J91B from the A6 Time Base board.

☐ Step 10: Position the 11403A to remove the A1 Plug-in Interface board through the top of the 11403A chassis.

☐ Step 11: Carefully remove the A1 Plug-in Interface board and its attached wire assemblies.

☐ Step 12: Disconnect connector J91 from the A1 Plug-in Interface board.

Note: *The J91 Ribbon cable assembly is not part of the FRU. Retain this cable for use when installing a replacement A1 Plug-in Interface board. All wires remaining attached to the board are part of the FRU and should remain attached to the FRU.*

Replacing the A1 Plug-in Interface board is the reverse of the above process.

Reconnect the J91 connector to the A1 Plug-in Interface board before reinstalling the board in the instrument.

CAUTION *Make sure the chassis ground wire is replaced on the Power Supply module.*

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Note: *To replace the nine Torx drive screws in the A1 Plug-in Interface connector receptacles, start the screws, reinstall the A1 Plug-in Interface board and tighten all nine screws into the connector receptacles.*

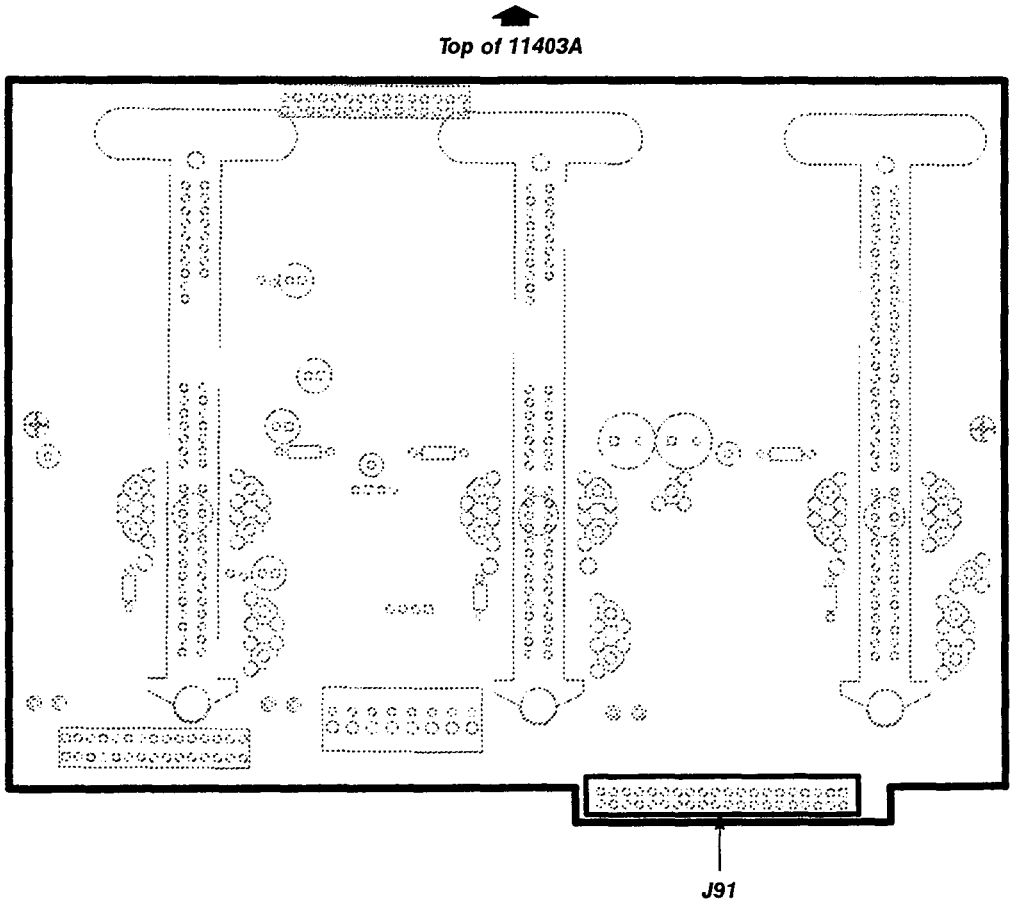


Figure 3-10 *— The A1 Plug-in Interface Board*

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Removing and Replacing the A4 Regulator Board—See Figures 3-1, 3-2, 3-6, 3-7, and 3-11 for board, connector, screw, and index locations.

Follow these steps to remove and replace the A4 Regulator board:

☐ Step 1: Remove the Power Supply module (see the section *Removing and Replacing the Power Supply Module* for more information).

☐ Step 2: Set the 11403A in the upright position (if it is not already in this position).

☐ Step 3: Disconnect connectors J57 and J60 from the A4 Regulator board. Note the position of the index triangles on these multi-pin connectors for correct orientation.

☐ Step 4: Remove the two Torx drive screws from the metal heat sink attached to the rear of this board.

Note: *The A4 Regulator board is now unfastened from the chassis, but still connected to the A1 Plug-in Interface board through interconnecting pins.*

☐ Step 5: Pull the A4 Regulator board toward the rear of the instrument to carefully disconnect its J95 and J96 pins.

☐ Step 6: Remove the A4 Regulator board.

Replacing the A4 Regulator board is the reverse of the above procedure.

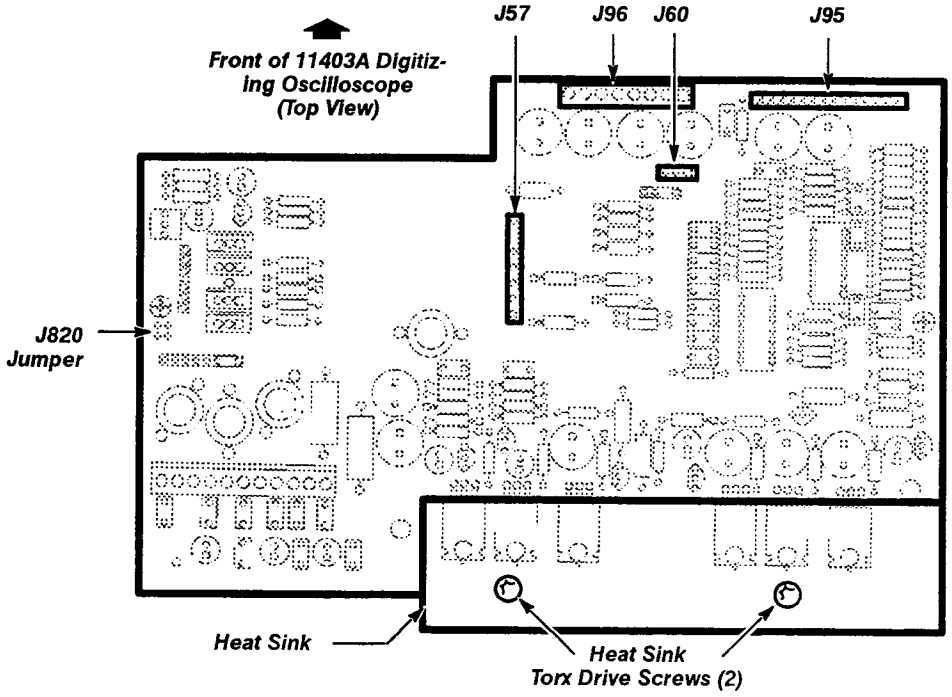


Figure 3-11 *— A4 Regulator Board Mounting Screw and Connector Locations*

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Removing and Replacing the A5 Acquisition Board—See Figures 3-1, 3-2, and 3-12 for board, connector, screw, and index locations.

Follow these steps to remove and replace the A5 Acquisition board:

☐ Step 1: Place the 11403A on its right side (as viewed facing the front). The board is located beneath the card cage and the Power Supply module and beside the A6 Time Base board.

☐ Step 2: Remove the seven Torx drive screws from the A6 Time Base board.

☐ Step 3: Remove the two long Torx drive screws from the support pivots at the front edges of the board.

☐ Step 4: Grasp the rear edge of the board and pivot it on its hinges approximately 90° (position the board nearly perpendicular to the bottom of the instrument), but do not stress the wire bundles.

☐ Step 5: Disconnect the Peltola connectors J01, J02, J03, J04, J05, J06, J26, J30, J31, J32, J33, J34 and J36 from the center and edges of the A5 Acquisition board. Tag all Peltola connectors that you remove with the corresponding J number to ensure that you can correctly replace them.

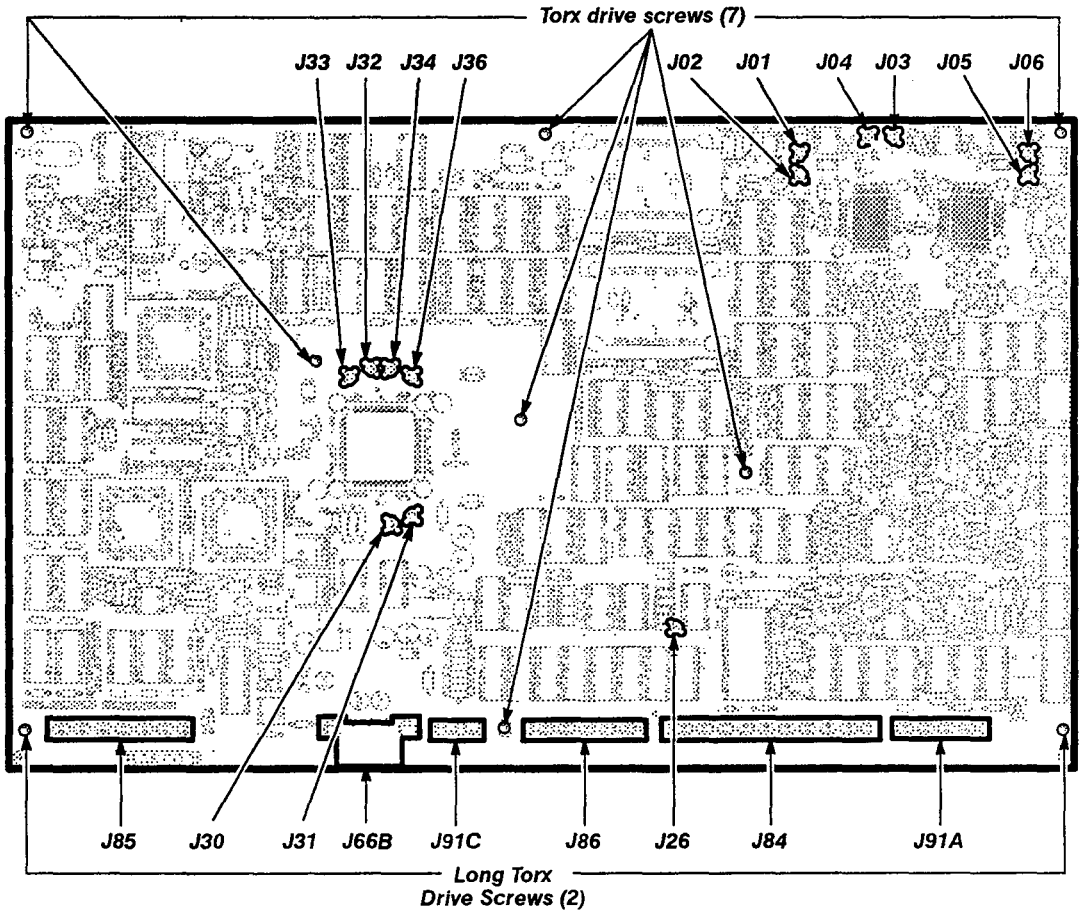


Figure 3-12 *— A5 Acquisition Board Screw and Connector Locations*

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☐ Step 6: Disconnect Peltola connectors J1 – J6 form the A5A3 Strobe Drive board. Tag all Peltola connectors that you remove with the corresponding J number to ensure that you can correctly replace them.

☐ Step 7: Disconnect connectors J66B, J84, J85, J86, J91A and J91C from along the inside edge of the A5 Acquisition board. Note the position of the index triangles on these multi-pin connectors for correct orientation.

☐ Step 8: Remove the A5 Acquisition board.

Replacing the A5 Acquisition board is the reverse of the above procedure.

Note: *When replacing the board, verify that all connections, including the six Peltola connections between the A1 Plug In interface board and the A5A3 Strobe Drive board, are correctly installed.*

See the Checks and Adjustments section of the 11A81 Service Reference for information on verifying the operation of the Strobe Drive board.

CAUTION

Do not pinch interconnecting wires while replacing the board. Arrange the wires away from the posts to prevent interference while you replace the Torx drive screws.

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Removing and Replacing the A5A2 Trigger Enhancement Board – See Figures 3-1, 3-2, 3-12, and 3-13 for board, connector, and screw locations. The A5A2 Trigger Enhancement board is mounted on the A5 Acquisition board.

Follow these steps to remove and replace the A5A2 Trigger Enhancement board:

☐ Step 1: Remove the A5 Acquisition board (see *Removing and Replacing the A5 Acquisition Board*).

☐ Step 2: Remove the two hex nuts that secure the A5A2 Trigger Enhancement board.

☐ Step 3: Disconnect the A5A2 Trigger Enhancement board from the J88 connector on the A5 Acquisition board.

Replacing the A5A2 Trigger Enhancement board is the reverse of the above procedure.

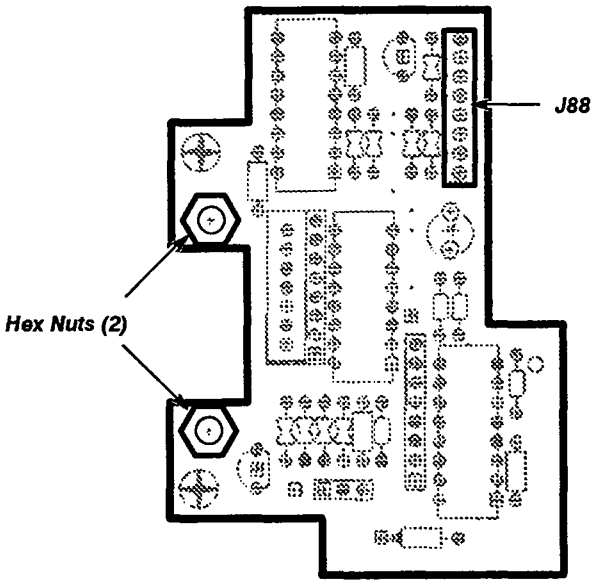


Figure 3-13 *– A5A2 Trigger Enhancement Board Screw and Connector Locations*

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Removing and Replacing the A5A3 Strobe Drive Board—See Figures 3-1, 3-2, 3-12, and 3-13 for board and connector locations. The A5A3 Strobe Drive board is soldered to connector pins on the A5 Acquisition board with the bottom ends of its Peltola connectors touching the ICs on the Acquisition board. Removing the A5A3 Strobe Drive board consists of unsoldering 7 connector pins and lifting the board away form the A5 Acquisition board.

Follow these steps to remove and replace the A5A3 Strobe Drive board:

☐ Step 1: Remove the A5 Acquisition board (see *Removing and Replacing the A5 Acquisition Board*).

☐ Step 2: If you have not already done so, disconnect Peltola connectors J1 - J6 from the A5A3 Strobe Drive board. Tag all Peltola connectors that you remove with the corresponding J number to ensure that you can correctly replace them.

☐ Step 3: Carefully unsolder the pins connecting the A5A3 Strobe Drive board to the A5 Acquisition board (pins 1, 5, 8, 9, 11, 13, and 16 on the A5A3 board).

☐ Step 4: Separate the A5A3 board from the A5 board.

Replacing the A5A3 Strobe Drive board is the reverse of the above procedure.

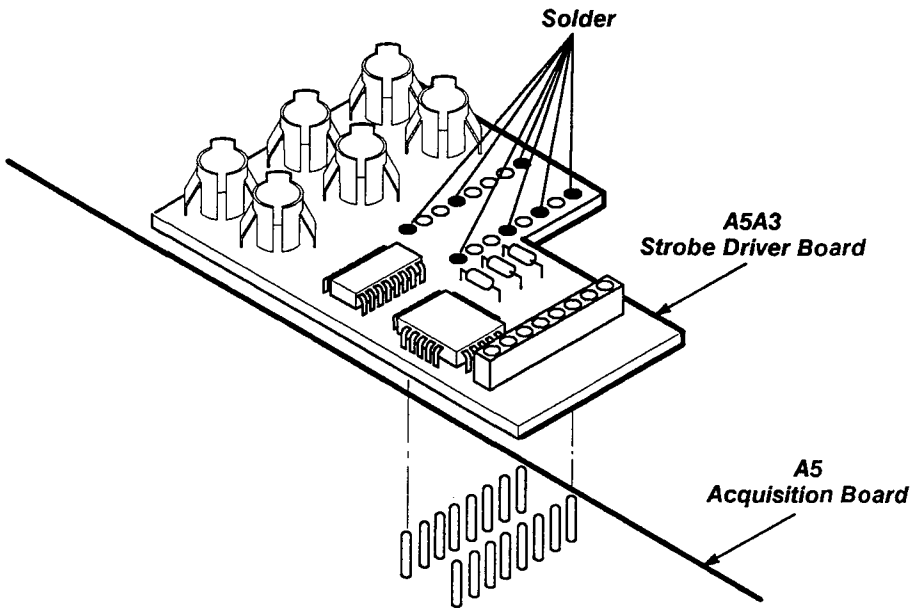


Figure 3-14 *— A5A3 Strobe Driver Board Connector Locations*

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Note: *When replacing the board, verify that all connections, including the six Peltola connections between the Strobe Drive and the A1 Plug In interface board, are correctly installed.*

See the Checks and Adjustments section of the 11A81 Service Reference for information on verifying the operation of the Strobe Drive board.

CAUTION

The replacement A5A3 Strobe Drive board must be installed with the bottom ends of its Peltola connectors touching the tops of the ICs on the A5 Acquisition board. If the A5A3 Strobe Drive board is incorrectly installed, it can be damaged during A5 Acquisition board removal because of interference with the edge of the rear panel frame.

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Removing and Replacing the A6 Time Base Board—See Figures 3-1, 3-2, 3-12, and 3-15 for board, connector, screw, and index locations.

Follow this procedure to remove and replace the A6 Time Base board:

☐ Step 1: Place the 11403A on its right side (as viewed facing the front). The A6 Time Base board is located next to the CRT and the A5 Acquisition board with the A5 board overlapping the rear edge of the A6 Time Base board.

☐ Step 2: Remove the seven Torx drive screws and the two long Torx head screws at the support pivots of the A5 Acquisition board. **Do not remove the board's connectors.**

☐ Step 3: Move the A5 Acquisition board so that it no longer overlaps the A6 Time Base board.

☐ Step 4: Remove connectors J66A, J83, J84, J85, J86, and J91B, from the A6 Time Base board. Note the position of the index triangles on these multi-pin connectors for correct orientation.

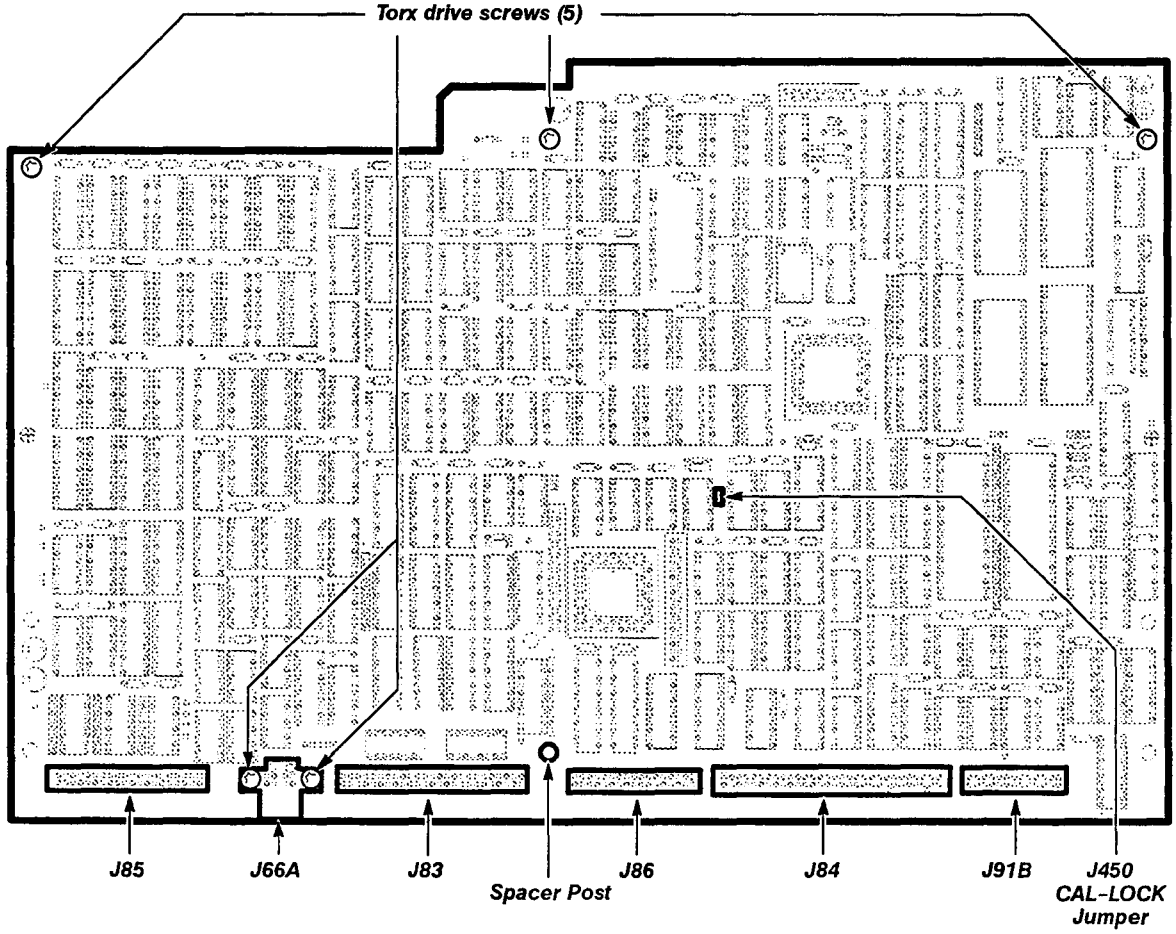


Figure 3-15 — A6 Time Base Board Screw, Connector, and Jumper Locations

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☐ Step 5: Remove the spacer post and the five Torx drive screws from the A6 Time Base board.

☐ Step 6: Remove the A6 Time Base board.

Replacing the A6 Time Base board is the reverse of the above procedure.

CAUTION

Be careful not to pinch or otherwise damage interconnecting wires.

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Removing and Replacing the A7 CRT Socket Board and A8 CRT Driver Board—See Figures 3-1, 3-2, 3-3, 3-4, 3-8, 3-16, 3-17, 3-20, and 3-21 for board, connector, screw, and index locations.

Follow this procedure to remove and replace the A7 CRT Socket board and the A8 CRT Driver board:

☐ Step 1: Remove the three Torx drive screws that secure the CRT cover and remove the cover.

☐ Step 2: Remove the two plastic circuit board guides on top of the card cage.

☐ Step 3: Remove the two Torx drive screws securing the A7 CRT Socket board cover and remove the cover.

☐ Step 4: Slowly pull the A7 CRT Socket board toward the rear to unplug it from the CRT.

☐ Step 5: Disconnect connectors J53 and J56 on the A7 CRT Socket board. Note the positions of the index triangles on the multi-pin connectors for correct connector replacement.

WARNING

The CRT anode voltage is 16 kV. Ground the anode lead from the CRT to the chassis to short any stored charge remaining in the CRT. Wait approximately ten minutes, then ground the anode lead to the chassis again (refer to Step 6).

☐ Step 6: Use a non-conducting tool to pry up the anode lead cap. This rubber cap is located on the upper part of the CRT, behind the front casting. Release the spring clip inside the cap and remove the anode. Insert one blade of a pair of needle-nose pliers against the anode, and touch the other blade to the top of the front casting to ground the anode to the chassis.

☐ Step 7: Remove the Torx drive screw securing the A8 CRT Driver board to the chassis using either of these methods:

- Remove the Torx drive screw with a very short handled T-15 Torx drive screwdriver. Be careful not to strike the CRT while removing the screw.
- Remove the A10 Front Panel Control board (see *Removing and Replacing the A10 Front Panel Control Board*). Then, use an extended-length Torx drive screwdriver to remove the Torx drive screw. Access the screw from the hole in the left side of the chassis, but be careful not to strike the CRT while removing the screw.

☐ Step 8: Remove the Torx drive screw securing the transformer on the A8 CRT Driver board to the chasis. This screw is located at the rear of the transformer.

☐ Step 9: Disconnect connectors J52, J56, and J57 from the A8 CRT Driver board. Note the position of the index triangles on the multi-pin connectors for correct connector replacement.

☐ Step 10: Lift the A8 CRT Driver board partially out of the chassis.

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☐ Step 11: Disconnect connectors J54 and J55 from the A8 CRT Driver board. Note the position of the index triangles on the multi-pin connectors for correct connector replacement.

☐ Step 12: Remove the A8 CRT Driver board and the A7 CRT Socket board.

☐ Step 13: Unsolder the two wires that connect the A8 CRT Driver board to the A7 CRT Socket board (the two boards are now separated).

Replacing the A8 CRT Driver board and the A7 CRT Socket board is the reverse of the above procedure.

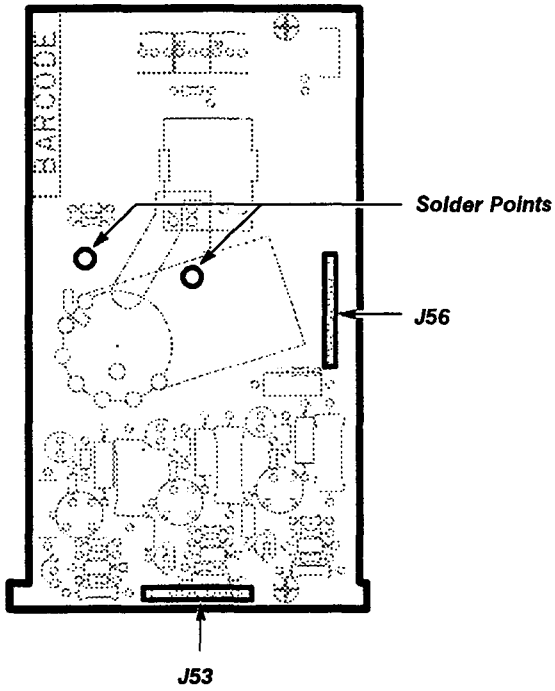


Figure 3-16 *— A7 CRT Socket Board Connector and Wire Locations*

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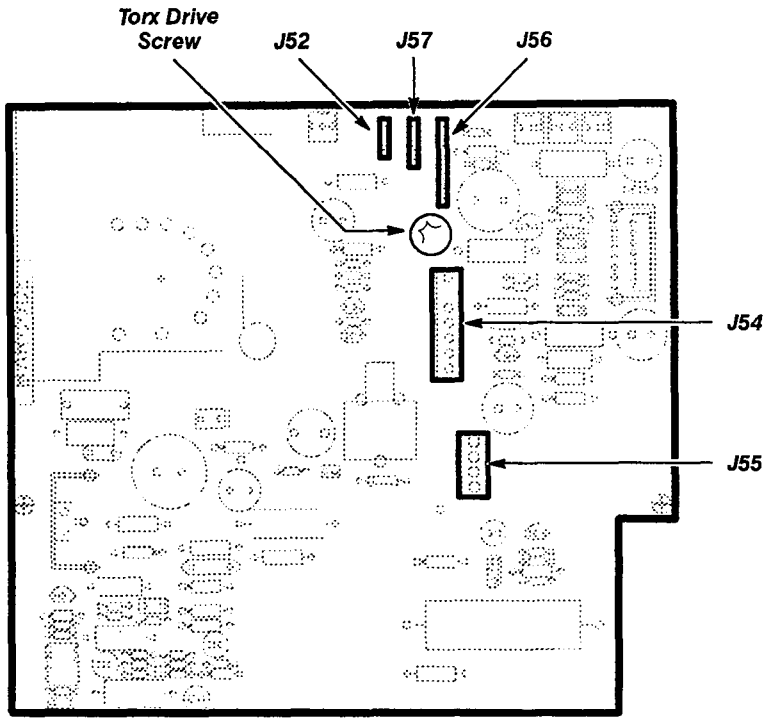


***Figure 3-17** — A8 CRT Driver Board Connector and Screw Locations*

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Removing and Replacing the A9 Touch Panel Assembly – See Figures 3-1, 3-2, 3-18, 3-19, and 3-21 for connector, screw, and index locations.

Follow this procedure to remove and replace the A9 Touch Panel assembly:

☐ Step 1: Place the 11403A on its right side. (With the CRT at the top.)

☐ Step 2: Use a $^{1}/_{16}$-inch allen wrench to loosen the small allen screws in the two control knobs.

☐ Step 3: Carefully remove the two control knobs so that you don't lose the allen screws.

☐ Step 4: Remove the two Torx drive screws at the bottom of the A9 Touch Panel Assembly.

☐ Step 5: Lift the bottom of the A9 Touch Panel Assembly and swing the assembly outward.

Note: *The top of the A9 Front Panel Assembly is held by two tabs. These tabs fit into two slots in the front-panel chassis.*

☐ Step 6: Disconnect the back ground wire from the quick-disconnect ground connector on the front panel casting.

☐ Step 7: Disconnect connector J73 from the A10 Front Panel Control board. Note the position of the index triangles on the multi-pin connector for correct replacement. Carefully remove the wire cable through the slot in the front casting.

To prevent scratching its plastic exterior, cover the A9 Touch Panel Assembly with protective material once it is removed.

Replacing the A9 Touch Panel Assembly board is the reverse of the above procedure.

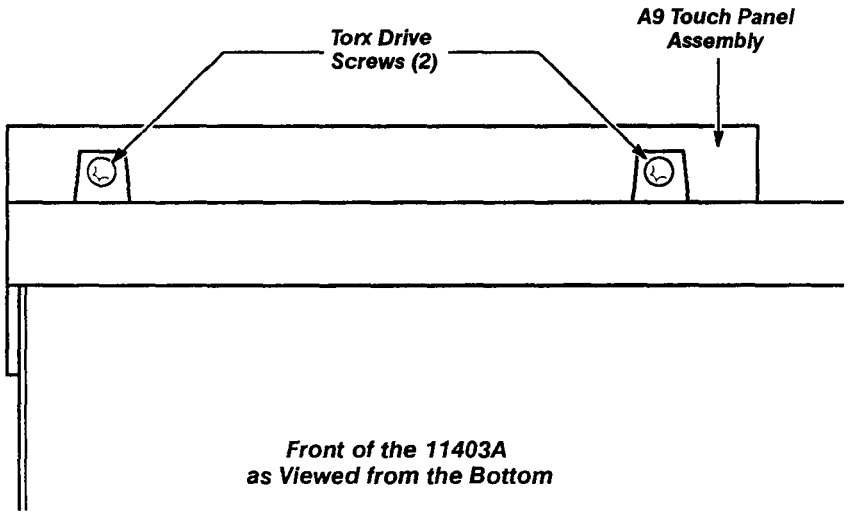


***Figure 3-18** — A9 Touch Panel Assembly Torx drive screw Locations*

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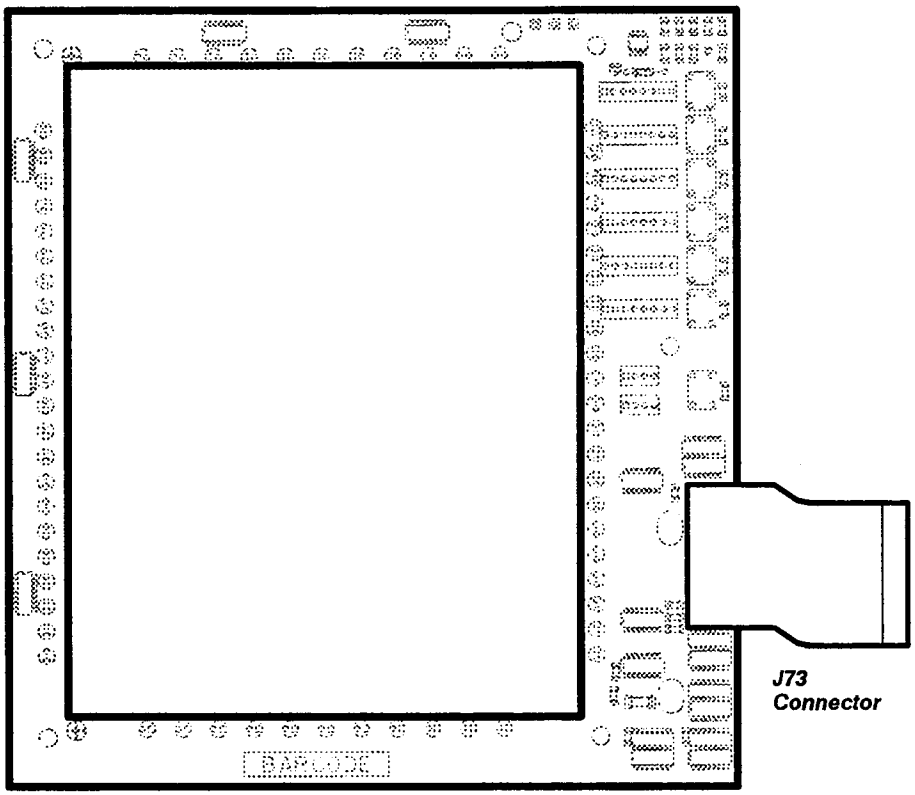


Figure 3-19 *— A9 Touch Panel Assembly Connector Location*

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A10 Front Panel Control Board—See Figures 3-1, 3-2, 3-3, 3-20, and 3-21 for board, connector, screw, and index locations.

Follow this procedure to remove and replace the A10 Front Panel Control board:

- ☐ Step 1: Remove the three Torx drive screws that secure the CRT cover and then remove the cover.
- ☐ Step 2: Remove the two Torx drive screws that secure the support bracket to the upper left side of the chassis. This support bracket secures the A10 Front Panel Control board to the chassis and provides support to the left Degauss coil.
- ☐ Step 3: Remove the Torx drive screw securing the plastic clamp between the left Degauss coil and the support bracket.
- ☐ Step 4: Disconnect connector J72 from the A10 Front Panel Control board. Note the position of the index triangles on the multi-pin connector for correct replacement.
- ☐ Step 5: Lift the A10 Front Panel Control board and its attached support bracket partially out of the chassis.
- ☐ Step 6: Disconnect connectors J73, J74, and J75 from the A10 Front Panel Control board. Note the position of the index triangles on the multi-pin connectors for correct replacement.
- ☐ Step 7: Remove the A10 Front Panel Control board and its attached support bracket from the plastic board guide at the bottom of the chassis.
- ☐ Step 8: Remove the two Torx drive screws that secure the A10 Front Panel Control board to the support bracket and separate bracket and board.

Replacing the A10 Front Panel Control board is the reverse of the above procedure.

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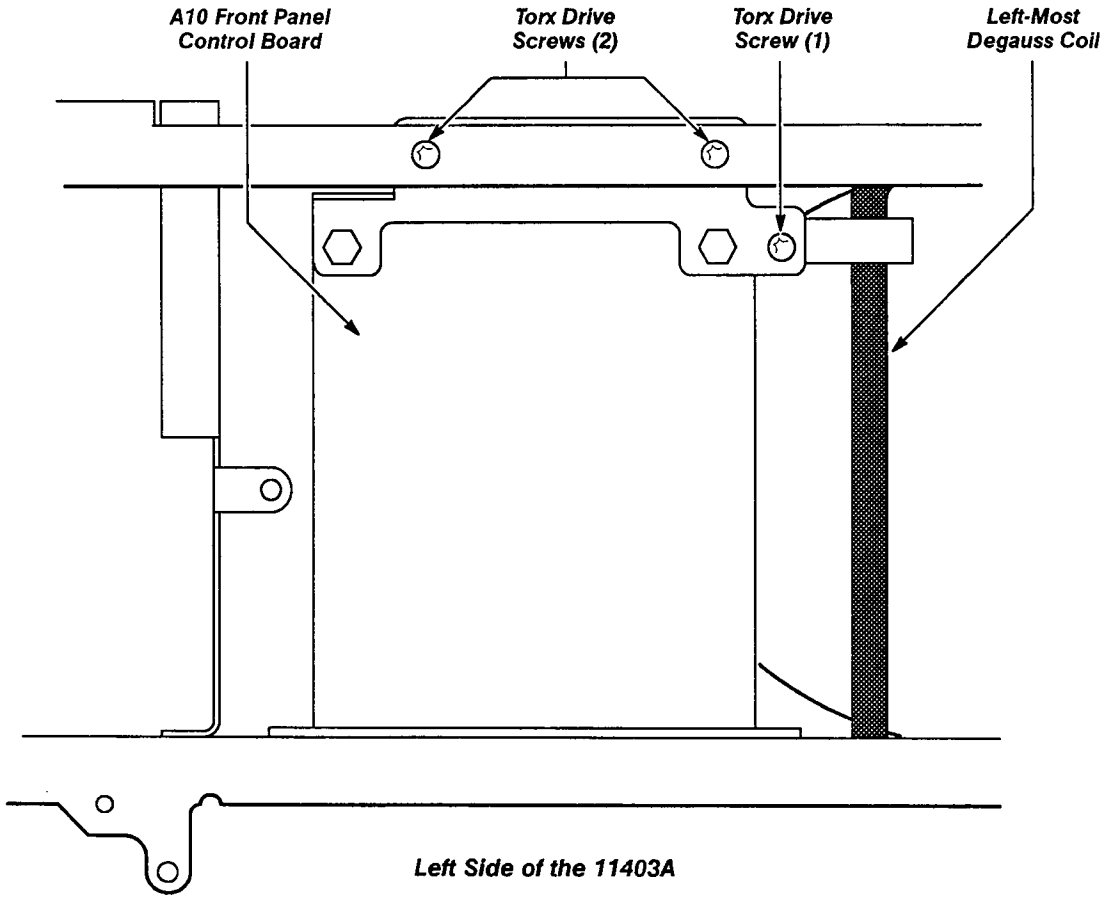


Figure 3-20 *— 11403A Left Side Major Features Near the A10 Front Panel Control Board*

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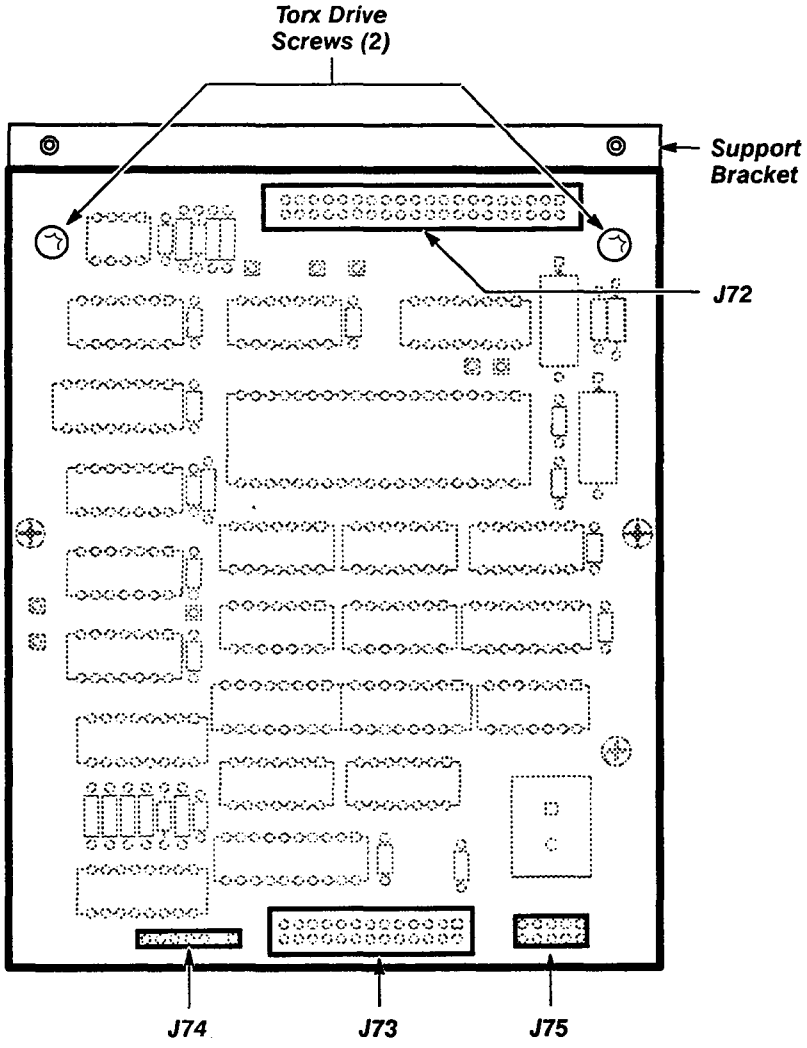


Figure 3-21 *— A10 Front Panel Control Board Screw and Connector Locations*

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Removing and Replacing the A11 Front Panel Button Board—See Figures 3-1, 3-2, 3-3, 3-20, 3-21, and 3-22 for board, connector, screw, and index locations.

Follow this procedure to remove and replace the A11 Front Panel Button board:

☐ Step 1: Remove the three Torx drive screws securing the CRT cover and remove the cover.

☐ Step 2: Remove the two Torx drive screws securing the support bracket attached to the upper-left side of the 11403A. This support bracket secures the A10 Front Panel Control board to the chassis and supports the left Degauss coil.

☐ Step 3: Remove the Torx drive screw securing the plastic clamp between the left Degauss coil and the support bracket.

☐ Step 4: Disconnect connector J72 from the A10 Front Panel Control board. Note the position of the index triangle on the multi-pin connector for correct replacement.

☐ Step 5: Lift the A10 Front Panel Control board partially out of the chassis and disconnect connector J75. Note the position of the index triangle on the multi-pin connector for correct replacement.

☐ Step 6: Route the J75 connector and cable under the CRT and out of the chassis.

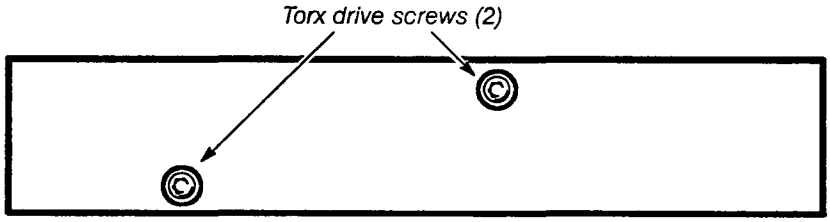
CAUTION

Make sure you don't strike or damage the CRT when routing the J75 connector out of, or into, the chassis.

☐ Step 7: Remove the two Torx drive screws from the A11 Front Panel Button board. These are located at the top and near the inside center of the front casting.

☐ Step 8: Remove the A11 Front Panel Button board.

Replacing the A11 Front Panel Button board is the reverse of the above procedure.



Rear View of the A11 Front Panel Button Board

***Figure 3-22** — Screw Locations on the A11 Front Panel Button Board*

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Removing and Replacing the A12 Rear Panel Assembly—See Figures 3-1, 3-2, 3-6, 3-23, and 3-25 for assembly, connector, screw, and index locations.

Follow this procedure to remove and replace the A12 Rear Panel assembly:

☐ Step 1: Remove all connectors from the RS-232-C, GPIB, and PRINTER ports.

☐ Step 2: Disconnect connector J78 from the A14 I/O board. Note the position of the index triangles on the multi-pin connector to ensure correct replacement.

☐ Step 3: Remove the eight Torx drive screws from the outer edges of the rear panel connector plate and tilt the plate away from the 11403A.

☐ Step 4: Remove connector J78 from the top of the A12 Rear Panel assembly. Note the position of the index triangles on the multi-pin connector to ensure correct replacement. Save the J78 cable (now detached) for replacing the A12 Rear Panel Assembly.

☐ Step 5: Remove the rear panel connector plate and the attached A12 Rear Panel Assembly.

☐ Step 6: Remove the black ground-wire screw from the card cage chassis.

☐ Step 7: Remove the following items from the rear panel connector plate:

- two bail brackets, screws, and washers from the PRINTER connector
- two posts from the GPIB connector
- posts, lockwashers, and flat washers from the RS-232-C connectors
- Torx drive screw and washer (at the lower left of the connector plate, if present)

☐ Step 8: Remove the A12 Rear Panel assembly from the rear-panel connector plate.

CAUTION *The metal covers on the PRINTER and the GPIB connectors are loose. If you invert the board, these covers will fall off.*

Replacing the A12 Rear Panel assembly is the reverse of the above procedure.

Note: *It is easier to replace connector J78 if you do so before reinstalling the rear panel connector plate on the rear of the chassis.*

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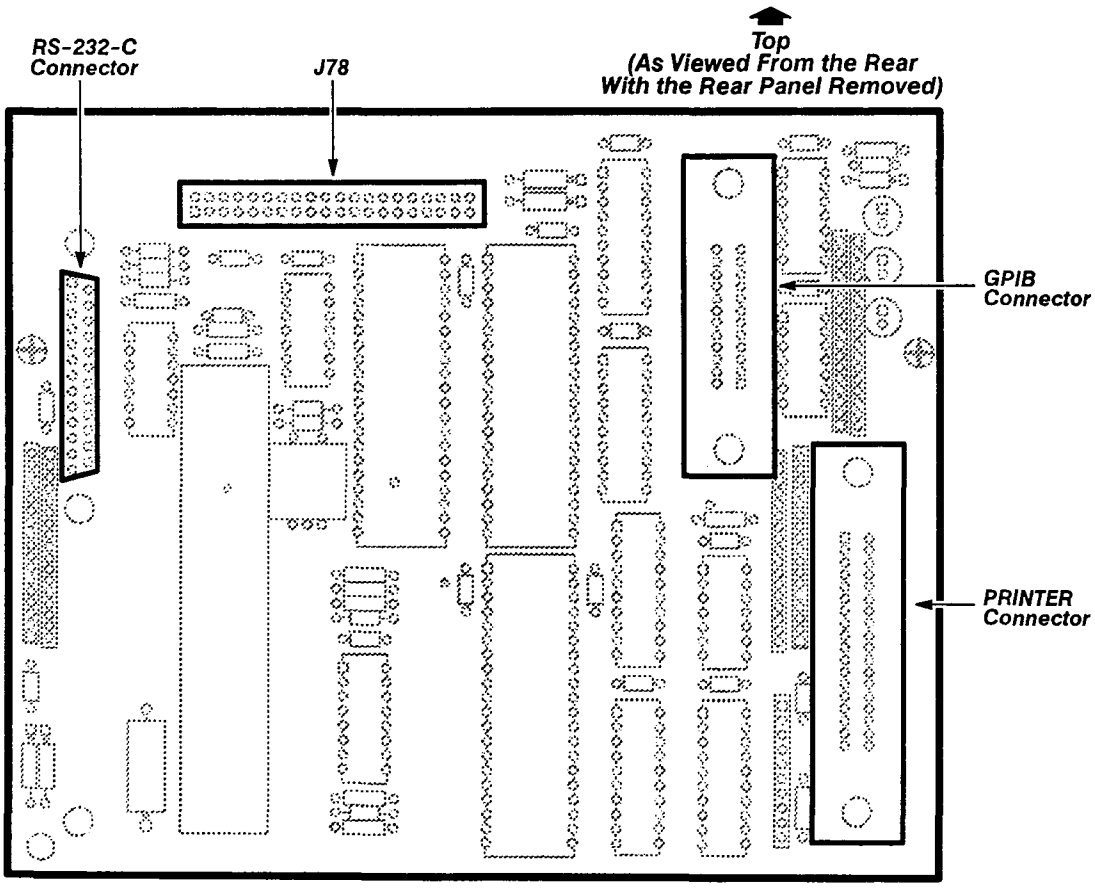


Figure 3-23 *— A12 Rear Panel Assembly Connector Locations*

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Removing and Replacing the A13 Mother Board—See Figures 3-1, 3-2, 3-3, 3-8, 3-24, 3-25, 3-26, 3-27, and 3-28 for board, connector, screw, and index locations.

Use the following procedure to remove and replace the A13 Mother board:

☐ Step 1: Remove the three Torx drive screws that secure the CRT cover and remove the cover.

☐ Step 2: Remove both plastic board guides from the top of the card cage. The guides are retained on their ends by two small catches located in holes in the left-side card-cage bracket. The other ends of the guides attach to the edge of a metal bracket. Both ends of the guides can be pried loose.

☐ Step 3: Remove the A14 I/O, A15 MMU, A17 Main Processor, and A18 Memory boards (see the removal and replacement procedures for these boards for more information). Note the position of the index triangles on the multi-pin connectors for correct replacement.

Note: *Tag the interconnecting plugs and mark the board locations to ensure that the plugs can be correctly replaced.*

☐ Step 4: Remove connector J63A from the A13 Mother board.

☐ Step 5: Remove the six Torx drive screws from the A13 Mother board.

☐ Step 6: Remove the A13 Mother board.

Replacing the A13 Mother board is the reverse of the above procedure.

CAUTION

Be careful not to pinch the wires along the inside edge while replacing this board.

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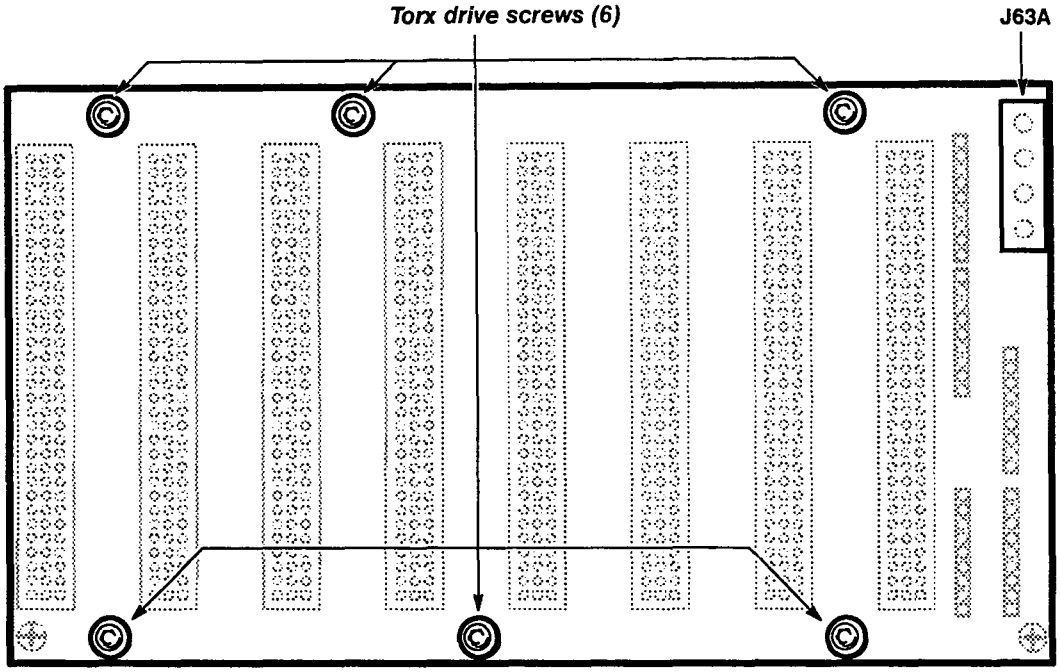


Figure 3-24 *— A13 Mother Board Connector and Screw Locations*

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Removing and Replacing the A14 Input/Output (I/O) Board—See Figures 3-1, 3-3, 3-8, and 3-25 for board, connector, screw, and index locations.

Use the following procedure to remove and replace the A14 I/O board:

☐ Step 1: Remove the three Torx drive screws securing the CRT cover and remove the cover.

☐ Step 2: Remove both plastic board guides from the top of the card cage. The guides are retained on their ends by two small catches located in holes in the left-side card-cage bracket. The other ends of the guides attach to the edge of a metal bracket. Both ends of the guides can be pried loose.

☐ Step 3: Disconnect connectors J72, J77, J78, and J90 from the A14 I/O board. Note the position of the index triangles on the multi-pin connectors to ensure correct replacement.

☐ Step 4: Lift the white, hinged tab at the upper front edge of the board. Pull the tab upward until the A14 I/O board separates from the A13 Mother board.

☐ Step 5: Remove the A14 I/O board.

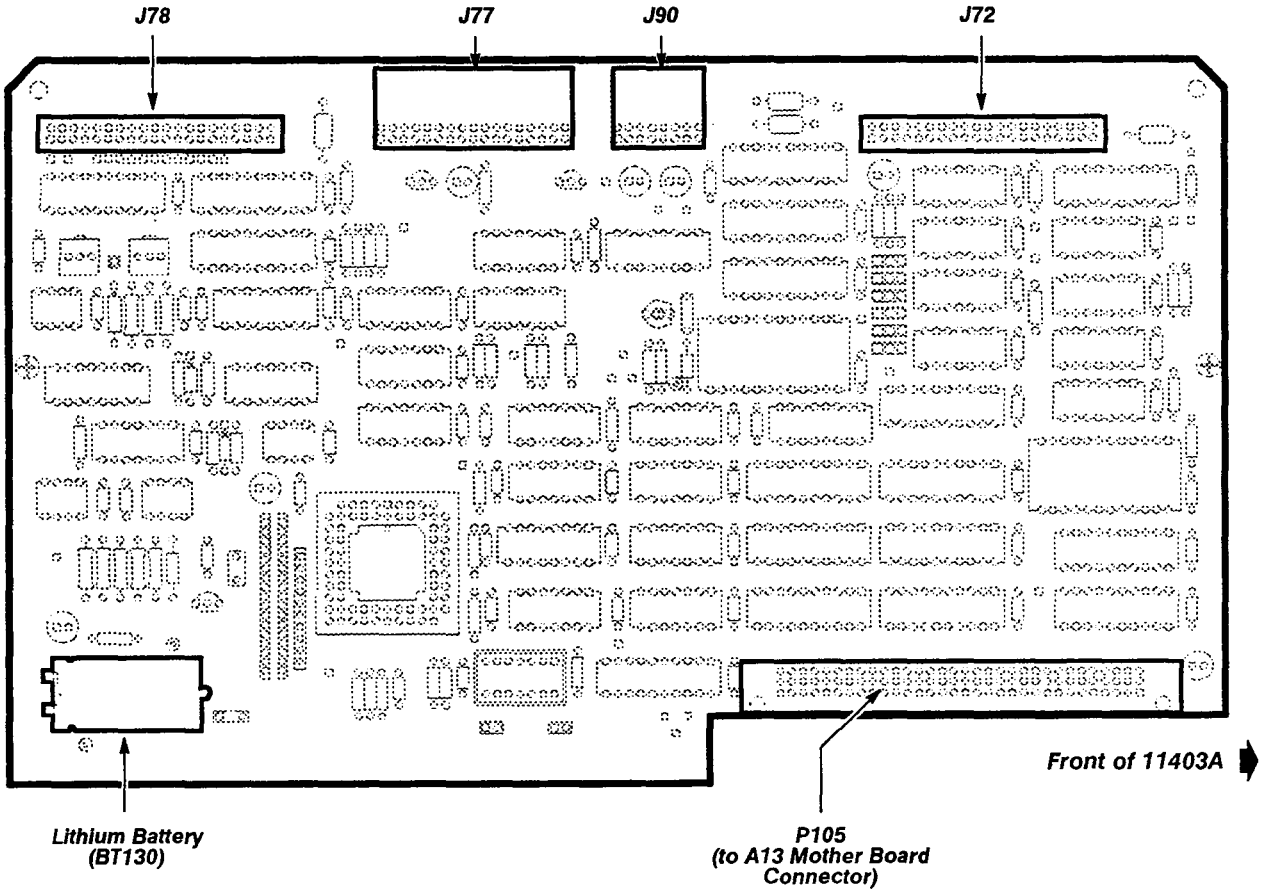


***Figure 3-25** — A14 I/O Board Battery and Connector Locations*

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Replacing the A14 I/O board is the reverse of the above procedure.

Note: *Insert the board edges into the plastic guides at each end of the card cage. Lower the board into position.*

Ensure that connector P105 is seated on the A13 Mother board connector. Push down firmly on the A14 I/O board to connect it to the A13 Mother board.

WARNING

A lithium battery (BT130) is mounted on the A14 I/O board. ***This battery requires special handling for disposal.*** *Refer to the instructions on Lithium Battery Disposal and First Aid earlier in this section. Care is required when placing the A14 I/O board on metal surfaces. If some IC or battery leads are shorted, the battery may discharge or overheat and vent. (You can use plastic standoffs to prevent short circuits.)*

Removing and Replacing the A15 Memory Management Unit (MMU) Board—See Figures 3-1, 3-3, 3-8, 3-25, and 3-26 for board, connector, screw, and index locations.

Use this procedure to remove and replace the A15 MMU board:

☐ Step 1: Remove the three Torx drive screws securing the CRT cover and remove the cover.

☐ Step 2: Remove both plastic board guides from the top of the card cage. The guides are retained on their ends by two small catches located in holes in the left-side card-cage bracket. The other ends of the guides attach to the edge of a metal bracket. Both ends of the guides can be pried loose.

☐ Step 3: Disconnect connectors J52, J57, and J83 from the A15 MMU board. Note the position of the index triangles on the multi-pin connectors for correct replacement.

☐ Step 4: Disconnect connector J90 from the A14 I/O board.

☐ Step 5: Lift the white, hinged tabs at the front and rear edges of the A15 MMU board. Pull the tabs upward until the A15 MMU board separates from the A13 Mother board.

☐ Step 6: Remove the A15 MMU board.

Replacing the A15 MMU board is the reverse of the above procedure.

Note: *Insert the board edges into the plastic guides at each end of the card cage. Lower the board into position.*

Ensure that connector P101 is seated on the A13 Mother board connector. Push down firmly on the A15 MMU board to connecr it to the A13 Mother board.

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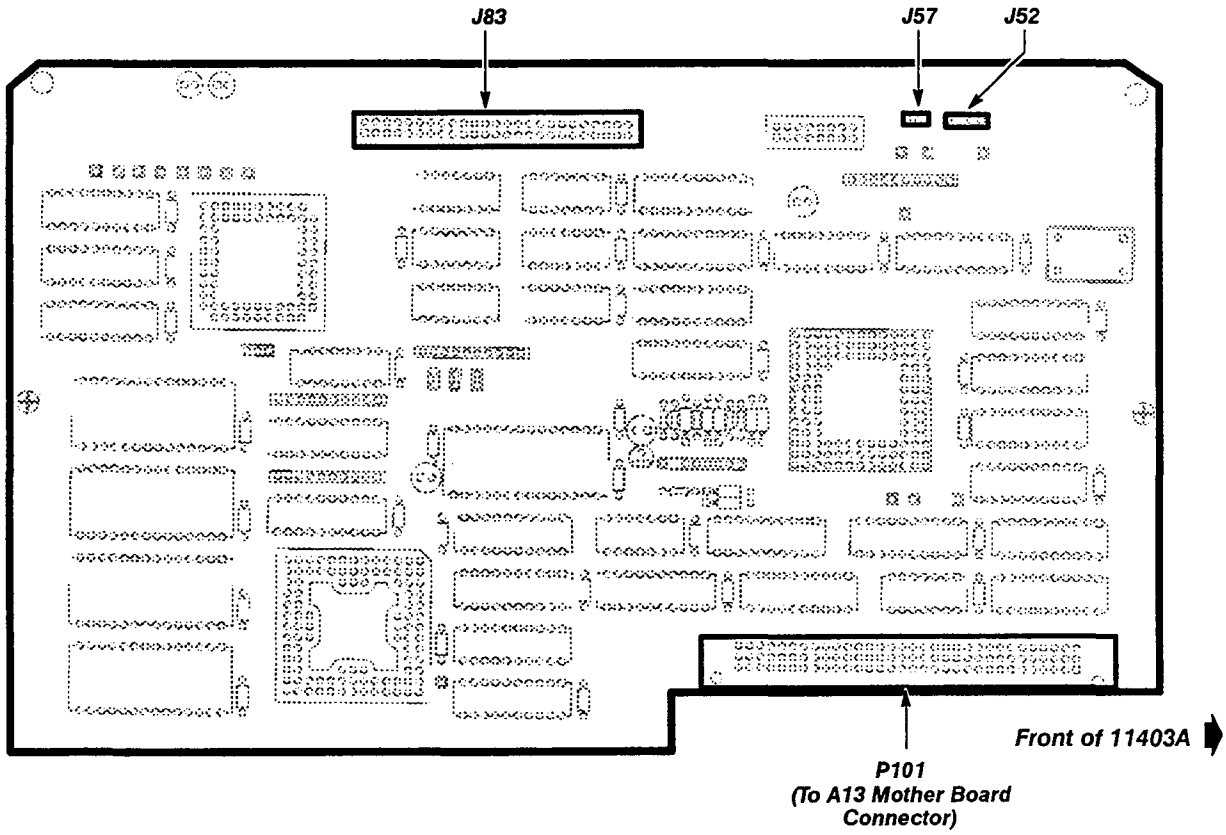


Figure 3-26 *— A15 MMU Board Connector Locations*

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Removing and Replacing the A17 Executive Processor (EXP) Board—See Figures 3-1, 3-3, 3-8, and 3-27 for board, connector, screw, and index locations.

Use the following procedure to remove and replace the A17 Executive Processor board:

☐ Step 1: Remove the three Torx drive screws securing the CRT cover and remove the cover.

☐ Step 2: Remove both plastic board guides from the top of the card cage. The guides are retained on their ends by two small catches located in holes in the left-side card-cage bracket. The other ends of the guides attach to the edge of a metal bracket. Both ends of the guides can be pried loose.

☐ Step 3: Disconnect connector J77 from the A17 Executive Processor board. Note the position of the index triangle on the multi-pin connector for correct replacement.

☐ Step 4: Lift the white, hinged tabs at the front and rear edges of the board. Pull the tabs upward until the A17 Executive Processor board separates from the A13 Mother board.

☐ Step 5: Remove the A17 Executive Processor board.

Replacing the A17 Executive Processor board is the reverse of the above procedure.

Note: *Insert the board edges into the plastic guides at each end of the card cage. Lower the board into position.*

Ensure that connector P104 on the A17 Executive Processor board is seated onto the of A13 Mother board connector. Push down firmly on the A17 Executive Processor board to connect it to the A13 Mother board.

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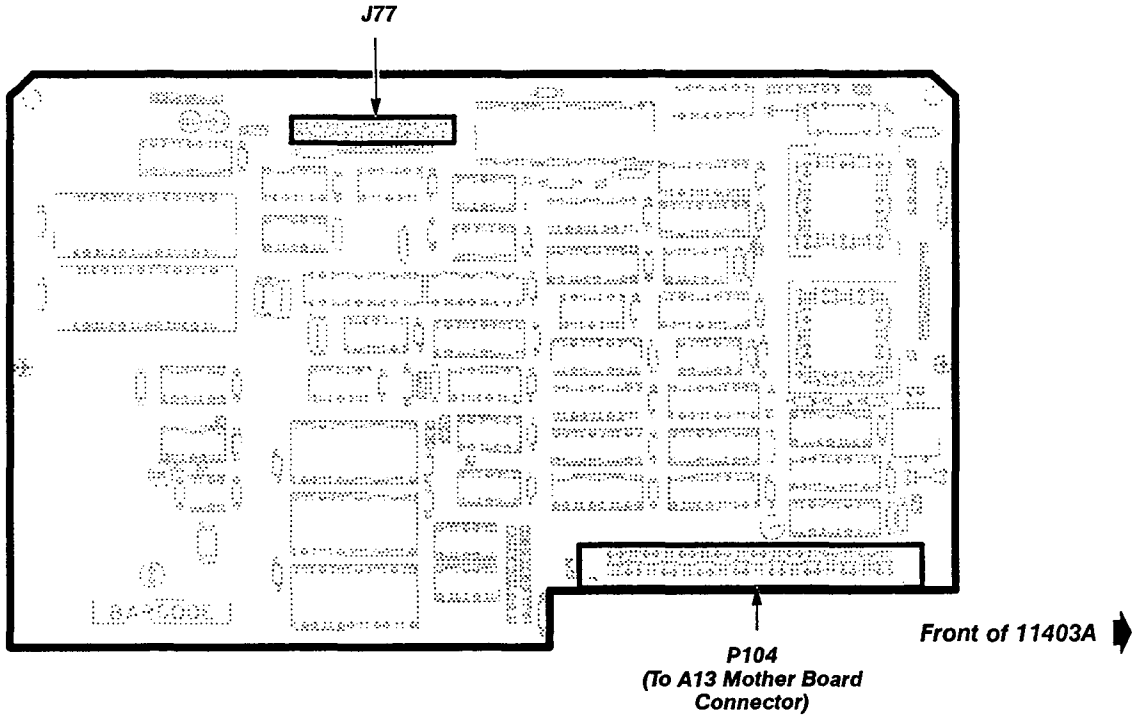


Figure 3-27 *— A17 Executive Processor Board Connector Locations*

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Removing and Replacing the A18 Memory Board—See Figures 3-1 3-3, 3-8, 3-27, and 3-28 for board, connector, screw, and index locations.

Use the following procedure to remove and replace the A18 Memory board:

☐ Step 1: Remove the three Torx drive screws that secure the CRT cover, and then remove the CRT cover.

☐ Step 2: Remove both plastic board guides from the top of the card cage. The guides are retained on their ends by two small catches located in holes in the left-side card-cage bracket. The other ends of the guides attach to the edge of a metal bracket. Both ends of the guides can be pried loose.

☐ Step 3: Disconnect connector J77 from the A17 Executive Processor board. Note the position of the index triangle on the multi-pin connector to ensure correct replacement.

☐ Step 4: Lift the white, hinged tabs at the front and rear edges of the board. Pull the tabs upward until the A18 Memory board separates from the A13 Mother board.

☐ Step 5: Remove the A18 Memory board.

Replacing the A18 Memory board is the reverse of the above procedure.

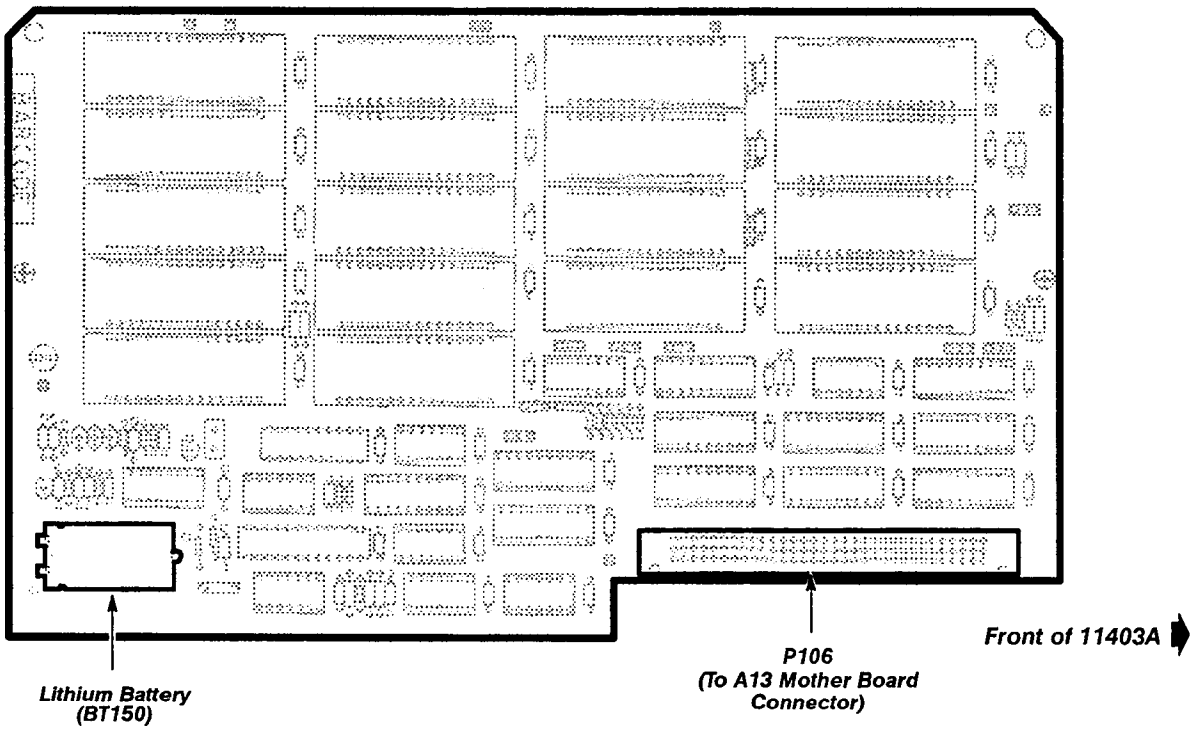


Figure 3-28 *— A18 Memory Board Connector and Battery Location*

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Note: *Insert the edges of the board into the plastic guides at each end of the card cage. Lower the board into position.*

Ensure that connector P106 is seated onto the A13 Mother board connector. Push down firmly on the A18 Memory board to connect it to the A13 Mother board.

WARNING

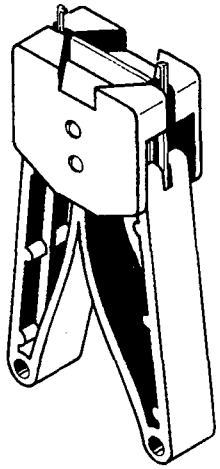
A lithium battery (BT150) is mounted on the A18 Memory board. ***The battery requires special handling for disposal.*** *Refer to the instructions on Lithium Battery Disposal and First Aid earlier in this section. Care is required when placing the A18 Memory board on metal surfaces. If some IC or battery leads are shorted, the battery may discharge or overheat and vent. (You can use plastic standoffs to prevent short circuits.)*

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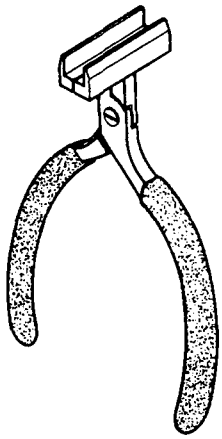
Removing and Replacing the FRU ICs

This section lists the procedures for removing and replacing the FRU ICs in the 11403A. See Figures 3-2, 3-29, 3-30, and 3-31 for board locations, IC locations, index information, and the proper tools for removing and replacing these ICs.

Destination Address Generator Integrated Circuits (DAG IC) and Direct Memory Address Integrated Circuit (DMA IC)—The DAG IC (U166) is located on the A6 Time Base board and the DMA IC is located on the A17 Executive Processor board. The ICs are seated in sockets and oriented to the sockets by a beveled corner (an IC corner and a corresponding socket corner are beveled while the others are notched).



DAG and DMA IC Extraction Pliers



DIP IC Extraction Tool

***Figure 3-29** — IC Extraction Tools*

Remove the DAG or DMA ICs using the following procedure:

CAUTION *Observe the special precautions described under Static-Sensitive Device Classification earlier in this section.*

- ☐ Step 1: Insert the hook-shaped, plier tips of the DAG IC and DMA IC extraction pliers (see Fig. 3-29) into the slots in the opposite corners of the IC socket.
- ☐ Step 2: Squeeze the handles of the pliers to lift the IC from the socket.
- ☐ Step 3: Carefully remove the IC without damaging the pins.

CAUTION *Avoid touching the IC or its socket contacts with your fingers. Finger oils can degrade reliability.*

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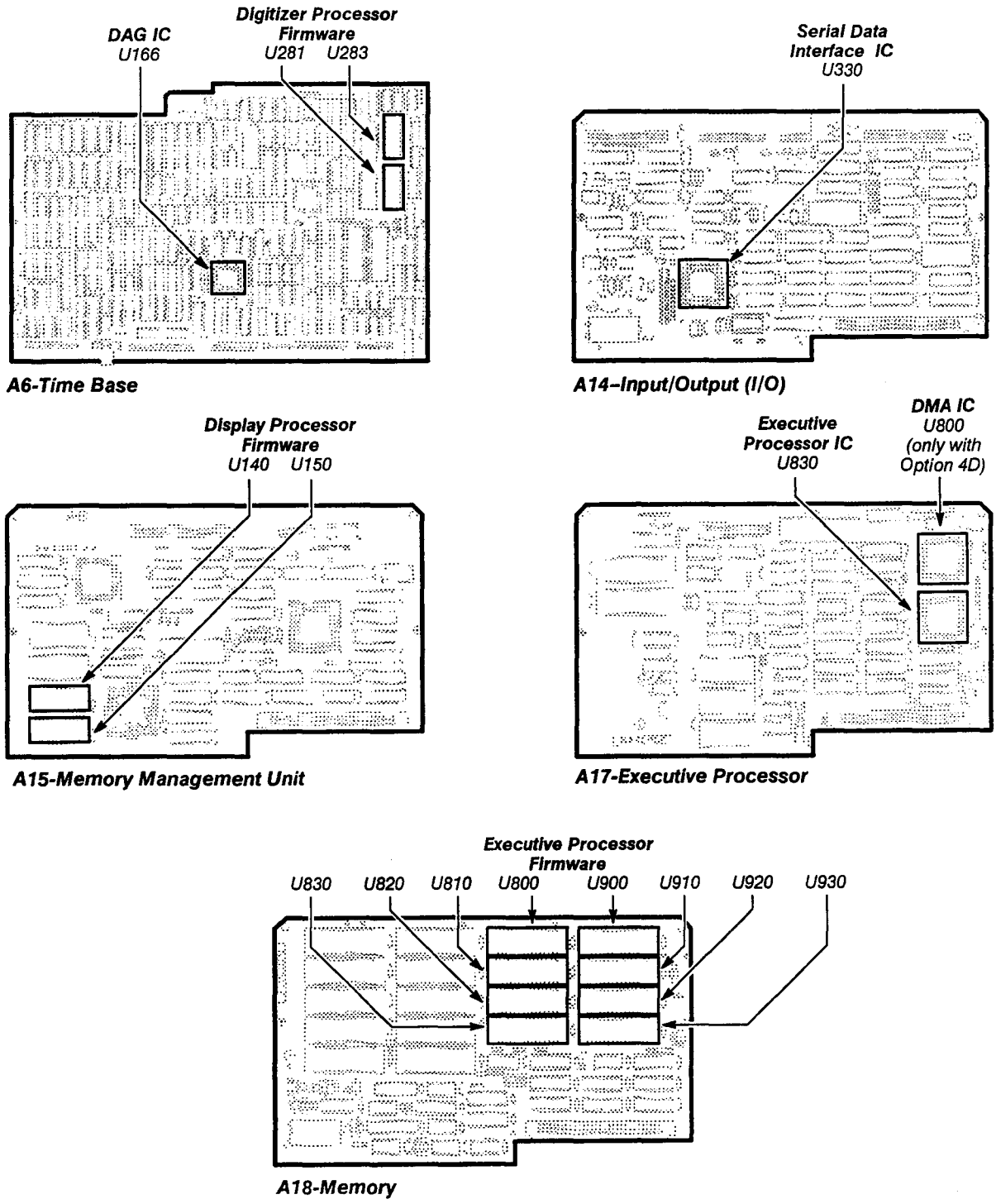
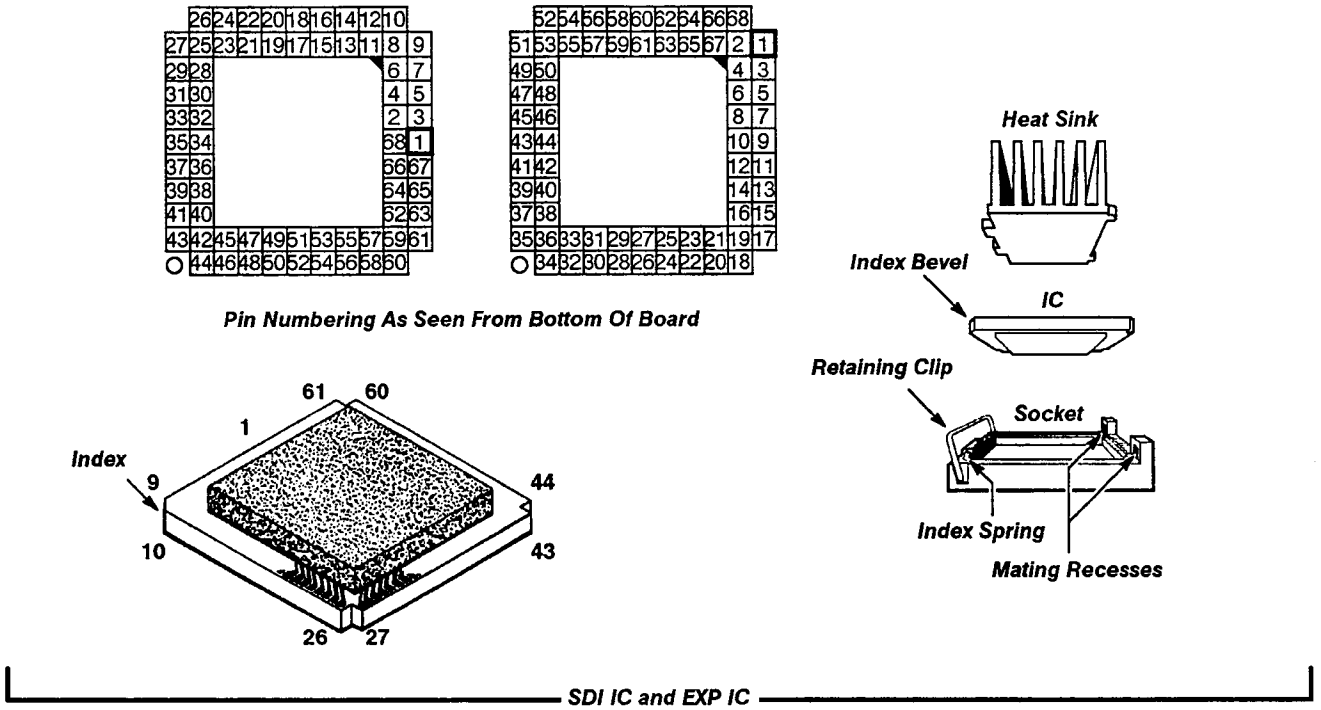


Figure 3-30 — FRU IC Location Detail

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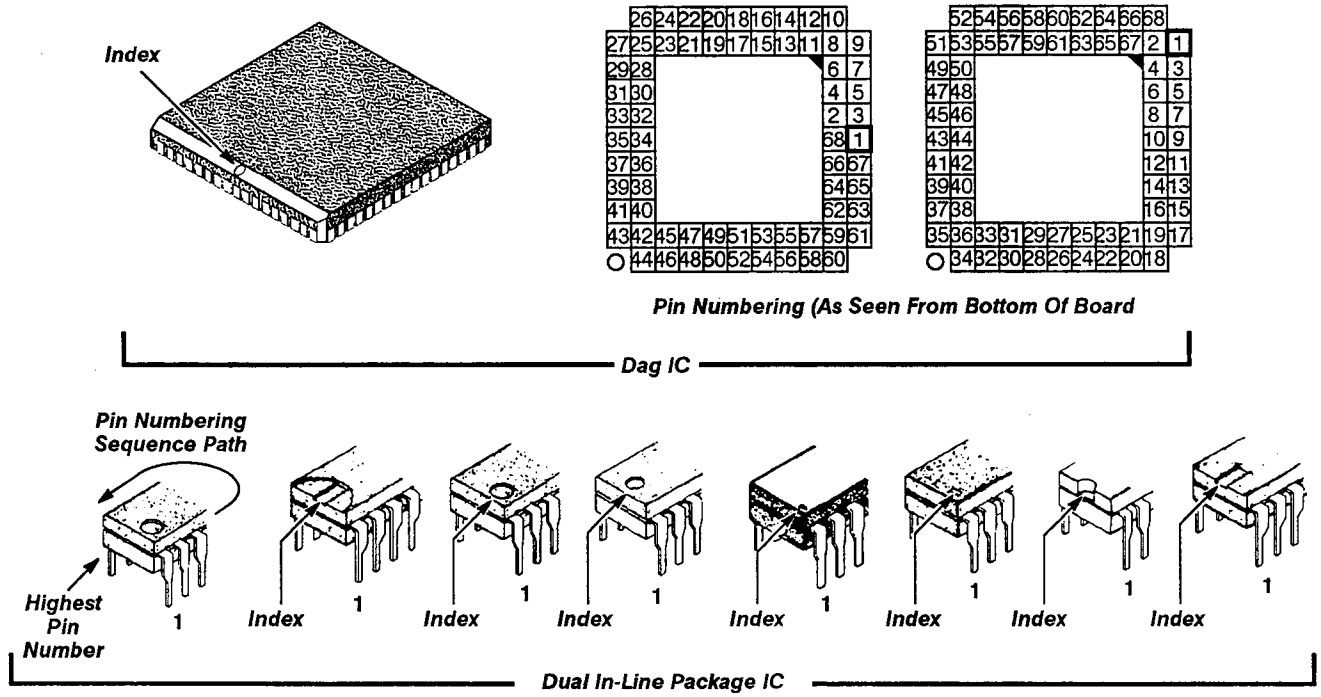


Figure 3-31 *— Semiconductor Pin Indexing Diagram*

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Use this procedure to replace the DAG or DMA IC:

Note: *One of the upper sides of the IC is also beveled. The dot on this side of the IC aligns with an arrow marked on the bottom of the IC socket.*

☐ Step 1: Align the beveled corner of the IC to the side of the socket to which the arrow points.

☐ Step 2: Ensure that the beveled IC corner also aligns with the outer beveled corner of the socket and that the IC is flat against the socket.

☐ Step 3: Ensure that all IC pins align correctly with their respective socket contacts.

☐ Step 4: Push down carefully on the IC to seat it in the socket.

Removing and Replacing the Serial Data Interface Integrated Circuit (SDI IC) and Executive Processor Integrated Circuit (EXP IC) – The SDI IC (U330) is mounted on the A14 I/O board and the EXP IC (U830) is located on the A17 Executive Processor board. These ICs have raised, ridged, heat sink covers and are oriented to their sockets by beveled corners. The other corners are notched to fit the socket edges. The beveled corner aligns with a spring (a small metal tab).

Use this procedure to remove the SDI IC or the EXP IC:

☐ Step 1: Remove the board containing the IC you are removing (either the A14 I/O board or the A17 Executive Processor board) from the card cage. See the removal and replacement procedures for these boards for more information.

☐ Step 2: Hold the cover in place (while simultaneously pushing it down down slightly) and move the retaining clip across the tabs to unfasten it.

CAUTION *Observe all the special precautions mentioned under Static-Sensitive Classification earlier in this section.*

☐ Step 3: Remove the cover slowly to prevent the IC from falling out.

Note: *Observe the orientation of the IC before removing it.*

☐ Step 4: Remove the IC with tweezers.

CAUTION *Avoid touching the IC or the socket contacts with your fingers. Skin oils can degrade reliability.*

Use this procedure to replace the SDI or the EXP IC:

☐ Step 1: Using tweezers, place the beveled corner of the replacement IC against the index spring.

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CAUTION *Do not damage the spring with the beveled corner. Shorting of the two corner contacts could result.*

☐ Step 2: Using the tweezers, arrange the other corners to fit evenly at the edges of the socket.

☐ Step 3: Set the cover flat on the IC with its end tabs properly aligned with, but not in, the mating recesses in the socket.

☐ Step 4: Push down on the cover, keeping it flat on the IC, and slide the cover end tabs into place. Hold the cover in this position while moving the retaining clip over the tabs at the other end of the cover.

☐ Step 5: Check that the cover is secure.

☐ Step 6: Replace the board in the chassis.

Removing and Replacing the Firmware ICs ("Dual In-Line Package" ICs) – The firmware ICs (FW ICs) are located on six separate boards. The boards and their respective FW are as follows:

- **A6 Time Base board** Digitizer FW (U281 and U283)
- **A15 MMU board** Display Processor FW (U140 and U150)
- **A18 Memory board** Executive Processor FW (U800, U810, U820, U830, U900, U910, U920, and U930)

The ICs listed above are ordered by one Tektronix Part Number. (the ICs may not be ordered separately.) For the 11403A Digitizing Oscilloscope, the firmware kit number is 020-1778-00.

Use the following procedure to remove and replace the FW ICs:

WARNING *Dangerous shock hazards may be exposed when covers are removed. Before proceeding, ensure that the PRINCIPAL POWER SWITCH is in the OFF position. Disconnect the 11403A from the power source. Disassembly should only be attempted by qualified service personnel.*

CAUTION *Observe all the special precautions described under Static-Sensitive Device Classification earlier in this section.*

Upgrading the Firmware—is outlined in the following steps:

☐ Step 1: Use the following procedure to prepare the 11403A for firmware upgrade:

- Set the PRINCIPAL POWER SWITCH to OFF and remove the power cord.
- Place the 11403A on its right side (if not already in this position).

☐ Step 2: Access the cardcage boards as follows:

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- Ensure that the PRINCIPAL POWER SWITCH is set to OFF and the power cord is disconnected.
- Remove the top panel cover.
- Remove the two plastic board guides from the top of the card cage (at the left rear).
- Remove the three Torx drive screws that secure the CRT cover and remove the cover (see Fig. 3-3).

☐ Step 3: Upgrade the A15 MMU board firmware as follows:

- Remove the A15 MMU board from the card cage. The A15 MMU board is typically located farthest from the outside (left side).
- Locate the two firmware ICs, U140 and U150.

CAUTION *Make sure that pin 1 is positioned correctly when replacing components.*

Note: *Use the DIP IC extraction tool for removing and replacing the ICs.*

Do not use the label on the IC for an index because it may have been applied incorrectly.

- Remove U140 and replace it with the upgraded IC. The last two-digit portion of the part number on the replacement IC should be the same as, or higher than, that on the removed IC. Make sure that pin 1 is oriented correctly.
- Similarly replace U150 with the upgraded IC.

☐ Step 4: Upgrade the A18 Memory board firmware as follows:

- Remove the A18 Memory board from the card cage. The A18 Memory board is typically located one slot from the outside (left side).
- On the A18 Memory board, replace the following ICs:

U800	U900
U812	U910
U820	U920
U830	U930

In each case, the last two-digits of the part number on the replacement IC should be the same as, or higher than, that on the removed IC. Again, make sure that pin 1 is oriented correctly.

- Replace the A18 Memory board in the card cage.

☐ Step 5: Upgrade the A6 Time Base board firmware as follows:

- Locate U281 and U283 on the A6 Time Base board. These components are found near the bottom front when the 11403A is positioned on its right side.

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- Replace U281 and U283.

  The last two digits of the part number on the replacement IC should be the same as, or higher than, that on the removed IC. Make sure that pin 1 is oriented correctly.

CAUTION

Clearing nonvolatile RAM erases all stored settings and waveforms. If you want to save stored settings and waveforms to an external device before clearing nonvolatile RAM, see the STORe command in the 11403A Programmer's Reference for information.

☐ Step 6: Clear NVRAM by powering off the 11403A, then holding down the WAVEFORM and TRIGGER major menu buttons while powering the 11403A back on. Release the buttons when the lights next to the major menu buttons stop flickering and remain lit.

☐ Step 7: Verify the serial number:

- Locate the CAL-LOCK pins, J450, on the A6 Time Base board (see Fig. 3-15), and install the terminal connector link.
- Connect a power cord.
- Connect a terminal or controller. Refer to the *User Reference* manual for more information on this connection.
- Set the PRINCIPAL POWER SWITCH and the ON/STANDBY switch to ON.
- Set necessary communication parameters; for example, baud rate.
- After the 11403A is powered-on, to establish communication from the terminal or controller, enter the following commands (<CR> is the return key):

  e<CR>
  v<CR>

- Verify that the serial number on the front panel matches the serial number in the **Ident** pop-up menu in the UTILITY major menu.
- If the numbers do not match, then enter the command:

  uid main:"**BXXXXXX**"<CR>

  where **XXXX** corresponds to the serial number digits found on the front panel serial number marker.
- Verify that the proper ID is now displayed in the **Ident** pop-up menu.

☐ Step 8: Remove the procedure setup as follows:

- Set the PRINCIPAL POWER SWITCH to OFF.
- Remove the J450 CAL-LOCK jumper on the A6 Time Base board.
- Replace the bottom cover, and set the 11403A upright.

☐ Step 9: Perform the final power-on and verification as follows:

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Note: *You must now perform the power-on sequence again for the 11403A to recognize the new CAL-LOCK strap configuration.*

- Set the PRINCIPAL POWER SWITCH and ON/STANDBY switch to ON.
- Verify that the 11403A powers-on and successfully completes the Self-Test diagnostics.
- Press the ENHANCED ACCURACY button, and verify that the 11403A successfully completes the sequence.

Note: *If problems are encountered check for the following:*

- *Proper orientation of components in the sockets*
- *All component pins are properly seated*
- *Components are installed in the correct location*

Checks After FRU Replacement

After any FRU is replaced, it is recommended that you perform the Checks and Adjustments procedures listed in Table 3-4, Checks Required After FRU Replacement.

Table 3-4 *— Checks Required After FRU Replacement*

FRU Replaced	Checks Required
CRT (Cathode Ray Tube)	Procedure 4 Display
Power Supply Module	Procedure 1 Power-On Diagnostics Procedure 2 Extended Diagnostics Procedure 3 Power Supply Procedure 5 Enhanced Accuracy Procedure 6 Calibration Output Accuracy Procedure 7 Probe Compensation Voltage Procedure 8 Acquisition Procedure 9 Vertical Input Offset Procedure 10a Sampler & Digitizer Performance Verification Procedure Procedure 11 ADC Linearity Procedure 12 Equivalent Time Step Response Procedure 13a Bandwidth Performance Verification Procedure Procedure 14 ADC RMS Noise Procedure 17a Time Base Performance Verification Procedure
A1 Plug-In Interface board	Procedure 5 Enhanced Accuracy (with a plug-in installed in each compartment)

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Table 3-4 *— Checks Required After FRU Replacement (Cont.)*

FRU Replaced	Checks Required
A4 Regulator board	Procedure 1 Power-On Diagnostics Procedure 2 Extended Diagnostics Procedure 3 Power Supply Procedure 5 Enhanced Accuracy Procedure 6 Calibration Output Accuracy Procedure 7 Probe Compensation Voltage Procedure 8 Acquisition Procedure 9 Vertical Input Offset Procedure 10a Sampler & Digitizer Performance Verification Procedure Procedure 11 ADC Linearity Procedure 12 Equivalent Time Step Response Procedure 13a Bandwidth Performance Verification Procedure Procedure 14 ADC RMS Noise Procedure 17a Time Base Performance Verification Procedure
A5 Acquisition board	Procedure 1 Power-On Diagnostics Procedure 2 Extended Diagnostics Procedure 5 Enhanced Accuracy Procedure 6 Calibration Output Accuracy Procedure 7 Probe Compensation Voltage Procedure 8 Acquisition Procedure 9 Vertical Input Offset Procedure 10a Sampler & Digitizer Performance Verification Procedure Procedure 11 ADC Linearity Procedure 12 Equivalent Time Step Response Procedure 13a Bandwidth Performance Verification Procedure Procedure 14 ADC RMS Noise Procedure 15 Trigger Sensitivity Procedure 16 Trigger Enhancement Procedure 17a Time Base Performance Verification Procedure Procedure 20 Triggering
A5A2 Trigger Enhancement	Procedure 1 Power-On Diagnostics Procedure 2 Extended Diagnostics Procedure 5 Enhanced Accuracy Procedure 16 Trigger Enhancement
A5A3 Strobe Drive	Procedure 1 Power-On Diagnostics Procedure 2 Extended Diagnostics Procedure 5 Enhanced Accuracy
A6 Time Base board	Procedure 17a Time Base Performance Verification Procedure
A7 CRT Socket board	Procedure 4 Display

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Table 3-4 *— Checks Required After FRU Replacement (Cont.)*

FRU Replaced	Checks Required	
A8 CRT Driver board	Procedure 4	Display
A9 Touch Panel board	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy
A10 Front Panel Control board	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy
A12 Rear Panel board	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy
A13 Mother board	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy
A14 Input/Output board	Procedure 1 Procedure 2 Procedure 5 Procedure 19	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy Input/Output
A15 Memory Management Unit board	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy
A17 Executive Processor board	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy
A18 Memory board	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy
SDI IC, DMA IC, and EXP IC	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy (with a plug-in amplifier installed in each compartment)
DAG IC	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy (with a plug-in amplifier installed in each compartment)
Firmware ICs	Procedure 1 Procedure 2 Procedure 5	Power-On Diagnostics Extended Diagnostics Enhanced Accuracy (with a plug-in amplifier installed in each compartment)

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Diagnostics and Troubleshooting

This section provides the information necessary to troubleshoot a faulty 11403A Digitizing Oscilloscope to the Field Replaceable Unit (FRU) level. In most cases an FRU is a circuit board. Two FRUs are exceptions, however: the Cathode Ray Tube (CRT) and the Power Supply Module.

There are two ways to troubleshoot this instrument:

1. Cross reference the error code output from the Kernel Diagnostics with the suspect boards listed in Tables 3-10, 3-13, and 3-15.
2. Use the built-in FRU **(?)Help** function available in the **EXTENDED DIAGNOSTICS** menu structure.

After replacing the faulty FRU, you will probably need to recalibrate the instrument. Conventional troubleshooting techniques are described at the end of this section to help identify faulty Power Supply, A4 Regulator board, CRT, A7 CRT Socket board, A8 CRT Driver board, A13 Mother board, or fuses.

Diagnostics Overview

Each subsystem (Executive, Display and Digitizer) processor runs a set of kernel diagnostics before running the Self-Test diagnostics. After the Display and Digitizer processors verify their support circuitry, these processors attempt to communicate with the Executive processor. If this link is successful, the Self-Test diagnostics verify the functionality of each subsystem. After all Self-Test diagnostics run, any failures cause the 11403A to enter Extended Diagnostics and to display the error index codes in the **EXTENDED DIAGNOSTICS** menu structure. Extended Diagnostics tests are a superset of the Self-Test diagnostics.

The Kernel diagnostics (low-level Self-Test diagnostics) and Self-Test/Extended Diagnostics produce and format error index codes differently, so these two sets of diagnostics are described separately.

Note that some of these tests that may indicate faulty FRU(s) are not run automatically during the Self-Test diagnostics (that is, some errors codes are only generated by manually selecting tests in the **EXTENDED DIAGNOSTICS** menu structure). Also, some tests may only indicate a faulty FRU(s) after achieving Enhanced Accuracy.

The following flowchart provides an overview of Kernel, Self-Test, and Extended Diagnostics.

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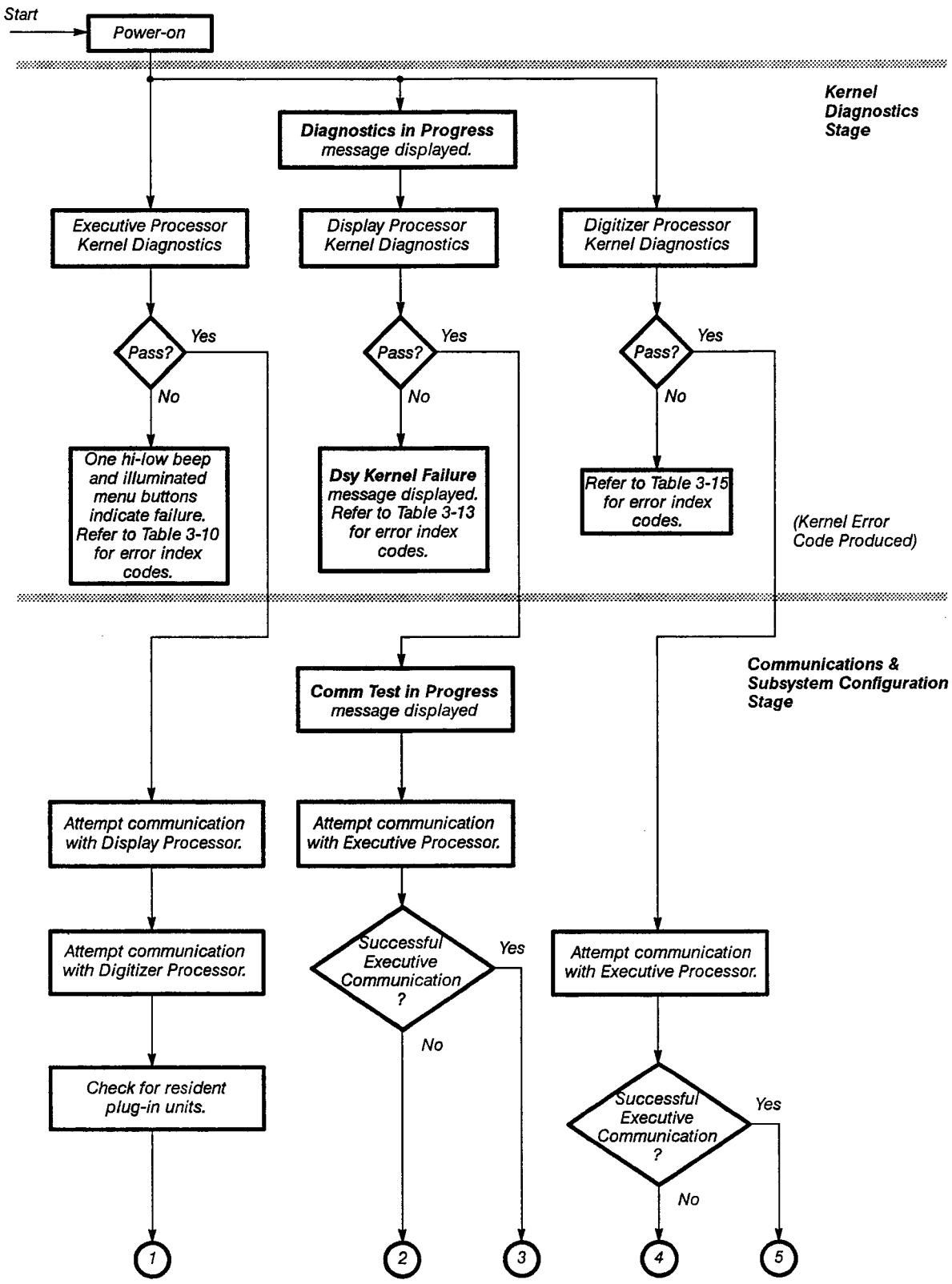


Figure 3-32 — *Diagnostics Flowchart*

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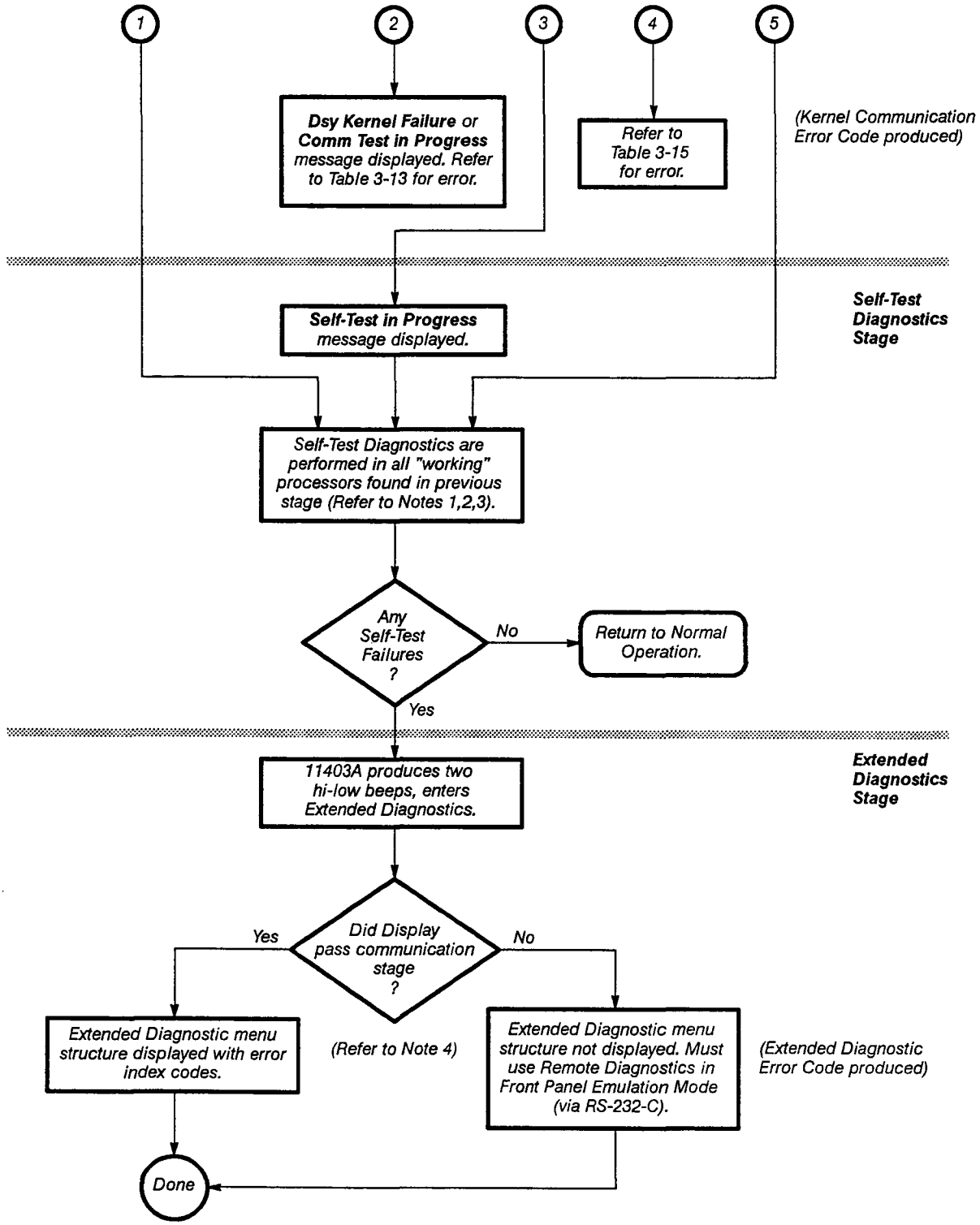


Figure 3-32 *— Diagnostics Flowchart (Cont.)*

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Notes:

1. *If the Executive processor has a kernel failure, no other processors can enter Self-Test diagnostics.*
2. *If the Display processor does not successfully communicate with the Executive processor, the Digitizer processor and plug-in units cannot enter Self-Test diagnostics.*
3. *If the Digitizer processor does not successfully communicate with the Executive processor, the plug-in units cannot enter Self-Test diagnostics.*
4. *The 11403A cannot enter normal operation from Extended Diagnostics unless both the Display and Digitizer processors have successfully communicated with the Executive processor.*

The EXTENDED DIAGNOSTICS Menu Structure

The **EXTENDED DIAGNOSTICS** menus format and display the error index codes. These menus are arranged in a four-level, hierarchical structure with the subsystem pop-up menu **Subsys** at the highest level.

The menu hierarchy (**Subsys**, **Block**, **Area**, and **Routine**) displays the error index codes. Each subsystem displayed in the **Subsys** pop-up menu can be selected and tested if there are functional processors and communication paths.

Each subsystem is further divided into parts or circuit blocks in the **Block** pop-up menu displayed for a selected subsystem. Similarly, each block is divided into circuit areas in the **Area** pop-up menu (the third level). The **Routine** pop-up menu (the fourth and lowest menu level) displays diagnostic information for the smallest selectable test unit.

The Extended Diagnostics error index codes

The Extended Diagnostics error index codes are five digit codes whose first character indicates the subsystem tested. The last four digits are hexadecimal (*hex*) numbers that list the block, area, routine, and specific failure mode. For example, E2321 is decoded as follows:

E Subsystem—Executive

2 Block name—Front Panel

3 Area name—Soft Keys

2 Routine name—Column Open

1 Failure Identity—specific failure mode

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Table 3-5 lists the subsystem character of an Extended Diagnostic error index code:

Table 3-5 *— Extended Diagnostics Error Index Code Descriptions*

Code	Meaning
E	Executive
D	Display
G	Digitizer
L	Left Plug-in Unit
C	Center Plug-in Unit
R	Right Plug-in Unit

Front panel controls are active during the Self-Test diagnostics sequence. Moving the controls may cause a test failure, forcing the 11403A into the Extended Diagnostics mode. Touch the **(E)Exit** label twice in succession to remove the **EXTENDED DIAGNOSTICS** menu structure and resume normal operation. If the Display or Digitizer processors have failed Kernel diagnostics, exiting diagnostics to normal operation will not be possible.

After the Self-Test/Extended Diagnostic programs have executed, error index codes are displayed next to the associated subsystem name in the **EXTENDED DIAGNOSTICS** menu structure. For each subsystem that had a failure, the display shows the first error encountered and the number of failures.

To get a more complete list of the error index codes in a subsystem, touch the selector of a failed subsystem (if the failed subsystem is not already selected) and touch the **Block** selector. Then touch the **Area** and **Routine** selectors to display the lowest level test routines in the selected block. The currently selected subsystem, block, area, and routine are shown below their labels at the bottom of the **EXTENDED DIAGNOSTICS** menu structure.

Several function and operating mode selectors are also available at the bottom of the screen. Selecting certain test routines may prevent you from selecting some of the operating modes. On the other hand, when you set some of the operating modes to certain states, some of the test routines may become unselectable.

The function and mode operators are:

- **(?)Help** – displays a list of FRUs for the currently selected routine. If the routine had a failure, the error index code for that routine is also displayed. The FRUs shown in the display are normally listed in a most-to-least probable cause for errors order. In some cases, the FRUs are listed according to their ease-of-replaceability to minimize the time required to identify the faulty FRU.
- In this menu you can move forward to the next routine or to the next failure by touching the appropriate selector in the lower portion of the screen (the selector behaves like a simple keypad). Scanning continues in circular fashion through all available subsystems.

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When you exit this menu, the 11403A returns to the menu level (**Subsys**, **Block**, **Area** and **Routine**) displayed when you invoked the **(?)Help** function. However, the displayed menu may be different if scanning was performed.

- **(-)Delete**—places an execution mark on the currently selected menu name (in the upper menu area) and all items beneath it, down to the **Routine** level. This process inhibits the actual execution of these routines when you invoke **Run**.

  Visually, execution marks are displayed on the screen as an asterisk (*) to the left of the menu name (in the upper menu area). If one, but not all, menu names in a menu are marked with an asterisk, the menu name at the next highest level (that is, from **Area** to **Block**) is preceded by an execution mark or a minus (-).

- **(+)Add**—removes the execution mark, if one is present, on the currently selected menu name and all execution marks on items (that is, blocks, areas, or routines) below the currently selected menu name to the **Routine** level. The execution mark, if present, changes from an asterisk (*) or minus (-) to a space.

- **(D)Debugger**—used by qualified service personnel only (cannot be selected).

- **E(Exit)**—touch this selector twice to terminate Extended Diagnostics and return the 11403A to normal operating mode. The first touch displays a confirmation promp at the top of the screen and the second touch terminates Extended Diagnostics.

- **(p)Loop**—toggles **On** and **Off**. When **On**, the selected test(s) is run for the number of iterations displayed.

- **(t)Terse**—toggles **On** and **Off**. When **On**, tests in the loop mode execute at the fastest rate, but the iteration (i.e. Loop) readout is not updated until you stop the test (by touching the screen or a button).

- **(x)All**—toggles **On** and **Off**. When **On**, all tests in the current menu are selected to run when started.

- **(s)Stop on Err**—toggles **On** and **Off**. When **On**, testing stops after the first failure.

- **(r)Run/(q)Quit**—starts or stops the currently selected tests.

  Note: *If you touch the screen or any front panel button while a test is running, the test will terminate when the current routine ends.*

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Diagnostic Menus

The upper part of the screen displays diagnostic menus containing items and fields. Menu items are selectable rows, while menu fields are columns of status information.

Four menus may appear in the menu area, one at a time: the **Subsys**, **Block**, **Area**, and the **Routine** pop-up menus. Entering any of these menus automatically selects a menu item (only one menu item may be selected at a time).

The **Subsys**, **Block** and **Area** menus are divided into four fields: execution mark, title, error index code, and failure count.

Execution Mark—The Execution Mark is a one-character field just before the title field and just after the keystroke selector identification. The three values of this field and their meanings are:

' ' All routines in the **Subsys**, **Block**, or **Area** menus are available for execution.

'*' No routines in the **Subsys**, **Block**, or **Area** menus are available for execution.

'–' One or more routines in the **Subsys**, **Block**, or **Area** menus are available for execution.

See the (–) Delete and (+) Add descriptions earlier in this section for more information.

Title—Title is a field containing the name of a specific hardware subsystem, block, or area. The title may contain up to ten ASCII characters (twelve characters are allowed for **Block** and **Area** titles).

Error Index Code—This is a field containing an index code. This field may display one of six types of status (indicating one of four types of tests:

"**pass**"	An automatic test has run successfully.
"**Yxxxx**"	A test has failed and the failure encountered in subsystem **Y** is **xxxx**. This index code contains one digit each for subsystem, block, area, and routine identification, and a test identification that gives information about the failure.
"****"	An automatic test has not yet been executed. When the test does execute, the test will provide **pass** or **Yxxxx** failure status.
"- - - -"	The test requires setup using the RS-232-C loopback connector. When run, this test provides **pass** or **Yxxxx** failure status. You must select this test to run it.
" " (blank)	Indicates that the test requires action from you (for example, the front panel verification tests), or that the test is for stimulus only. A blank does not provide failure status. You must select this test to run it.

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"????"	Indicates that an option was found that was not present in the current instrument configuration or that a subsystem was found that did not have a working communication path.

Failure Count—This field indicates the total number of routine failures (one per routine) currently encountered in the subsystem, block, or area. The failure count will never be more than the total number of routines in the subsystem. If no tests have been run or if no failures have occurred, this field remains blank.

Since the failure count field is an indication of routines with failures, it is possible to have a failure field count greater than the loop count (for example, there could be five routine failures after the first loop).

A field display of **65535+** indicates that the failure count field has exceeded 65534 and that an overflow condition has occurred.

Besides these four fields (execution mark, title, error index code, and failure count), the **Routine** pop-up menu contains three test-result fields.

Test Result Fields

Three test results fields contain information useful for troubleshooting and are in one of the following formats:

- test address, expected data, and actual data
- expected data lower bound (minimum), expected data upper bound (maximum), and actual data

Creating a Hardcopy

You may create a hardcopy of a menu when you press the hardcopy button on the 11403A's front panel. The 11403A sends the hardcopy to the printer attached to the PRINTER port. You may also obtain screen hardcopies from other menus (for example, from the help, interactive test, and hardware debugger menus).

After the hardcopy prints, the 11403A issues a formfeed to the printer. If no printer is attached, or if the printer is unable to print (for example, if the printer is off line or out of paper) the 11403A displays this warning in the Input/Prompt area:

Hardcopy absent or off line.

The hardcopy function may not be available for certain tests that require human interaction, such as touch-panel interactive tests, some display tests, and CRT/touch panel calibration patterns.

The knobs control screen intensity in the four main diagnostic menu levels. The touch panel on/off button enables or disables the touch panel.

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Running the Diagnostics from a Terminal

The RS-232-C port drives a terminal mode conforming to the ANSI 3.64 standard and providing a screen-driven, interactive user interface. Terminal mode is useful when either the display or touch panel is not functioning properly, or when you want to to run the diagnostics remotely with a modem and phone link.

Several single-keystroke commands are equivalent to front panel buttons. Others are terminal-only commands that don't appear on the display screen. The following terminal keystrokes also appear on the screen and are shown in quotes:

- **'B' < baud rate > < cr >** – followed by the baud rate and a carriage return, this keystroke allows you to change the default baud rate to any allowable baud rate. The default power-on baud rate is set by two internal jumpers located on the A14 I/O board (300, 1200, 9600, 19200). The default setting is 9600 baud.
- **'T'** – toggles between the current screen display and an ANSI-compatible display. The terminal should initially be set to ANSI mode.
- **'K'** – toggles between the current screen display and a Tektronix 4x05 (for example, the 4105 or 4205).
- **'L'** – toggles between the current screen display and a Tektronix 4x07 (for example, the 4107 or 4207).
- **'H'** – produces a hardcopy of the current diagnostic menu as described earlier in 'Creating a Hardcopy.'
- **'O'** – disables/enables the touch panel. Pressing this key is equivalent to using the TOUCH PANEL ON/OFF button.
- **'Q'** – when used in interactive test menus, this keystroke stops and starts the display information in the keypad prompt area. Pressing this key is equivalent to using the DIGITIZER RUN/ARMED – STOP button in these menus.

The 11403A must be in the Extended Diagnostic mode to gain access to the terminal mode diagnostics.

To exit terminal mode, cycle the power (turn the ON/STANDBY switch to STANDBY and then to ON) and then either enter the (Exit) keystroke twice to begin normal operation, or enter the appropriate L keystroke.

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Using System Mode (GPIB and RS-232-C)

The Self-Tests diagnostics and Extended Diagnostics are accessible using the two commands listed in Table 3-6.

***Table 3-6** — System Mode Commands*

Header	Argument	Notes
TEST		Set-only
TEST	**[XTND]**	Set-only
TEST	**[MAN]**	Set-only
DIAG?		Query-only

The **TEST** command invokes Self-Test diagnostics or Extended Diagnostics. The **TEST** command without arguments initiates Self-Tests diagnostics. The **TEST** command with argument **XTND** initiates Extended Diagnostics.

Refer to the 11403A *Programmer Reference* for more information on TEST and DIAG command syntax and usage.

The return of one of the two event codes listed in Table 3-7 to the GPIB and RS-232-C ports signals that diagnostic testing is complete.

***Table 3-7** — Event Code Descriptions*

Event Code	Explanation
460	Self-Test or Extended Diagnostics were completed successfully
394	Self-Test or Extended Diagnostics were completed and failed

In either case, a GPIB/RS-232-C controller may obtain pass/fail information through the **DIAG?** query.

The **TEST** command with the argument **MAN** invokes Extended Diagnostics (this is like entering Extended Diagnostics via the front panel UTILITY menu). This command allows the operator to gain remote access to the diagnostics through the RS-232-C interface.

CAUTION

The **TEST** *command with argument* **MAN** *violates normal GPIB protocols. When this command is used, the 11403A no longer responds to further GPIB command until normal operation is resumed.*

The **DIAG?** query returns pass/fail information from the most recent invocation of Self-Test or Extended Diagnostics. Examples of possible responses and explanations are:

DIAG PASSED: C????,C????,R????,d????

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This response indicates that the Self-Test diagnostics or Extended Diagnostic operation did not detect faults and there were no 11000-Series plug-in units installed. Had there been one or more 11000-Series plug-in units installed, this response would have indicated a 11403A-to-amplifier hardware communication problem.

DIAG PASSED: NONE

This response indicates that the Self-Test diagnostics or Extended Diagnostic operation did not detect test faults and that all plug-in compartments contain functional 11000-Series plug-in units.

DIAG FAILED: E1311, R????, E1711, E1721, E1731

This response indicates that the Extended Diagnostic operation detected test faults and that there is no 11000-Series plug-in unit installed in the right plug-in compartment.

DIAG FAILED: E1311, D1211, G1431, R????

This response indicates that the Self-Test diagnostics or Extended Diagnostic operation detected test faults.

DIAG BYPASSED

This response indicates that a power-on has occurred and that Self-Test diagnostics were bypassed by a jumper setting on the A14 I/O board.

Testing the Battery

The 11403A contains two lithium batteries to provide power when it is turned off. The following discussions will help determine if a battery has exceeded its lifetime and if it is causing the instrument to operate incorrectly (a battery's lifetime typically exceeds five years). If the battery voltage measures (at 20°C) equal to or greater than the voltages given, then the circuit should operate correctly from 0°C to 50°C. (The voltages are measured with instrument power off.)

Battery BT130 provides power for the real-time clock on the A14 I/O board. If the clock begins to lose time rapidly when the 11403A is turned off, the diagnostics will report that the **Real Time Clk (E42XX)** has failed or that the battery should be tested. If battery voltage measures less than 2.7 V, the most likely source of the problem is the battery. After replacing the battery, follow the instructions for battery disposal in the maintenance section.

Battery BT150 provides power for the nonvolatile RAM (NVRAM) on the A18 Memory board. If the diagnostics consistently reports an **NVRAM Battery (E141X)** failure over several power-on cycles, test the battery. If battery voltage measures less than 2.7 V, the most likely source of the problem is the battery. After replacing the battery, follow the instructions for battery disposal in the maintenance section.

Note: *Turning the 11403A off while the Extended Diagnostics is running an NVRAM memory test may cause the test to fail. If the diagnostics report an NVRAM battery failure, exit the diagnostics. This will rewrite the confidence words into the NVRAM. Turn off the 11403A for at least one hour. Then, turn*

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it back on. If the diagnostics still indicate an NVRAM battery failure, then the battery should be tested.

Before Calling Customer Service

If you suspect a problem with the 11403A, follow these steps before calling Tektronix Customer Service. Performing these steps can often correct apparent faulty instrument behavior and eliminate the need to return the instrument to Tektronix for service.

1. Power down the 11403A and power it up again.
2. If diagnostic errors appear during the power-up sequence, exit Diagnostics and attempt to run the Enhanced Accuracy mode.
3. After running Enhanced Accuracy, power down the 11403A and power it up again. No diagnostic failures should appear during the power-up sequence.
4. If these steps fail to correct the problem, clear the NVRAM as described below, rerun Enhanced Accuracy, power the 11403A down, and power it up again.
5. If these steps fail to correct the problem, note the events and conditions in effect when the problem occurred. What was happening, how was the instrument being used, and what error messages were displayed on the screen?
6. When you call Tektronix Customer Service, be prepared to give Customer Service personnel the serial number of the instrument and its firmware version numbers.

CAUTION

Clearing nonvolatile RAM erases all stored settings and waveforms. If you want to save stored settings and waveforms to an external device before clearing nonvolatile RAM, see the STORe command in the 11403A Programmer's Reference for information.

Clearing NVRAM

Some instrument failures may corrupt information stored in the 11403A's nonvolatile RAM. Symptoms include internal software error messages displayed at the top of the screen, and no response to operator input.

Note: *If you see the symptoms descrbed above, power down the 11403A and power it up again. If the symptoms disappear after cycling the power, it is not necessary to clear the nonvolatile RAM.*

You can clear the information stored in NVRAM by powering off the 11403A, then holding down the WAVEFORM and TRIGGER major menu buttons while powering the 11403A back on. Release the buttons when the lights next to the major menu buttons stop flickering and remain lit. When the power-on sequence is complete, you should see the following message at the top of the display:

TekSecure nonvolatile RAM erased - Instrument ID and enhanced accuracy constants retained

The Executive processor resets the NVRAM to a default state after it has performed its kernel diagnostics and before the Self-Test disgnostics begin.

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When the stored settings and waveforms are erased, the NVRAM is initialized by filling all but a few of the memory locations with a default value. The following items are unaffected by an NVRAM reset:

- Number of 11403A power-ons (POWERON?)
- 11403A power-on time (UP TIME?)
- 11403A serial number (UID? MAIN)
- Digitizer calibration constants

A Guide to the Field Replaceable Units (FRUs)

This section correlates Kernel Diagnostic error index codes with the components or boards suspected of causing each error. Suspect FRU(s) for Self-Test/Extended Diagnostics error index codes are identified by using the built-in FRU help function **(?)Help**, described under Self-Test/Extended Diagnostics earlier in this section.

The suspect FRU(s) in the following error index tables are listed in most-to-least probable cause order. If diagnostic errors occur, inspect the suspect FRU for loose connections and components and repeat the diagnostic test. If any diagnostic errors reoccur, replace the suspect FRU with a known good one. Make sure that the new FRU is configured exactly like the old one, and that installed firmware is the same version or later than the old firmware.

The error index codes and tests are divided into three groups based on the three 11403A subsystems: Executive, Display, and Digitizer processors. Each subsystem group has a table of kernel diagnostic error index codes. The Executive and Digitizer processors also have a table of manual test error index codes. These tables extend the confidence level of the 11403A's functionality. Amplifier (plug-in unit) error index codes are covered in the appropriate plug-in unit service reference manual.

If necessary, you may read kernel error index codes as TTL logic levels on circuit board pins using a logic probe.

Abbreviations of FRU Names

All active boards are listed in Table 3-8 with their respective abbreviations.

Table 3-8 — Board FRUs

FRU	Board/Assembly	Board No.
CRT	Cathode Ray Tube	
PIINT	Plug-In Interface board	(A1)
REG	Regulator board	(A4)
ACQ	Acquisition board	(A5)
TB	Time Base board	(A6)

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Table 3-8 — Board FRUs (Cont.)

FRU	Board/Assembly	Board No.
CRTSOC	CRT Socket board	(A7)
CRTDR	CRT Driver board	(A8)
TOUCH	Touch Panel board	(A9)
FPCTRL	Front Panel Control board	(A10)
FPBUT	Front Panel Button board	(A11)
REAR	Rear Panel board	(A12)
MOTHER	Mother board	(A13)
IO	Input/Output board	(A14)
MMU	Memory Management Unit board	(A15)
EXP	Executive Processor board	(A17)
MEM	Memory board	(A18)

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Abbreviations of Component and Module Names

All active components and modules are listed in Table 3-9 with their respective abbreviations. The Executive, Display, and Digitizer processor firmware are not separate components, but are packaged in a single firmware (FW) kit.

Table 3-9 — Component Module FRUs

FRU	Component/Module
FW	Executive Processor Firmware
FW	Display Processor Firmware
FW	Digitizer Processor Firmware
SDI	Serial Data Interface IC
DAG	DAG IC
PS	Power Supply Module

Executive Subsystem Error Index Codes—The codes are listed in Table 3-10 with the suspected FRUs.

Table 3-10 — Executive Processor Kernel Error Index Codes

Error Index$_{hex}$	Hybrid/IC FRUs	Suspect Board FRUs
1F - 1D		MEM, EXP
1C - 19	FW	MEM
18 - 16		IO, EXP
15		EXP
14		EXP, MEM
13		FPCTRL, IO, MPU
12		IO, EXP
11		IO, EXP
10 - 0E		REAR, IO, MPU
0D		MMU, EXP
0C		EXP, MEM
0B		REAR, IO, EXP

Bit patterns for the listed hexadecimal error index codes are displayed with the front panel MENUS LEDs in bottom-to-top bit order. The UTILITY label represents the MSB (most significant bit) and the WAVEFORM label represents the LSB (least significant bit). When lit, the LEDs represent a one.

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For example, error index code 12*hex* causes the UTILITY and TRIGGER LEDs to light.

The status LEDs (DS306 and DS307) on the A17 Executive Processor board will flash while the Kernel diagnostic tests are executing. If a kernel failure is detected, one or both LEDs will remain on. Table 3-11 lists the various LED configurations and their significance.

You may also read the Executive processor subsystem error bits from the A17 Executive Processor board test points TP201 (MSB) to TP205 (LSB). See Figure 3-33 for the location of these test points and status LEDs. The bits are high (+5 V) true.

Table 3-11 *– Executive Processor Status LED Configuration*

DS307	DS306	Significance
ON	ON	Power-On
ON	OFF	Kernel Tests Executing
OFF	ON	Kernel Tests Failed
OFF	OFF	Kernel Tests Finished

Table 3-12 lists the Executive processor manual tests and verification procedures. If the conditions specified in the verification procedure listed are not met, then the suspect FRUs can be found using the **(?) Help** function.

These tests are performed manually and produce no error index code displays. They are included to help you locate faulty boards that the Kernel or Self-Test diagnostics may not have located. Interconnections, such as the A13 Mother board cables and the power supply boards, are not listed. However, these interconnections are considered as possible problem sources.

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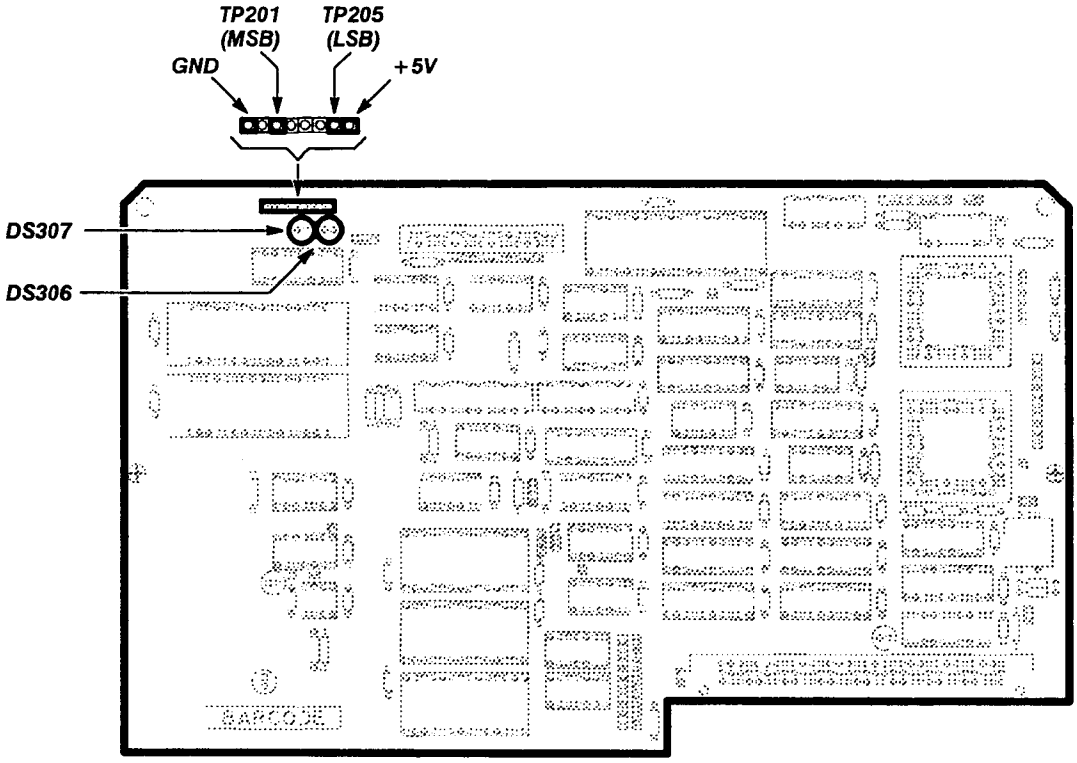


Figure 3-33 *— A17 Executive Processor Board Test Point and Status LED Locations*

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Table 3-12 — Executive Processor Manual Tests

Test	Verification Procedure
Front Panel	
Verify	
Hard Keys	This test allows you to interactively verify the operation op-peration of the hard keys. The test verifies key operation with both visual and audio feedback. The test requires your interaction and can be run only in the **Routine** pop-up menu with the **All** and **Loop** modes set to **Off**. Once the test is invoked, you can press any of the hard keys on the oscilloscope to verify that the correspond-ing image of the key on the screen is highlighted, that the associated LED is turned on, and that an audio click is generated.
Soft Keys	This test allows you to interactively verify the operation of the soft keys. The test verifies the operation of a key with both visual and audio feedback. This test requires your interaction and can be run only in the **Routine** pop-up menu with the **All** and **Loop** modes set to **Off**. Once this test is invoked, you can touch any of the soft keys in the oscilloscope to verify that a touch box is drawn around the soft key on the screen and that an audio click is generated.
Knobs	This test allows you to turn either of the knobs and verify their operation. The test verifies knob movement with visual feedback. This test requires your interaction and can be run only in the **Routine** pop-up menu with the **All** and **Loop** modes set to **Off**. Once this test is invoked, you can turn either of the knobs on the oscilloscope and verify that the correspond-ing knob pointer on the screen rotates and that the asso-ciated counter value changes.
Front Panel	
Test Pattern	
Gray Scale Green Grid White Grid Red Display Green Display Blue Display HV Reg Dsply	These tests allow you to examine and adjust the CRT color adjustments. The tests require your interaction and can be run only in the **Routine** pop-up menu with the **All** and **Loop** modes set to **Off**. Once one of the tests is invoked, you can examine and adjust the CRT by following the procedure outlined in the checks and adjustments section.

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Table 3-12 *– Executive Processor Manual Tests (Cont.)*

Test	Verification Procedure
Internal I/O	
Tone Gen	
Ramp Tone	This test verifies the oscilloscope's ability to generate tones through its internal speaker. The test requires your interaction and can be run only in the **Routine** pop-up menu with the **Loop** mode set to **On** and the **Terse** and **All** modes set to **Off**. After invoking this test, you should verify that a high-speed clicking sound occurs.
Real Time Clk	
Calibrate	This test allows you to check and adjust the period of the Real Time Clock. The test requires your interaction and can be run only in the **Routine** pop-up menu with the **All** and **Loop** modes set to **Off**. Once this test is invoked, you can examine and adjust the real time clock period following the procedure outlined in Procedure 19, Input/Output in the checks and adjustments chapter.
External I/O	
Printer	
Pattern	This test prints a set of patterns (all printable ASCII characters) to help you verify the external printer interface. The test requires your interaction and can be run only in the **Routine** pop-up menu with the **All** mode set to **Off**. Before running this test, you should connect a Centronics-compatible printer to the PRINTER connector on the oscilloscope's rear panel.
RS-232	
Extern Loop	This test verifies parts of the external RS-232-C interface. The test requires your interaction and can be run only in the **Routine** pop-up menu with the **All** mode set to **Off**. Before running this test, you should connect an external loopback connector to the RS-232-C connector on the rear panel of the oscilloscope.
GPIB	
Inrpt Reset Reset Status Data Lines Interrupt	These tests verify the Executive processor interface to the internal GPIB circuitry. The major external GPIB functions are not tested. These tests requires your interaction and can be executed only in the **Routine** pop-up menu with the **All** and **Loop** modes set to **Off**. Before executing these tests, you should disconnect the oscilloscope from the GPIB connector.

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Display subsystem error index codes—These index codes are listed in Table 3-13 along with the suspect FRUs.

Table 3-13 *— Display Processor Kernel Error Index Codes*

Error Index*hex*	Suspect Hybrid/ IC FRUs	Suspect Board FRUs
1 - 4	FW	MMU
5 - 7		MMU

The name of the first Display kernel test that fails is displayed on the screen. The Display processor error index codes is read from the A15 MMU board test points DIAG0 (LSB) to DIAG2 (MSB). The bits are high (+5 V) true.

The status LEDs (DS201 and DS200) on the A15 MMU board will flash while the Kernel diagnostic tests are running. If a kernel failure is detected, then one or both LEDs will remain on. Table 3-14 lists the various LED configurations and their significance. See Figure 3-34 for the location of these test points and status LEDs.

Table 3-14 *— Display Processor Status LED Configuration*

DS200	DS201	Significance
ON	ON	Power-On
ON	OFF	Kernel Tests Executing
OFF	ON	Kernel Tests Failed
OFF	OFF	Kernel Tests Finished

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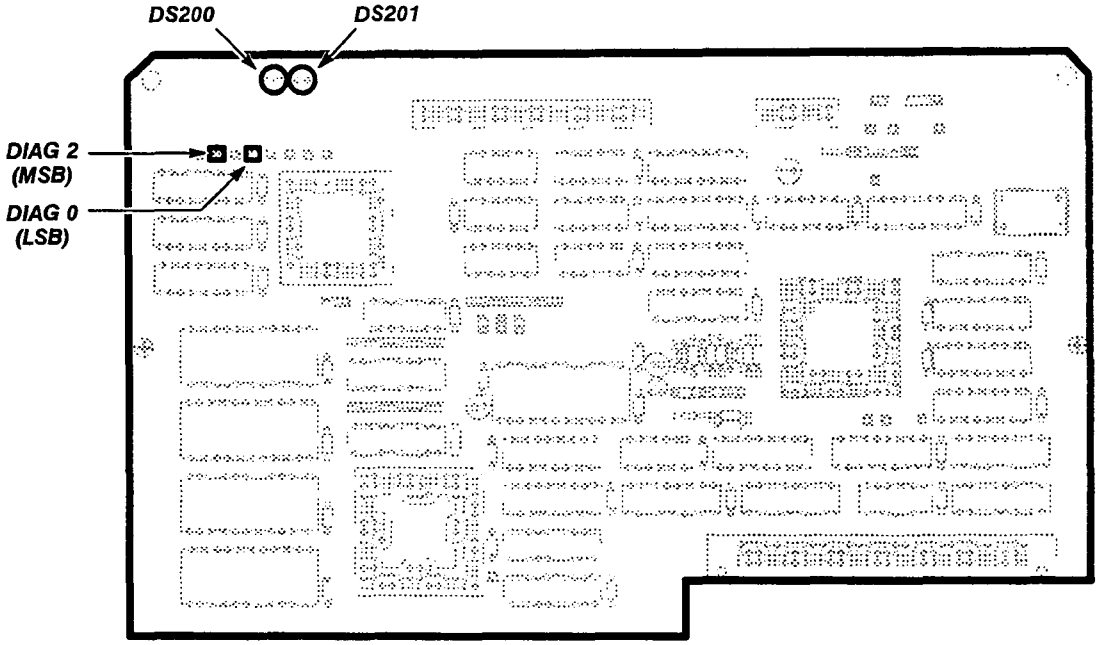


Figure 3-34 *— A15 MMU Board Test Point and Status LED Locations*

Digitizer Subsystem Error Index Codes—These error index codes are listed in Table 3-15 along with the suspect FRUs.

Table 3-15 *— Digitizer Processor Kernel Error Index Codes*

Error Index*hex*	Suspect Hybrid/ IC FRUs	Suspect Board FRUs
1F - 1E		TB
1D - 1A	FW	TB
19 - 17		TB
16		TB, MMU

The 11403A reads the error index code bits of the first Digitizer Kernel test that fails from the A6 Time Base board test connector J290, pins 2 (LSB) to 6 (MSB). See Figure 3-35 for the location of these status pins. The bits are high (+5 V) true.

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The status LEDs (DS90 and DS92) on the A6 Time Base board flash while the Kernel diagnostic tests are running. If a kernel failure is detected, one or both LEDs remain on. Table 3-16 lists the various LED configurations and their significance. See Figure 3-35 for the location of this test connector and the status LEDs.

Table 3-16 *— Digitizer Processor Status LED Configuration*

DS90	DS92	Significance
ON	ON	Power-On
ON	OFF	Kernel Tests Executing
OFF	ON	Kernel Tests Failed
OFF	OFF	Kernel Tests Finished

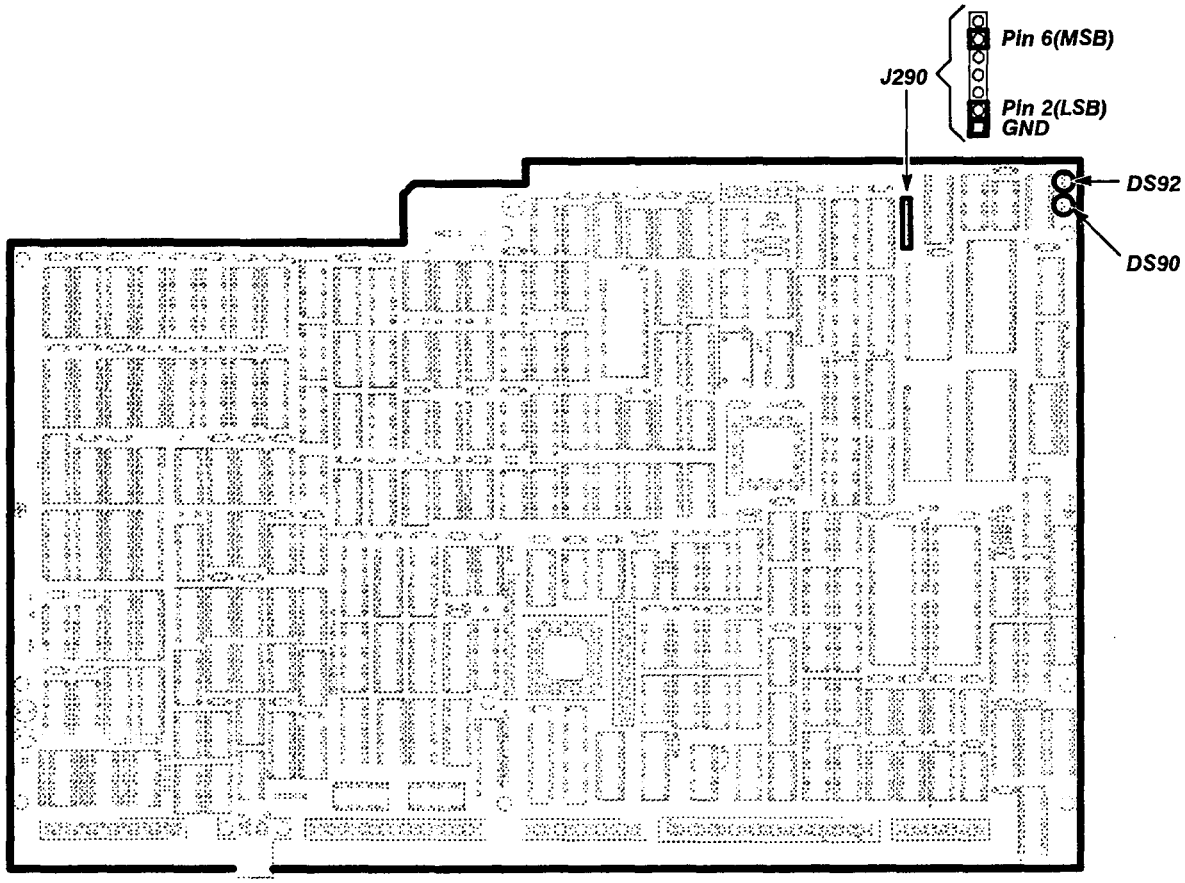


Figure 3-35 *— A6 Time Base Board Test Connector and Status LED Locations*

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Table 3-17 lists the Digitizer Processor manual test, the verification procedures, and the suspect board FRUs. If the conditions specified in the verification procedure listed are not met, then the board FRUs listed are suspect.

These tests are performed manually by selecting them individually. They may not produce error index code displays. They are included to help you locate faulty boards that the Kernel or Self-Tests diagnostics may not have located. Interconnections (such as the A13 Mother board, cable, and the Power Supply module interconnections) are not listed, but are considered as possible problem sources.

Table 3-17 *— Digitizer Processor Manual Tests*

Error Index	Verification Procedure
Points Acq	
FP Cal Refs	
FP 1 kHz	This test verifies that the front panel CALIBRATOR can generate a 6 V peak-to-peak, 1 kHz square wave centered around 0 V. When the test is invoked, you can use a test oscilloscope to verify the waveform present on the front panel CALIBRATOR BNC. See Table 2-2 for a description of the test oscilloscope required.
FP 1 MHz	This test verifies that the front panel CALIBRATOR can generate a 6 V peak-to-peak, 1 MHz square wave centered around 0 V. When this test is invoked, you can use a test oscilloscope to verify the waveform present on the front panel CALIBRATOR BNC. See Table 2-2 for a complete description of the test oscilloscope required.
FP -10.000 V FP -5.000 V FP -2.5000 V FP -1.000 V FP -100.00 mV FP 0.0000 V FP +99.951 mV FP +999.51 mV FP +2.4988 V FP +4.9976 V FP +9.9951 V	These tests allow you to check and adjust the output of the front panel CALIBRATOR. Once the tests are invoked, you can use a digital multimeter to check and adjust the voltage present on the front panel CALIBRATOR BNC. See Procedure 6, Calibration Output Accuracy, in Chapter 2.

Note: *In Table 3-17, Points Acq means points acquired, Cal Refs means calibrator references, and FP refers to the Front Panel.*

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Enhanced Accuracy Mode Troubleshooting

Table 3-18 lists the error messages that may be displayed in the Enhanced Accuracy mode and the suggested corrective actions. Enhanced Accuracy mode is available after a 20-minute warmup period.

***Table 3-18** — Enhanced Accuracy Mode Error Messages and Troubleshooting*

Error Message	Suggested Troubleshooting
A/D Out of Specification	Replace the A5 Acquisition board
A/D Quantizer 1	Replace the A5 Acquisition board
A/D D/A Converter	Replace the A5 Acquisition board
A/D Quantizer 2 Positive	Replace the A5 Acquisition board
A/D Quantizer 2 Negative	Replace the A5 Acquisition board
Main Time Interpolator	Replace the A5 Acquisition board
Window Time Interpolator	Replace the A5 Acquisition board
Main Fine Holdoff	Replace the A5 Acquisition board
Window Fine Holdoff	Replace the A5 Acquisition board
Main Trigger Level	Replace the A5 Acquisition board and/or the A1 Plug-in Interface board
Window Trigger Level	Replace the A5 Acquisition board and/or the A1 Plug-in Interface board

Note: *In Table 3-18, A/D means analog-to-digital and D/A means digital-to-analog.*

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Troubleshooting Other Components

Power Supply Module

This procedure requires an Extended Diagnostics power supplies troubleshooting fixture. Refer to Table 2-2 for a complete description of the equipment required.

Module Troubleshooting—If any Power Supply module problems are present, they appear when the ON/STANDBY switch is set to ON. If the green light beside the ON label fails to light, check for the following:

- The PRINCIPAL POWER SWITCH located on the back panel is in the ON position.
- The LINE VOLTAGE SELECTOR on the back panel is set to the same voltage as the functional power source that the line cord is connected to.
- The fuse is good. If the fuse is blown, replace it.
- The fan is exhausting air from the 11403A when the ON/STANDBY switch is ON. A defective fan causes an over-temperature shutdown in the power supply.

If these checks fail to correct the problem, connect the Extended Diagnostics 11000-Series Power Supplies Test Fixture to the Power Supply module (refer to the documentation accompanying the test fixture for troubleshooting techniques). The test fixture indicates which power supply voltage source is at fault.

To help isolate the source of the problem, set the 11403A's ON/STANDBY switch to STANDBY and disconnect the suspected faulty voltage source from the Power Supply module. Set the ON/STANDBY switch to ON. If the test fixture does not record a fault, then you have verified the suspected faulty power source. This procedure is only effective for externally shorted power supplies. Refer to the documentation accompanying the test fixture for more troubleshooting information.

A4 Regulator Board

This board is implicitly verified. In other words, if all other FRUs pass diagnostic testing, you can assume that the A4 Regulator board is operating correctly.

CRT, A7 CRT Socket board, or A8 CRT Driver Board

This procedure requires a test terminal and a compatible RS-232-C serial interface cable. Refer to Table 2-2 for a complete description of the equipment required.

Module Troubleshooting—If the 11403A powers-on (the ON/STANDBY light is on), but the display gives scrambled information or none at all, then the CRT and A8 CRT Driver board are suspect. The following two procedures can help you determine whether the A15 MMU board or one of the CRT units (either the CRT, the A7 CRT Socket board, or the A8 CRT Driver board) is at fault.

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- With power off (ON/STANDBY switch to STANDBY), remove the top cover, then turn the power on. Observe the two LEDs on the A15 MMU board and those on the A17 Executive Processor board in the card cage. These LEDs should flicker on and off until the diagnostic tests are complete and then all turn off. If any of these LEDs remain lit, it indicates a problem with the board on which the LED resides. If all LEDs turn off, then the CRT, A7 CRT Socket board, or the A8 CRT Driver board is suspect.
- With power off, connect a test terminal (ANSI 3.64-compatible) to the 11403A using an RS-232-C cable. Touch the screen during the full power-on cycle to force a diagnostic error and make the 11403A enter Extended Diagnostics. On the test terminal type **T** to display the **EXTENDED DIAGNOSTICS** menu on the terminal display. If the displayed errors are only for the front panel touch screen, then the CRT, the A7 CRT Socket board or the A8 CRT Driver board is at fault. Note any other errors and use Table 3-5, earlier in this section, to identify the suspect subsystem.

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A13 Mother Board

This board is implicitly verified. In other words, if all other FRUs pass diagnostic testing you can assume that the A13 Mother board is operating correctly.

Testing Fuses

The A14 I/O board has four fuses (see Fig. 3-36). F200 protects the line supplying +5 V to the A12 Rear Panel board. F800 protects the line supplying +5 V to the A10 Front Panel Control and A9 Touch Panel boards. F600 protects the line supplying +15 V to the A14 I/O board, card cage, A10 Front Panel Control board, A9 Touch Panel board, A11 Front Panel Button board, and A12 Rear Panel board (reduced to +12 V). F602 protects the line supplying -15 V to the A14 I/O board, card cage, A10 Front Panel Control board (reduced to -5 V), and A12 Rear Panel board (reduced to -12 V).

- F200 protects the line supplying +5 V to the A12 Rear Panel board. If diagnostics report failure of all three ports (RS-232-C, GPIB, and PRINTER), this fuse is the probable suspect (assuming that the ribbon cable to the A12 Rear Panel board is connected). When tested with a multimeter, this fuse should measure less than 1.5 V.
- F800 protects the line supplying +5 V to the A10 Front Panel Control board and the A11 Front Panel board. If the diagnostics report both an A9 Touch Panel board failure and knob failures, this fuse is one possible problem source. When tested with a multimeter, resistance across this fuse should measure less than 1 Ω.
- F600 protects the line supplying +15 V to the A14 I/O board temperature sensor and tone generator, the lights of the A11 Front Panel Button board, the A9 Touch Panel board, the A12 Rear Panel board's RS-232 output line drivers, the card cage, and the A18 Memory board's NVRAM. If the NVRAM battery test and the **RS-232 External Loop Back** test fail (but the **Internal Loop Back** test passes), and the A11 Front Panel Button board's lights, temperature sensor, and tone generator are off, this fuse is the probable suspect. When tested with a multimeter, resistance across this fuse should measure less than 1 Ω.
- F602 protects the line supplying -15 V to the A14 I/O board temperature sensor and tone generator, A12 Rear Panel board's RS-232 output line drivers, the A9 Touch Panel board, and the card cage. If the temperature sensor, tone generator, and **RS-232 External Loop Back** tests fail (but the **Internal Loop Back** test passes), this fuse is the probable suspect. When tested with a multimeter, resistance across this fuse should measure less than 1 Ω.

The A14 I/O board uses on-board +15 V and -15 V supplies to operate the temperature sensor and tone generator. Of the other cardcage boards, the A18 Memory board uses the +15 V supply to operate the NVRAM circuitry. The information above and in Table 3-19 will help you identify a failure of one of these fuses. If a test fails, then check the fuses.

CAUTION

Using a replacement fuse with an incorrect current rating may cause the ribbon cables to melt and create fire danger during a component fault.

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When you must replace a fuse, unsolder it from the board, but be careful not to damage the board's solder pads. (It may be helpful to straighten the fuse leads on the rear of the board before removing them from their holes in the circuit board.) See Chapter 5 for the correct fuse values and part numbers.

Table 3-19 *— A14 I/O Board Fuse Failures*

Fuse	**Executive Kernel Test Failure** (refer to Table 3-5)	**Self-Test/Extended Test Failure**	
F200 open	10*hex* (GPIB Interrupt)		
F800 open	13*hex* (Front Panel Inter) **Note:** *The front panel lights do not work, so the code must be read from the error status test points (TP200–TP205) on the A17 Main Processor board.*		
F600 open	Passes the Kernel diagnostic tests, but the front panel lights are not lit.	Executive Control NVRAM Battery *Data Lines *Addr/Data Internal I/O Temp Sensor Comparator *Tone Gen *Ramp Tone (works) **Note:** *The front panel lights, soft keys, and hard keys do not work.*	E1411 3 E1411 3 E1411 1 E1421 1 E1431 1 E3111 1 E3111 1 E3111 1 — —
F602 open	OE*hex* (Front Panel Inter) **Note:** *The tone generator has a very different tone.*		

**indicates a manual test forced by the operator. The test is not automatically executed by Self-Test diagnostics.*

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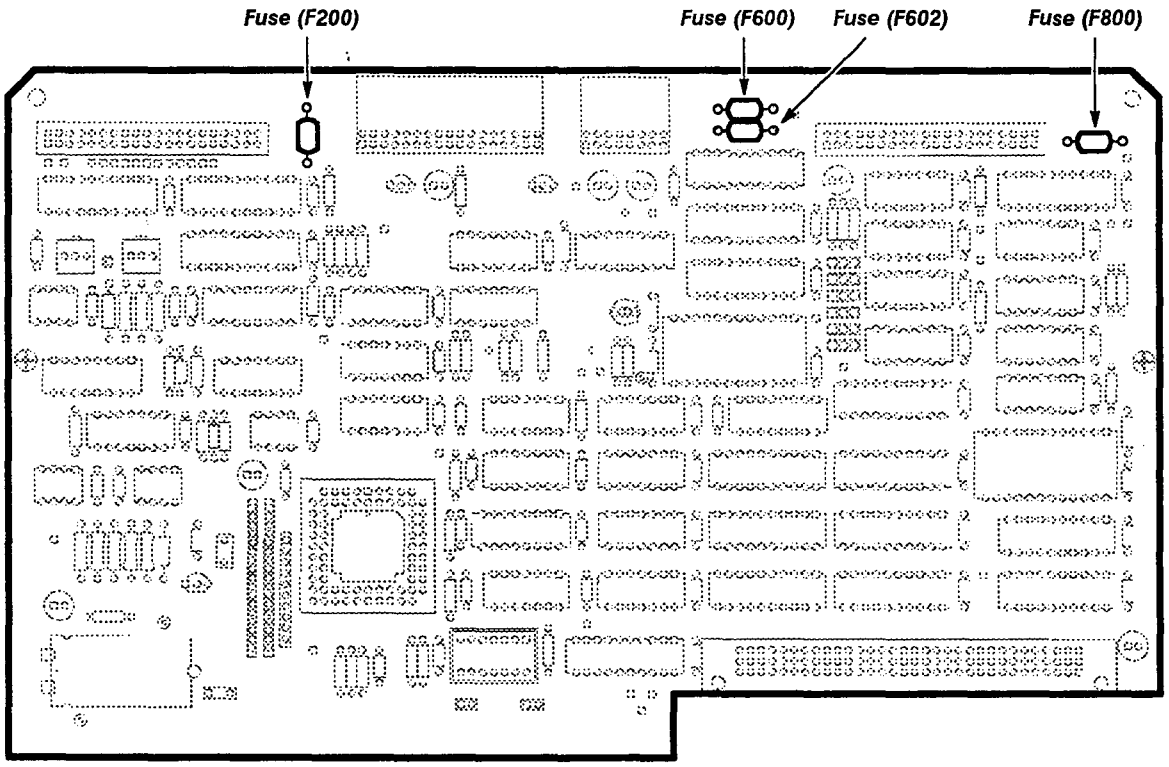


Figure 3-36 *— A14 I/O Board Fuse Locator Diagram*

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Theory of Operation

The 11403A Digitizing Oscilloscope is a high-resolution instrument with three plug-in unit compartments. It accommodates up to 12 input channels. The features of this instrument include:

- Sweep rate range of 1 ns/division to 100 s/division
- Autoset-adjusted display for viewing and for further manual adjustment
- Windows for viewing expanded sections of a trace
- Self-Test diagnostics to assure continuous accuracy of waveform data and measurements
- Digital waveform storage and display
- On-board measurement capabilities
- Menu-driven touch-screen operation
- RS-232-C, GPIB, and printer interfaces
- Color display

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System Functional Overview

The following paragraphs of this section describe and illustrate the major functional blocks of the 11403A (see Fig. 4-1).

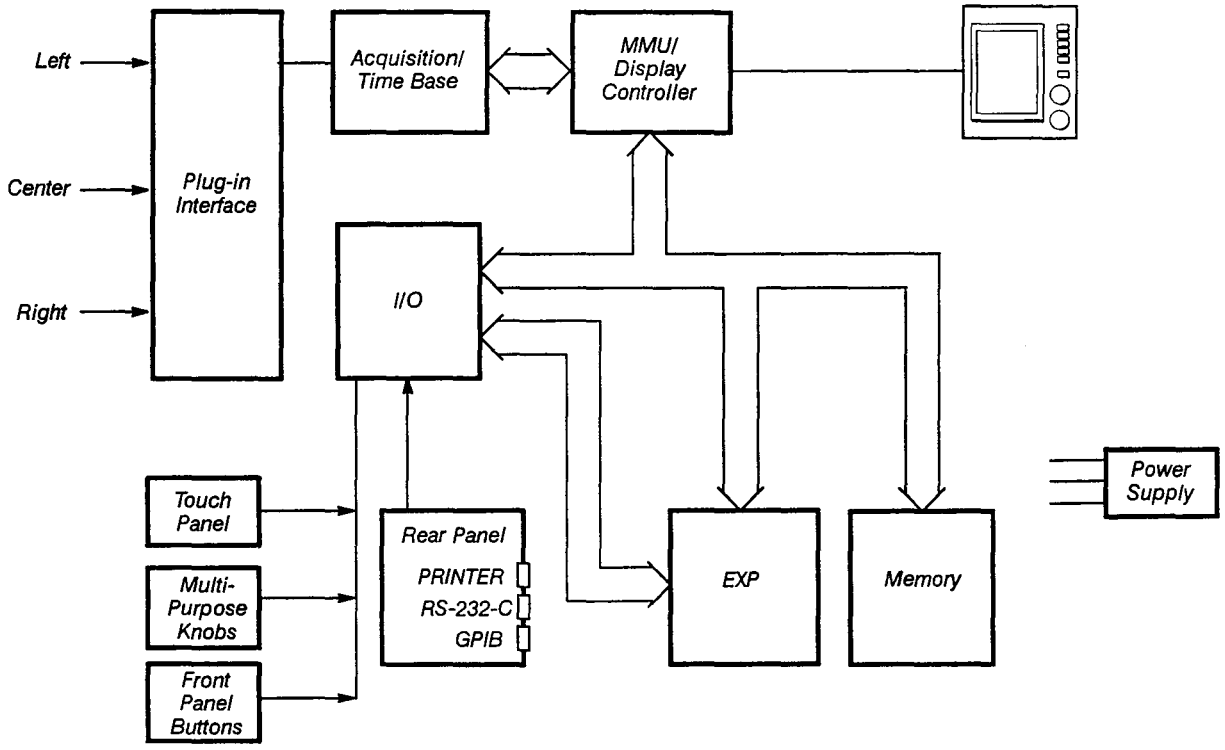


***Figure 4-1** — 11403A System Functional Block Diagram*

Plug-in Interface Block

The Plug-in Interface block is the interface between the plug-in amplifiers input signals and the Acquisition/Time Base block of the 11403A. The Plug-in Interface block accommodates up to four input channels for the left, center, and right plug-in compartments, for a total of twelve input channels.

Acquisition/Time Base Block

The Acquisition/Time Base block comprises four systems:

- Digitizer
- Microprocessor with local RAM and ROM
- Time base and trigger circuits
- Interface to the Memory Management Unit (MMU) and the Plug-in Interface

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Memory Management Unit (MMU)/Display Controller Block

The Memory Management Unit arbitrates Memory Block access requests from the Display processor, Digitizer processor and Executive processor. This arbitration allows memory access for each processor without interference from the others.

The Display Controller provides visual information to the user. This information includes waveform traces, graticules, axes, and annotation data, and also menus, labeling for touch panel input, and current mode-setting information.

Input/Output (I/O) Block

The Input/Output (I/O) block provides an interface to the Rear Panel block, front panel buttons, touch panel, and multi-purpose knobs.

Front Panel Controls

The user controls the 11403A with:

- Front panel (major menu) buttons
- Display touch panel
- Multi-purpose knobs

The major menu buttons are the top-level menu selections for the 11403A. Touching an icon, menu item, or waveform on the display touch panel selects that icon, menu item, or waveform. The multi-purpose knobs control the function of the selected item.

Rear Panel Block

The Rear Panel block provides GPIB, RS-232-C, and printer ports for interfacing various peripheral devices.

Executive Processor (EXP) Block

After you request an operation (for example, with a front panel control), the Executive processor (EXP) directs the 11403A to perform the operation. The EXP also runs self-test diagnostics at power up or on request. To control instrument operations, the EXP controls and monitors the other boards sharing the Executive system bus. Via boards on the Executive system bus, the EXP also indirectly controls the other 11403A boards. It does this by generating commands and status signals to control on-board and I/O devices (such as GPIB and RS-232-C interfaces) that process data and control the instrument.

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Memory Block

The main function of the Memory block is to provide the EXP with the static RAM and EPROM needed for waveform memory storage and other instrument operations. All accesses to the Memory block are initiated by the EXP. Memory support circuitry and diagnostic circuitry for troubleshooting are also included in the Memory block.

Power Supply

The 11403A operates from 115 V or 230 V nominal line voltage source at a line frequency of 48 - 440 Hz. The LINE VOLTAGE SELECTOR switch allows selection of AC line inputs of 90 - 132 V rms or 180 - 250 V rms.

To apply power to the 11403A:

- Set the rear panel PRINCIPAL POWER switch to ON
- Set the front panel ON/STANDBY switch to ON

A small green indicator lamp lights to indicate that the power is on.

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Typical Waveform Processing Cycle

The following sequence is a brief overview of how the 11403A Digitizing Oscilloscope acquires, processes, and displays a waveform:

1. Analog signals are connected to the instrument's channel inputs.
2. The Acquisition/Time Base block converts the signals to digital signals.
3. Data from the digitized signals is stored in waveform memory (in the MMU/Display Controller block).
4. The EXP processes information from the user interfaces (the menus, icons, buttons, and knobs that control the oscilloscope).
5. After processing, the EXP sends commands to the MMU/Display Controller block to display the function selected.
6. When instructed by the EXP, the MMU/Display Controller block receives the waveform data from waveform memory and converts it to a unique vertical raster-scan format for display.

Detailed Block Diagram

This section describes the 11403A block diagram (see Fig. 4-2).

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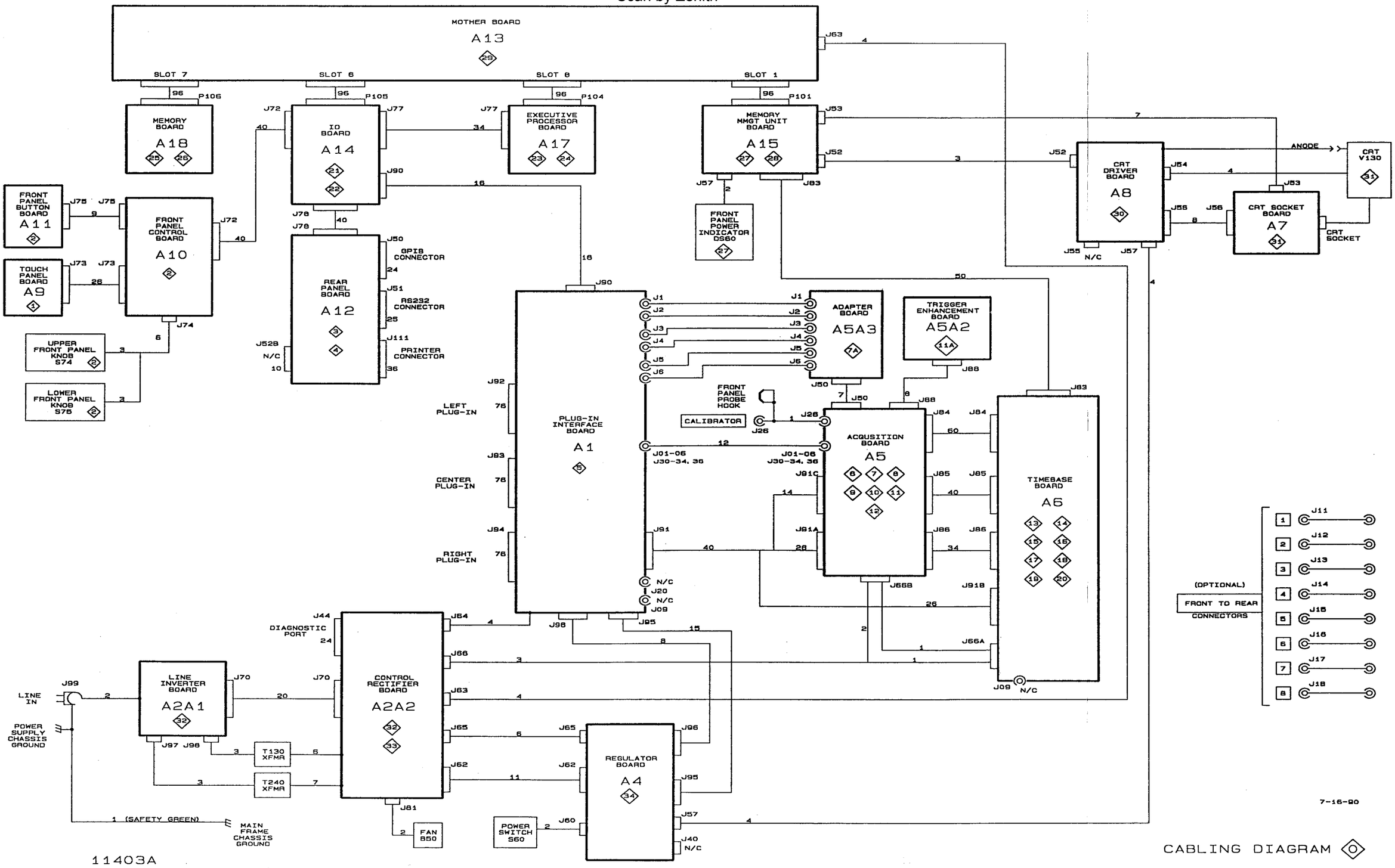


Figure 4-2 *— 11403A Detailed Block (Cabling) Diagram*

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A1 Plug-in Interface Board

The A1 Plug-in Interface board is the interface between the plug-in units and the the other 11403A subsystems (Executive, Display, and Digitizer). This board performs the following functions:

- Routes signals and voltages inside the 11403A through the A1 Plug-in Interface board
- Buses power supply voltages from the Power Supply module

The A1 Plug-in Interface board contains no active components.

A4 Regulator Board

The regulators on this board convert semi-regulated voltages into stabilized low-ripple output voltages. The A4 Regulator board consists of the voltage fault detect circuitry and the following regulators:

- +50 V
- -50 V
- +15 V
- -15 V
- +5 V
- -5 V

The operational amplifiers for these regulators require that the following special voltages be generated:

- the semi-regulated +54 V supply generates the +10 V and +20 V supplies.
- the semi-regulated -54 V supply generates the -10 V and -20 V supplies.
- the +10.0 V REF is a reference voltage.

See Figure 4-3 for a block diagram of this board.

The voltage fault detect circuitry—consists of two window comparators and associated resistors. This circuitry detects whether any regulated supply is over-voltage or under-voltage. The associated resistors set a hysteresis window that is 5% of the regulator sense line voltages.

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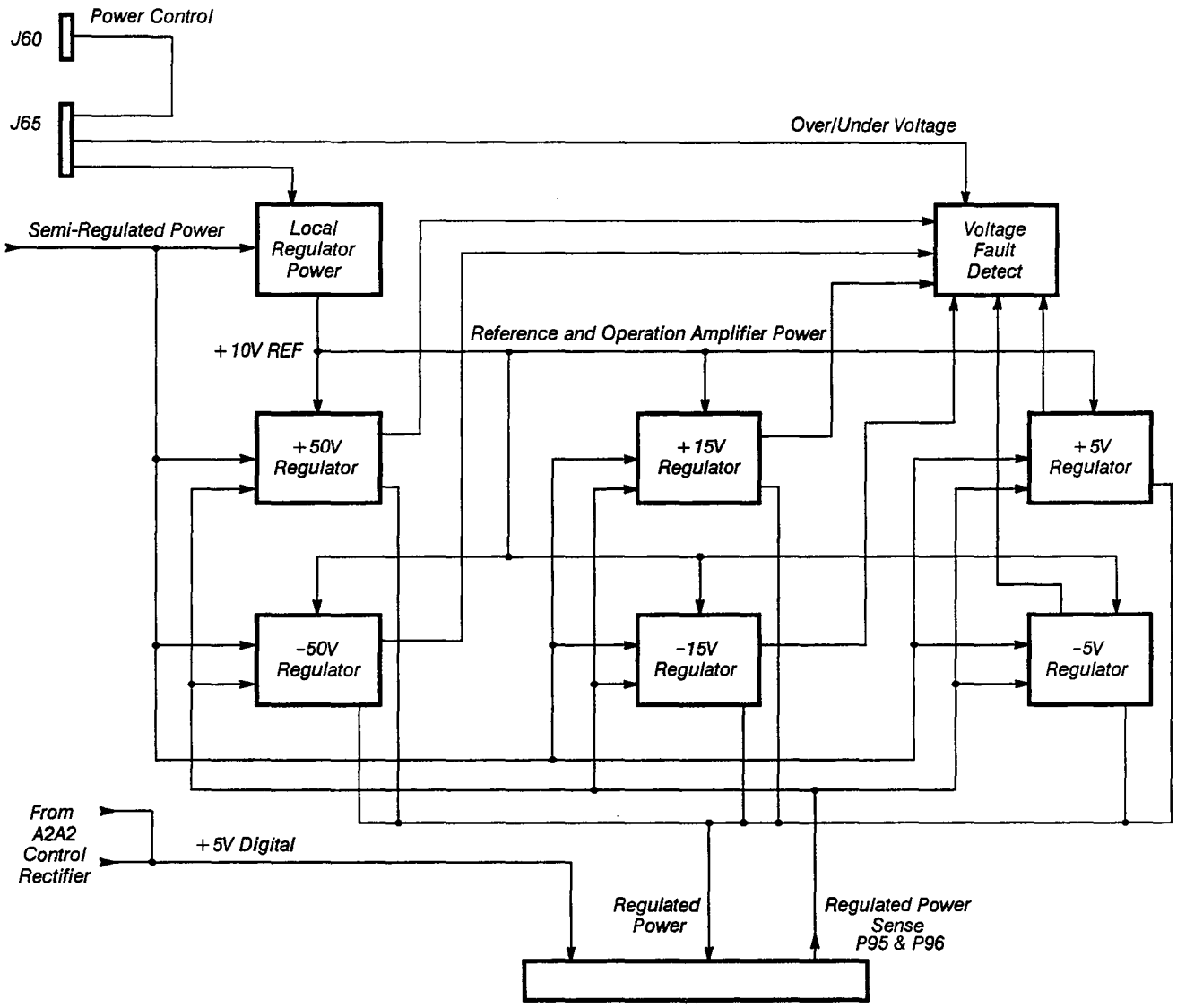


***Figure 4-3** — A4 Regulator Board Block Diagram*

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A5 Acquisition Board

The A5 Acquisition board consists of the following systems:

- Sample-and-hold (S/H) circuits and the channel switch
- Sample strobe generators
- Analog-to-digital converter (ADC)
- Clock generator
- Main and Window trigger circuits
- hold-off control
- Main and Window time interpolators
- hold-off by events counters
- Programmable control voltages
- Scope calibrator

See Figure 4-4 for a block diagram of this board.

The sample-and-hold (S/H) circuits and the channel switch—collect input signals from the plug-in amplifiers in the left, center, and right plug-in compartments (each plug-in compartment has a dedicated S/H circuit). The voltage present when the sample is acquired is stored in a capacitor connected to a buffer amplifier. The output of each buffer amplifier is fed to a channel switch. The ADC selects its input from the channel switch at the beginning of its conversion cycle.

The sample strobe generators—generate the sampling strobe signals that drive the S/H circuits. The strobe signal is a narrow pulse that places the S/H circuit into the hold state and captures the high-frequency components of the input signals. The S/H circuits are driven simultaneously, but analog-to-digital conversion is performed one sample at a time.

The analog-to-digital converter (ADC)—is a 10-bit, two-stage flash converter with error correction.

The clock generator—consists of two asynchronous oscillators. The first oscillator supplies signals to the strobe generators, ADC, time interpolators, and time-base circuits. The second oscillator supplies a clock for the main and window hold-off control circuits.

Main and Window trigger circuits—provide similar features. An input channel switch selects the input signal sources. The channel switch provides a signal to the trigger latch. The hold-off control circuit resets and enables this latch.

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Hold-off control – determines triggering. This circuitry allows triggering on specific portions of a complex signal. It also allows the system to prevent triggering when other operations are in progress.

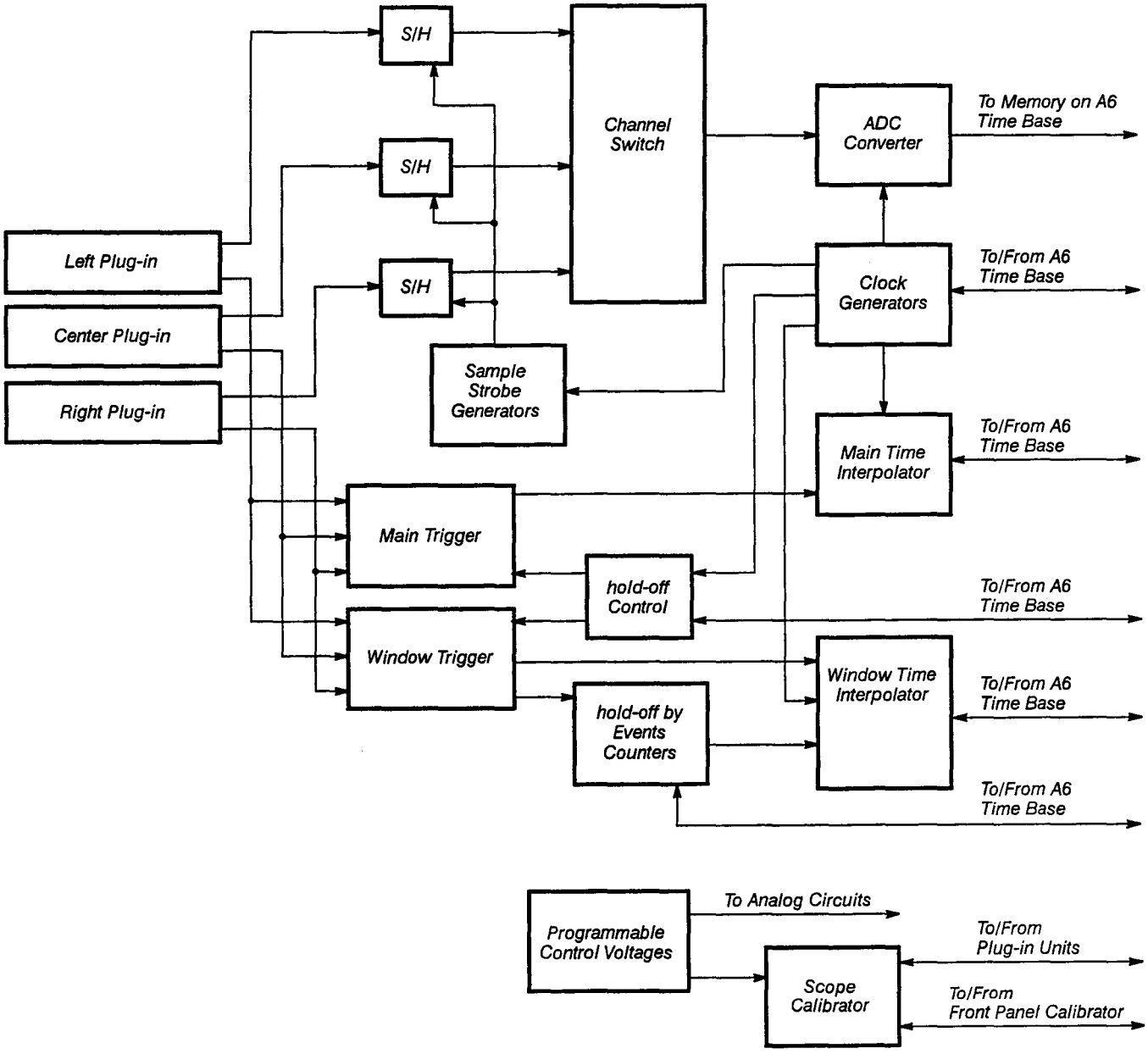


***Figure 4-4** — A5 Acquisition Board Block Diagram*

Independent hold-off controls are provided for main and window triggers. Each circuit consists of fine and coarse sections. The coarse section consists of counters for relatively long delay periods. The fine section uses analog-ramp circuits for smaller delay increments not possible with the counters.

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Main and Window time interpolators—measure the time between the trigger event and the sample strobe. This measurement allows high-resolution placement of the input signal samples in the waveform record. Counters and the time interpolators provide both coarse and fine sample time placement.

Hold-off by events counters—consists of low- and high-speed counters. The high-speed counters are located on the A5 Acquisition board and the low-speed counters are on the A6 Time Base board. After the main trigger has occurred, the counters inhibit window triggers until a user-selected number of events has occurred.

Programmable control voltages—are voltages for the 11403A's Enhanced Accuracy mode. The circuit that provides these programmable control voltages uses one precision DAC and numerous S/H circuits with output buffer amplifiers.

Scope calibrator—provides a precision voltage reference signal that the input channels or probes use in Enhanced Accuracy mode. A squarewave signal is also provided for compensating and deskewing probes.

A6 Time Base Board

The A6 Time Base board receives waveform data, organizes the data in its proper sequence, assigns the data a specific address in waveform memory, and relays the data to waveform memory through the MMU interface. The hardware consists of the following systems:

- input data latches
- main record circuitry
- window record circuitry
- chop sequencer
- acquisition memory
- end-detect circuitry
- destination Address Generator (DAG)
- MMU interface
- MPU (main processing unit) system

See Figure 4-5 for a block diagram of this board.

Input data latches—temporarily store incoming data points from the A5 Acquisition board.

Main record circuitry—consists of counters and logic circuitry. This hardware provides the sampling rates for each acquired record. The counters count the number of samples taken to determine the position of each record in time.

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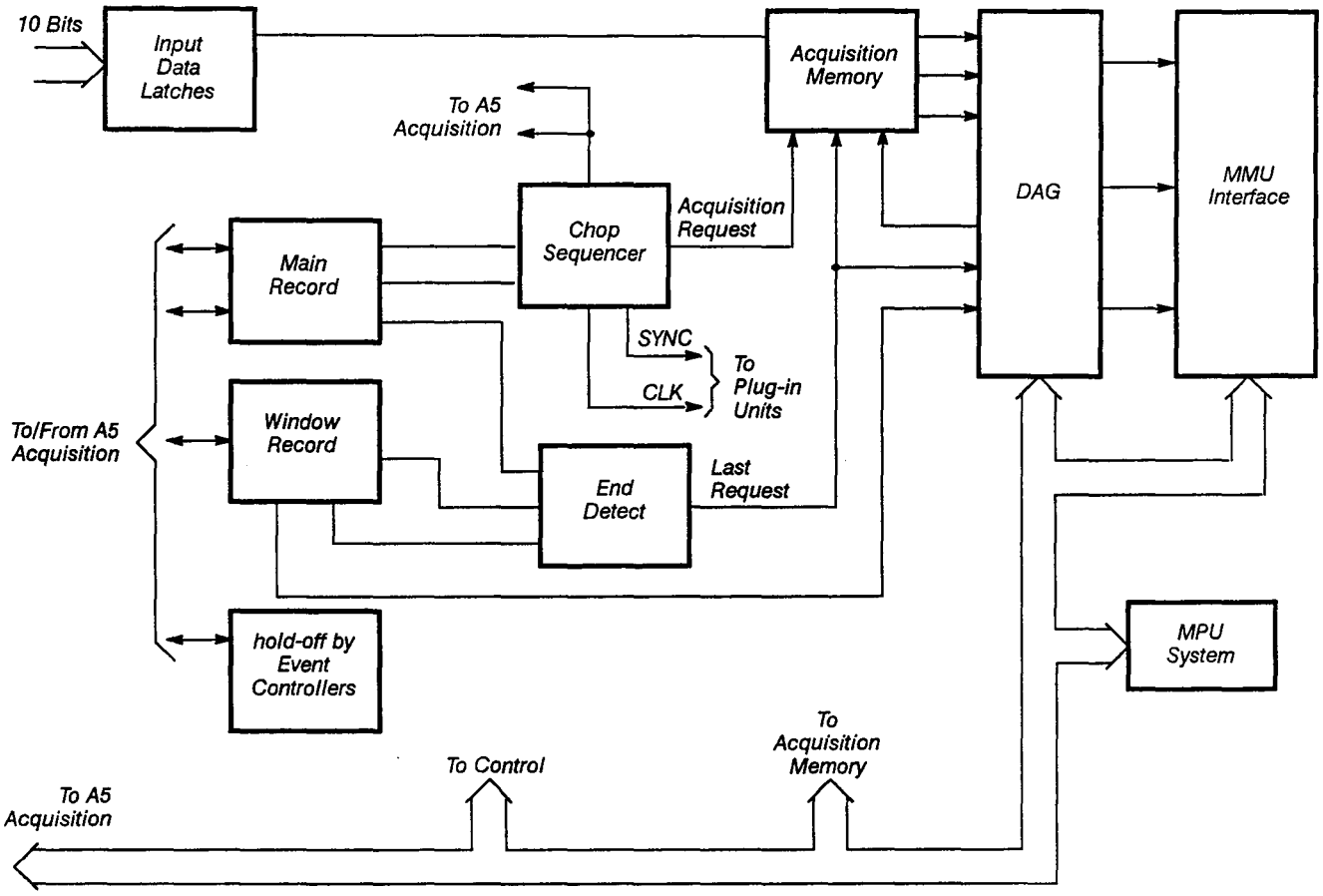


***Figure 4-5** — A6 Time Base Board Block Diagram*

Window record circuitry—consists of the same hardware as the Main record logic circuitry. The Window record logic circuitry supports two windows: Window 1 and Window 2.

Chop sequencer—coordinates the timing among the various input signals through two clock signals, SYNC and CLK. The chop sequencer also tags the waveform data with record identification information for storing the data in the acquisition memory.

Acquisition memory—holds the digitized waveform data and record identification tag until the A6 Time Base board is ready to transfer the data through the MMU interface.

End-detect circuitry—detects the end of the sweep for each record.

Destination Address Generator (DAG)—assigns each waveform data point an address in waveform memory. The memory location assigned depends on which input channel the data point was acquired from and when it was acquired during the sweep.

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MMU interface – interfaces the Digitizer subsystem (the A5 Acquisition board and the A6 Time Base board) to the EXP and waveform memory. Waveform data is transferred from the A6 Time Base board via the MMU interface to the waveform memory. The MMU interface also serves as the communication path between the MPU system (the Digitizer processor) and the Executive processor.

The MPU system – is based on an 8 MHz microprocessor. This microprocessor addresses several different blocks of memory and various I/O devices. A possible 256 kilobytes of EPROM and 16 kilobytes of RAM can be addressed by the microprocessor.

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A7 CRT Socket Board

The A7 CRT Socket board is an interface from the A15 MMU board to the CRT. This board consists of the following circuits:

- red, green, and blue video amplifiers
- RED, GREEN, and BLUE cutoff adjustments
- CONVERGENCE adjustment

See Figure 4-6 for a block diagram of this board.

Red, green, and blue video amplifiers—are three identical high-speed video amplifiers that drive the three cathodes (R, G, and B; red, green, and blue, respectively) of the CRT. Each of the three colors can be programmed to display 64 different levels, yielding a possible 262,144 colors. Eight of these colors can be displayed at any time.

Red, green, and blue adjustments—control the color cutoff point (the point at which a certain color becomes invisible).

Convergence adjustment—controls the vertical convergence of the red, green, and blue deflection beams.

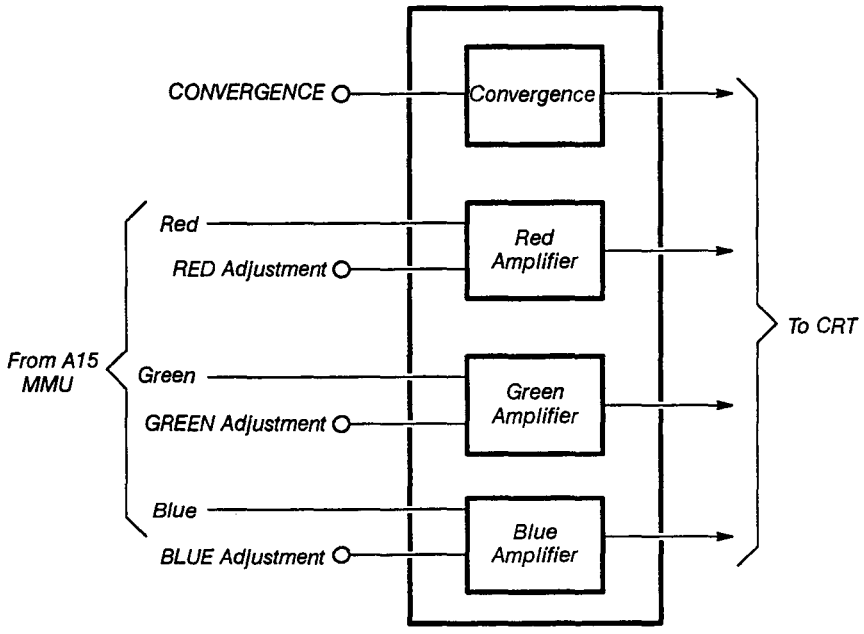


***Figure 4-6** — A7 CRT Socket Board Block Diagram*

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A8 CRT Driver Board

The A8 CRT Driver board consists of the following circuits:

- Horizontal sweep circuitry
- Vertical sweep circuitry
- High-voltage and grid-voltage generator circuitry
- Degauss circuit
- Beam current limit circuit
- Grid bias circuit

The A8 CRT Driver board circuitry drives the raster scan CRT. The VIDEO and SYNC signal inputs from the A15 MMU board generate the Z-Axis and sweep signals and grid bias voltages for the CRT.

See Figure 4-7 for a block diagram of this board.

Horizontal sweep circuitry—generates the sweep current for the horizontal deflection yoke. The horizontal driver includes an oscillator, voltage ramp generator, high-gain amplifier, and a flyback generator. These components provide sweep synchronization, horizontal deflection, and linearity.

The horizontal adjustments, H-SIZE, H-POS, and H-LIN, allow you to optimize the appearance of the display.

Vertical sweep circuitry—produces a deflection current that sweeps the video beam from the bottom to the top of the CRT. This circuit also produces a signal to the flyback transformer that is in parallel with the deflection yoke.

The vertical adjustments, VERT SIZE and VERT POS, set the display's vertical size and position.

High voltage and grid voltage generator circuitry—consists of the flyback transformer. This transformer generates the 16 kV CRT anode potential and other bias voltages. In parallel with the yoke, the flyback transformer also supplies some of the sweep current for the yoke winding.

The SCREEN adjustment provides the cutoff point (the point where no information is visible on the display screen). The FOCUS adjustment provides manual focusing of the display image.

Degauss circuit—removes magnetic fields induced by magnetic sources from the steel aperture grille at each power-on.

The Degauss circuit produces an exponentially decaying sine wave with a frequency of about 3.7 kHz. This waveform is applied to the degauss coils located on both sides of the CRT. The decayed oscillation through the coils causes an induced magnetic field in the CRT's steel aperture grille. The magnetic field saturates the steel and forces the stored magnetic field to zero as the steel is driven around its hysteresis curve.

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Beam current limit circuit—limits the average power to the CRT toless than 15 W. An amplifier circuit compares the sum of the anode current and the FOCUS adjustment current to a reference current of 0.72 mA. If the sum of these currents exceed the reference current, the three video amplifiers on the A7 CRT Socket board are disabled.

Grid bias circuit—provides -40 V of grid bias to the A7 CRT Socket board. At power-off, the grid is supplied with -90 V until the focus circuit discharges a high voltage. This prevents a bright spot from appearing at the center of the screen at power-off.

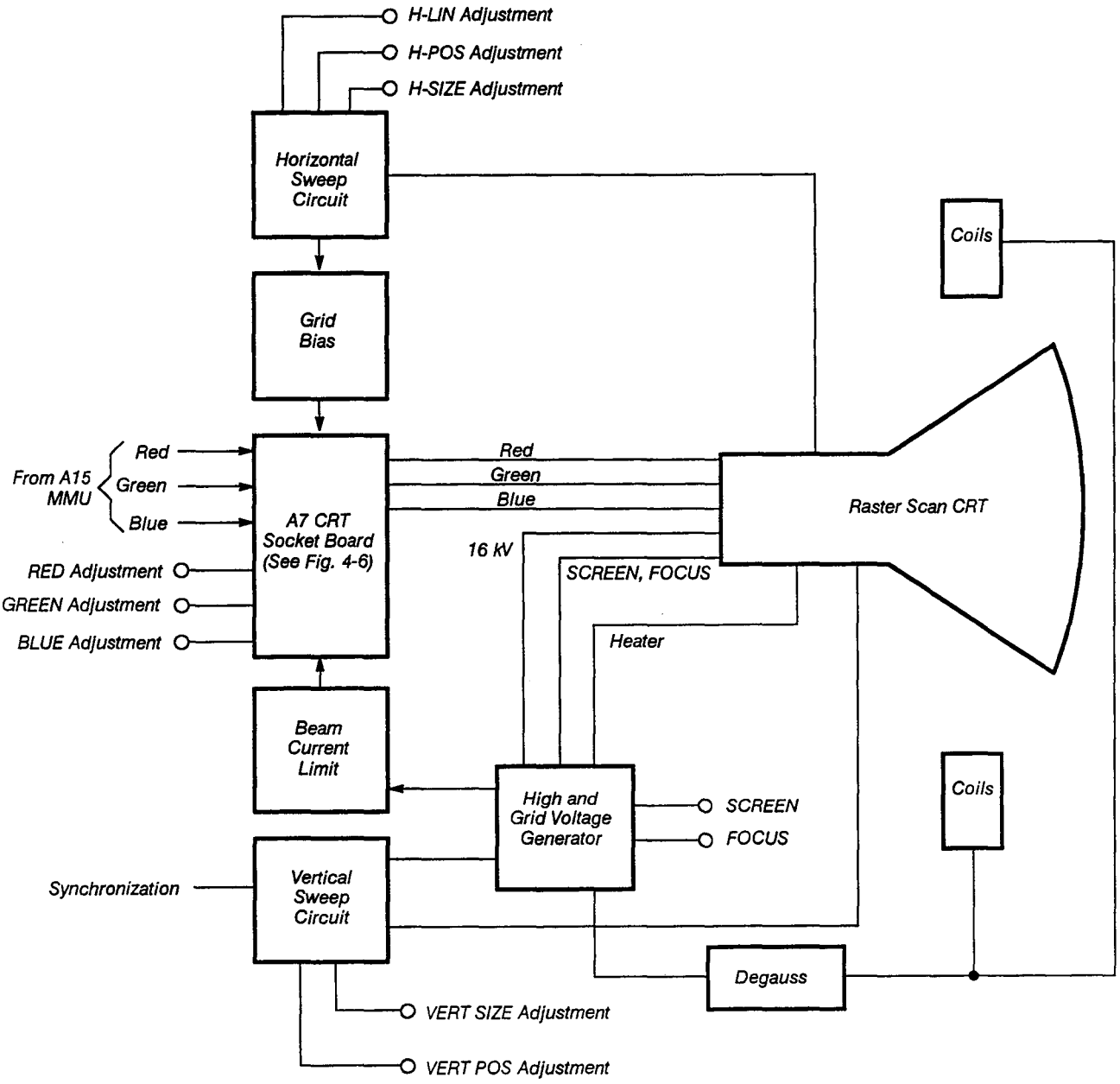


Figure 4-7 *— A8 CRT Driver Board Block Diagram*

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A9, A10, and A11 Front Panel Boards

The three Front Panel boards are:

- A9 Touch Panel assembly
- A10 Front Panel Control board
- A11 Front Panel Button board

The touch panel, major menu buttons (hard keys), and menu status LEDs interface to the EXP through a general purpose programmable keyboard and display controller IC on the A10 Front Panel Controller board. The keyboard function of this IC controls the touch matrix and hard keys. The display function drives the menu LED light bars.

The A9 Touch Panel assembly—is composed of infrared LEDs that produce a light-beam matrix. When you touch a touch zone on the display, your fingers interrupt the light beams. The touch panel and hard key matrix are continuously scanned until an interruption (a shadow or keypress) is detected. When a keypress is detected, that scan is complete, and the keyboard display controller IC asserts the respective interrupt line. While the interrupt is active no new data is written into the sensor RAM from the touch panel or hard keys. The data remains stable in sensor RAM while the microprocessor reads it.

During scanning, only one infrared LED is turned on at a time, and only the phototransistor directly opposite is selected to receive light. This prevents any crosstalk between emitter/detector pairs.

The A10 Front Panel Control board—generates the 6-bit address that selects an infrared LED and its corresponding phototransistor on the A9 Touch Panel board. The A10 Front Panel Control board also reads the A9 Touch Panel Assembly.

The A11 Front Panel Button board—is composed of the LED light bars driven by the display refresh register output of the keyboard and display controller IC. Internally, the light bars are an 8-bit by 8-bit matrix of display RAM. This display RAM is scanned column by column (automatically) lighting the appropriate LED bar(s) when a high bit is encountered.

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A12 Rear Panel Assembly

The A12 Rear Panel assembly links the 11403A to other devices. This assembly contains connectors for the following:

- GPIB port
- RS-232-C port
- PRINTER port (Centronix style)

The A12 Rear Panel assembly is controlled from the A14 Input/Output (I/O) board through a 40-wire cable. This cable contains the following:

- 8-bit bidirectional data bus
- Four-bit address bus
- Interrupt lines (4)
- GPIB DMA request and grant lines
- Device control lines (4)
- Assorted power supply and ground lines

See Figure 4-8 for a block diagram of this assembly.

The GPIB port – drives the GPIB controller. The GPIB controller determines if the microprocessor is attempting a read or write. The interrupt controllers in the A17 Executive Processor board monitor an interrupt line from the GPIB controller and signal the microprocessor to service the GPIB controller if an interrupt occurs.

A GPIB controller interrupt indicates the following:

- The receiver register of the GPIB controller contains a byte of data from the GPIB bus that the microprocessor must read
- The empty transmitter register of the GPIB controller is ready to receive another byte of data
- A microprocessor notification if the status of the GPIB bus or the GPIB controller has changed

On the other side of the GPIB controller is another bus system. This bus system includes an 8-bit data bus that accesses a directional GPIB data buffer and an eight-bit control bus that accesses a GPIB control driver. The GPIB bus is connected to the opposite side of the buffer and control driver. These two devices are specially designed to be TTL signal-level compatible on the bus side of one side and GPIB bus compatible on the other.

The state of three GPIB controller signals are monitored and displayed on LEDs located on the rear panel of the 11403A. These LEDs show the state of the GPIB controller, not the state of the GPIB bus.

Two other significant signals are GPIB REQ and GPIB GR. The DMA controller on the A17 Executive Processor board uses these signals to communicate with the GPIB controller (if the DMA controller is installed). The microprocessor can program the DMA to service either the receiver or the transmitter section.

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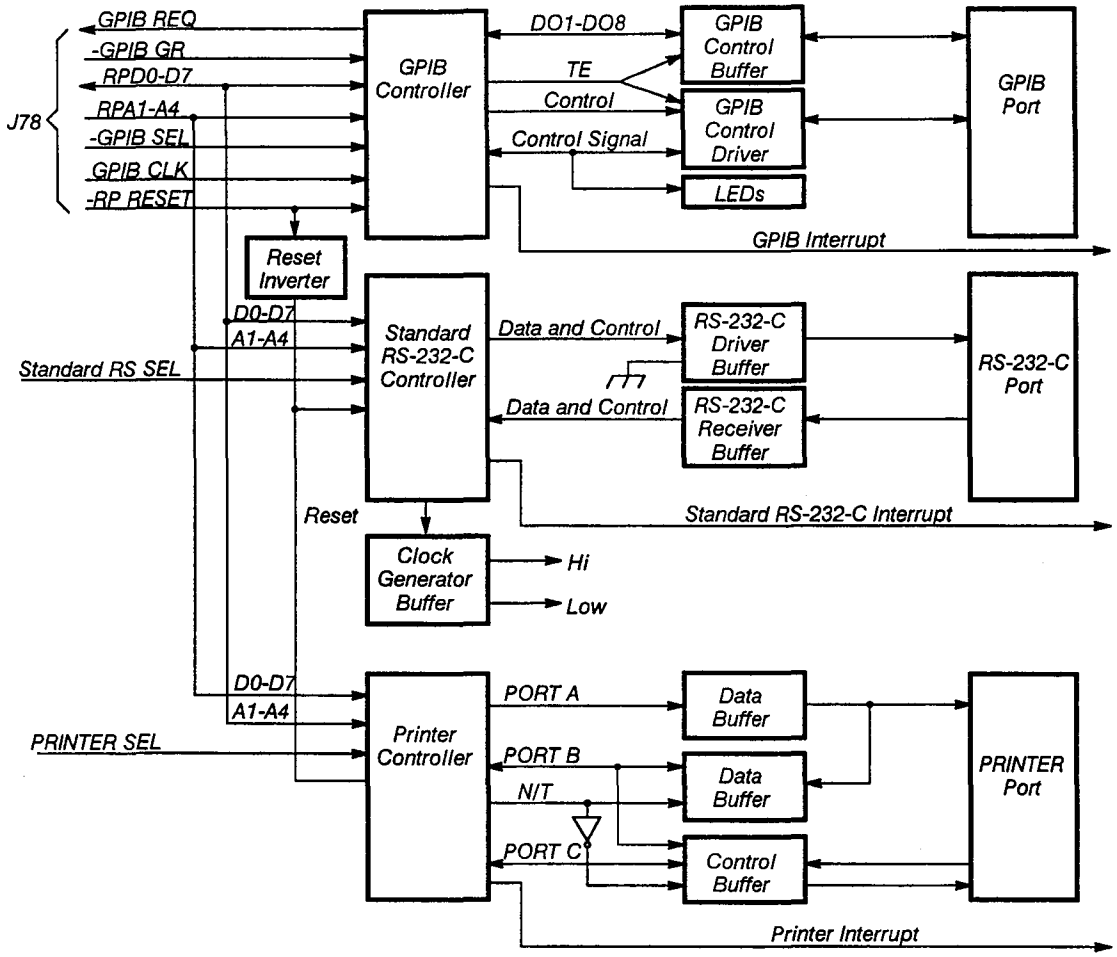


***Figure 4-8** — A12 Rear Panel Assembly Block Diagram*

Note: *DMA controller is present only if the 11403A is equipped with Option 4D. The DMA controller shortens the GPIB transfer time and also the transmission time of waveforms.*

The standard RS-232-C controller—is connected to the same data bus and address bus as the GPIB controller. The RPD0-D7 address lines transfer data to and from the microprocessor. The microprocessor uses the RPA1-A4 address lines to select individual registers in the RS-232-C controller. The Standard RS SEL (STD RS SEL) line becomes low when the microprocessor attempts to communicate with the RS-232-C controller. This line also drives the chip enable.

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The microprocessor drives the WR and RD signals if the RS-232-C controller is to be written into or read. The standard RS-232-C controller sets the standard RS-232-C interrupt (STD RS INTR) line low to request service from the microprocessor. The microprocessor writes a byte into the controller's transmit buffer to transmit data on the RS-232-C bus. The microprocessor reads a byte from the receiver buffer to receive data from the RS-232-C bus. The microprocessor can also read the status of the controller. The RS-232-C controller translates the parallel data from the microprocessor to serial data for the RS-232-C bus and converts serial data from the RS-232-C bus to parallel data for the microprocessor.

The PRINTER port—is controlled by a programmable peripheral interface IC. This IC has the control lines for connecting the port to a microprocessor. It also has two general purpose eight-bit ports and the control signals necessary to use them. The A12 Rear Panel Assembly data bus and address bus connect to the IC and have the same function as described for the GPIB and RS-232-C controllers. The microprocessor sets the PRINTER SEL line low when it communicates with this port. The RD and WR lines allow the microprocessor to either read or write to the registers in the programmable peripheral interface IC. The microprocessor must initialize this IC for PORT A to be a strobed output port and PORT B to be a strobed input port. PORT C provides the control signals for these ports. This IC sets the Printer Interrupt line low when its output buffer is empty (the printer is ready for the next byte). The microprocessor then writes the next data byte to the IC.

A13 Mother Board

Provides the interconnection for the microprocessor signals and the +5 V digital power between the following boards:

- A14 I/O board
- A15 MMU board
- A17 Executive Processor board
- A18 Memory board

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A14 Input/Output (I/O) Board

The A14 I/O board contains the following:

- Data buffers
- Timer configuration circuitry
- Real time clock
- Serial data interface (SDI)
- Temp/tone readback buffer
- Tone generator

The A14 I/O board is an interface between the Executive Processor (EXP) and devices on the A9, A10, and A11 Front Panel boards, the A12 Rear Panel assembly, and on-board I/O devices. The EXP reads and writes to these I/O devices at specific I/O addresses. These I/O addresses are decoded to produce device select signals to enable the addressed device. Each I/O device is located on I/O address boundaries of at least 100*hex*.

The lower eight bits of the Executive data bus transmit data to and from the various I/O devices. Note that only one I/O device can be accessed at a time.

When the DMA controller is installed on the A17 Executive Processor board, the A14 I/O board altersthe way it controls GPIB operations.

See Figure 4-9 for a block diagram of this board.

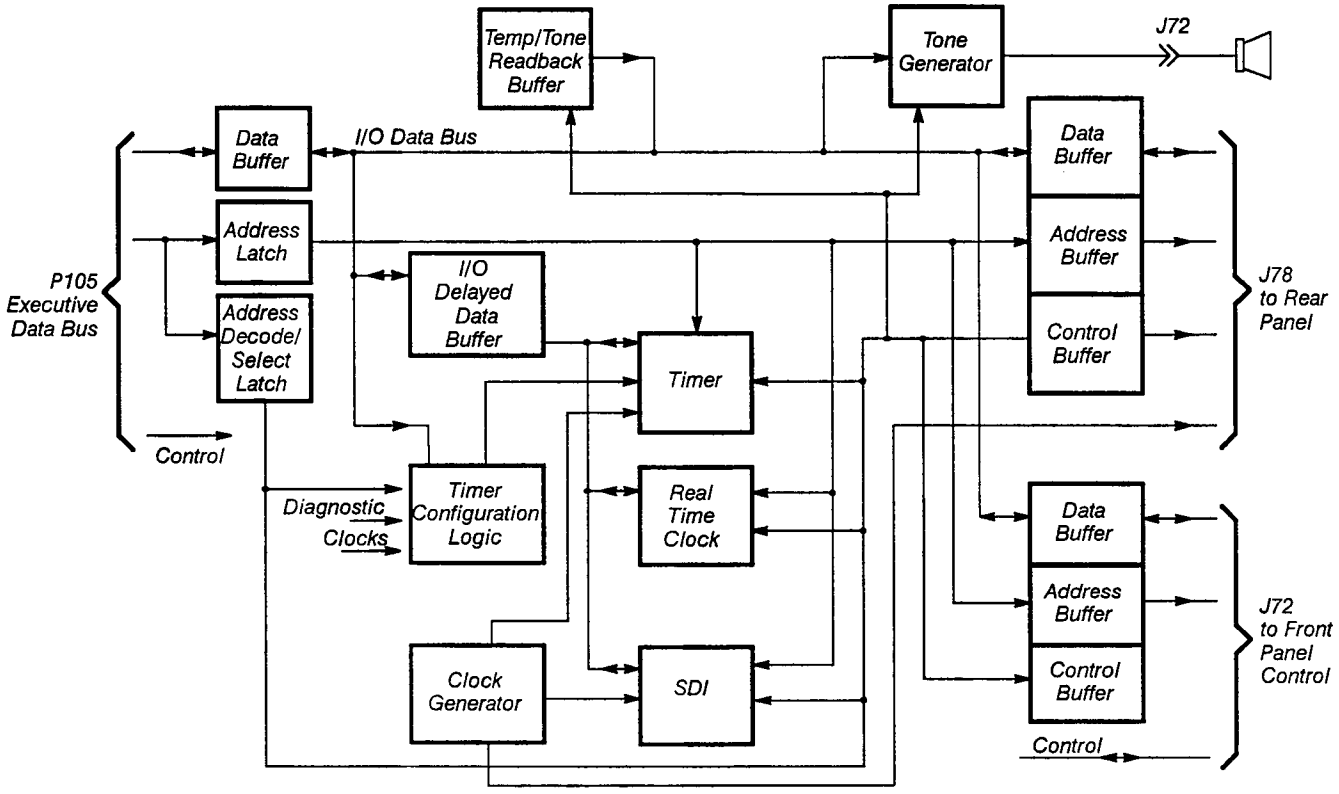


Figure 4-9 *— A14 I/O Board Block Diagram*

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The I/O data buffer—buffers the lower eight bits of the Executive data bus from P105. The output of the I/O data bus drives data to the following six on-board devices:

- I/O delayed data buffer
- Rear panel data buffer
- Front panel data buffer
- Tone generator
- Tone/temp readback buffer
- Timer configuration circuitry

The I/O delayed data buffer—interfaces between the I/O data bus and the Write Delayed data bus.

The timer configuration—is composed of a latch and three two-input data multiplexers with discrete gates. When a byte of data on the I/O data bus is latched, some of the data bits configure counters 1 and 2. This allows the timer to accept different inputs for different system tasks. The operating system uses counter 0 as a real-time clock based on the 2 MHz CLK input from the clock generator (operating at 8 MHz).

The real time clock—and its oscillator circuit maintain the current time of day. The EXP sets the real time clock and also interrupts the Executive processor (EXP) every second to request the time from the EXP.

The serial data interface (SDI)—is a custom IC that interfaces the EXP to the three plug-in compartments and with both front panel knobs. The EXP controls the SDI, which interrupts the EXP when a device requires service.

The tone generator—uses a DAC and a timer. The timer is equipped with a special current switch and capacitor to set it's frequency. The timer outputs a square wave whose frequency is inversely proportional to the digital value written to the temp/tone DAC. Thus, if a zero value is read into the DAC, the tone generator produces the highest tone.

The temp/tone readback buffer—is an eight-line buffer connected to the I/O data bus. The EXP uses this buffer to monitor the tone generator.

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A15 Memory Management Unit (MMU) Board

The A15 MMU board consists of the following:

- MMU IC
- Waveform RAM
- Display interface
- Digitizer interface
- Execution processor (EXP) interface
- Display IC
- Microprocessor
- Bit map RAM
- Waveform display RAM circuitry
- Video DAC

The A15 MMU board coordinates communications among the following three instrument subsystems:

- Display
- Digitizer
- Executive

See Figure 4-10 for a block diagram of this board.

The MMU IC—controls all data transfers to and from waveform RAM. The MMU gate array controls high-speed transfers of waveform data and communication messages between waveform RAM and the three subsystem interfaces (Display, Digitizer and Executive processors). A set of handshaking lines designed for the DMA facilities of each subsystem coordinates each subsystem interface.

The waveform RAM—consists of 512 K of RAM. The RAM holds waveform data and messages that are read and written by the Digitizer, Display, and Executive subsystems.

Through the Display Interface—data is transferred to and from the Display subsystem and to and from the MMU IC. The data is buffered with the bidirectional display data buffers.

Through the Digitizer Interface—data is transferred to and from the digitizer subsystem and to and from the MMU IC.

The Executive Processor (EXP) Interface—consists of bidirectional buffers, address mapping programmable array logic (PAL), and interface timing control PALs. This circuitry directs bidirectional data flow between the EXP and the MMU IC.

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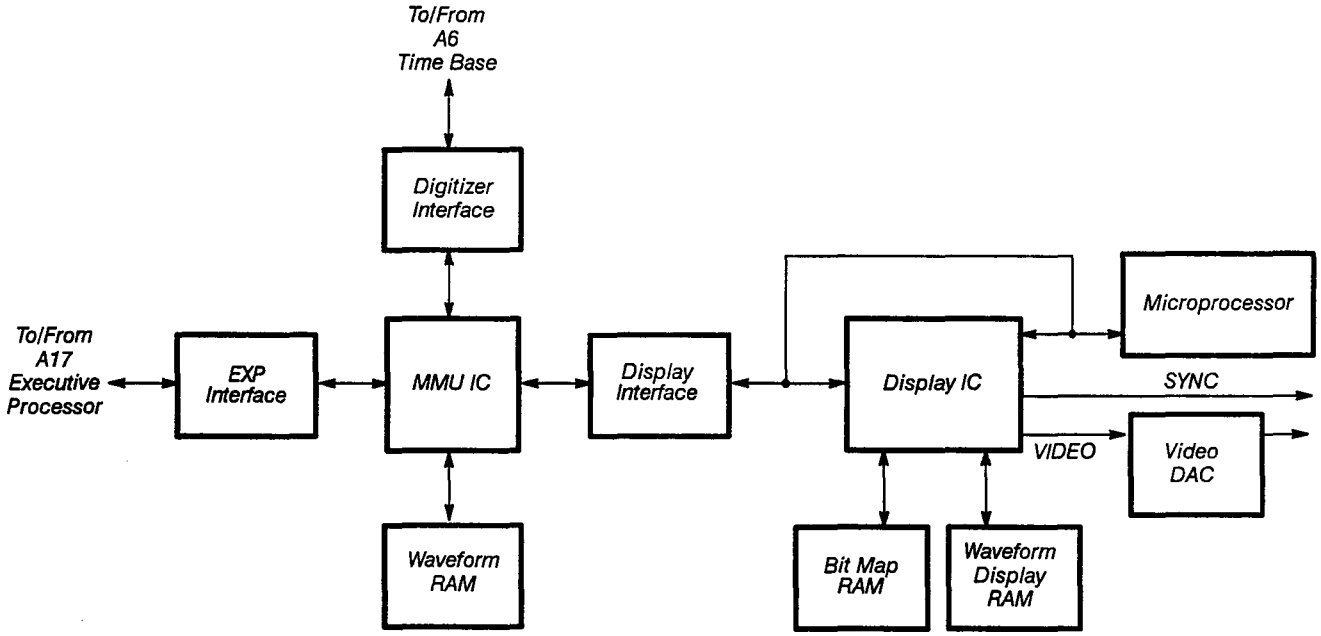


Figure 4-10 *— A15 MMU Board Block Diagram*

The Display IC—consists of the following functional circuits:

- CRT controller
- Video output circuitry
- Compressor circuit

The basic function of the CRT Controller is to produce VIDEO and SYNC signals that indicate to the CRT where to position video information. The controller is virtually automatic in operation and invisible to the firmware programmer, except for several internal registers that must be initialized at power-on.

The video output circuitry is where the hardware recognizes and displays specific data structures, while the raster-scan CRT displays the contents of the bit map.

During screen refresh the hardware acquires bit map data along with waveform display data to yield a final color index.

The compressor circuit receives a waveform composed of any possible number of data points, and outputs 512 pairs (one minimum and one maximum) to the display.

The microprocessor—transforms the entire Display subsystem into an intelligent peripheral dedicated to operating the display. The firmware that controls the Display subsystem runs from ROM in the microprocessor's address space. The clock for this microprocessor operates at 8 MHz.

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The bit-map RAM—consists of 256 kilobytes of RAM divided into 4 bit planes of 65,536 bytes each. Three of the bit planes are for text and the remaining bit plane is for XY, point accumulate waveforms. Each bit in a plane represents a single pixel of the display. Setting the representative pixel bit in each of the planes controls the color or intensity.

The waveform-display RAM—consists of 65,536 bytes. These bytes contain the minimum/maximum pairs of values, along with color index information and overrange/underrange settings.

The video digital-to-analog converter (DAC)—converts the digital data from the Display IC into analog data for the A7 CRT Socket board.

A17 Executive Processor Board

The A17 Executive Processor board consists of:

- Executive processor (EXP)
- Numeric co-processor circuitry
- Bus buffer circuitry
- Rreset circuitry
- Wait state circuitry
- Auxiliary EPROMS
- Interrupt controllers
- DMA Controller (option 4D only)

See Figure 4-11 for a block diagram of this board.

The Executive processor (EXP)—controls 11403A operation by running firmware routines stored in EPROMS located on the A18 Memory board. Along with the numeric co-processor, the EXP does all data processing not directly related to generating the display or digitizing the waveform. When power is first applied to the instrument, the EXP executes the local and system diagnostic tests located in the EPROMs on the A18 Memory board.

The EXP performs these functions with three main circuits:

- The clock generator generates the timing and synchronized reset signals for the microprocessor
- The microprocessor reads and writes data, generates addresses for I/O and memory devices, and generates status signals for the bus controller
- The bus controller interprets the microprocessor's status signals and generates the necessary bus control signals for the Executive bus

Address decoders, address latches, and data buffers are all support circuits for I/O operations.

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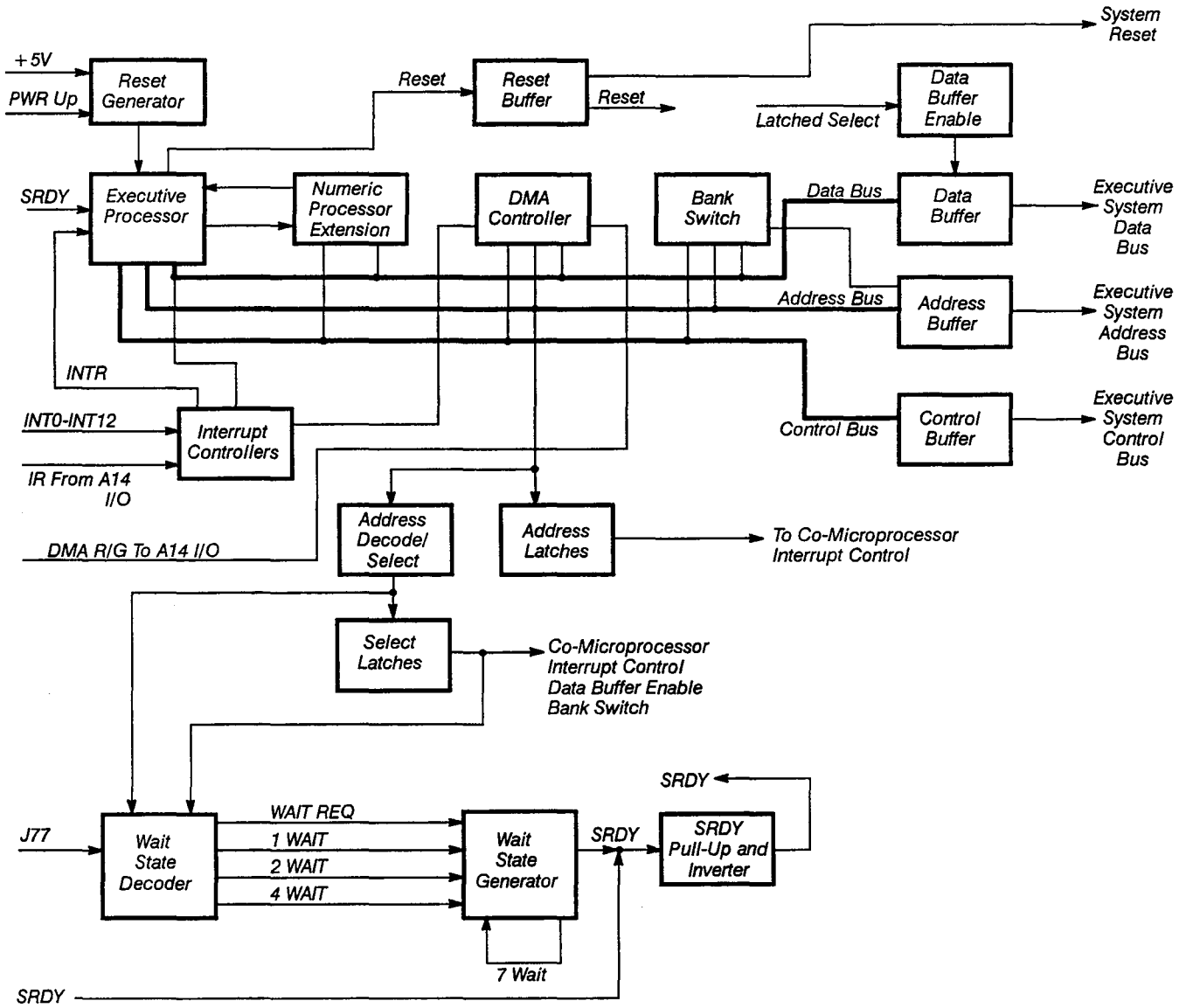


***Figure 4-11** — A17 Executive Processor Board Block Diagram*

The numeric co-processor circuitry—is a high-speed floating-point processor that executes instructions in parallel with the EXP. The EXP programs and controls the numeric co-processor as an I/O device at addresses 0F8*hex* to 0FF*hex*.

The bus controller circuitry—consists of data, address, and control buffers that provide command and control signals from the microprocessor to the three Executive buses. The Executive buses consist of the following:

- **The system data bus**, a bidirectional bus, allows the microprocessor to fetch instructions from memory. The system data bus also allows the microprocessor to write data to and read data from memory. The memory used by the microprocessor is located on the A18 Memory board.

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- **The system address bus**—contains the address of a device when the microprocessor requests access to that device. Once the microprocessor has access, the addressed device can then respond to the microprocessor.
- **The system control bus**—contains control signals sent by the microprocessor. These control signals are sent to the devices that the microprocessor addresses.

The reset circuitry—generates synchronized ready and reset control signals.

The wait state circuitry—extends the bus cycle for slower devices to have sufficient time to read or write data.

The interrupt controllers—constantly monitor the EXP's interrupt lines to ensure that the highest priority interrupt gets serviced first. The Interrupt controllers provide the ability to assign priority levels (and to mask) the system's interrupt lines.

Note: *The DMA controller is present only if your 11403A is equipped with Option 4D. The DMA controller shortens the GPIB transfer time and the waveform transmission time.*

A18 Memory Board

The 18 Memory Board provides the Executive processor (EXP) with system RAM (SRAM) and EPROM for most operations. Support circuitry for the memories and diagnostic circuitry for troubleshooting is located on-board. All accesses to SRAM or EPROMs are initiated by the A17 Executive Processor board (by the EXP or the DMA controller). Refer to the discussion of the A17 Executive Processor board, earlier in this section, for bus-cycle timing information.

The A18 Memory board consists of the following:

- Address latches
- Address decode and memory select circuitry
- EPROM and system RAM
- Memory data buffers
- Wait state generator
- Wait state diagnostics
- Memory configuration readback
- Waveform storage RAM and battery backup (optional)

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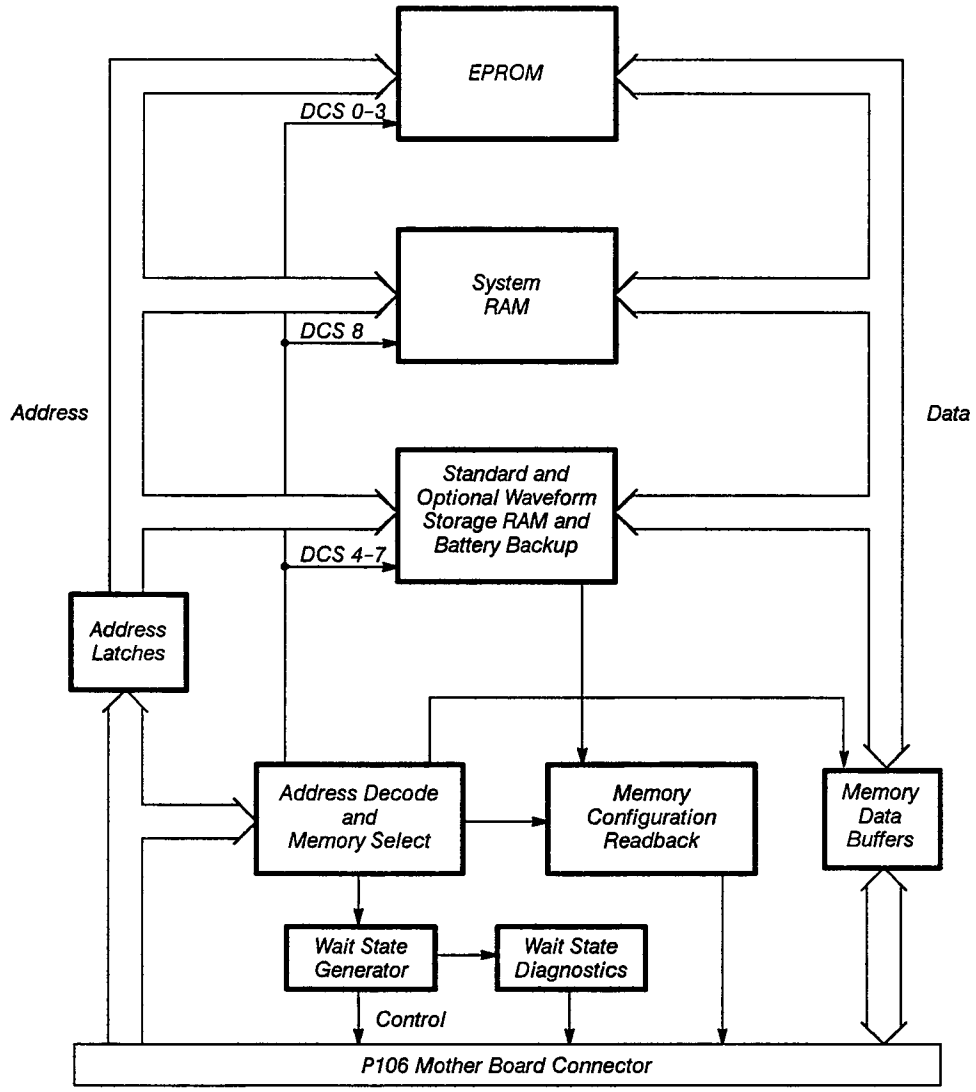


***Figure 4-12** — A18 Memory Board Block Diagram*

Address latches—buffer and hold the address lines for the EPROMs, SRAMs and other on-board devices until the end of the bus cycle.

The address decode and memory select circuitry—consists of a PAL device that decodes the address lines to produce five RAM select signals (DCS4-8) and four EPROM select signals (DCS0-3). DCS8 enables the SRAM. All EPROM and RAM select lines are latched, and the latch outputs are normally enabled. When the latch enable signal is high, the latch outputs are responsive to changes on the inputs. When the latch enable signal is low, the select lines are latched.

The EXP on the A17 Executive Processor board generates the address line inputs, A14-A19. Depending on the position of a jumper on the A17 Executive Processor board, address lines A20-A23 can be memory bank-select lines or micro-processor address lines.

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The memory select circuitry provides latched memory select lines and an enable signal for the memory data buffers.

The EPROM and system RAM (SRAM) – The EPROMs contain all operating system and diagnostics code for the EXP. All memory shares the latched address bus. The SRAM stores miscellaneous constants that the operating system code uses and produces. The memory is organized into high and low-byte pairs. The address decode PAL generates latched chip-select signals. A separate latched chip-select signal selects each of these pairs. The memory data buffers buffer the data lines to the Executive data bus.

The memory data buffers – drive data between the memories and the Executive data bus. Both 8-bit buffers are enabled when all of their inputs are high.

The wait state generator – allows the EXP to access memory devices when the EXP is operating at higher clock frequencies. When the EXP is operating at frequencies greater than 8 MHz, the bus cycle time is too short to allow reads or writes to the present memory devices. The wait state generator sets the SRDY line (see Fig. 4-11) on the Executive bus low to signal the EXP to lengthen the bus cycles.

The wait state generator also contains a circuit to generate control signals (similar to those on the Executive bus). These control signals are: early address latch (ELATCH), early memory write control (EMWTC), and early memory read control (EMRDC).

The wait state diagnostics – measure the time interval that the wait state generator generates when a one (1) is written to I/O address 8020*hex*. This causes the wait state diagnostics to connect the SRDY signal to the DIAGNSIG line on the Executive bus. A timer on the A14 I/O board can then measure the length of the wait.

Memory configuration readback – allows the diagnostics to read the position of the memory configuration straps and the bank address lines. One bit of the readback data byte also indicates if the battery is at 2.5 V (an early warning of a low battery). The EXP performs an I/O read at address 8040*hex* to read this information.

The waveform storage RAM and battery backup (optional) – provide standby power to the waveform storage RAM when the 11403A is powered off.

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Replaceable Parts

This section contains a list of the components that are replaceable for the CSA 404 Communications Signal Analyzer. As described below, use this list to identify and order replacement parts.

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.

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

Module Replacement

The CSA 404 is serviced by module replacement, so there are three options you should consider:

- **Module Exchange.** In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1-800-TEKWIDE, ext. BVJ5799.
- **Module Repair.** You may ship your module to us for repair, after which we will return it to you.
- **New Modules.** You may purchase new replacement modules in the same way as other replacement parts.

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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 its description by a colon (:). However, because of space limitations, an item name may sometimes appear as incomplete. For further item name identification, use the U.S. Federal Cataloging Handbook H6-1 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:

1 2 3 4 5 Name & Description

Assembly and/or Component
Attaching parts for Assembly and/or Component
(END ATTACHING PARTS)

Detail Part of Assembly and/or Component
Attaching parts for Detail Part
(END ATTACHING PARTS)

Parts of Detail Part
Attaching parts for Parts of Detail Part
(END ATTACHING PARTS)

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

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Table 5-1 — Board FRUs

FRU	Part Number	Description
A1	671-1965-00	Plug-in Interface Board
A2	620-0022-05	Power Supply
A4	670-8840-01	Regulator Board
A5	671-1986-00	Acquisition Board
A5A2	671-1022-00	Trigger Enhancement Board
A5A3	671-1980-00	Adapter Board
A6	671-1026-02	Timebase Board
A7	671-1028-01	CRT Socket Board
A8	671-1027-00	CRT Driver Board
A9	614-0850-00	Front Panel Assembly
A10	670-8847-01	Front Panel Control Board
A11	671-1130-00	Front Panel Button Board
A12	671-0013-00	Rear Panel Board
A13	671-1129-00	Mother Board
A14	670-8854-01	Input/Output Board
A15	671-1023-01	Memory Management Unit Board
A17	671-1024-00	Main Processor Board (Standard)
A17	671-1024-50	Main Processor Board (Opt. 4D)
A18	671-1025-00	Memory Board (Standard)
A18	671-1025-50	Memory Board (Opt. 2D)

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CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
S0482	SONY CONSUMER ELECTRONICS		TOKYO JAPAN
S3109	FELLER	72 Veronica Ave Unit 4	Summerset NJ 08873
S3629	SCHURTER AG H C/O PANEL COMPONENTS CORP	2015 SECOND STREET	BERKELEY CA 94170
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK0488	CURRAN COIL SPRING INC	635 NW 16TH	PORTLAND OR 97209-2206
TK0588	UNIVERSAL PRECISION PRODUCTS	1775 NW 216TH	HILLSBORO OR 97123
TK1159	IMPROVED PRODUCTS	3400 OLYMPIC STREET	SPRINGFIELD OR 97477
TK1163	POLYCAST INC	9898 SW TIGARD ST	TIGARD OR 97223
TK1262	MURPHY ELECTRONICS INC (DIST)	14933 NE 40TH ST	REDMOND WA 98052-5326
TK1302	MOUNTAIN MOLDING	606 SECOND STREET	BERTHOUD CO 80513
TK1374	TRI-TEC ENGINEERING CORP		
TK1416	SHARP CORP	22-22 NAGAIKE-CHO ABENO-KU	OSAKA JAPAN
TK1465	BEAVERTON PARTS MFG CO	1800 NW 216TH AVE	HILLSBORO OR 97124-6629
TK1547	MOORE ELECTRONICS INC (DIST)	19500 SW 90TH COURT PO BOX 1030	TUALATIN OR 97062
TK1719	NEDELCO BV (THOMAS & BETTS)	POSTBUS 6431	3002 AK ROTTERDAM THE NETHERLANDS
TK1869	ALPS	100 N CNTRE AVE	ROCKVILLE CENTRE NY 11570
TK1916	SKS DIE CASTING CO	2200 4TH	BERKELEY CA 94710-2215
TK1943	NEILSEN MANUFACTURING INC	3501 PORTLAND ROAD NE	SALEM OR 97303
TK1967	SYNDETEK	3915 E MAIN	SPOKANE WA 99202
TK2105	QUALTEK ELECTRONICS CORP FAN-S DIV	7158 INDUSTRIAL PARK BLVD	MENTOR OH 44060
TK2122	INDUSTRIAL GASKET INC	1623 SE 6TH AVE	PORTLAND OR 97214-3502
TK2469	UNITREK CORPORATION	3000 LEWIS & CLARK WAY SUITE #2	VANCOUVER WA 98601
0B445	ELECTRI-CORD MFG CO INC	312 EAST MAIN ST	WESTFIELD PA 16950
0JR05	TRIQUEST CORP	3000 LEWIS AND CLARK HWY	VANCOUVER WA 98661-2999
0J260	COMTEK MANUFACTURING OF OREGON (METALS)	PO BOX 4200	BEAVERTON OR 97076-4200
0KB01	STAUFFER SUPPLY	810 SE SHERMAN	PORTLAND OR 97214
00779	AMP INC	2800 FULLING MILL PO BOX 3608	HARRISBURG PA 17105
06915	RICHCO PLASTIC CO	5825 N TRIPP AVE	CHICAGO IL 60646-6013
07416	NELSON NAME PLATE CO	3191 CASITAS	LOS ANGELES CA 90039-2410
1Y013	ACACIA/DEANCO	3101 SW 153RD DRIVE	BEAVERTON OR 97006
11897	PLASTIGLIDE MFG CORP	2701 W EL SEGUNDO BLVD	HAWTHORNE CA 90250-3318
2W944	PAPST MECHATRONIC CORP	AQUIDNECK INDUSTRIAL PK	NEWPORT RI 02840
24931	SPECIALTY CONNECTOR CO INC	2100 EARLYWOOD DR PO BOX 547	FRANKLIN IN 46131

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CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
28520	HEYCO MOLDED PRODUCTS	750 BOULEVARD P O BOX 160	KENILWORTH NJ 07033-1721
29870	VICTOR CORP	618 MAIN STREET	WEST WARWICK RI 02893
30010	BICC-VERO ELECTRONICS INC	40 LINDEMAN DR	TRUMBULL CT 06611-4739
34649	INTEL CORP SALES OFFICE /ST4-2/	3065 BOWERS AVE	SANTA CLARA CA 95051
5Y400	TRIAX METAL PRODUCTS INC DIV OF BEAVERTON PARTS MFG CO	1800 216TH AVE NW	HILLSBORO OR 97124-6629
50579	SIEMENS COMPONENTS INC OPTOELECTRONICS DIV	19000 HOMESTEAD RD	CUPERTINO CA 95014-0712
52814	TECH-ETCH INC	45 ALDRIN RD	PLYMOUTH MA 02360
53387	MINNESOTA MINING MFG CO	PO BOX 2963	AUSTIN TX 78769-2963
61058	MATSUSHITA ELECTRIC CORP OF AMERICA PANASONIC INDUSTRIAL CO DIV	ONE PANASONIC WAY PO BOX 1502	SECAUCUS NJ 07094-2917
61857	SAN-0 INDUSTRIAL CORP	85 ORVILLE DR PO BOX 511	BOHEMIA LONG ISLAND NY 11716-2501
66302	VLSI TECHNOLOGY INC	1109 MCKAY DR	SAN JOSE CA 95131-1706
71400	BUSSMANN DIV OF COOPER INDUSTRIES INC	114 OLD STATE RD PO BOX 14460	ST LOUIS MO 63178
73743	FISCHER SPECIAL MFG CO	111 INDUSTRIAL RD	COLD SPRING KY 41076-9749
75915	LITTELFUSE INC SUB TRACOR INC	800 E NORTHWEST HWY	DES PLAINES IL 60016-3049
78189	ILLINOIS TOOL WORKS INC SHAKEPROOF DIV	ST CHARLES ROAD	ELGIN IL 60120
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
83486	ELCO INDUSTRIES INC	1101 SAMUELSON RD	ROCKFORD IL 61101
83553	ASSOCIATED SPRING BARNES GROUP INC	15001 S BROADWAY P O BOX 231	GARDENA CA 90248-1819
85480	BRADY W H CO CORP H Q INDUSTRIAL PRODUCTS DIV	2221 W CAMDEN RD PO BOX 2131	MILWAUKEE WI 53209
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61108-5181

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	200-3759-00			1	COVER,CABINET:TOP,LIFT OFF	0J260	ORDER BY DESC
-2	214-0603-02			4	.PIN ASSY,SECRG:W/SPRING WASHER	0J260	ORDER BY DESC
-3	386-1151-00			4	.CLAMP,RIM CLENC:SPG STL CD PL	83553	ORDER BY DESC
-4	386-0227-00			4	.STOP,CLP,RIM CL:ACETAL	0JR05	386-0227-00
-5	200-3758-00			1	COVER,CABINET:BOTTOM,LIFT OFF	0J260	ORDER BY DESC
-6	214-0603-02			4	.PIN ASSY,SECRG:W/SPRING WASHER	0J260	ORDER BY DESC
-7	386-1151-00			4	.CLAMP,RIM CLENC:SPG STL CD PL	83553	ORDER BY DESC
-8	386-0227-00			4	.STOP,CLP,RIM CL:ACETAL	0JR05	386-0227-00
-9	348-0596-00			4	PAD,CAB.FOOT:0.69 X 0.255 X 0.06,PU	TK2122	348-0596-00
-10	348-0879-00			4	FOOT,CABINET:BOTTOM,BLUE,POLYCARB ATTACHING PARTS	TK1163	ORDER BY DESC
-11	211-0711-00			4	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS	0KB01	ORDER BY DESC
-12	348-0875-00			1	FLIPSTAND,CAB.:	TK0488	ORDER BY DESC

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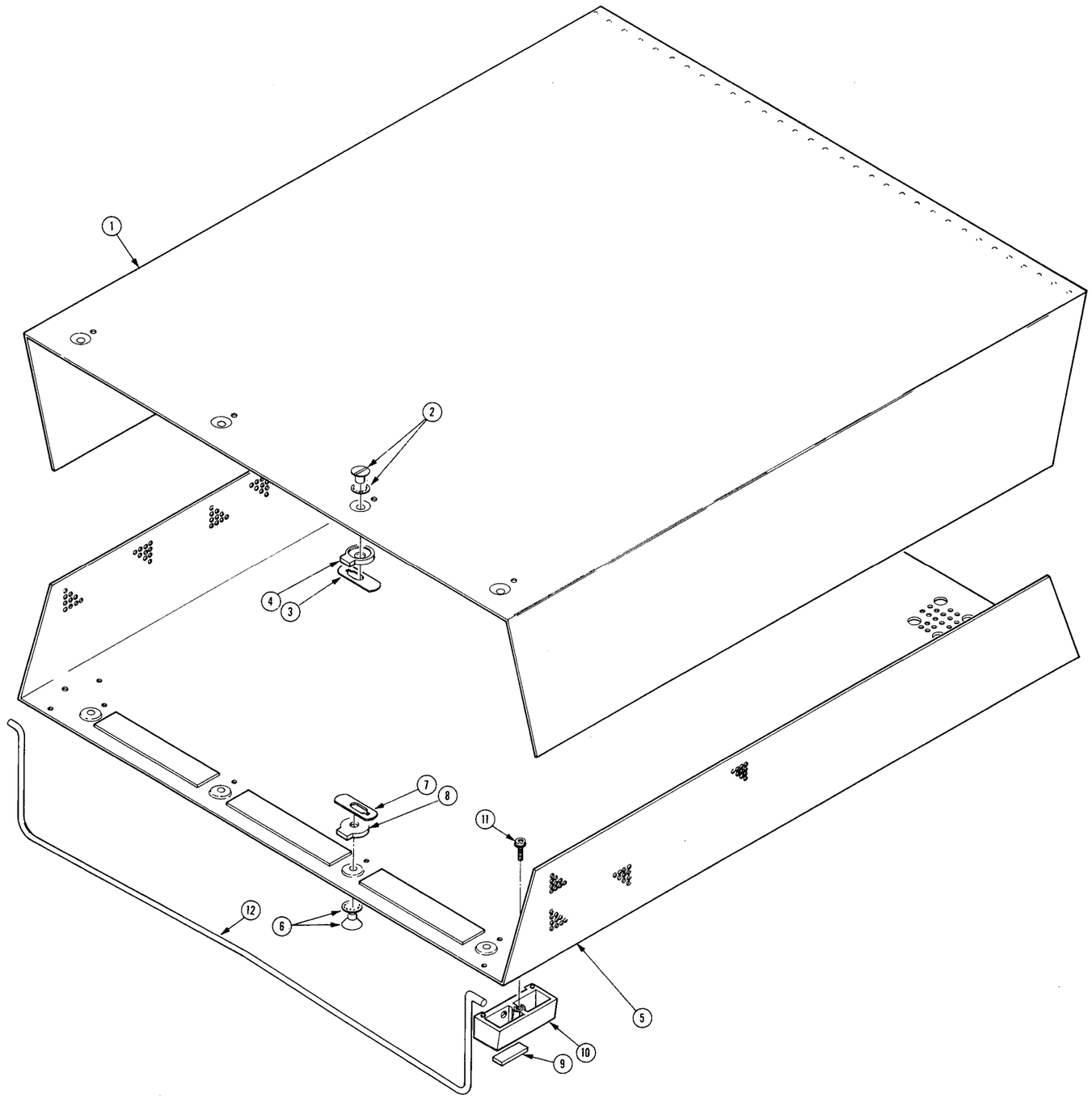
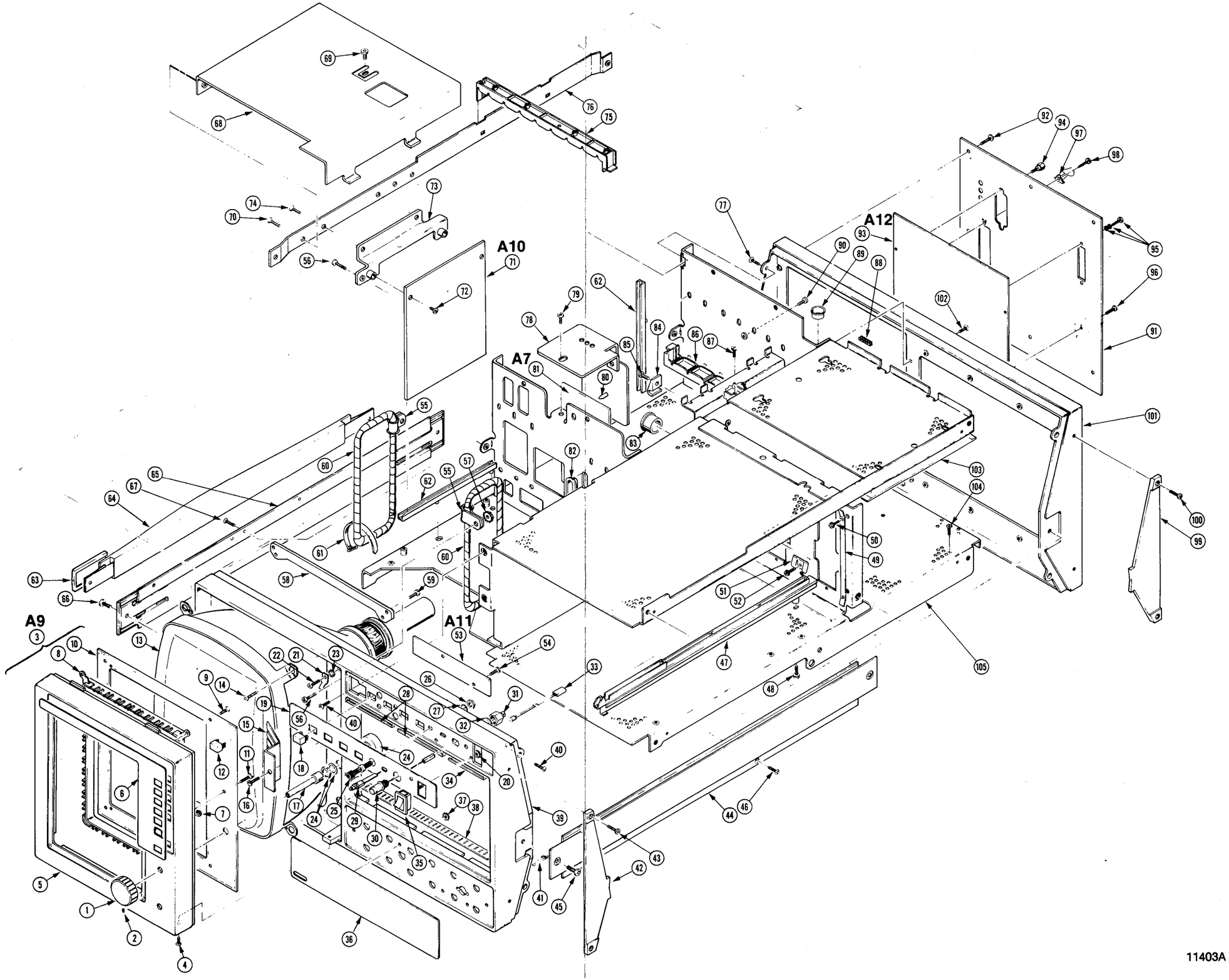


Fig. 1 Cabinet

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Fig. 2 Front, Chassis, Rear



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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-1	366-0582-00			2	KNOB:ENCODER	TK1163	ORDER BY DESC
-2	213-0022-00			2	SETSCREW:4-40 X 0.188,STL	0KB01	ORDER BY DESC
-3	614-0850-00			1	FRONT PNL ASSY:11403A (SEE A9, EXCHANGE ITEM) ATTACHING PARTS	80009	614085000
-4	211-0373-00			2	SCREW,MACHINE:4-40 X 0.25,PNH,STL END ATTACHING PARTS TOUCH PANEL ASSEMBLY INCLUDES:	83486	ORDER BY DESC
-5	200-3143-01			1	.COVER,CRT SCALE:BEZEL	TK1163	ORDER BY DESC
-6	333-3925-00			1	.PANEL,FRONT:11403A ATTACHING PARTS	07416	ORDER BY DESC
-7	210-0586-00			3	.NUT,PL,ASSEM WA:4-40 X 0.25,STL END ATTACHING PARTS	TK0435	ORDER BY DESC
-8	386-5806-00			1	.FRAME,LENS:TOUCH PANEL ATTACHING PARTS	0JR05	ORDER BY DESC
-9	211-0372-00			4	.SCREW,MACHINE:4-40 X 0.312,PNH,STL END ATTACHING PARTS	93907	B80-00020-003
-10	----------			1	CKT BOARD ASSY:TOUCH PANEL (NOT REPLACEABLE, ORDER BY DESC)		
-11	211-0378-00			1	.SCR,ASSEM WSHR:4-40 X 0.375.PNH,STL,T9 END ATTACHING PARTS	0KB01	ORDER BY DESC
-12	366-0600-00			7	.PUSH BUTTON:0.269 X 0.409,ABS	TK1163	ORDER BY DESC
-13	154-0946-00			1	ELECTRON TUBE:CRT,COLOR ATTACHING PARTS	S0482	09FXES-C1
-14	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL END ATTACHING PARTS	0KB01	ORDER BY DESC
-15	131-4763-00			1	CONTACT,ELEC:GROUND,CU BE ATTACHING PARTS	TK2469	ORDER BY DESC
-16	211-0711-00			1	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS	0KB01	ORDER BY DESC
-17	384-1682-01	B010100	B011071	2	EXTENSION SHAFT:2.375 L,POLYCARB	TK1163	ORDER BY DESC
	384-1682-02	B011072		2	SHAFT,EXTENSION:1.833 L,ALUMINUM	80009	384168202
-18	366-0600-00			4	PUSH BUTTON:0.269 X 0.409,ABS	TK1163	ORDER BY DESC
-19	333-3691-00			1	PANEL,FRONT:UPPER ATTACHING PARTS	07416	ORDER BY DESC
-20	210-0586-00			4	NUT,PL,ASSEM WA:4-40 X 0.25,STL END ATTACHING PARTS	TK0435	ORDER BY DESC
-21	131-1688-00			1	TERM,QIK DISC.:0.250 SPADE,STUD MT ATTACHING PARTS	00779	42822-4
-22	211-0721-00			1	SCREW,MACHINE:6-32 X 0.375,PNH,STL	0KB01	ORDER BY DESC
-23	210-0006-00			1	WASHER,LOCK:#6 INTL,0.018 THK,STL END ATTACHING PARTS	78189	1206-00-00-0541
-24	311-2320-00			2	ENCODER,DIGITAL:INCREMENTAL,50PPR	TK1869	EC24B50000FB
-25	129-0103-00			1	POST,BDG,ELEC:ASSEMBLY ATTACHING PARTS	TK0588	ORDER BY DESC
-26	210-0455-00			1	NUT,PLAIN,HEX:0.25-28 X 0.375,BRS NP	73743	3089-402
-27	210-0046-00			1	WASHER,LOCK:0.261 ID,INTL,0.018 THK,STL END ATTACHING PARTS	78189	1214-05-00-0541

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-28	348-0876-00	B010100	B011019	2	SHLD GSKT,ELEK:SOLID TYPE,2.480 L	52814	ORDER BY DESC
	348-1075-00	B011020		2	SHLD GSKT,ELEK:SOLID TYPE,1.66 L	52814	ORDER BY DESC
-29	131-1768-00			1	CONTACT,ELEC:DELAY LINE,BRS	80009	131176800
-30	131-3767-00			1	CONN ASSY,ELEC:CAL TERMINAL ATTACHING PARTS	TK2469	ORDER BY DESC
-31	103-0268-01			1	ADPTR COAX CONN:0.438 HEX,SST	TK0588	103-0268-01
-32	210-0012-00			1	WASHER,LOCK:0.384 ID,INTL,0.022 THK,STL END ATTACHING PARTS	78189	1220-02-00-0541
-33	150-0121-13			1	LIGHT,INDICATOR:5V,GREEN,INCANDECENT	TK1967	ORDER BY DESC
-34	348-0877-00	B010100	B011019	1	SHLD GSKT,ELEK:SOLID TYPE,1.860 L	52814	ORDER BY DESC
	348-1076-00	B011020		1	SHLD GSKT,ELEK:SOLID TYPE,2.28 L	52814	ORDER BY DESC
-35	260-2275-00			1	SWITCH,ROCKER:SPST,30MA,12V	TK1262	MEO1O-D
-36	333-3231-00			1	PANEL,FRONT:LOWER(STANDARD)	07416	ORDER BY DESC
	333-3215-00			1	PANEL,FRONT:LOWER,(OPTION) (OPTION 1C ONLY) ATTACHING PARTS	07416	ORDER BY DESC
-37	210-0586-00			4	NUT,PL,ASSEM WA:4-40 X 0.25,STL END ATTACHING PARTS	TK0435	ORDER BY DESC
	174-0178-01			1	CABLE ASSY,RF:4,50 OHM COAX,31.25 L (FRONT TO REAR BNC'S, OPTION 1C ONLY)	80009	174017801
	174-0252-01			1	CABLE ASSY,RF:4,50 OHM COAX,31.25 L (FRONT TO REAR BNC'S, OPTION 1C ONLY)	80009	174025201
	131-1315-01			16	CONN,RF JACK:BNC/PNL,:50 OHM,FEMALE,STR (J11 THRU J18 FRONT & BACK, OPT. 1C ONLY)	24931	28JR306-1
-38	348-0878-00			1	SHLD GSKT,ELEK:SOLID TYPE,7.646 L	52814	ORDER BY DESC
-39	386-5268-07			1	SUBPANEL,FRONT:FINISHED ATTACHING PARTS	TK1916	386-5268-07
-40	211-0718-00			5	SCREW,MACHINE:6-32 X 0.312,FLH,STL END ATTACHING PARTS	0KB01	ORDER BY DESC
-41	348-0886-00			4	SHLD GSKT,ELEK:FINGER TYPE,18.310 L	TK1159	ORDER BY DESC
-42	101-0107-00			2	TRIM,DEC:RIGHT SIDE,FRONT CASTING ATTACHING PARTS	TK1163	ORDER BY DESC
-43	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL END ATTACHING PARTS	0KB01	ORDER BY DESC
-44	426-2099-01			1	FRAME SECT,CAB.:RIGHT SIDE ATTACHING PARTS	TK1465	ORDER BY DESC
-45	212-0681-00			2	SCREW,MACHINE:10-32 X 0.25,PNH,STL	83486	MACHINE SCREW
-46	211-0718-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,STL END ATTACHING PARTS	0KB01	ORDER BY DESC
-47	351-0744-00			3	GUIDE,PLUG-IN:POLYAMIDE ATTACHING PARTS	TK1163	ORDER BY DESC
-48	211-0711-00			3	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS	0KB01	ORDER BY DESC
-49	131-0800-03			2	CONTACT,ELEC:PLUG-IN GND,BE NI HT TR ATTACHING PARTS	TK1943	ORDER BY DESC
-50	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL,T10 END ATTACHING PARTS	93907	829-06815-024
-51	131-0799-00			4	CONTACT,ELEC:PLUG-IN GND,BE NI ATTACHING PARTS	80009	131079900
-52	211-0408-00			4	SCR,ASSEM WSHR:4-40 X 0.250,PNH,STL,T10 END ATTACHING PARTS	93907	829-06815-024

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-53	671-1130-00			1	CIRCUIT BD ASSY:FRONT PANEL BUTTON (SEE A11, EXCHANGE ITEM)	80009	671113000
					ATTACHING PARTS		
-54	211-0410-00			2	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,T10	93907	829-07510-024
					END ATTACHING PARTS		
-55	343-0004-00			3	CLAMP,LOOP:0.312 ID,PLASTIC	06915	E5 CLEAR ROUND
					ATTACHING PARTS		
-56	211-0720-00			3	SCR,ASSEM WSHR:6-32 X 0.50,PNH,STL,T15	0KB01	ORDER BY DESC
-57	210-0457-00			1	NUT,PL,ASSEM WA:6-32 X 0.312,STL	TK0435	ORDER BY DESC
					END ATTACHING PARTS		
-58	381-0469-00			2	BAR,SUPPORT:CRT	5Y400	ORDER BY DESC
					ATTACHING PARTS		
-59	211-0722-00			4	SCREW,MACHINE:6-32 X 0.25,PNH,STL	0KB01	ORDER BY DESC
					END ATTACHING PARTS		
-60	108-1462-00			2	COIL,RF:FXD	TK1967	ORDER BY DESC
-61	346-0143-00			1	STRAP,TIEDOWN,E:14.5 X 0.14,PLASTIC	TK1719	TY244M
-62	351-0765-00			11	GUIDE,CKT BOARD:NYLON	30010	29-0124D
-63	200-2191-00			2	CAP,RETAINER:PLASTIC	0JR05	ORDER BY DESC
-64	367-0248-01			1	HANDLE,CARRYING:16.341 L,W/CLIP	TK1465	ORDER BY DESC
-65	426-2098-01			1	FRAME SECT,CAB.:LEFT SIDE	TK1465	ORDER BY DESC
					ATTACHING PARTS		
-66	212-0681-00			2	SCREW,MACHINE:10-32 X 0.25,PNH,STL	83486	MACHINE SCREW
-67	211-0718-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,STL	0KB01	ORDER BY DESC
					END ATTACHING PARTS		
-68	200-3690-00	B010100	B011096	1	COVER,HV:ALUMINUM	80009	200-03690-00
	200-3690-01	B011097		1	COVER,HIGH VOLT:ALUMINUM	80009	200369001
					ATTACHING PARTS		
-69	211-0718-00			1	SCREW,MACHINE:6-32 X 0.312,FLH,STL	0KB01	ORDER BY DESC
-70	211-0718-00			2	SCREW,MACHINE:6-32 X 0.312,FLH,STL	0KB01	ORDER BY DESC
					END ATTACHING PARTS		
-71	670-8847-01			1	CIRCUIT BD ASSY:FRONT PANEL CONTROL (SEE A10, EXCHANGE ITEM)	80009	670884701
					ATTACHING PARTS		
-72	211-0711-00			2	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15	0KB01	ORDER BY DESC
					END ATTACHING PARTS		
-73	407-3840-00			1	BRACKET,SUPPORT:	TK1943	ORDER BY DESC
					ATTACHING PARTS		
-74	211-0718-00			2	SCREW,MACHINE:6-32 X 0.312,FLH,STL	0KB01	ORDER BY DESC
					END ATTACHING PARTS		
-75	351-0746-00			2	GUIDE,CKT BOARD:NYLON 6.803 L	0JR05	ORDER BY DESC
-76	407-3438-02			1	BRACKET,CHASSIS:ALUMINUM	TK1943	ORDER BY DESC
					ATTACHING PARTS		
-77	211-0718-00			3	SCREW,MACHINE:6-32 X 0.312,FLH,STL	0KB01	ORDER BY DESC
					END ATTACHING PARTS		
-78	200-3708-00			1	COVER,CKT BOARD:	TK1943	ORDER BY DESC
					ATTACHING PARTS		
-79	211-0711-00			2	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15	0KB01	ORDER BY DESC
					END ATTACHING PARTS		
-80	386-1559-00			1	SPACER,CKT BD:0.47 H,ACETAL	80009	386155900

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
2-81	671-1028-00	B010100	B011015	1	CIRCUIT BD ASSY:CRT SOCKET	80009	671102800
	671-1028-01	B011016		1	CIRCUIT BD ASSY:CRT SOCKET (SEE A7, EXCHANGE ITEM)	80009	671102801
-82	348-0253-00			1	GROMMET,PLASTIC:BLACK,OBLONG	0JR05	ORDER BY DESC
-83	348-0532-00			1	GROMMET,PLASTIC:BLACK,ROUND,0.625 ID	28520	2096
-84	343-0081-00			1	STRAP,RETAINING:0.125 DIA,NYLON ATTACHING PARTS	85480	CPNY-172BK
-85	211-0711-00			1	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS	0KB01	ORDER BY DESC
-86	351-0746-00			1	GUIDE,CKT BOARD:NYLON 6.803 L ATTACHING PARTS	0JR05	ORDER BY DESC
-87	211-0711-00			1	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS	0KB01	ORDER BY DESC
-88	255-0334-00			1	PLASTIC CHAN:12.75 X 0.175 X 0.155,NYLON	11897	122-NN-2500-060
-89	342-0313-00			1	GROMMET,PLASTIC:0.437 ID X 0.562 OD,NYLON	28520	2066
-90	211-0711-00			1	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 ATTACHES REAR PANEL GROUND WIRE	0KB01	ORDER BY DESC
	334-6776-00	B010100	B011086	1	MARKER,IDENT:MKD GPIB	07416	ORDER BY DESC
-91	386-5369-01	B010100	B011086	1	PLATE,CONNECTOR:ALUMINUM	0J260	ORDER BY DESC
	386-5369-02	B011087		1	PLATE,CONNECTOR:STD,ALUMINUM	TK1465	386-5369-02
	386-5336-01			1	PLATE,CONNECTOR:OPT 1C,ALUMINUM (OPTION 1C ONLY) ATTACHING PARTS	TK1943	ORDER BY DESC
-92	211-0721-00			8	SCREW,MACHINE:6-32 X 0.375,PNH,STL END ATTACHING PARTS	0KB01	ORDER BY DESC
	334-6776-00			1	MARKER,IDENT:MKD GPIB	07416	ORDER BY DESC
-93	671-0013-00			1	CIRCUIT BD ASSY:REAR PANEL (SEE A12, EXCHANGE ITEM) ATTACHING PARTS	80009	671001300
-94	129-0744-00			2	SPACER,POST:0.875 L,4-40 BOTH ENDS,AL	80009	129074400
-95	214-3106-00			2	HARDWARE KIT:JACK SOCKET	53387	3341-1S
-96	211-0410-00			1	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,T10 END ATTACHING PARTS	93907	829-07510-024
-97	214-2476-01			2	HDW ASSY KIT:BAIL LOCK,ELEC CONN RCPT ATTACHING PARTS	53387	3475-4
-98	211-0410-00			2	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,T10 END ATTACHING PARTS	93907	829-07510-024
-99	101-0106-00			2	TRIM,DECORATIVE:LEFT SIDE,FRONT CASTING ATTACHING PARTS	TK1163	ORDER BY DESC
-100	211-0721-00			4	SCREW,MACHINE:6-32 X 0.375,PNH,STL END ATTACHING PARTS	0KB01	ORDER BY DESC
-101	386-5269-02			1	SUBPANEL,REAR:PLATED ATTACHING PARTS	TK1916	ORDER BY DESC
-102	211-0718-00			5	SCREW,MACHINE:6-32 X 0.312,FLH,STL END ATTACHING PARTS	0KB01	ORDER BY DESC
-103	386-5283-00			2	SUPPORT,CHASSIS:POWER SUPPLY,POLYCARB	0JR05	ORDER BY DESC
-104	211-0722-00			1	SCREW,MACHINE:6-32 X 0.25,PNH,STL (ATTACHING PART TO PWR SPLY GND WIRE)	0KB01	ORDER BY DESC
-105	610-0751-04			1	CHASSIS ASSY:WELDED	TK1943	ORDER BY DESC

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-1	671-1026-02			1	CIRCUIT BD ASSY:TIMEBASE (SEE A6, EXCHANGE ITEM) ATTACHING PARTS	80009	671102602
-2	211-0711-00			6	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS TIMEBASE BOARD ASSEMBLY INCLUDES:	0KB01	ORDER BY DESC
-3	156-2645-00			1	.MICROCKT,DGTL:CMOS,SEMI CUSTOM (U166)	66302	VF4366QC CC0001
-4	129-0591-00			1	SPACER,POST:0.937 L,6-32 INT-EXT,STL	80009	129059100
-5	386-1559-00			3	SPACER,CKT BD:0.47 H,ACETAL	80009	386155900
-6	671-1027-00			1	CIRCUIT BD ASSY:CRT DRIVER (SEE A8, EXCHANGE ITEM) ATTACHING PARTS	80009	671102700
-7	211-0711-00			1	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15	0KB01	ORDER BY DESC
-8	211-0711-00			1	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS CRT DRIVER BOARD ASSEMBLY INCLUDES:	0KB01	ORDER BY DESC
-9	159-0235-00			1	.FUSE,WIRE LEAD:0.75A,125V,FAST (F330)	71400	TR/MCR 3/4
-10	407-3824-00			1	.BRACKET,SUPPORT:HV XFMR,0.062 AL ATTACHING PARTS	5Y400	ORDER BY DESC
-11	213-0992-00			1	.SCREW,TPG,TF:4-24 X 0.375,PNH,STL	93907	B80-70000-003
-12	211-0711-00			1	.SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS	0KB01	ORDER BY DESC
-13	671-1129-00			1	CIRCUIT BD ASSY:MOTHER (SEE A13) ATTACHING PARTS	80009	671112900
-14	211-0711-00			6	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15 END ATTACHING PARTS	0KB01	ORDER BY DESC
-15	671-1024-00			1	CIRCUIT BD ASSY:MAIN PROCESSOR (SEE A17, EXCHANGE ITEM)	80009	671102400
	671-1024-50			1	CIRCUIT BD ASSY:MAIN PROCESSOR (SEE A17, OPTION 4D ONLY, EXCHANGE ITEM)	80009	671102450
-16	156-3812-00			1	.MICROCKT,DGTL:HMOS,MICROPROCESSOR (U830)	34649	R80286-10
	156-3821-00			1	.IC,PROCESSOR:NMOS,PERIPHERAL (U800, OPTION 4D ONLY)	50579	SAB82258A-1N
-17	671-1025-00			1	CIRCUIT BD ASSY:MEMORY (SEE A18, EXCHANGE ITEM)	80009	671102500
	671-1025-50			1	CIRCUIT BD ASSY:MEMORY (SEE A18, OPTION 2D ONLY, EXCHANGE ITEM)	80009	671102550
-18	146-0055-00			1	.BATTERY,DRY:3.0V,1200 MAH,LITHIUM (BT150)	61058	BR-2/3A-E2P
-19	670-8854-01			1	CIRCUIT BD ASSY:INPUT/OUTPUT (SEE A14, EXCHANGE ITEM)	80009	670885401
-20	146-0055-00			1	.BATTERY,DRY:3.0V,1200 MAH,LITHIUM (BT130)	61058	BR-2/3A-E2P
-21	159-0245-00			4	.FUSE,WIRE LEAD:1A,125V,FAST (F200,F600,F602,F800)	71400	TR/MCR-1
-22	156-2622-00			1	.MICROCKT,DGTL:HMOS,SEMI CUSTOM (U330)	66302	VF4157RC CC0001

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
3-23	671-1023-01			1	CIRCUIT BD ASSY:MEM MANAGEMENT UNIT (SEE A15, EXCHANGE ITEM)	80009	671102301
-24	671-1965-00			1	CIRCUIT BD ASSY:PLUG-IN INTERFACE (SEE A1, EXCHANGE ITEM) ATTACHING PARTS	80009	671196500
-25	211-0410-00			9	SCR,ASSEM WSHR:4-40 X 0.437,PNH,STL,T10 END ATTACHING PARTS	93907	829-07510-024
-26	670-8840-01			1	CIRCUIT BD ASSY:REGULATOR (SEE A4, EXCHANGE ITEM) ATTACHING PARTS	80009	670884001
-27	211-0721-00			2	SCREW,MACHINE:6-32 X 0.375,PNH,STL END ATTACHING PARTS REGULATOR BOARD ASSEMBLY INCLUDES:	0KB01	ORDER BY DESC
-28	159-0220-00			1	.FUSE,WIRE LEAD:3A,125V,FAST (F430)	61857	SP5-3A
-29	671-1986-00			1	CIRCUIT BD ASSY:ACQUISITION (SEE A5, EXCHANGE ITEM) ATTACHING PARTS	80009	671198600
-30	211-0711-00			7	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,T15	0KB01	ORDER BY DESC
-31	211-0754-00			2	SCR,ASSEM WSHR:6-32 X 1.375,PNH,STL END ATTACHING PARTS ACQUISITION BOARD ASSEMBLY INCLUDES:	93907	ORDER BY DESC
-32	671-1022-00			1	.CIRCUIT BD ASSY:TRIGGER ENHANCEMENT (SEE A5A2, EXCHANGE ITEM) ATTACHING PARTS	80009	671102200
-33	210-0407-00			2	.NUT,PLAIN,HEX:6-32 X 0.25,BRS END ATTACHING PARTS	73743	3038-402
-34	386-5429-01			1	SUPPORT,PIVOT:ECB,RIGHT SIDE ATTACHING PARTS	TK1302	ORDER BY DESC
-35	213-0992-00			1	SCREW,TPG,TF:4-24 X 0.375,PNH,STL END ATTACHING PARTS	93907	B80-70000-003
-36	386-5428-01			1	SUPPORT,PIVOT:ECB,LEFT SIDE ATTACHING PARTS	TK1302	ORDER BY DESC
-37	213-0992-00			1	SCREW,TPG,TF:4-24 X 0.375,PNH,STL END ATTACHING PARTS	93907	B80-70000-003
	020-1903-00			1	COMP KIT:11201A/203,11402A/403/403A,CSA404	80009	020190300
-38	671-1980-00			1	CIRCUIT BD ASSY:ADAPTER (SEE A5A3, EXCHANGE ITEM)	80009	671198000

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
					WIRE ASSEMBLIES		
	174-0287-00			1	CABLE ASSY,RF:50 OHM COAX,29.0 L (FROM A5J26 TO FRONT PANEL)	80009	ORDER BY DESC
	174-0580-00			1	CA ASSY,SP,ELEC:50,28 AWG,14.0 L,RIBBON (FROM A5J83 TO A6J83)	TK1547	ORDER BY DESC
	174-1557-00			1	CA ASSY,SP,ELEC:8,22 AWG,(4)12.5 L,(4)11.125 L (FROM A10J74 TO ENCODERS S74 AND S75)	TK1967	ORDER BY DESC
	174-1559-00			1	CA ASSY,SP,ELEC:8,26 AWG,12.0 L (FROM A7J56 TO A8J56)	TK1967	ORDER BY DESC
	174-1560-00			1	CA ASSY,SP,ELEC:4,26 AWG,21.0 L,RIBBON (FROM A4J57 TO A8J57)	TK1967	ORDER BY DESC
	174-1561-00			1	CA ASSY,SP,ELEC:3,26 AWG,9.0 L (FROM A8J52 TO A15J52)	TK1967	ORDER BY DESC
	174-1743-00			1	CA ASSY,SP,ELEC:4,18 AWG,18.5 L (FROM A2A2J63 TO A13J63)	TK1967	ORDER BY DESC
	174-1744-00			1	CA ASSY,SP,ELEC:50,28 AWG (FROM A10J72 TO A14J72)	TK1547	ORDER BY DESC
	174-1748-00			1	CABLE ASSY,RF:50 OHM COAX,17.5 L (FROM A1J30,J31,J32,J33,J34,J36 TO A5J30, J31,J32,J33,J34,J36)	80009	ORDER BY DESC
	175-9798-00			1	CA ASSY,SP,ELEC:18.0 L (FROM A2A2J66 TO A5J66,A6J66)	TK1967	ORDER BY DESC
	175-9803-00			2	CA ASSY,SP,ELEC:7,26 AWG,7.5 L,RIBBON (FROM A2A2J65 TO A4J65) (FROM A7J53 TO A15J53)	TK1967	ORDER BY DESC
	175-9804-00			1	CA ASSY,SP,ELEC:34,4.0 L (FROM A5J86 TO A6J86)	TK1547	ORDER BY DESC
	175-9805-00			1	CA ASSY,SP,ELEC:40,4.0 L (FROM A5J85 TO A6J85)	TK1547	ORDER BY DESC
	175-9806-00			1	CA ASSY,SP,ELEC:60,4.0 L (FROM A5J84 TO A6J84)	TK1547	ORDER BY DESC
	175-9812-00			1	CA ASSY,SP,ELEC:26,7.0 L (FROM A1J91 TO A5J91,A6J91)	TK1547	ORDER BY DESC
	175-9814-00			1	CA ASSY,SP,ELEC:34,3.0 L (FROM A14J77 TO A17J77)	TK1547	ORDER BY DESC
	174-1113-00			1	CA ASSY,SP,ELEC:40,28 AWG,6.0 L,RIBBON (FROM A14J78 TO A12J78)	TK1547	ORDER BY DESC
	175-9857-00			1	CA ASSY,SP,ELEC:11,18 AWG,7.25 L,RIBBON (FROM A4J62 TO A2A2J62)	TK1967	ORDER BY DESC
	175-9905-00			1	CABLE ASSY,RF:50 OHM COAX,18.0 L,9-1 (FROM A1J01 TO A5J01)	80009	ORDER BY DESC
	175-9906-00			1	CABLE ASSY,RF:50 OHM COAX,18.0 L,9-2 (FROM A1J02 TO A5J02)	80009	ORDER BY DESC
	175-9907-00			1	CABLE ASSY,RF:50 OHM COAX,18.0 L,9-3 (FROM A1J03 TO A5J03)	80009	ORDER BY DESC
	175-9908-00			1	CABLE ASSY,RF:50 OHM COAX,18.0 L,9-4 (FROM A1J04 TO A5J04)	80009	ORDER BY DESC
	175-9909-00			1	CABLE ASSY,RF:50 OHM COAX,18.0 L,9-5 (FROM A1J05 TO A5J05)	80009	ORDER BY DESC
	175-9910-00			1	CABLE ASSY,RF:50 OHM COAX,18.0 L,9-6 (FROM A1J06 TO A5J06)	80009	ORDER BY DESC

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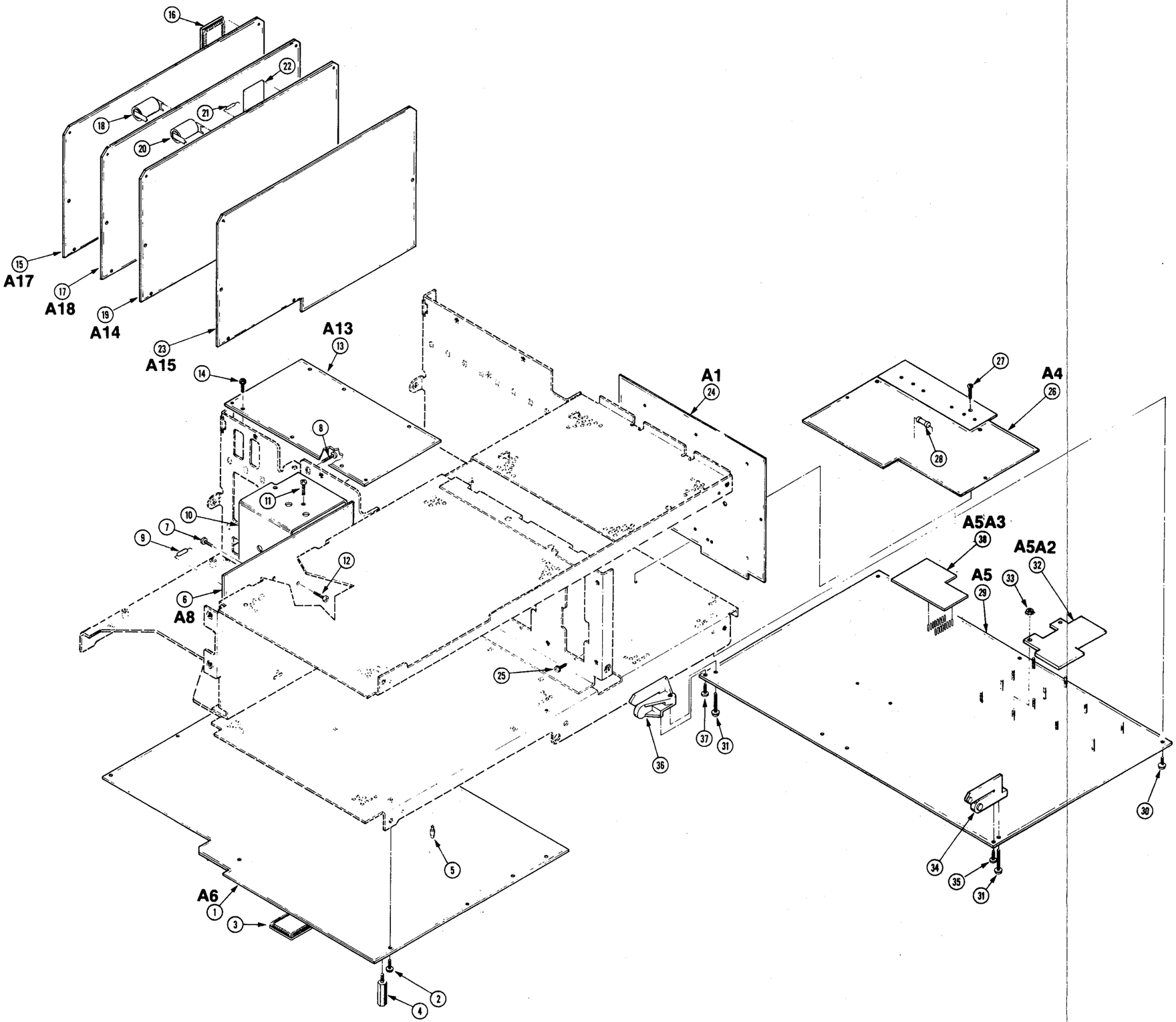
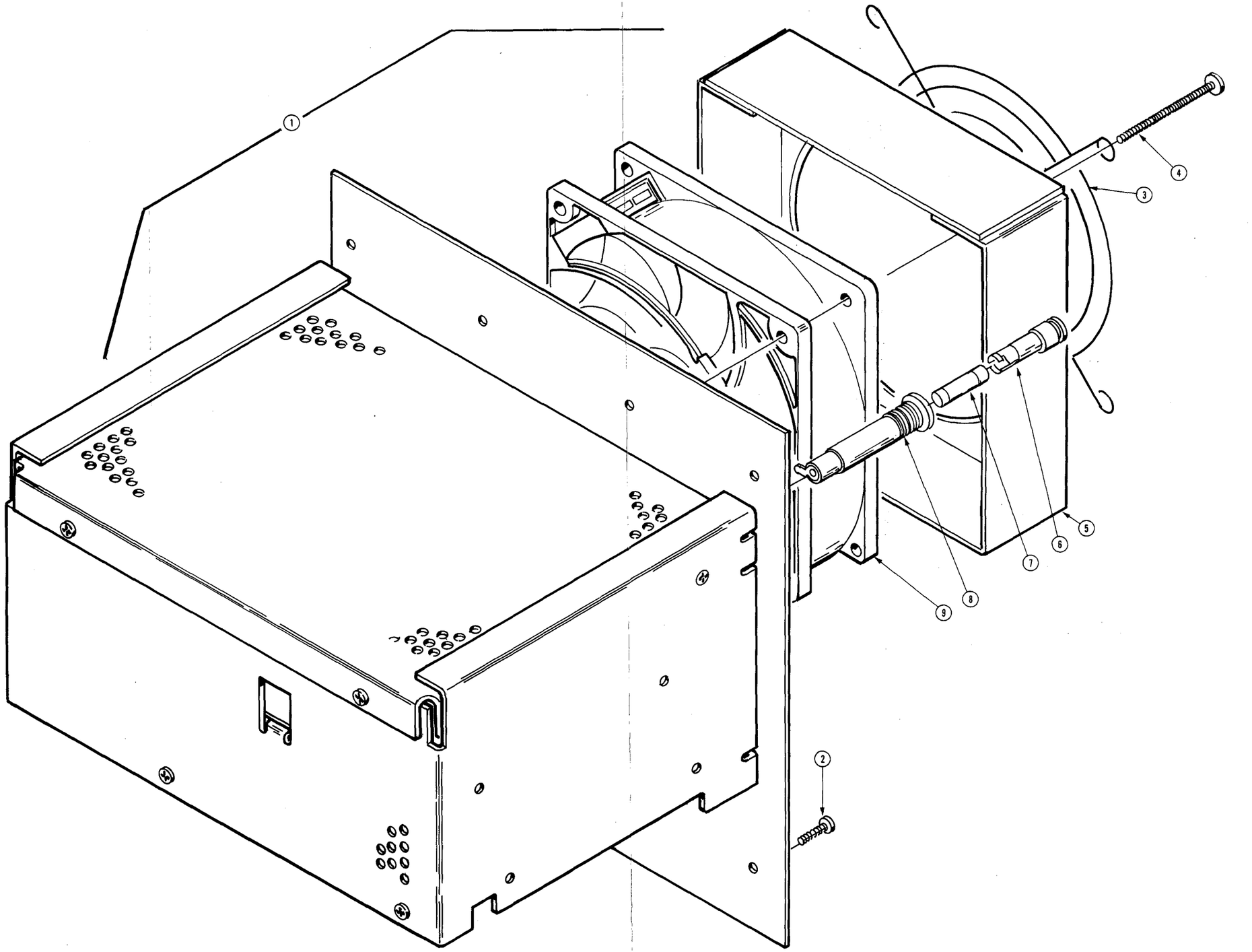


Fig. 3 Circuit Boards

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Fig. 4 Power Supply



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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
4 -1	620-0022-05			1	POWER SUPPLY:ET,RTHLRES MAINFRAMES (SEE A2, EXCHANGE ITEM) (ATTACHING PARTS)	80009	620002205
-2	211-0721-00			8	SCREW,MACHINE:6-32 X 0.375,PNH,STL END ATTACHING PARTS POWER SUPPLY ASSEMBLY INCLUDES:	0KB01	ORDER BY DESC
-3	200-2222-00			1	.GUARD,FAN:7912AD, ATTACHING PARTS	TK2105	08213
-4	211-0744-00			4	.SCREW,MACHINE:6-32 X 2.0,PNH,STL END ATTACHING PARTS	TK0435	ORDER BY DESC
-5	407-3362-00			1	.BRACKET,FAN:0.050 5005 H-34	5Y400	ORDER BY DESC
-6	200-2264-00			1	.CAP,FUSEHOLDER:3AG FUSES	S3629	FEK 031 1666
-7	159-0013-00			1	.FUSE,CARTRIDGE:3AG,6A,250V,FAST BLOW (F99, USED IN FUSE HOLDER)	75915	312006
	159-0021-00			1	.FUSE,CARTRIDGE:3AG,2A,250V,FAST BLOW (F410, PART OF LINE INVERTER BOARD)	71400	AGC-2
	159-0248-00			1	.FUSE,WIRE LEAD:1.5 A,AXIAL LEAD (F650, PART OF LINE INVERTER BOARD)	71400	TR/MCR-1 1/2
	159-0220-00			1	.FUSE,WIRE LEAD:3A,125V,FAST (F740, PART OF CONTROL RECTIFIER BOARD)	61857	SP5-3A
-8	204-0832-00			1	.BODY,FUSEHOLDER:3AG & 5 X 20MM FUSES	S3629	031 1673 (FEU M
-9	119-1725-01			1	.FAN,TUBEAXIAL:8 14.5VDC,6W,3200RPM	2W944	4112 KX

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Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
					STANDARD ACCESSORIES		
5-1	161-0066-00			1	CABLE ASSY,PWR,:3,18AWG,115V,98.0 L,	0B445	ECM-161-0066-00
-2	161-0066-09			1	CABLE ASSY,PWR,:3,0.75MM SQ,220V,99.0 L (OPTION A1 ONLY)	S3109	86511000
-3	161-0066-10			1	CABLE ASSY,PWR,:THREE 0.75MM SQ,250V (OPTION A2 ONLY)	S3109	BS/13-H05VVF3G0
-4	161-0066-11			1	CABLE ASSY,PWR,:3,0.75MM,240V,96.0 L (OPTION A3 ONLY)	S3109	SAA/3-OD3CCFC3X
-5	161-0066-12			1	CABLE ASSY,PWR,:3,18 AWG,250V,99.0 L (OPTION A4 ONLY)	29870	ORDER BY DESC
-6	161-0154-00			1	CABLE ASSY,PWR,:3,1.00MM SQ,250V,10A,2.5M (OPTION A5 ONLY)	S3109	12-H05VVF3G 00-
	012-0208-00			8	CABLE,INTCON:10.0 L (OPTION 1C ONLY)	1Y013	ORDER BY DESC
	070-6274-00			1	MANUAL,TECH:INSTR,11K SERIES RACK MT (OPTION 1R ONLY)	80009	070627400
	015-0580-00			1	POCKET SIG GEN:TUTORIAL MANUAL AID	80009	015058000
	070-8190-00			1	MANUAL,TECH:TUTORIAL,11402A/403A	80009	070819000
	070-8191-00			1	MANUAL,TECH:USER REF,11402A/403A	80009	070819100
	070-8192-00			1	MANUAL,TECH:PRGM REF,11402A/403A	80009	070819200
	070-8193-00			1	MANUAL,TECH:QUICK REF,11402A/403A	80009	070819300
	070-8194-00			1	MANUAL,TECH:SERVICE REF,11403A	80009	070819400
					OPTIONAL ACCESSORIES		
	012-0555-00			1	CABLE,INTCON:CENTRONIX,3M,36 POS	TK1416	DKIT-0034HCZZ
	012-0911-00			1	CABLE,INTCON:RS232;10 FT,15,24 AWG	TK1374	ORDER BY DESC
	012-0991-00			1	CABLE,COMPOSITE:IDC,GPIB:2M,24 COND	00779	553577-3
	016-0829-00			1	PANEL,BLANK:PLUG-IN HOUSING,11K SERIES	80009	016082900
	067-1264-00			1	FIXTURE,CAL:PWR SPLY EXT DIAGNOSTICS	80009	067126400
	067-1267-00			1	FIXTURE,CAL:TROUBLE SHOOTING AID EXT	80009	067126700

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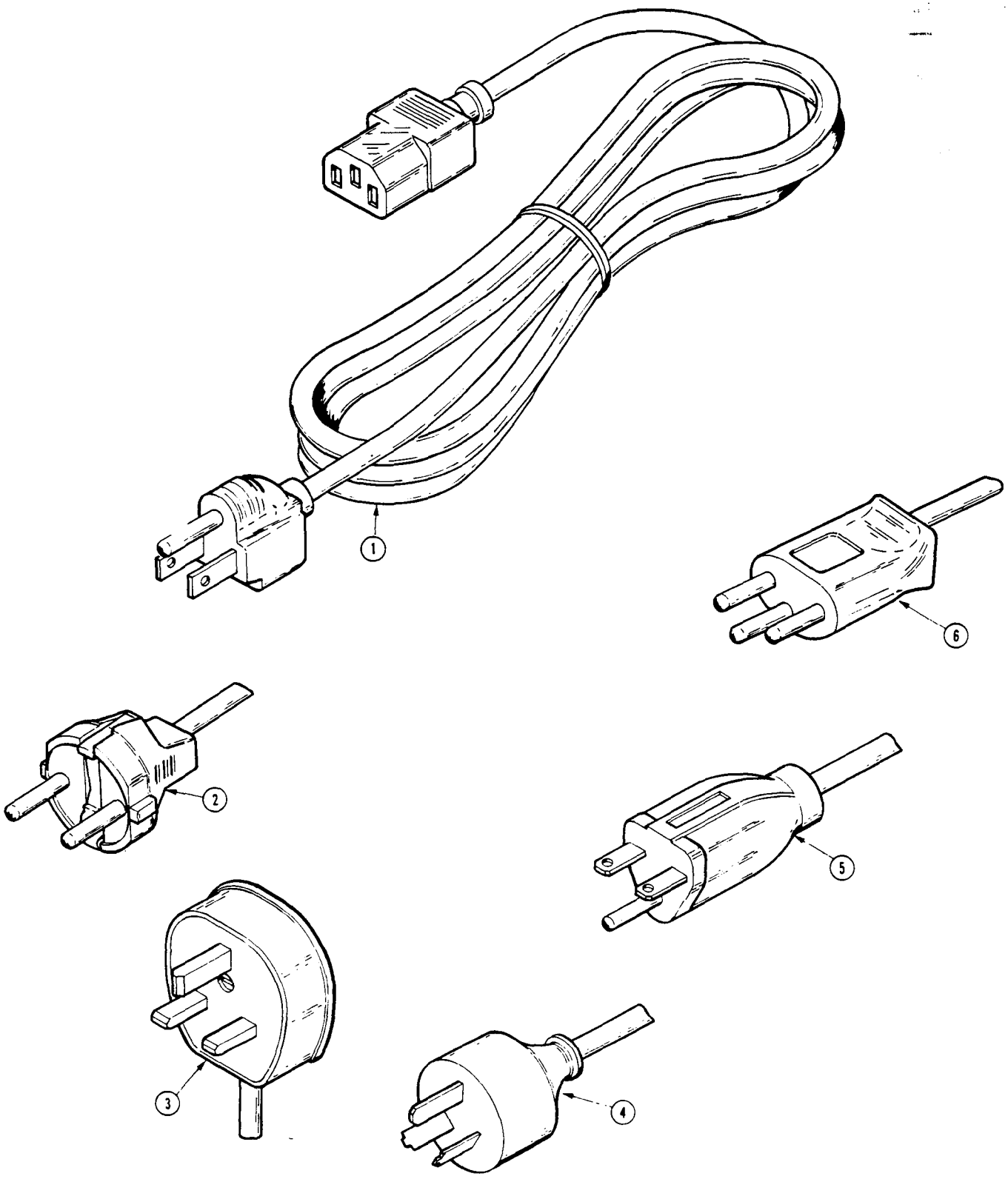


Fig. 5 Accessories

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