Part No. 070-6786-00
Product Group 47

11A52
Two Channel Amplifier

Service Reference

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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COMMITTED TO EXCELLENCE

INSTRUMENT SERIAL NUMBERS

Each instrument has a serial number on a panel insert, tag, or stamped on the chassis. The first number or letter 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:

B000000	Tektronix, Inc. Beaverton, Oregon, USA
1000000	Tektronix Guernsey, Ltd., Channel Islands
2000000	Tektronix United Kingdom, Ltd., London
3000000	Sony/Tektronix, Japan
7000000	Tektronix Holland, NV, Heerenveen, The Netherlands

Printed in U.S.A.

Contents

The Replaceable Parts Section at the rear of this manual lists the Tektronix part numbers for all Standard Accessories provided with this product.

Manuals (Standard Accessories)

List of Illustrations

List of Tables

Safety Summary

The general safety information in this part of the summary is for both operating and servicing personnel. Specific warnings and cautions will be found throughout the manual where they apply, but may not appear in this summary.

Terms

In This Manual

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

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

As Marked on Equipment

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

DANGER indicates a personal injury hazard immediately accessible as one reads the marking.

Symbols

In This Manual

Static-Sensitive Devices.

This symbol indicates where applicable cautionary or other information is to be found.

As Marked on Equipment

DANGER – High Voltage.

Protective ground (earth) terminal.

ATTENTION – refer to manual.

Warnings

Power Source

This product is intended to operate in a mainframe connected to 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 mainframe power cord, is essential for safe operation.

Grounding the Product

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

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 electric shock.

Do Not Operate in Explosive Atmospheres

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

Do Not Service Alone

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

Use Care When Servicing with Power On

Dangerous voltages exist at several points in this product. To avoid personal injury, do not touch exposed connections and components while power is on.

Disconnect power before removing protective panels, or replacing components.

Section 1
General Information

This section gives all the information needed to apply power to the 11A52 Two Channel Amplifier.

Information on installing and removing the plug-in, instrument options, packaging for shipment, as well as environmental conditions such as operating temperature is included here.

Introduction

This manual is designed for use by qualified service personnel. It contains information necessary to check, troubleshoot, and maintain the 11A52 Two Channel Amplifier. Troubleshooting is primarily based upon internal Power-up Diagnostics. These diagnostics identify suspect Field Replaceable Unit(s) (FRUs). Once the faulty FRU is identified, use the instructions provided in this manual to remove and replace it. Section 5, Replaceable Parts gives a complete list of the FRUs in this instrument.

The 11A52 is a two-channel, wide-bandwidth plug-in amplifier that plugs into any of the 11000-series plug-in mainframes. Commands from the mainframe control all the plug-in functions. The plug-in front panel has a momentary pushbutton and a back-lighted "display on" indicator for each input channel. Other controls and status indicators are located on the mainframe.

The impedance of each input is 50 Ω. Bandwidth can be limited to 20 MHz or 100 MHz. Each channel provides a display and a trigger output to the host mainframe. Each of these outputs is comprised of any mainframe-specified combination of the input signals. The plug-in also provides an auxiliary output from each channel to the mainframe.

Each channel has a TEKPROBE® input connector. The TEKPROBE® input connector accepts a Level 1 or Level 2 TEKPROBE®, a probe with a BNC connector, or a BNC connector. The plug-in detects the probe-encoding information and uses this information to automatically achieve the desired settings.

Plug-in to Mainframe Compatibility

The system bandwidth depends on the host mainframe. Details about bandwidth are included in Part 4, Specification, of the User's Reference Supplement, and in the Tektronix Corporate Catalog. Refer to the Tektronix Corporate Catalog for complete compatibility information.

Initial Inspection

This instrument was inspected mechanically and electrically before shipment. Therefore, this instrument should not have any mars or scratches and should meet all electrical specifications.

Inspect the plug-in for possible physical damage incurred in transit. Use the Incoming Inspection Procedure shipped with the instrument to verify instrument performance. If you find damage or deficiency, contact your local Tektronix Field Office or representative.

Installing and Removing the Plug-In

To install the plug-in in any 11000-series oscilloscope mainframe:

1. Set the mainframe ON/STANDBY switch to STANDBY to prevent damage to the instrument.

CAUTION

If the green indicator light remains ON when the STANDBY position is selected, then the switch has been left internally disabled after the servicing of the Power Supply. To enable the ON/STANDBY switch, refer to the Maintenance section of the mainframe Service Manual.

2. Align the grooves in the top and bottom of the plug-in with the guides in the mainframe plug-in compartment.
3. Insert the plug-in into the mainframe until its front panel is flush with the front panel of the mainframe.

To remove the plug-in from a mainframe.

1. Set the mainframe ON/STANDBY switch to STANDBY to prevent damage to the instrument.
2. Pull the release latch (refer to Fig. 1-1) to disengage the unit from the mainframe.
3. Pull the plug-in straight out of the plug-in compartment.

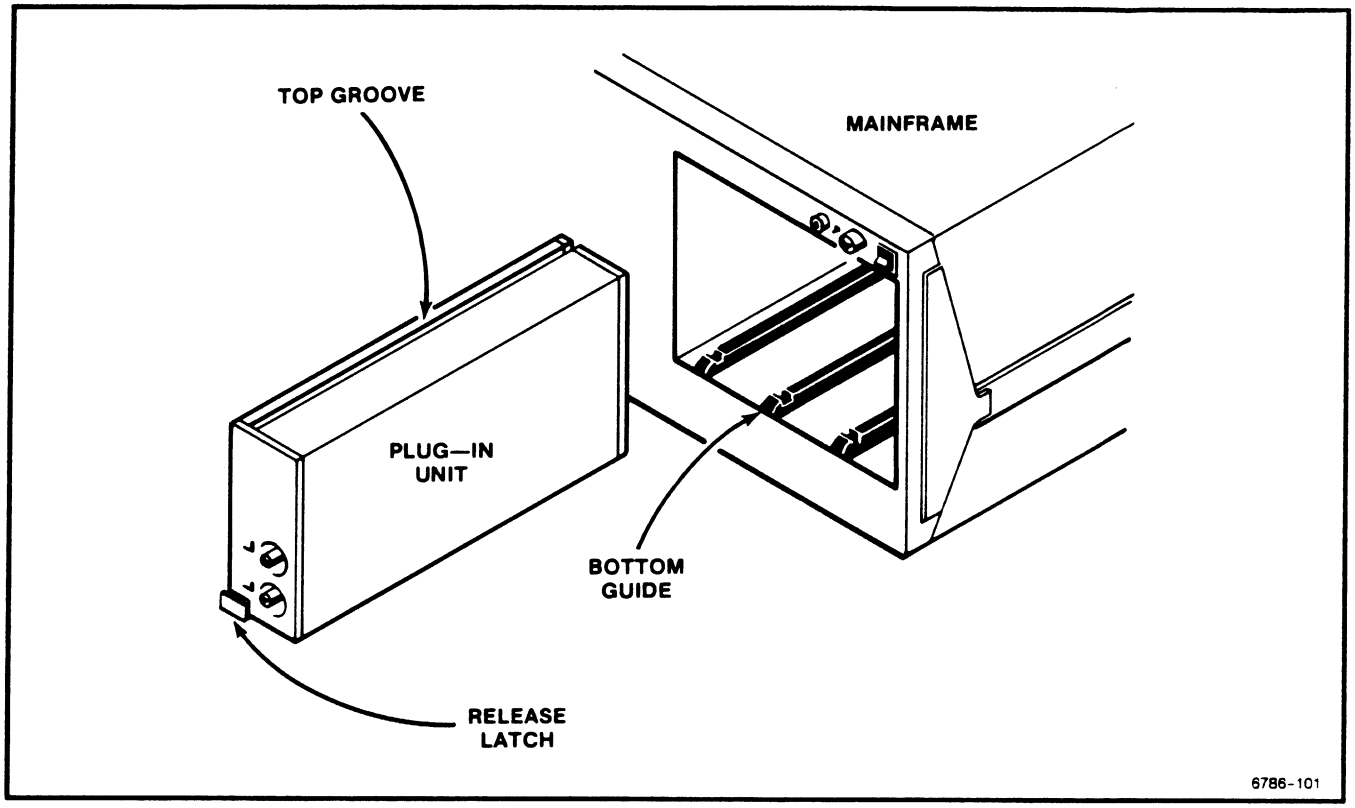


Figure 1-1. Installing a plug-in in a mainframe oscilloscope.

Instrument Options

The customer can order Option 25, which includes two P6231 probes.

Packaging for Shipment

If possible, save and reuse the original carton and packaging to package the instrument when shipping it by commercial transportation. Package and ship the plug-ins and mainframes separately.

Attach a tag to the plug-in if it is shipped to a Tektronix Service Center for service or repair. Include the following information on the tag:

- Name and address of the instrument owner
- Name of a person at your firm who can be contacted about the instrument
- Complete instrument type and serial number
- A description of the service required

Package the plug-in as follows, if the original package is not available or is not fit for use:

1. Obtain a corrugated cardboard carton with inside dimensions at least six inches (15 cm) greater than the instrument dimensions. Use a carton with a bursting test strength of at least 200 pounds per square inch.
2. Fully wrap the plug-in with anti-static sheeting, or its equivalent, to protect the finish.
3. Tightly pack dunnage or urethane foam between the carton and the instrument to cushion the plug-in on all sides. Allow three inches of packing on each side.
4. Seal the carton with shipping tape or with industrial staples.
5. Mark the address of the Tektronix Service Center and your return address on the carton in one or more prominent places.

Operating Environment

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

Operating Temperature

Operate the plug-in where the ambient air temperature is between 0° and +50° C. Store the plug-in in ambient temperatures from -40° to +75° C. After storing the plug-in at temperatures outside the operating limits, allow the chassis to reach the safe operating temperature before applying power.

Enhanced system accuracy is available after a 20-minute warmup period. After entry into Enhanced Accuracy, the instrument reverts to non-enhanced accuracy if the internal mainframe temperature changes more than 5° C.

Section 2
Checks and Adjustments

This section contains procedures to check electrical specifications and to manually set all internal adjustments. This procedure provides a logical sequence of check and adjustment steps for either returning the instrument to specified operation following repair or for performing a part of a routine maintenance program. Consult the User's Reference manual for more information about advertised specifications and instrument operation. Consult the test equipment manuals for information concerning test equipment setup or interconnection. The Specifications or Measurement Limits are given at the beginning of each procedure.

Using this Procedure

In these procedures, the following conventions are used:

- CAPITAL letters within the body of text identify front-panel controls, indicators, and connectors (for example, MEASURE) on the mainframe and plug-in.
- **Bold** letters identify menu labels and display messages.
- Initial Capital letters identify connectors, controls, and indicators (for example, Position) on associated test equipment. Initial Capital letters also identify adjustments inside the plug-in (for example Vert Pos).

A heading system is used to readily identify the steps that contain performance verification and/or adjustment instructions. 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 indicate whether the instrument is operating properly; 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 procedure. Comprehensive descriptions of menus and instrument features are located in the User's Reference manual.

The mainframe tutorial manual is strongly recommended to familiarize the first-time user with the mainframe controls and features.

Plug-In Installation and Removal

CAUTION

To avoid instrument damage, set the mainframe ON/STANDBY switch to STANDBY before installing or removing the plug-ins.

Turning the instrument power off during probe calibration, self-calibration, Extended Diagnostics, or other intense system activity may result in some internal data being corrupted. If corruption occurs, refer to Restoring Calibration Data in Section 3.

Initialized Setting

At the beginning of most steps, the user is instructed to **Initialize** the instrument as part of the setup. The **Initialize** feature, available through the UTILITY menu, presets all instrument controls and functions to known values. Initializing the instrument at the beginning of a step eliminates the possibility of settings from previous steps causing erroneous or confusing results. For more information on initialization, refer to the mainframe User's Reference manual.

Test Equipment

Table 2-1 contains suggested test equipment used with the Checks and Adjustment Procedure. The Procedures are based on the test equipment examples shown in the Setups, but other equipment with similar specifications may be substituted. However, using other equipment could alter the test results, the Setup information, or the related connectors and adapters required.

Procedure Parts

The procedure is divided into the following parts which should be performed sequentially:

1. Initial Setup
2. Check/Examine/Adjust High Frequency Response
3. Check Enhanced Accuracy
4. Check DC Balance
5. Check ΔV DC Accuracy
6. Check DC Offset Accuracy

TABLE 2-1
Test Equipment

Description	Minimum Specification	Examples of Applicable Test Equipment
11000-series Plug-in Mainframe	Tektronix plug-in mainframe.	TEKTRONIX 11301 11302 11401 11402
Power Module	Tektronix four-compartment power module.	TEKTRONIX TM 504 Power Module.
Leveled Sine Wave Generators	250 MHz to 1000 MHz, Leveled variable amplitude, 50 kHz or 6 MHz reference.	TEKTRONIX SG 504 Leveled Sine Wave Generator with a TM 500-series Power Module.
	250 kHz to 250 MHz, Leveled variable amplitude, 50 kHz reference.	TEKTRONIX SG 503 Leveled Sine Wave Generator with a TM 500-series Power Module.
Power Supply	Continuously variable from 0-40 V; current limit, adjustable from 0-400 mA.	TEKTRONIX PS 503A Dual Power Supply with a TM 500-series Power Module.
DC Voltage Calibrator (optional)	Output, 0-4 V.	Data Precision 8200.
Pulser	Amplitude; 250 mV Rise time; $\leq$125 ps Aberrations $<1\%$.	TEKTRONIX 067-0681-01 Tunnel Diode Calibration Fixture.
Digital Multimeter (w/test leads)	Accuracy $\leq 0.01\%$.	Fluke 8842A Digital Multimeter.
Signal Standardizer	Tektronix Calibration Fixture with interface connector modified for 11000-series use.	TEKTRONIX 067-0587-02 Signal Standardizer.
Calibration Generator	Period, 0.1 ms, Amplitude, -60 V.	TEKTRONIX PG 506 Calibration Generator with a TM 500-series Power Module.
Coaxial Cable (2 required)	50 Ω, 36-inch, male BNC connectors.	Tektronix Part 012-0482-00.
Adapter, BNC to Alligator Clips	BNC Female to Clip leads.	Tektronix Part 013-0076-00.
Term Conn Link	Shorting strap.	Tektronix Part 131-0993-00.

TABLE 2-1 (cont)
Test Equipment

Description	Minimum Specification	Examples of Applicable Test Equipment
Terminal and Connecting Cable	Any GPIB (IEEE-1978) Controller or ASCII terminal equipped with an RS-232-C port.	Compaq Portable II PC with ProCom Software.
Attenuator, 2.5X	Impedance: 50 Ω, one male and one female BNC connector.	Tektronix Part 011-0076-02.
Attenuator, 5X	Impedance: 50 Ω, one male and one female BNC connector.	Tektronix Part 011-0060-02.
Attenuator, 10X	Impedance: 50 Ω, one male and one female BNC connector.	Tektronix Part 011-0059-02.
Adapter, BNC to Banana (2 required)	BNC Female to Dual Banana	Tektronix Part 103-0090-00.
Connector, T	BNC, T: Two female and one male BNC connector.	Tektronix Part 103-0030-00.
Resistor	430 Ω, 10% tolerance; power rating, 1 W.	Tektronix Part 303-0431-00.
Alignment Tool (insulated slot)	Insulated slot.	Tektronix Part 003-0675-01.
Magnetic Screwdriver	Holder for Torx tips.	Tektronix Part 003-0293-00.
Torx Screwdriver Tips	#6 tip #7 tip #8 tip #10 tip #10 tip narrow shank #15 tip	Tektronix Part 003-1415-00. Tektronix Part 003-1293-00. Tektronix Part 003-0964-00. Tektronix Part 003-0814-00. Tektronix Part 003-0815-00. Tektronix Part 003-0966-00.
Integrated Circuit Extracting Tools	IC Insertion-Extraction Pliers 28-pin type	General Tool P/N U505BG or equivalent.
24-pin Socket		Tektronix Part 136-0751-00.
Needle-nose pliers		
Tweezers		
Static Control Mat		Tektronix Part 006-3414-00.
Wrist Strap		Tektronix Part 006-3415-00.

Part 1 – Initial Setup

Description

Perform the Checks and Adjustments procedure within the ambient temperature range of +18° and +28° C, to assure proper instrument operation.

CAUTION

To avoid instrument damage, set the mainframe ON/STANDBY switch to STANDBY before installing or removing plug-in units.

Turning the instrument power off during probe calibration, self-calibration, Extended Diagnostics, or other intense system activity may result in some internal data being corrupted. If corruption occurs, refer to Restoring Calibration Data in Section 3.

Procedure

a. Power on the following test equipment so that it is warmed up with the instrument to be tested:

   Power Supply
   Calibration Generator
   Leveled Sine Wave Generators
   Digital Multimeter

b. With the ON/STANDBY switch set to STANDBY, connect the mainframe to a suitable power source.

c. Install a Signal Standardizer in the Center plug-in compartment and the 11A52 in the Left plug-in compartment.

d. Set the front-panel ON/STANDBY switch to ON.

e. Allow the equipment to warm up for 20 minutes before continuing.

Part 2a – Check/Examine/Adjust High Frequency Response: Standard Procedure

Description

The Amplifier high frequency peaking is adjusted so that the bandwidth is adequate and the aberrations are not excessive. The Standard Procedure requires the use of an 11402 mainframe to assure that the plug-in performs properly in any mainframe. If an 11402 mainframe is not available, then use an 11401 to perform this procedure. If neither the 11401 nor 11402 mainframe is available, then use the Alternative Procedure at the end of this part.

First, the Signal Standardizer provides a reference waveform to characterize the mainframe high frequency response. Mainframe aberrations are displayed at 2% per division. Amplitude is measured at specification frequencies.

Then, the step response waveform is compared with the characterizations of the waveform in the Examine Mainframe High Frequency Response procedure to determine the plug-in's contribution to the aberrations.

Set the values in the non-volatile RAM to adjust the step response in the 11A52. The values are set with a terminal connected to the RS-232-C interface.

Examine each channel at six deflection factors. Table 2-2 lists the Deflection Factors and associated Cal Addresses for each channel.

The Pulser produces a constant amplitude output when properly triggered so attenuators are used to reduce the amplitude to the plug-in for the lower deflection factors.

Finally, the displayed amplitude is checked at the specification frequencies to determine the plug-in's contribution to the bandwidth.

Measurement Limits

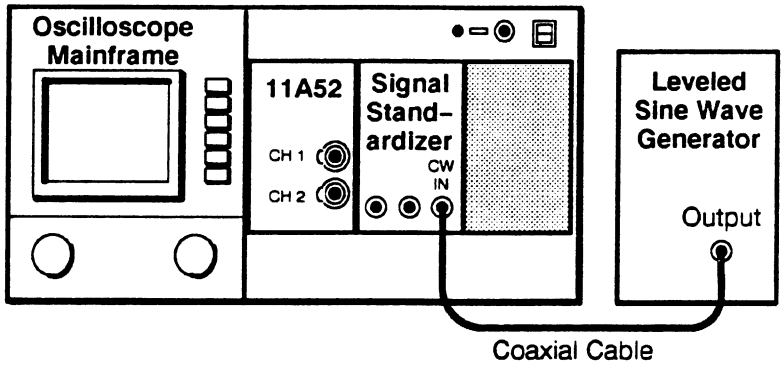
The difference between the two waveform aberrations should not exceed 4% peak (2 divisions) and 7% (3.5 divisions) peak-to-peak. One major graticule division = 2%.

Specifications

Refer to Table 2-4 for the bandwidth specifications.

Examine Mainframe High Frequency Response

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings in the order listed:

Oscilloscope Mainframe
- UTILITY menu ..... **Instrument Options**
  Waveform Scaling (Forced)
- **Def Wfm** ..... **C** (center)
- TRIGGER menu ..... **Source Desc**
- **Main Trigger Source Description** menu ..... **C** (center)

Left Plug-in
- Not used in this procedure.

Signal Standardizer
- Test ..... Vert or Horiz + Step Resp
- Rep Rate ..... 100 kHz
- Position ..... 12 o'clock
- Amplitude ..... 9 o'clock

Oscilloscope Mainframe
- **Main Size** ..... **2 ns/div**
- **Trig Level** **40%**
- **Main Pos** ..... position positive pulse transition one division from left edge of graticule.
- Acquire Description
  - **Average N** ..... **On**
  - **Set Avg N** **8**

Signal Standardizer
- Amplitude ..... 5 div vertical step.

Oscilloscope Mainframe
- **Vert Pos: Wfm** ..... position top of step on center horizontal graticule line.
- **Vert Mag: Wfm** ..... **100 mV**

Leveled Sine Wave Generator
- Frequency ..... reference

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Procedure

a. Record the displayed waveform on graph paper or make a hardcopy of the display. This waveform is used in the Examine/Adjust Plug-in Step Response procedure for comparison against the plug-in step response.

b. Set **Average N** to **Off**. Set **Main Size** to **10 µs/div.**

c. Set the Signal Standardizer Test switch to Vert or Horiz Freq Resp.

d. Set the Leveled Sine Wave Generator output amplitude so that the Signal Standardizer CW Leveled light is on. CHECK that the light remains on throughout the following steps. The reference frequency must be between 50 kHz and 6 MHz.

e. Set the Signal Standardizer Position and Amplitude for a 6-division display amplitude, centered on the screen.

f. Set the Leveled Sine Wave Generator frequency to each Test Frequency in column (1) of Table 2-4, and record the Displayed Amplitude in column (2) on a copy of Table 2-4. This data is used in the Check Plug-in Bandwidth procedure for calculating the plug-in bandwidth.

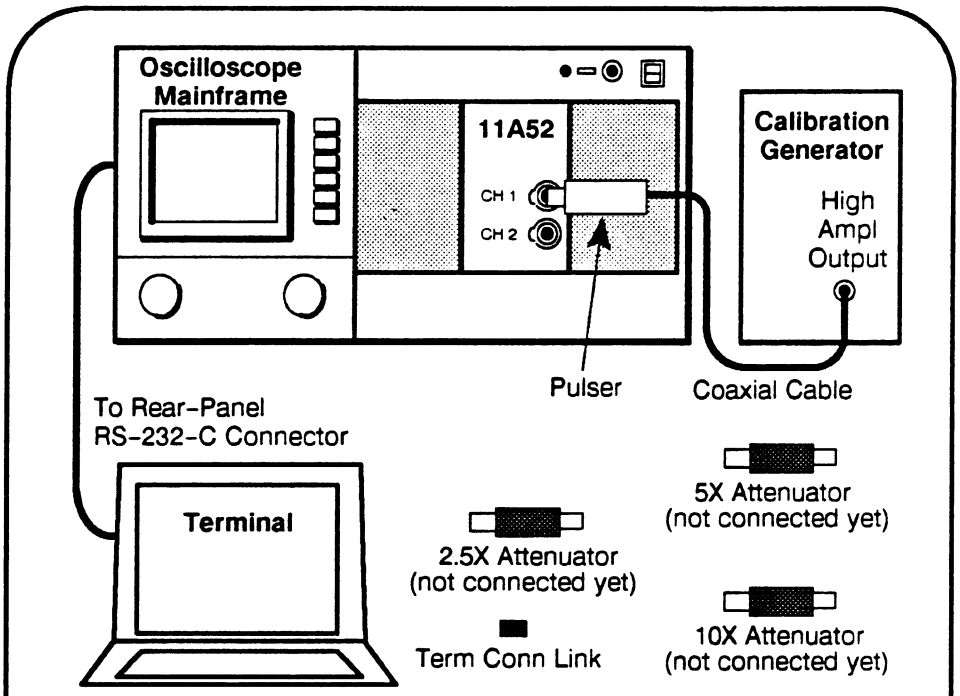
   This procedure may require more than one Leveled Sine Wave Generator to test all the Test Frequencies listed. When changing to another Leveled Sine Wave Generator, repeat steps d and e.

g. Set the mainframe ON/STANDBY switch to STANDBY.

h. Remove the Signal Standardizer from the Center plug-in compartment. Remove the 11A52 from the Left plug-in compartment, and install it in the Center plug-in compartment.

Examine/Adjust Plug-In Step Response

Setup



Perform the following settings in the order listed:

1. Remove the bottom cover of the mainframe and install a Term Conn Link (shorting strap) on the CAL-LOCK terminals located on the A6 Time Base board. Refer to Figure 2-2 for pin locations.
2. In the plug-in, change Term Conn Link J611 on the A1 Main board to its horizontal position. Refer to Figure 2-1 for the test point location.
3. Connect the Terminal to the mainframe rear-panel RS-232-C connector. Configure the Terminal for 8-bit characters.

Calibration Generator
Function switch ..... High Ampl
Period ..... 0.1 ms
Pulse Amplitude ..... Max

Pulser
TD Triggered Level ..... Fully clockwise

Oscilloscope Mainframe
ON/STANDBY switch ..... ON
Wait for calibration cycle to complete.
UTILITY menu ..... **Initialize**
UTILITY menu ..... **Instrument Options Waveform Scaling (Forced)**
RS232 Parameters
Echo ..... **on**
Verbose ..... **on**
Baud **9600**

Center Plug-In
CH 1 Display on/off ..... on

Oscilloscope Mainframe
Vert Size ..... **50 mV/div**
Main Size ..... **1 µs/div**
Main Pos ..... position positive-going edge to first graticule line from left edge of graticule.

Setup (cont)

Pulser
TD Triggered Level ..... rotate control counterclockwise until the step disappears, then rotate clockwise just enough to obtain a step.

Oscilloscope Mainframe
Main Size ..... **2 ns/div**
Main Pos ..... position positive-going edge between the first and second graticule lines from the left edge of the graticule.
Vert Offset ..... position top of step 2.5 divisions above the center horizontal graticule line.
Acquire Description
Average N ..... **On**
Set Avg N **8**
Numeric Entry & Knob Res menu ..... **Fine**
Vert Size ..... 5 div step amplitude display.
Vert Offset ..... position right side of trace to the center horizontal graticule line.
Vert Size ..... set readout for 10% of present readout (~4 mV/div).
Vert Offset ..... position right side of trace to the center horizontal graticule line.

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Procedure

a. *EXAMINE*—compare the displayed waveform with the waveform recorded in the previous Examine Mainframe High Frequency Response procedure, and examine the plug-in's contribution for aberrations within 4% peak (2 divisions) and 7% peak-to-peak (3.5 divisions).

DO NOT attempt to adjust the step response, if it is within the stated limits. Proceed to step d.

b. *ADJUST*—to adjust the signal step response, enter a new value using the Terminal. Refer to Table 2-3 for the command to enter a new value.

The Cal Address is shown in Table 2-2. Choose a decimal fraction between +1.0000 and -1.0000 for the new value. -1.0000 provides the most damping and +1.0000 produces the most peaking. Entering a value with two decimal places usually provides adequate resolution. Excessive damping adversely affects the bandwidth.

c. *EXAMINE*—verify that the Plug-in Aberrations are within 4% peak (2 divisions) and 7% peak-to-peak (3.5 divisions) as in step a. If this is not the case, then repeat step b using a different value.

d. Set **Average N** to **Off**.

e. Refer to Table 2-2 and set **Vert Size** as shown in the Deflection Factor column. Install attenuator(s) between the Pulser and the plug-in input connector.

f. Repeat the Setup Procedure beginning at the second Pulser setting and proceeding through steps a through e in this procedure, until all CH 1 Deflection Factors in Table 2-2 are examined for aberrations (and adjusted if necessary).

g. Press the CH 1 Display on/off button (off). Press the CH 2 Display on/off button (on).

h. For CH 2, repeat the Setup Procedure beginning at the second Oscilloscope Mainframe settings and proceeding through steps a through f in this procedure. Perform the adjustments using the CH 2 addresses in Table 2-2. The command to install the value is CHC2 SENS: <deflection factor being set>. Refer to Table 2-3 for 11A52 commands.

TABLE 2-2
Deflection Factors and Associated Test Conditions

Deflection Factor	CH1 Cal Address	CH2 Cal Address	Attenuator Between Pulser and Plug-in	Plug-in Aberrations[1]	
				Peak	Peak-to-Peak
50 mV/div	58	186	none	4%	7%
20 mV/div	57	185	2.5X	4%	7%
10 mV/div	56	184	5X	4%	7%
5 mV/div	55	183	10X	4%	7%
2 mV/div	54	182	10X + 2.5X	4%	7%
1 mV/div	53	181	10X + 5X	4%	7%

[1]**This aberration percentage does not include the mainframe aberration, which is characterized in the Examine Mainframe High Frequency procedure.**

TABLE 2-3
11A52 Commands (11401/11402)

Command or Query	Description
CCAL? <address>	Returns the present value for the channel and deflection factor step response being adjusted.
CCAL <address>:<value>	Writes new value into RAM.
CHC1 SENS: <deflection factor being set>	Sets the new cal constant in the amplifier and causes the waveform aberrations to change accordingly. This is not a value read from the control knob label, but is the deflection factor for which the step response is being adjusted.
CHC2 SENS: <deflection factor being set>	Sets the new cal constant in the amplifier and causes the waveform aberrations to change accordingly. This is not a value read from the control knob label, but is the deflection factor for which the step response is being adjusted.

For example, to enter a value for CH 1 at the 50 mV/div setting, enter:

CCAL? 58	to get the current value.
CCAL58: -.4	sets the 50 mV/div value to -0.4.
CHC1 SENS:.05	to set the new value in the amplifier.

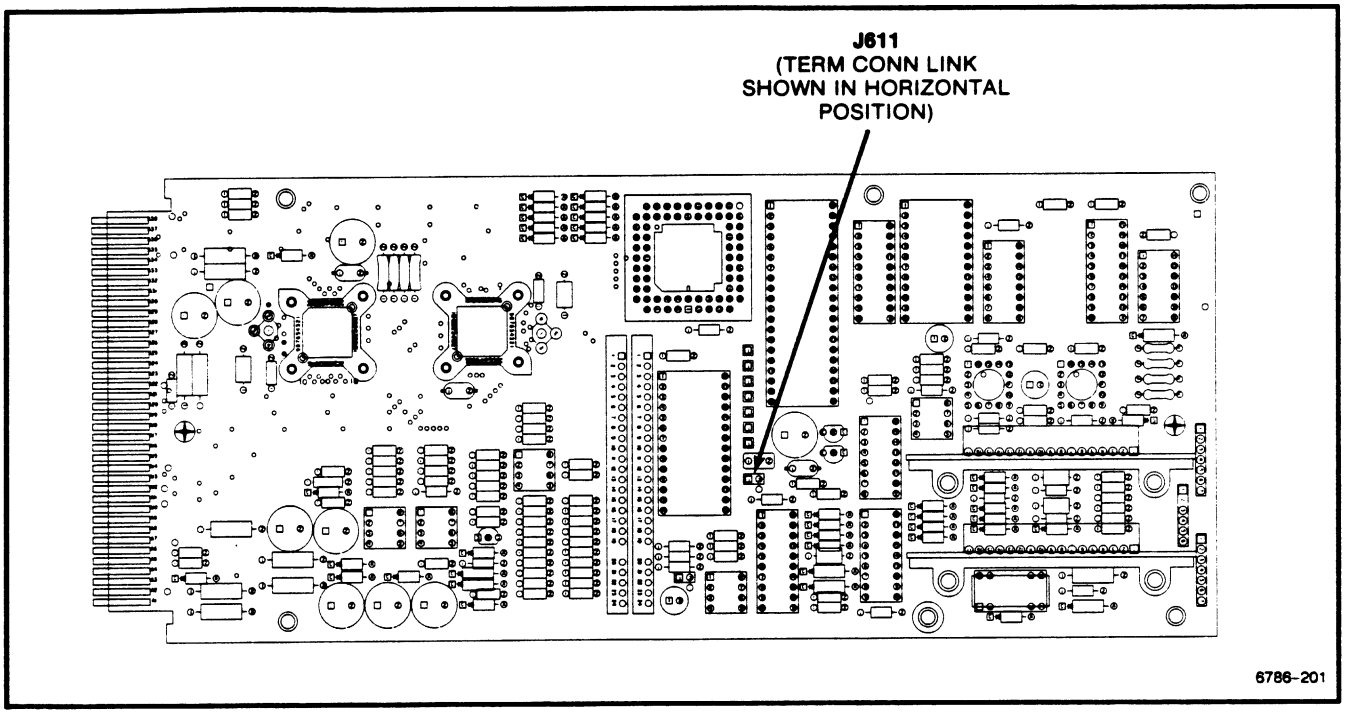


Figure 2-1. A1 Main board plug-in jumper location.

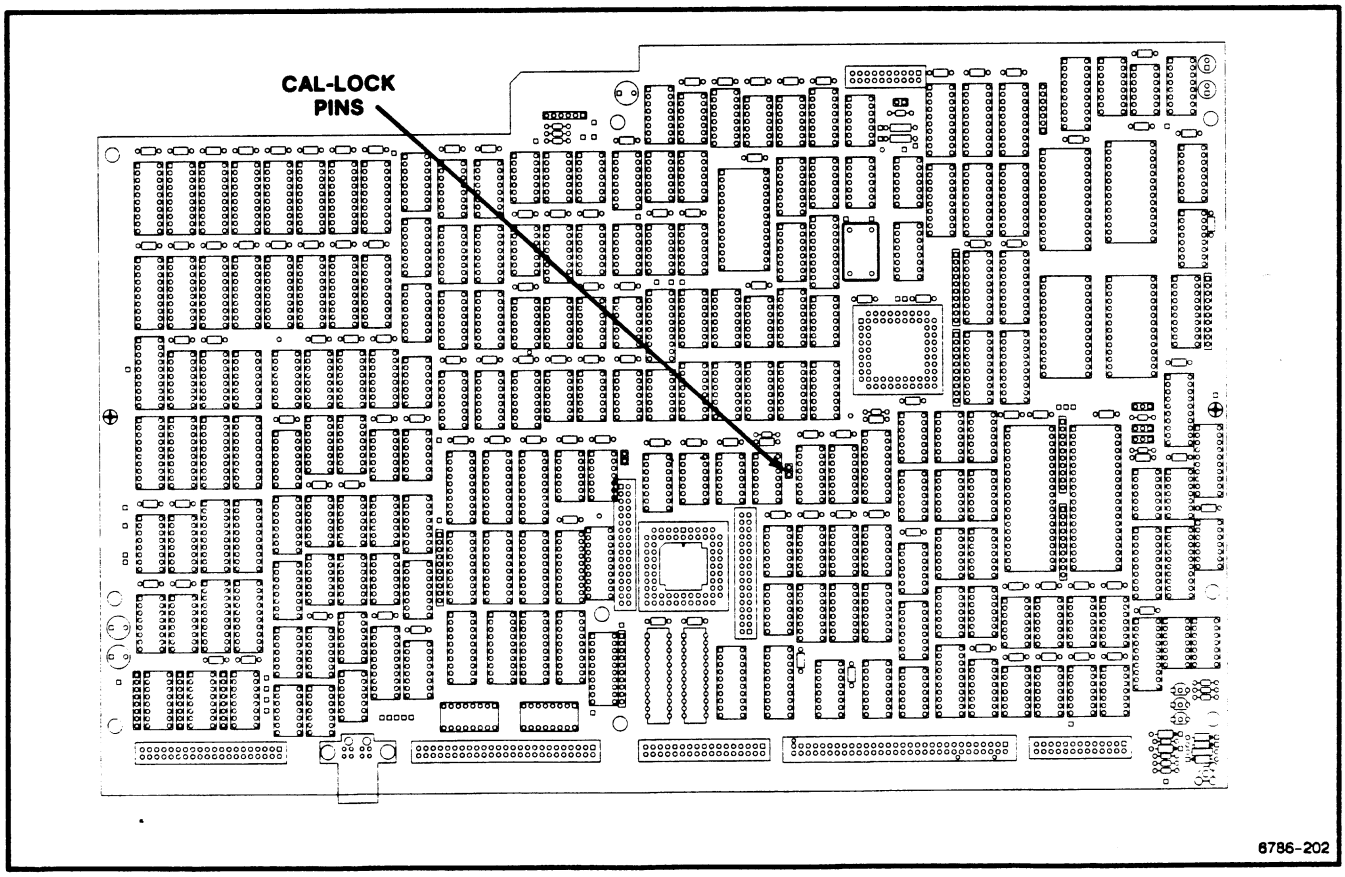
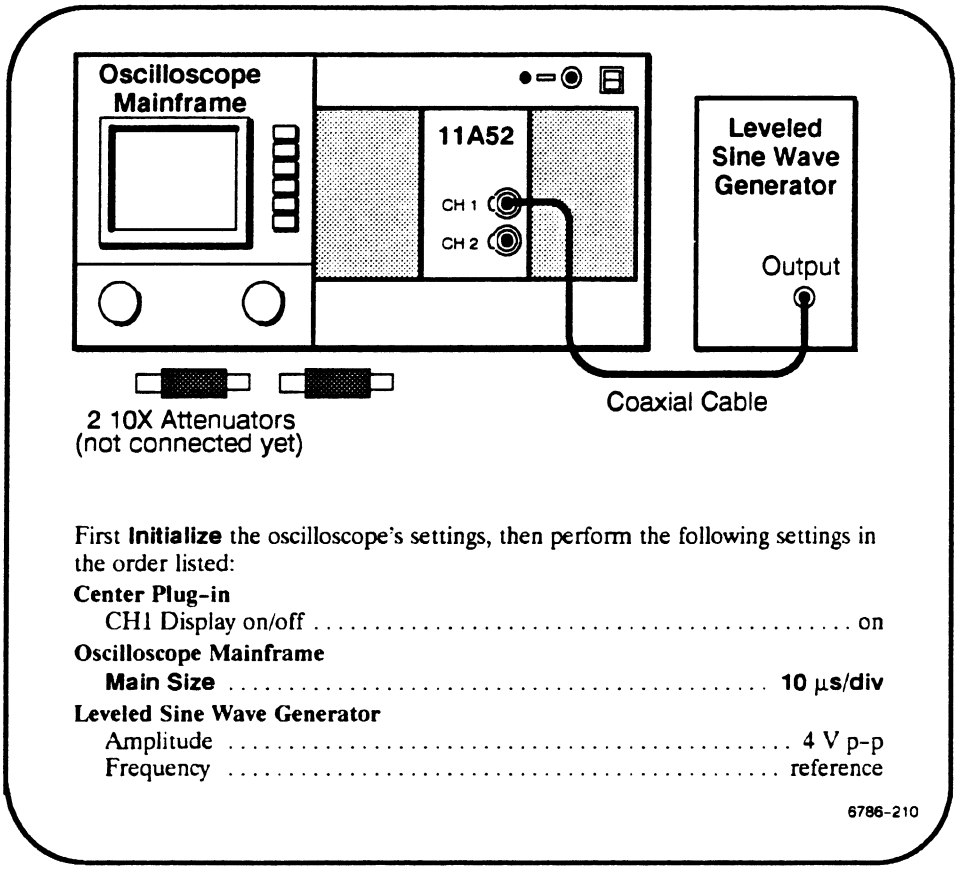


Figure 2-2. 11401/11402 A6 Time Base board CAL-LCCK pin locations.

Check Plug-in Bandwidth

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings in the order listed:

Center Plug-in
CH1 Display on/off ..... on

Oscilloscope Mainframe
Main Size ..... **10 µs/div**

Leveled Sine Wave Generator
Amplitude ..... 4 V p-p
Frequency ..... reference

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If the Leveled Sine Wave Generator has a remote leveling head, then you must connect it to the plug-in input connector without additional coaxial cables.

The reference frequency must be between 50 kHz and 6 MHz.

Procedure

Perform this procedure for each Vertical Size listed in column (3) of Table 2-4; then repeat for CH 2.

This procedure may require the use of more than one Leveled Sine Wave Generator to test all the frequencies listed in Table 2-4.

If the Leveled Sine Wave Generator is not equipped with internal attenuators, then use the 10X Attenuators at the plug-in input when setting amplitude.

To measure the amplitude, either count the divisions, or use the ΔV cursors.

a. Set the Leveled Sine Wave Generator amplitude as shown in the Reference Amplitude column (4).

b. Set the Leveled Sine Wave Generator frequency as shown in the Frequency column (1).

c. Record the Displayed Amplitude in column (5).

d. *CHECK* – that the plug-in amplitude, computed by dividing column (5) by column (2), is at least the value shown in column (6).

e. Set the Leveled Sine Wave Generator to the reference frequency.

TABLE 2-4
11A52 Bandwidth

(1)	(2)	(3)	(4)	(5)		(6)	
	Mainframe with Standardizer	Mainframe with Plug-in				Plug-in only	
Test Frequency MHz	Displayed Amplitude: div	Vertical Size	Reference Amplitude: div	Displayed Amplitude: div		Calculated Amplitude: col (5) ÷ col (2)	
				CH 1	CH 2	CH 1	CH 2
600	____	1 V/div	4	____	____	___ ≥0.509	___ ≥0.509
600	____	500 mV/div	6	____	____	___ ≥0.763	___ ≥0.763
600	____	50 mV/div	6	____	____	___ ≥0.763	___ ≥0.763
600	____	20 mV/div	6	____	____	___ ≥0.763	___ ≥0.763
600	____	10 mV/div	6	____	____	___ ≥0.763	___ ≥0.763
400	____	5 mV/div	6	____	____	___ ≥0.855	___ ≥0.855
250	____	2 mV/div	6	____	____	___ ≥0.820	___ ≥0.820
200	____	1 mV/div	6	____	____	___ ≥0.810	___ ≥0.810

If there are any failures, then the step response must be readjusted for the appropriate deflection factors, so that the Measurement Limits for step response aberrations and the Specifications for bandwidth are both met.

Before continuing with Part 3:

a. Set the ON/STANDBY switch to STANDBY.

b. Remove the plug-in from the mainframe, return the Term Conn Link J611 to its normal vertical position to prevent the values from being changed, and reinstall the plug-in in the Center plug-in compartment. Refer to Figure 2-1 for the plug-in jumper location.

c. Remove the Term Conn Link from the CAL-LOCK pins on the mainframe's A6 Time Base board. Refer to Figure 2-2 for the CAL-LOCK pin locations. Reinstall the mainframe's bottom cover.

d. Set the ON/STANDBY switch to ON.

Part 2b—Check/Examine/Adjust High Frequency Response: Alternative Procedure

Description

The Amplifier high frequency peaking is adjusted so that the bandwidth is adequate and the aberrations are not excessive. This Alternative Procedure is used when the available mainframe is an 11301 or 11302. Performance is assured only for the particular plug-in and mainframe combination examined and adjusted during this procedure.

First, the mainframe performance is characterized at the specification frequencies using the Signal Standardizer.

Then, the plug-in and mainframe aberrations are displayed at 20% per division.

Set the values in the non-volatile RAM to adjust the step response in the 11A52. The values are set with a terminal connected to the RS-232-C interface.

Examine each channel at six deflection factors. Associated with each deflection factor is a unique address at which the cal constant is stored. Table 2-5 lists the Deflection Factors and associated Cal Addresses for each channel.

The Pulser produces a constant amplitude when properly triggered so attenuators are used to reduce the amplitude to the plug-in for the lower deflection factors.

Finally, the displayed amplitude is checked at the specification frequencies to determine the plug-in's contribution to the bandwidth.

Measurement Limits

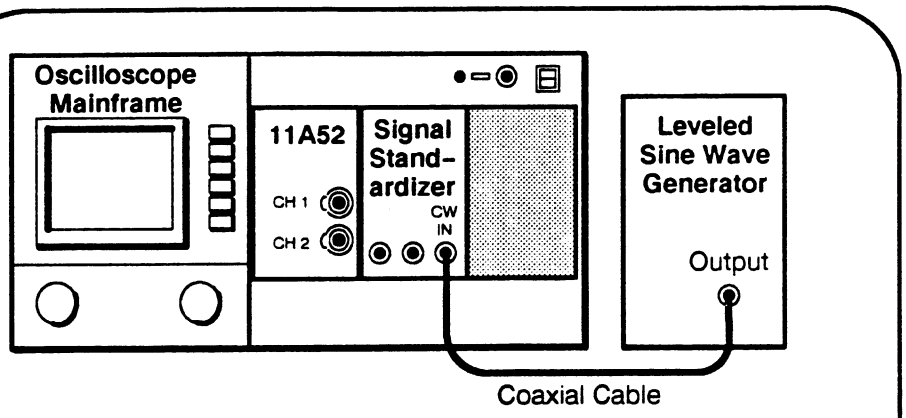
The waveform aberrations should not exceed 4% peak (0.2 division) and 7% (0.35 division) peak-to-peak. One major graticule division = 20%.

Specifications

Refer to Table 2-7 for the bandwidth specifications.

Examine Mainframe High Frequency Response

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings in the order listed:

Oscilloscope Mainframe
- Waveform ..... **C** (center)
- Trigger Source ..... **C** (center)
- **Main Size** ..... **10 µs/div**

Left Plug-in
- Not used in this procedure.

Signal Standardizer
- Test ..... Vert or Horiz + Freq Resp

Leveled Sine Wave Generator
- Frequency ..... reference

6786-205

Procedure

The reference frequency must be between 50 kHz and 6 MHz.

a. Set the Leveled Sine Wave Generator output amplitude so that the Signal Standardizer CW Leveled light is on. CHECK that the light remains on throughout the following steps.

b. Set the Signal Standardizer Position and Amplitude for a 6-division display amplitude, centered on the screen.

c. Set the Leveled Sine Wave Generator frequency to each Test Frequency in column (1) of Table 2-7, and record the displayed amplitude in the Displayed Amplitude column (2) on a copy of Table 2-7. This data is used in the Check Plug-in Bandwidth procedure for calculating the plug-in bandwidth.

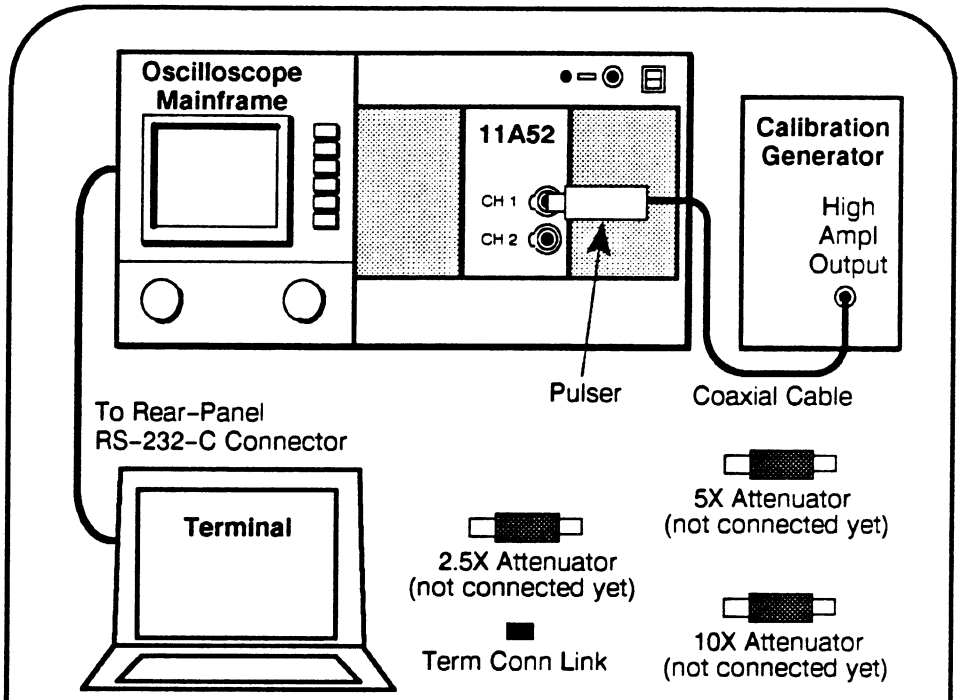
   This procedure may require more than one Leveled Sine Wave Generator to test all the Test Frequencies listed. When changing to another Leveled Sine Wave Generator, repeat steps a and b.

d. Set the mainframe ON/STANDBY switch to STANDBY.

e. Remove the Signal Standardizer from the Center plug-in compartment. Remove the 11A52 from the Left plug-in compartment, and install it in the Center plug-in compartment.

Examine/Adjust Plug-In Step Response

Setup



Perform the following settings in the order listed:

1. Remove the top cover of the 11301 or 11302 mainframe and set switch S1740-5 on the A11 Main Processor board to the closed position. Refer to Figure 2-3 for the switch location.
2. In the plug-in, change Term Conn Link J611 on the A1 Main board to its horizontal position. Refer to Figure 2-1 for the test point location.
3. Connect the Terminal to the mainframe rear-panel RS-232-C connector. Configure the Terminal for 8-bit characters and 9600 baud.

Calibration Generator
- Function switch ..... High Ampl
- Period ..... 0.1 ms
- Pulse Amplitude ..... Max

Pulser
- TD Triggered Level ..... Fully clockwise

Oscilloscope Mainframe
- ON/STANDBY switch ..... ON
- Wait for calibration cycle to complete
- UTILITY menu ..... **Initialize**
- **RS232 Parameters**
  - **Baud** 9600

Center Plug-In
- CH 1 Display on/off ..... on

Oscilloscope Mainframe
- **Vert Size** ..... **50 mV/div**
- **Main Size** ..... **1 µs/div**
- **Main Pos** ..... position positive-going edge to first graticule line from left edge of graticule.

Setup (cont)

Pulser
TD Triggered Level ..... rotate control counterclockwise until the step disappears, then rotate clockwise just enough to obtain a step.

Oscilloscope Mainframe
Main Size ..... **5 ns/div**
Main Pos ..... position positive-going edge between the first and second graticule lines from the left edge of the graticule.
Vert Offset ..... position top of step 2.5 divisions above the center horizontal graticule line.
Vert Size: Fine ..... 5 div step amplitude display.

6786-206

Procedure

a. *EXAMINE* – that the displayed waveform aberrations are less than 4% peak (0.2 division) and 7% peak-to-peak (0.35 division).

STOP DO NOT attempt to optimize the aberrations if they are within the stated limits. Proceed to step d.

b. *ADJUST* – to adjust the signal step response, enter a new value using the Terminal. Refer to Table 2-6 for the command to enter a new value.

The Cal Address is shown in Table 2-5 for new value. Choose a decimal fraction between +1.0000 and -1.0000. -1.0000 provides the most damping and +1.0000 produces the most peaking. Entering a value with two decimal places usually provides adequate resolution. Excessive damping adversely affects the bandwidth.

c. *EXAMINE* – verify that the aberrations are within 4% peak (0.2 division) and 7% peak-to-peak (0.35 division) as in step a. If this is not the case, then repeat step b using a different value.

d. Refer to Table 2-5 and set **Vert Size** as shown in the next line in the Deflection Factor column. Install attenuator(s) between the Pulser and the plug-in input connector.

e. Repeat the Setup Procedure beginning at the second Pulser setting and proceeding through steps a through d in this procedure, until all CH 1 Deflection Factors in Table 2-5 are examined for Plug-in Aberrations (and adjusted if necessary).

f. Press the CH 1 Display on/off button (off). Press the CH 2 Display on/off button (on).

g. For CH 2, repeat the Setup Procedure beginning at the second Oscilloscope Mainframe settings and proceeding through steps a through e in this procedure. Perform the adjustments using the CH 2 addresses in Table 2-5. The command to install the value is CHC2 SENS: <deflection factor being set>. Refer to Table 2-6 for 11A52 commands.

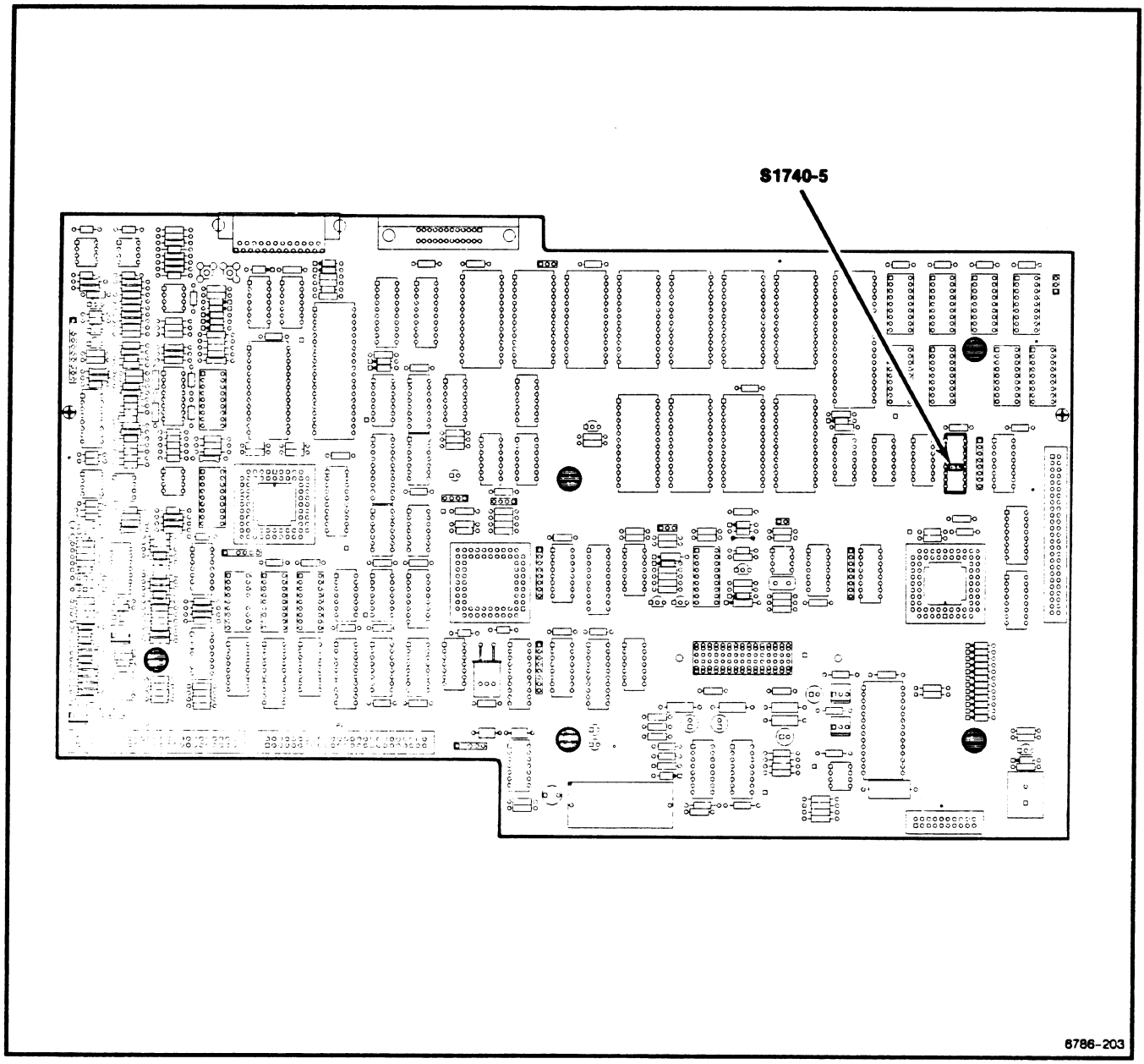


Figure 2-3. 11301/11302 A11 Main Processor board switch location.

TABLE 2-5
Deflection Factors and Associated Test Conditions

Deflection Factor	CH1 Cal Address	CH2 Cal Address	Attenuator Between Pulser and Plug-in	Plug-in Aberrations	
				Peak	Pk-Pk
50 mV/div	58	186	none	4%	7%
20 mV/div	57	185	2.5X	4%	7%
10 mV/div	56	184	5X	4%	7%
5 mV/div	55	183	10X	4%	7%
2 mV/div	54	182	10X + 2.5X	4%	7%
1 mV/div	53	181	10X + 5X	4%	7%

TABLE 2-6
11A52 Commands (11301/11302)

Command or Query	Description
CCALCONSTANT? < address >	Returns the present value for the channel and deflection factor step response being adjusted.
CCALCONSTANT < address > : < value >	Writes new value into RAM.
CHC1 SENS: < deflection factor being set >	Sets the new cal constant in the amplifier and causes the waveform aberrations to change accordingly. This is not a value read from the control knob label, but is the deflection factor for which the step response is being adjusted.
CHC2 SENS: < deflection factor being set >	Sets the new cal constant in the amplifier and causes the waveform aberrations to change accordingly. This is not a value read from the control knob label, but is the deflection factor for which the step response is being adjusted.

For example, to enter a value for CH 1 at the 50 mV/div setting, enter:

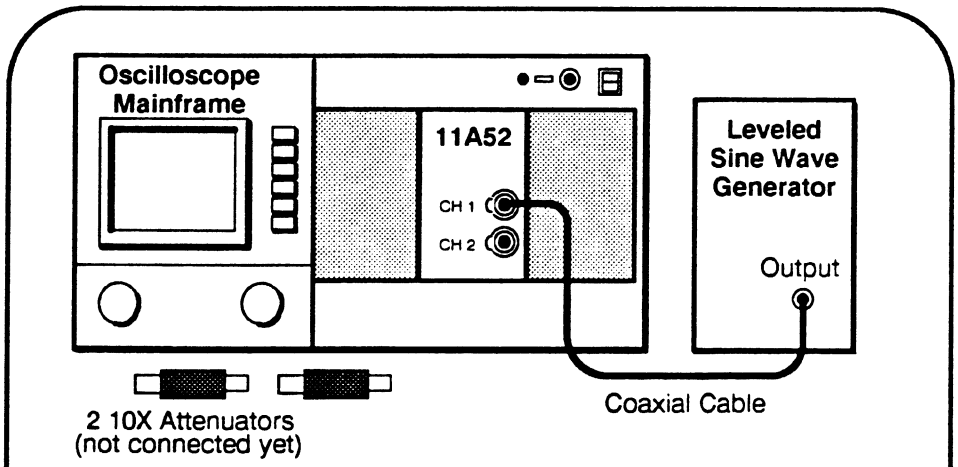
CCALCONSTANT? 58 to get the current value.

CCALCONSTANT58: -.4 sets the 50 mV/div value to -0.4.

CHC1 SENS:.05 to set the new value in the amplifier.

Check Plug-in Bandwidth

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings the order listed:

Center Plug-in
CH1 Display on/off ..... on

Oscilloscope Mainframe
Main Size ..... **10 µs/div**

Leveled Sine Wave Generator
Amplitude ..... 4 V p-p
Frequency ..... reference

6786-210

If the Leveled Sine Wave Generator has a remote leveling head, then you must connect it to the plug-in input connector without additional coaxial cables.

The reference frequency must be between 50 kHz and 6 MHz.

Procedure

Perform this procedure for each Vertical Size listed in column (3) of Table 2-7; then repeat for CH 2.

This procedure may require the use of more than one Leveled Sine Wave Generator to test all the frequencies listed in Table 2-7.

If the Leveled Sine Wave Generator is not equipped with internal attenuators, then use the 10X Attenuators at the plug-in input when setting amplitude.

To measure the amplitude, either count the divisions or use the ΔV cursors.

a. Set the Leveled Sine Wave Generator amplitude as shown in the Reference Amplitude column (4).

b. Set the Leveled Sine Wave Generator frequency as shown in the Frequency column (1).

c. Record the Displayed Amplitude in column (5).

d. *CHECK*—that the plug-in amplitude, computed by dividing column (5) by column (2), is at least the value shown in column (6).

e. Set the Leveled Sine Wave Generator to the reference frequency.

TABLE 2-7
11A52 Bandwidth

(1)	(2)	(3)	(4)	(5)		(6)	
	Mainframe with Standardizer	Mainframe with Plug-in				Plug-in only	
Test Frequency MHz	Displayed Amplitude: div	Vertical Size	Reference Amplitude: div	Displayed Amplitude: div		Calculated Amplitude: col (5) ÷ col (2)	
				CH 1	CH 2	CH 1	CH 2
400	____	1 V/div	4	____	____	___ ≥0.573	___ ≥0.573
400	____	500 mV/div	6	____	____	___ ≥0.860	___ ≥0.860
400	____	50 mV/div	6	____	____	___ ≥0.860	___ ≥0.860
400	____	20 mV/div	6	____	____	___ ≥0.860	___ ≥0.860
400	____	10 mV/div	6	____	____	___ ≥0.860	___ ≥0.860
350	____	5 mV/div	6	____	____	___ ≥0.825	___ ≥0.825
250	____	2 mV/div	6	____	____	___ ≥0.820	___ ≥0.820
200	____	1 mV/div	6	____	____	___ ≥0.810	___ ≥0.810

If there are any failures, the step response must be readjusted for the appropriate deflection factors, so that the Measurement Limits for step response aberrations and the Specifications for bandwidth are both met.

Before continuing with Part 3:

a. Set the ON/STANDBY switch to STANDBY.

b. Remove the plug-in from the mainframe, return the plug-in Term Conn Link J611 to its normal vertical position to prevent the values from being changed, and reinstall the plug-in in the Center plug-in compartment. Refer to Figure 2-1 for the plug-in jumper location.

c. Set switch S1740-5 to the open position on the A11 Main Processor board. Reinstall the mainframe's top cover. Refer to Figure 2-3 for the switch location.

d. Set the ON/STANDBY switch to ON.

Part 3—Check Enhanced Accuracy

Description

When displayed, the Enhanced Accuracy symbol (**EA**) indicates that the instrument is at its highest accuracy state. The instrument saves the calibration time and the ambient temperature, since this data is used in maintaining the Enhanced Accuracy state.

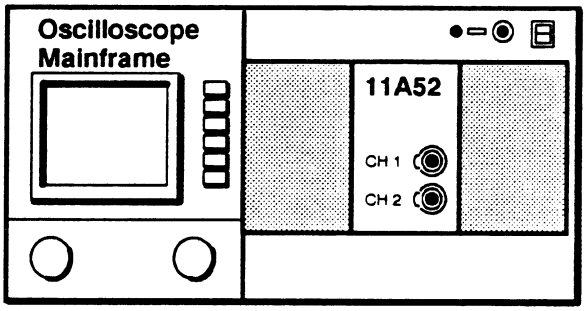
For more information about the Enhanced Accuracy state, refer to Enhanced Measurement Accuracy Indicator in the mainframe User's Reference manual.

While Enhanced Accuracy is in effect, to verify the DC measurement accuracy of the plug-in and mainframe system, apply and monitor test voltages, and compare these test voltages with the measurements made on the screen.

Specifications

When invoked, the self-calibration activity executes successfully.

Setup



Initialize the oscilloscope's setting.

Center Plug-in
No setting changes.

Oscilloscope Mainframe
No setting changes.

6786-207

Procedure

a. Twenty minutes after power up, the instrument must recalibrate itself to achieve the Enhanced Accuracy state. Press the ENHANCED ACCURACY button. Another prompt then appears on the display. Press the ENHANCED ACCURACY button again. Self-calibration takes a couple of minutes.

CAUTION

Turning the instrument power off during self-calibration may result in losing some of the non-volatile RAM data. This could cause diagnostic errors at the next power-up and affect normal instrument operation in unpredictable ways. If this occurs, refer to Restoring Calibration Data in Section 3.

b. *CHECK*—for the message, **"Calibration in Progress"** or **"Enhanced Accuracy in Progress"**, indicating that the instrument began self-calibration.

c. *CHECK*—for the message, **"Calibration completed and passed"** or **"Self calibration completed successfully"**, indicating successful self-calibration. The **EA** indicator appears on the display when calibration is finished.

Part 4—Check DC Balance

Description

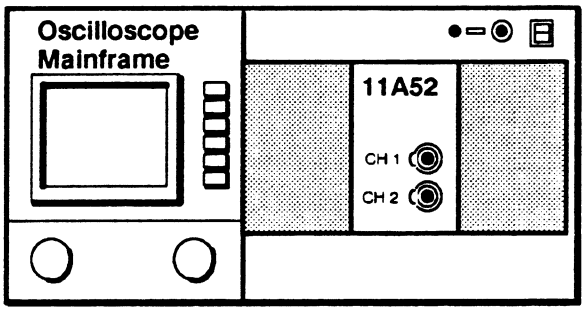
The position of the displayed trace with no input signal applied is examined.

The purpose of this procedure is to confirm that dc balance can be accomplished accurately. This procedure does not test for drift over time or temperature. Therefore, the specifications are more precise than the specifications in the User's reference Manual and this procedure must be performed immediately after Enhanced Accuracy calibration.

Specifications

Refer to Table 2-8.

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings in the order listed:

Center Plug-in

CH 1 Display on/off ..... on

Oscilloscope Mainframe

Vert Size ..... **10 V/div**

BW Limit or **HF Limit** ..... **20 MHz**

6786-207

Procedure

Perform this procedure for each channel.

CHECK—that the displayed trace position is at the center graticule line, within the limits listed in Table 2-8 for each Vertical Size setting.

If you are using the 11301 or 11302 mainframe, use **Vertical Cursors** to help measure the trace position.

If you are using the 11401 or 11402 mainframe, set **Average N** to **ON** and use **Mean (whole zone)** in the MEASURE menu to help measure the trace position.

TABLE 2-8
11A52 DC Balance

Vertical Size	11401, 11402 Position		11301/11302 Position (± div)
	(± div)	(± mV)	
10 V/div	0.052	520	0.093
5 V/div	0.054	270	0.095
2 V/div	0.060	120	0.103
1 V/div	0.070	70	0.115
0.5 V/div	0.054	27	0.095
0.2 V/div	0.060	12	0.103
0.1 V/div	0.070	7.0	0.115
50 mV/div	0.054	2.7	0.095
20 mV/div	0.060	1.2	0.103
10 mV/div	0.070	0.70	0.115
5 mV/div	0.090	0.45	0.140
2 mV/div	0.15	0.30	0.215
1 mV/div	0.25	0.25	0.340

Part 5a—Check ΔV DC Accuracy: 11401/11402 Mainframe Procedure

Description

The system ΔV DC Accuracy is checked using a precision Digital Multimeter and a Power Supply.

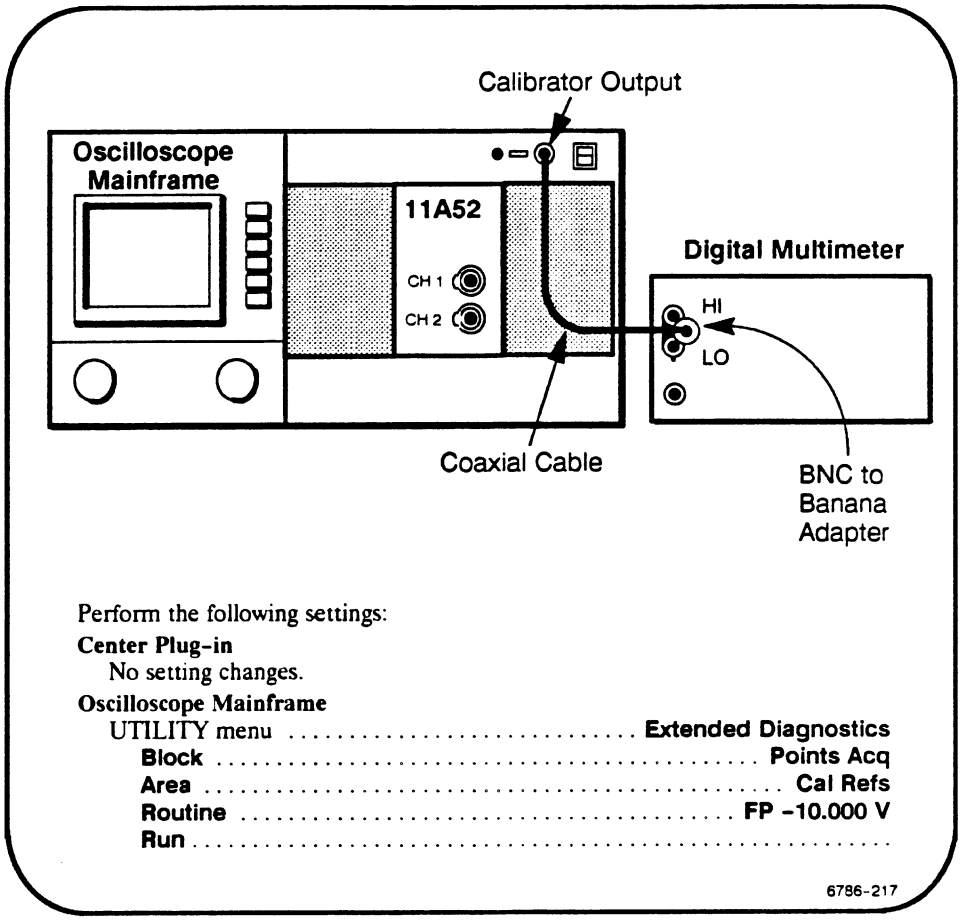
The purpose of this procedure is to confirm that the plug-in can be accurately calibrated. This procedure does not test for mainframe calibration voltage reference accuracy or long term stability. Therefore, the mainframe is characterized and tests must be performed immediately after an Enhanced Accuracy calibration. Also, the plug-in specifications are more stringent than those in the User's Reference Manual.

Specifications

ΔV DC Accuracy within ±0.53%.

Characterize 11401/11402 Mainframe

Setup



Perform the following settings:

Center Plug-in

No setting changes.

Oscilloscope Mainframe

UTILITY menu ..... **Extended Diagnostics**
Block ..... **Points Acq**
Area ..... **Cal Refs**
Routine ..... **FP -10.000 V**
Run .....

Procedure

a. Record the DMM absolute value.

b. Press **Exit.**

c. Press **FP + 9.9951 V.**

d. Press **Run.**

e. Record the DMM reading.

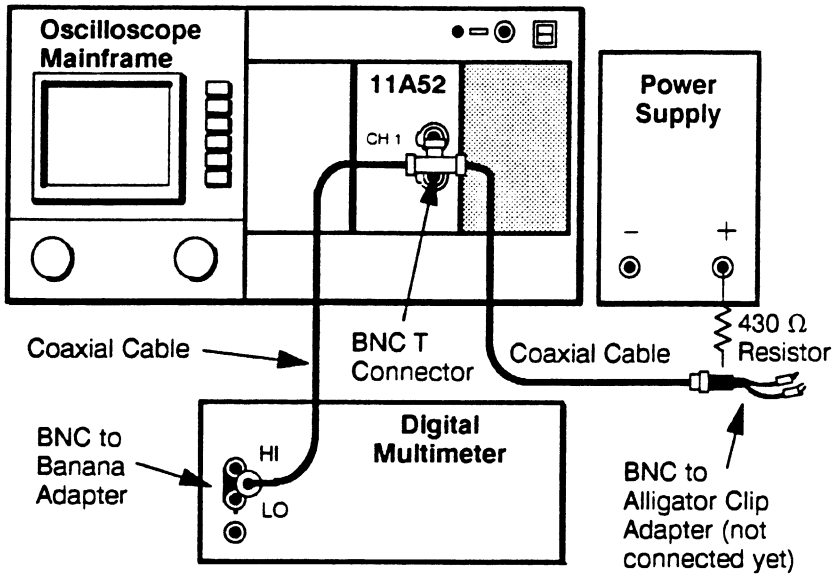
f. Press **Exit.**

g. Press **Exit Diagnostics.**

h. Add the DMM absolute values of the readings obtained in steps a and e. Divide the result by 19.9951 V to obtain the mainframe's calibration voltage reference characterization factor (which is used in the Test Plug-in procedure).

Test Plug-in

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings in the order listed.

Center Plug-in
CH 1 Display on/off ..... on

Oscilloscope Mainframe
BW Limit or **HF Limit** ..... **20 MHz**

Power Supply
Output ..... on

Digital Multimeter
Mode ..... DC
Range ..... Auto

6786-208

If the environment is electrically noisy, then connect a capacitor (at least 0.1 μF) across the input terminals of the DMM.

Procedure

Press the Enhanced Accuracy button twice. Immediately after self-calibration has completed and passed, perform this procedure for each channel.

It is helpful if you use a pocket calculator to do the calculations required for evaluating the data in this part. If your Digital Multimeter is equipped with a comparison or relative reference feature, use this feature for the readings and calculation required in steps b and d.

When connecting the alligator clips, connect one clip directly to the Power Supply's negative terminal and the other clip to the 430 Ω resistor (not the Power Supply's positive terminal).

a. Set **Average N** to **ON** select **Mean (whole zone)** in the MEASURE menu, and set **Compare** to **ON**.

b. Connect the alligator clips to the Power Supply and set the voltage so that the trace is within ±0.2 division of the first graticule line above the bottom of the screen. Read the Digital Multimeter and record the absolute value (that is, ignore the polarity).

c. Select **Save Current Meas Value as References** in the Compare and Reference popup menu of the MEASURE menu.

d. Connect the alligator clips to the Power Supply and set the voltage so that the trace is within ±0.2 division of the first graticule line below the top of the screen. Read the Multimeter and add the absolute value (that is, ignore the polarity) to the reading obtained in step b.

e. Read the ΔMean value in the MEASURE menu.

f. Divide the sum obtained in step d by the Δ readout obtained in step e. Then, divide this result by the mainframe characterization factor (obtained in step h of the Characterize 11401/11402 Mainframe procedure).

g. ***CHECK***—that the result obtained in step f is ≥0.9947 but ≤1.0053.

h. Repeat steps b through g for the vertical size settings listed below. When testing with small voltages, it may help to install attenuators in series between the BNC to alligator clip adapter and the coaxial cable so that you can set the voltages with better resolution. You can also use a DC Voltage Calibrator to achieve better resolution (when testing with small voltages).

1 V/div
0.5 V/div
0.2 V/div
0.1 V/div
50 mV/div
49.8 mV/div
23 mV/div
20 mV/div
10 mV/div
5 mV/div
2 mV/div
1 mV/div

Part 5b—Check ΔV DC Accuracy: 11301/11302 Mainframe Procedure

Description

The system ΔV DC Accuracy is checked using a precision Digital Multimeter and a Power Supply.

The purpose of this procedure is to confirm that the plug-in can be accurately calibrated. This procedure does not test for mainframe calibration voltage reference accuracy or long term stability. Therefore, the mainframe is characterized and tests must be performed immediately after an Enhanced Accuracy calibration. Also, the plug-in specifications are more stringent than those in the User's Reference Manual.

Specifications

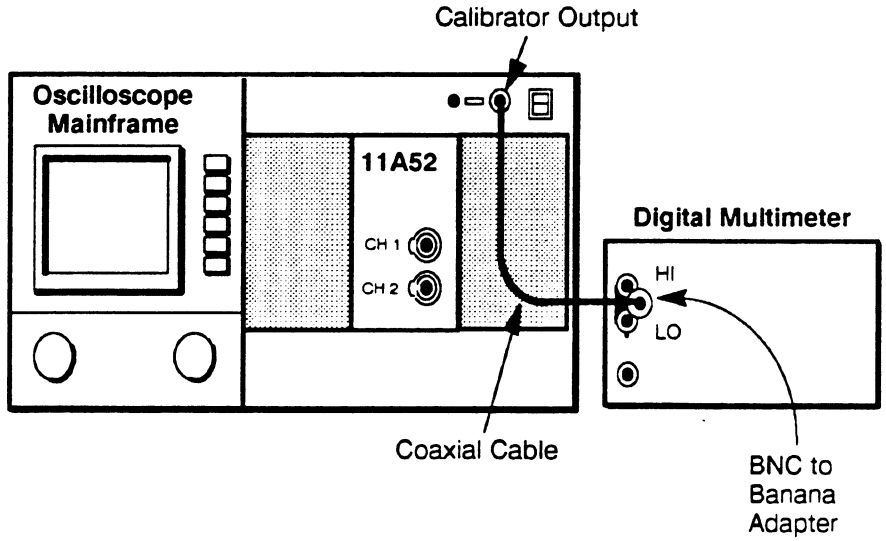
ΔV DC Accuracy within ±1.2%.

Characterize 11301/11302 Mainframe

NOTE

After entering Extended Test, verify that your mainframe's firmware is Version V2.4 or higher. If your mainframe's firmware version is lower than V2.4, then you cannot perform this procedure.

Setup



Perform the following settings:

Center Plug-in

No setting changes.

Oscilloscope Mainframe

UTILITY menu ..... **Ext Test**
Block ..... **Front Panel**
Area ..... **FP Calibrator**
Routine ..... **-9.9988 V**
Loop ..... **cnt( )**
Run .....

6786-217

Procedure

a. Record the DMM reading.

b. Select **Exit.**

c. Select **Routine** and set to **+0.9939V**.

d. Select **Run**.

e. Record the DMM reading.

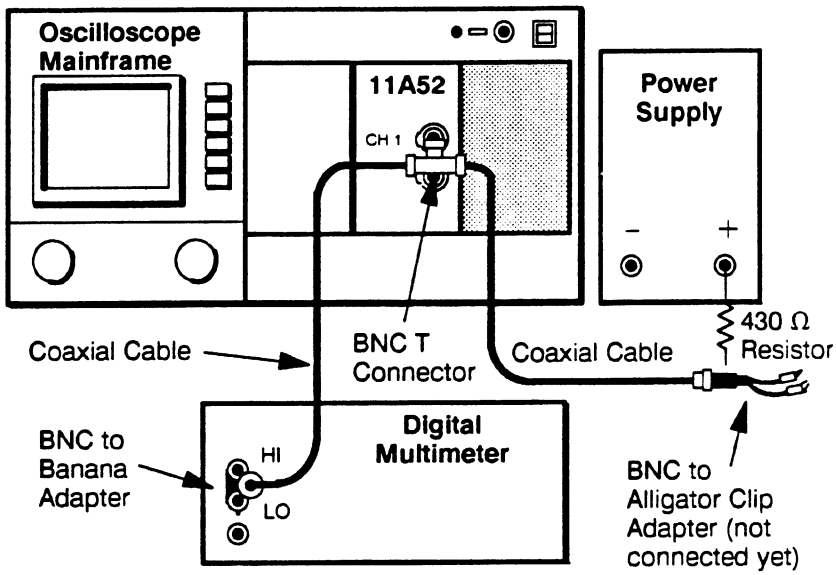
f. Select **Exit.**

g. Select **Exit Diagnostic**.

h. Add the absolute values of the DMM readings obtained in steps a and e. Divide the result by 19.9927 to obtain the mainframe's calibration voltage reference characterization factor (which is used in the Test Plug-in procedure.)

Test Plug-in

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings in the order listed.

Center Plug-in
CH 1 Display on/off ..... on

Oscilloscope Mainframe
BW Limit or **HF Limit** ..... **20 MHz**

Power Supply
Output ..... on

Digital Multimeter
Mode ..... DC
Range ..... Auto

5786-208

If the environment is electrically noisy, then connect a capacitor (at least 0.1 μF) across the input terminals of the DMM.

Procedure

Press the Enhanced Accuracy button twice. Immediately after self-calibration has completed and passed, perform this procedure for each channel.

It is helpful if you use a pocket calculator to do the calculations required for evaluating the data in this part. If your Digital Multimeter is equipped with a comparison or relative reference feature, use this feature for the readings and calculation required in steps b and d.

When connecting the alligator clips, connect one clip to the Power Supply's negative terminal directly and the other clip to the 430 Ω resistor (not the Power Supply's positive terminal).

a. Select **Vertical Cursors.**

b. Connect the alligator clips to the Power Supply and set the voltage so that the trace is within ±0.2 divisions of the first graticule line above the bottom of the screen. Read the Digital Multimeter and record the absolute value (that is, ignore the polarity).

c. Set the Vert Ref cursor on the trace using the left function control knob with FINE resolution.

d. Connect the alligator clips to the Power Supply and set the voltage so that the trace is within ±0.2 divisions of the first graticule line below the top of the screen. Read the Multimeter and add the absolute value to the reading obtained in step b.

e. Set the ΔVert cursor on the trace using the right function control knob with FINE resolution. Read the ΔVert readout.

f. Divide the sum obtained in step d by the Δ readout obtained in step e. Then divide this result by the mainframe characterization factor obtained in step h of the Characterize 11301/11302 Mainframe procedure.

g. ***CHECK*** – that the result obtained in step f is ≥0.988 but ≤1.012.

h. Repeat steps b through g for the vertical size settings listed below. When testing with small voltages, it may help to install attenuators in series between the BNC to alligator clip adapter and the coaxial cable so that you can set the voltages with better resolution. You can also use a DC Voltage Calibrator to achieve better resolution (when testing with small voltages).

1 V/div
0.5 V/div
0.2 V/div
0.1 V/div
50 mV/div
49.8 mV/div
23 mV/div
20 mV/div
10 mV/div
5 mV/div
2 mV/div
1 mV/div

Part 6—Check DC Offset Accuracy

Description

The system DC Offset is checked using a precision Digital Multimeter and a Power Supply.

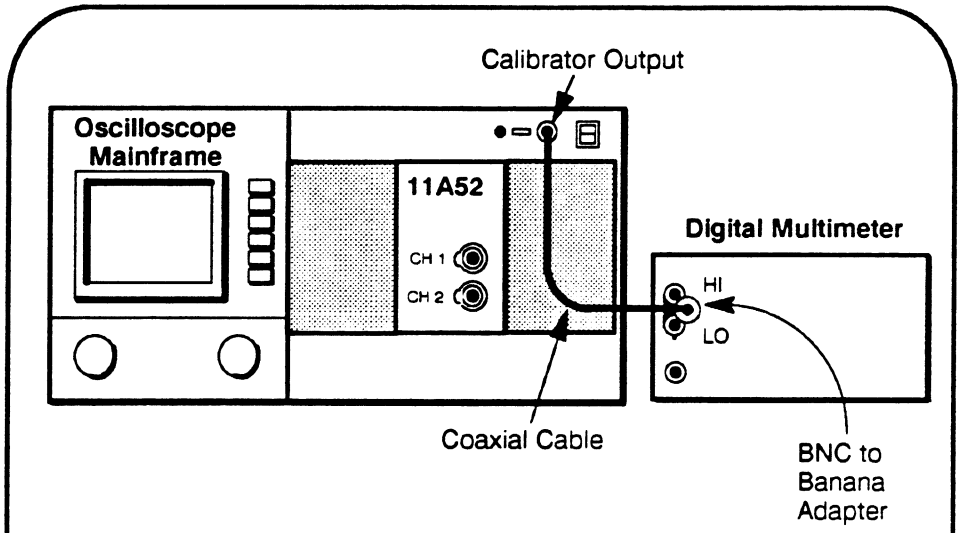
The purpose of this procedure is to confirm that the plug-in can be accurately calibrated. This procedure does not test for mainframe calibration voltage reference accuracy or long term stability. Therefore, the mainframe is characterized and tests must be performed immediately after an Enhanced Accuracy calibration. Also, the plug-in specifications are more stringent than those in the User's Reference Manual.

Specifications

Refer to Table 2-9.

Characterize 11401/11402 Mainframe

Setup



Perform the following settings:

Center Plug-in

No setting changes.

Oscilloscope Mainframe

UTILITY menu ..... **Extended Diagnostic**
Block ..... **Points Acq**
Area ..... **Cal Refs**
Routine ..... **FP -10.000 V**
Run .....

6786-217

Procedure

a. Record the DMM absolute value.

b. Press **Exit.**

c. Press **FP + 9.9951 V.**

d. Press Run.

e. Record the DMM reading.

f. Press **Exit.**

g. Press **Exit Diagnostics.**

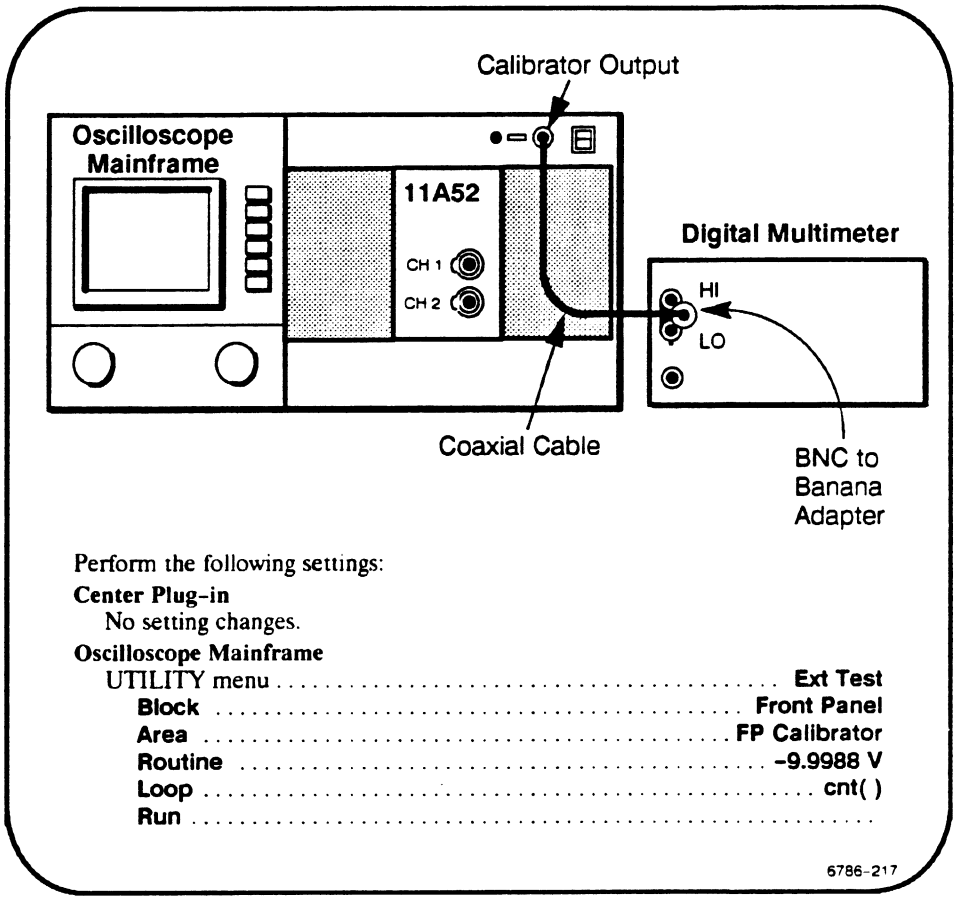
h. Add the absolute values of the DMM readings obtained in steps a and e. Divide the result by 19.9951 V to obtain the mainframe's calibration voltage reference characterization factor (which is used in the Test Plug-in procedure).

Characterize 11301/11302 Mainframe

NOTE

After entering Extended Test, verify that your mainframe's firmware is Version V2.4 or higher. If your mainframe's firmware version is lower than V2.4, then you cannot perform this procedure.

Setup



Perform the following settings:

Center Plug-in
No setting changes.

Oscilloscope Mainframe
UTILITY menu ..... **Ext Test**
Block ..... **Front Panel**
Area ..... **FP Calibrator**
Routine ..... **-9.9988 V**
Loop ..... **cnt( )**
Run .....

6786-217

Procedure

a. Record the DMM reading.

b. Select **Exit.**

c. Select **Routine** and set to **+0.9939.**

d. Select **Run.**

e. Record the DMM reading.

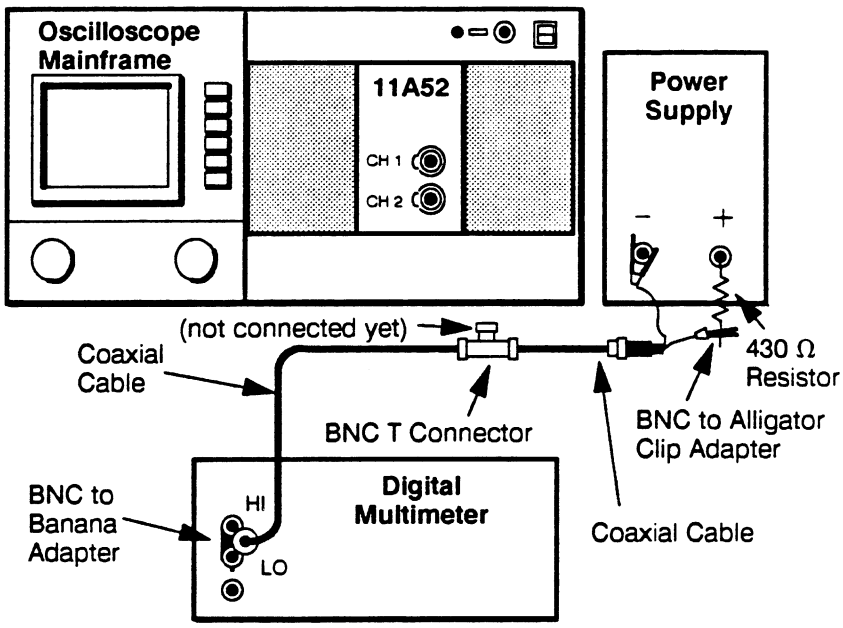
f. Select **Exit.**

g. Select **Exit Diagnostic.**

h. Add the absolute values of the DMM readings obtained in steps a and e. Divide the result by 19.9927 to obtain the mainframe's calibration voltage reference characterization factor (which is used in the Test Plug-in procedure.)

Test Plug-in

Setup



First **Initialize** the oscilloscope's settings, then perform the following settings in the order listed.

Center Plug-in
CH 1 Display on/off ..... on

Oscilloscope Mainframe
BW Limit or **HF Limit** ..... **20 MHz**

Power Supply
Output ..... on

Digital Multimeter
Mode ..... DC
Range ..... Auto

6786-209

If the environment is electrically noisy, then connect a capacitor (at least 0.1 μF) across the input terminals of the DMM.

Procedure

Press the Enhanced Accuracy button twice. Immediately after self-calibration has completed and passed, perform this procedure for each channel.

When connecting the alligator clips, connect one clip directly to the Power Supply's negative terminal and the other clip to the 430 Ω resistor (not the Power Supply's positive terminal).

a. Note the position of the displayed trace (it should be near the center of the graticule).

   If you are using the 11301 or 11302 mainframe, use **Vertical Cursors** to help measure and set the trace position.

   If you are using the 11401 or 11402 mainframe, set **Average N** to **ON** and use **Mean (whole zone)** in the MEASURE menu to help measure and set the trace position.

b. Connect the BNC T Connector to the CH 1 input connector, with the DMM connected.

c. Set the **Vert Offset** to **4 V**. Set the Power Supply voltage so that the displayed trace returns to the position noted in step a. Divide the DMM reading by the mainframe characterization factor (obtained in the Characterize Mainframe procedure) and subtract the Vertical Offset.

d. *CHECK*—that the result obtained in step c is less than the Error Limit shown in Table 2-9.

e. Disconnect the BNC T connector at the CH 1 input connector and set **Vert Offset** to **0**.

f. Repeat steps a through e for each Vertical Size and Offset shown in Table 2-9. When testing with small voltages, it may help to install attenuators in series between the BNC to alligator clip adapter and the coaxial cable so that you can set the voltages with better resolution. You can also use a DC Voltage Calibrator to achieve better resolution (when testing with small voltages).

TABLE 2-9
11A52 DC Offset Accuracy

Vertical Size	Vertical Offset	Error Limit (± Volts)
1 V/div	4 V	46 mV
0.1 V/div	4 V	10 mV
1 mV/div	1 V	1.4 mV
1 mV/div	800 mV	1.2 mV
1 mV/div	600 mV	1.0 mV
1 mV/div	400 mV	0.8 mV
1 mV/div	200 mV	0.6 mV

Section 3
Maintenance

This section contains information for performing preventive maintenance, corrective Field Replaceable Units (FRU) maintenance, testing, and diagnostics. All support-related items mentioned in this section are listed in Table 2-1.

Preventive Maintenance

Preventive maintenance performed regularly can prevent or forestall plug-in breakdown and may improve plug-in reliability. The severity of the environment to which the plug-in is subjected determines the frequency of maintenance.

Plug-in Shield Removal

The side shields, top and bottom frames, and front panel reduce radiation of electromagnetic interference (EMI) from the instrument. The side shields are held in place by grooves in the frame.

To remove a shield, pry it out with your fingers, beginning at the rear of the appropriate side. To install a shield, position it over the frame grooves, then press down with your fingers until the shield snaps into place. Pressure must be applied along the full length of the frames to secure the shield.

The plug-in will not slide into the mainframe if the side shields are not fully seated in the frames.

Cleaning

The plug-in should be cleaned as often as operating conditions require. Accumulation of dirt on components acts as an insulating blanket and prevents efficient heat dissipation, which can cause overheating and FRU breakdown. Dirt also provides an electrical conduction path that can result in plug-in failure.

The cabinet panels of the mainframe, in which the plug-in is installed, reduce the amount of dust reaching the interior of the plug-in. Keep the cabinet panels in place for safety and cooling.

CAUTION

Avoid the use of chemical cleaning agents which might damage the materials used in this plug-in. Use only isopropyl alcohol or totally denatured ethyl alcohol. Before using any other type of cleaner, consult your Tektronix Service Center or representative.

Exterior

Loose dust accumulated on the outside of the plug-in can be removed with a soft cloth or small brush. The brush is particularly useful for dislodging dirt in and around the side-shield ventilation holes and front-panel switches. Remove the side shields before cleaning them.

Interior

Cleaning the interior of the plug-in should seldom be necessary. The best way to clean the interior is to blow off the accumulated dust with dry, low-velocity air (such as from a vacuum cleaner). Remove any dirt that remains with a soft brush or a cloth dampened with a mild solution of detergent and water. A cotton-tipped swab is useful for cleaning in narrow spaces, or for cleaning more delicate circuit components.

CAUTION

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

Visual Inspection

The plug-in should be inspected occasionally for loosely-seated or heat-damaged components. The corrective procedure for most visible defects is obvious. However, particular care must be taken if heat-damaged parts are found. Overheating usually indicates other problems with the plug-in. Therefore, correcting the cause of overheating is important to prevent reoccurrence of the damage.

Periodic Electrical Adjustment

To ensure accurate measurements, check the electrical adjustment of this plug-in after each 2,000 hours of operation, or every 24 months if used infrequently. Instructions are given in Section 2, Checks/Adjustments.

Corrective Maintenance

Corrective maintenance consists of FRU module replacement and plug-in repair. Special techniques required to replace the FRU modules in the plug-in are given here.

Ordering Parts

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

- Instrument type
- Instrument serial number
- Description of the part (if electrical, include circuit number)
- Tektronix part number

Static-Sensitive Device Classification

CAUTION

Static discharge can damage any semiconductor in this plug-in.

This plug-in contains electrical components that are susceptible to damage from static discharge. Table 3-1 gives relative susceptibility of various classes of semiconductors. Static voltages of 1 kV to 30 kV are common in unprotected environments.

Observe the following precautions to avoid damage:

1. Minimize handling of static-sensitive components.
2. Transport and store static-sensitive components or assemblies in their original containers either on a metal surface or conductive foam. Label any package that contains static-sensitive assemblies or components.
3. Discharge the static voltage from your body by wearing a wrist strap while handling these components Servicing static-sensitive assemblies or components should be performed only at a static-free work station by qualified service personnel. We recommend use of the static control mat.
4. Allow nothing capable of generating or holding a static charge on your work station surface.
5. Keep the component leads shorted together whenever possible.
6. Pick up components by the body, never by the leads

7. Do not slide the components over any surface.

8. Avoid handling components in areas that have a floor or work-surface covering capable of generating a static charge.

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)	1
ECL	2
Schottky signal diodes	3
Schottky TTL	4
High-frequency bipolar transistors	5
JFETs	6
Linear microcircuits	7
Low-power Schottky TTL	8
TTL (least sensitive)	9

[1]Voltage equivalent for levels.

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

(Voltage discharged from a 100 pF capacitor through a resistance of 100 ohms.)

Removing and Replacing FRUs

CAUTION

To avoid instrument damage, set the mainframe ON/STANDBY switch to STANDBY and remove the plug-in from the mainframe before removing or replacing FRUs.

To determine the location of a FRU, refer to Figure 3-1.

The side shields will have to be removed to gain access to the circuit boards and other FRUs.

The exploded-view drawing associated with the Replaceable Parts list may be helpful in the disassembly procedures that follow. This drawing is located in Section 5, at the end of this manual.

CAUTION

If the green indicator light remains lit when the STANDBY position is selected, then the switch has been left internally disabled after servicing the Power Supply. To enable the ON/STANDBY switch, refer to the Maintenance section of the mainframe Service Reference Manual.

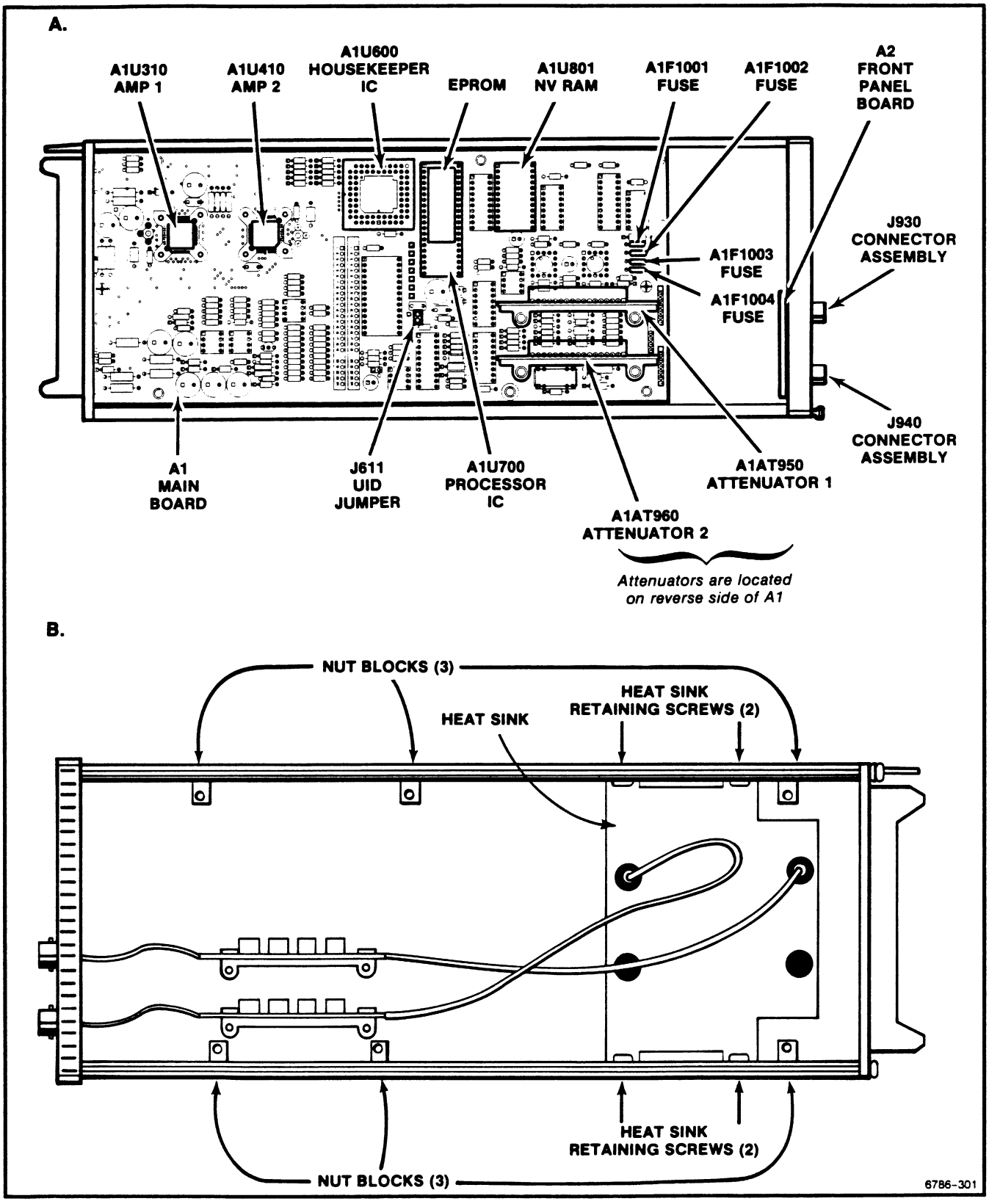


Figure 3-1. Field Replaceable Units (FRU) locator and A1 Main board securing hardware.

Semiconductor FRU Removal

CAUTION

Observe all the special precautions mentioned under Static-Sensitive Device Classification earlier in this section.

Housekeeper Integrated Circuit ("Slam-Pack" IC)

The Housekeeper IC is indexed to its socket by a beveled corner. The other corners are notched to fit the edges of the socket. The beveled corner aligns with a spring (small metal tab) at one corner of the socket. Refer to Figure 3-2.

Remove the Housekeeper IC as follows:

1. Unfasten the retaining clip by moving it across the tabs. It may help to push down slightly on the cover.
2. Remove the cover slowly to prevent the IC from falling out. Observe the index of the IC before removing it.
3. Remove the IC with tweezers.

CAUTION

Avoid touching the IC or the socket contacts with your fingers. Finger oils can lessen reliability.

Replace the Housekeeper IC as follows:

1. Using tweezers, place the beveled corner of the replacement IC against the index spring.

CAUTION

Do not damage the spring with the beveled corner. Shorting of the two corner contacts could result.

2. Arrange the other IC corners, with the tweezers, to fit evenly at the edges of the socket.
3. Set the cover flat on the IC with its end tabs properly aligned with the mating recesses in the socket. (The cover is not symmetrical.)
4. Push the cover down, keeping it flat on the IC, and slide into place. Hold the cover in place while moving the retaining clip over the tabs on the other end.

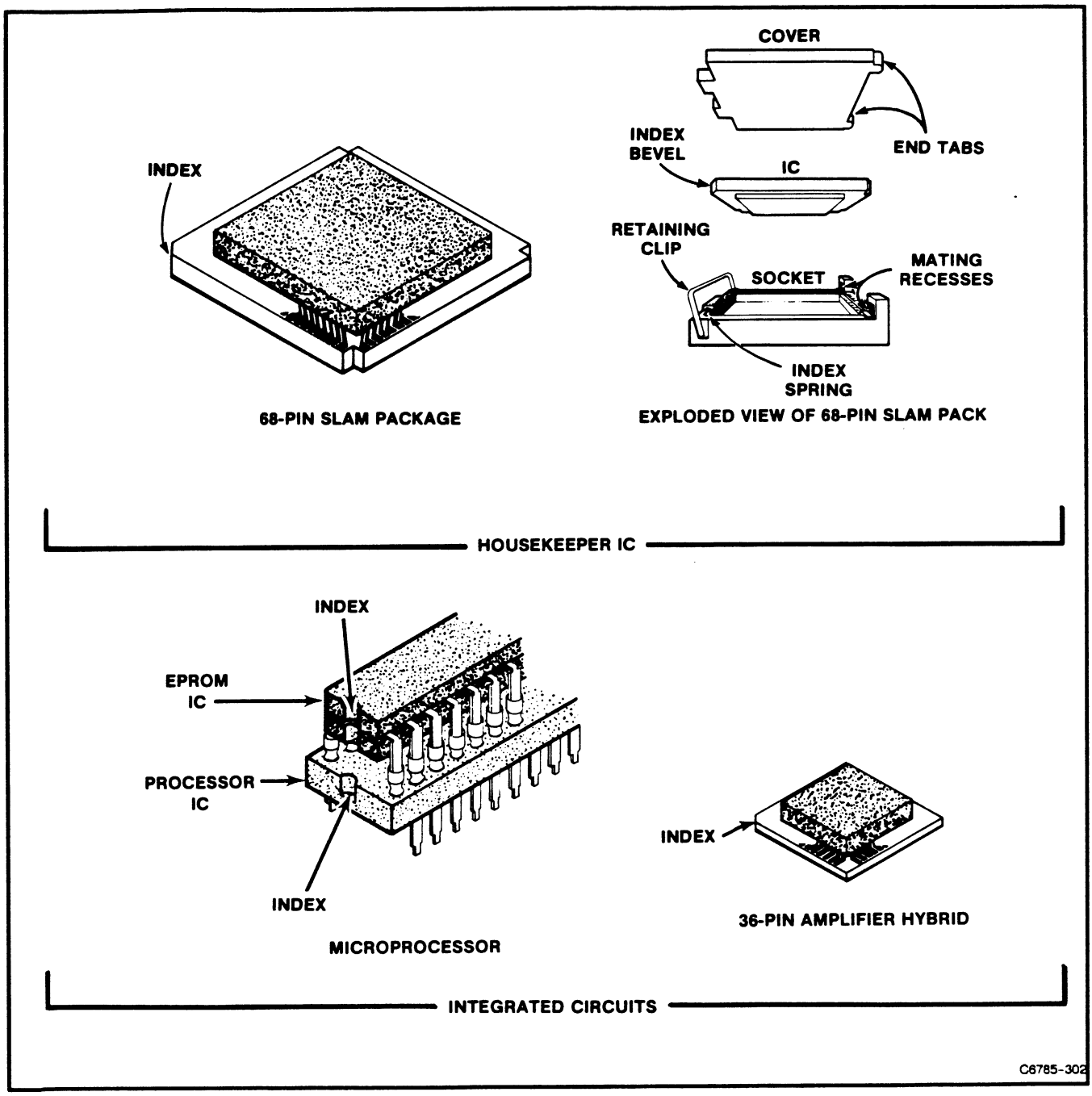


Figure 3–2. Semiconductor indexing diagram.

Amplifier Hybrids

Figure 3-3 shows an exploded view of the Hypcon (Hybrid-printed circuit connector) and gives disassembly and replacement instructions. When replacing the hybrid, do not touch the elastomer's gold-plated contacts with your fingers. Use a cleaner which will not lessen contact reliability. The Hypcon socket contacts are fragile. Use caution when removing and replacing a Hypcon to avoid damaging these contacts.

Before reinstallation, use a 4X (or greater) magnifying glass to examine the hybrid, elastomer, and its contacts under light for dust, hair, lint, etc. If the etched circuit board surfaces require more cleaning, scrub with a soft rubber eraser. Blow or vacuum clean, while dusting the surface with a small, clean brush.

If the hybrid and elastomer contact holders are contaminated, clean them by flushing or spraying with alcohol and oven dry at +50° C. **Do not scrub with a cotton-tipped swab or similar device.** (Cotton fibers may adhere to the contacts.) If the contact holder is excessively contaminated, replace it with a new one.

Tighten the mounting screws with two inch-pounds of torque (2.3 kg-cm) to secure the Hypcon to the circuit board.

Make sure that the elastomer is properly seated in the contact holder before remounting the assembly to the circuit board. Use care when mounting the whole assembly to the circuit board to prevent misalignment between the connector and board.

CAUTION

Because of close tolerances involved, special care must be taken to ensure correct index alignment of each Hypcon part during reassembly. (Fig. 3-3 shows the index locations.) Failure to do so can result in a cracked hybrid substrate.

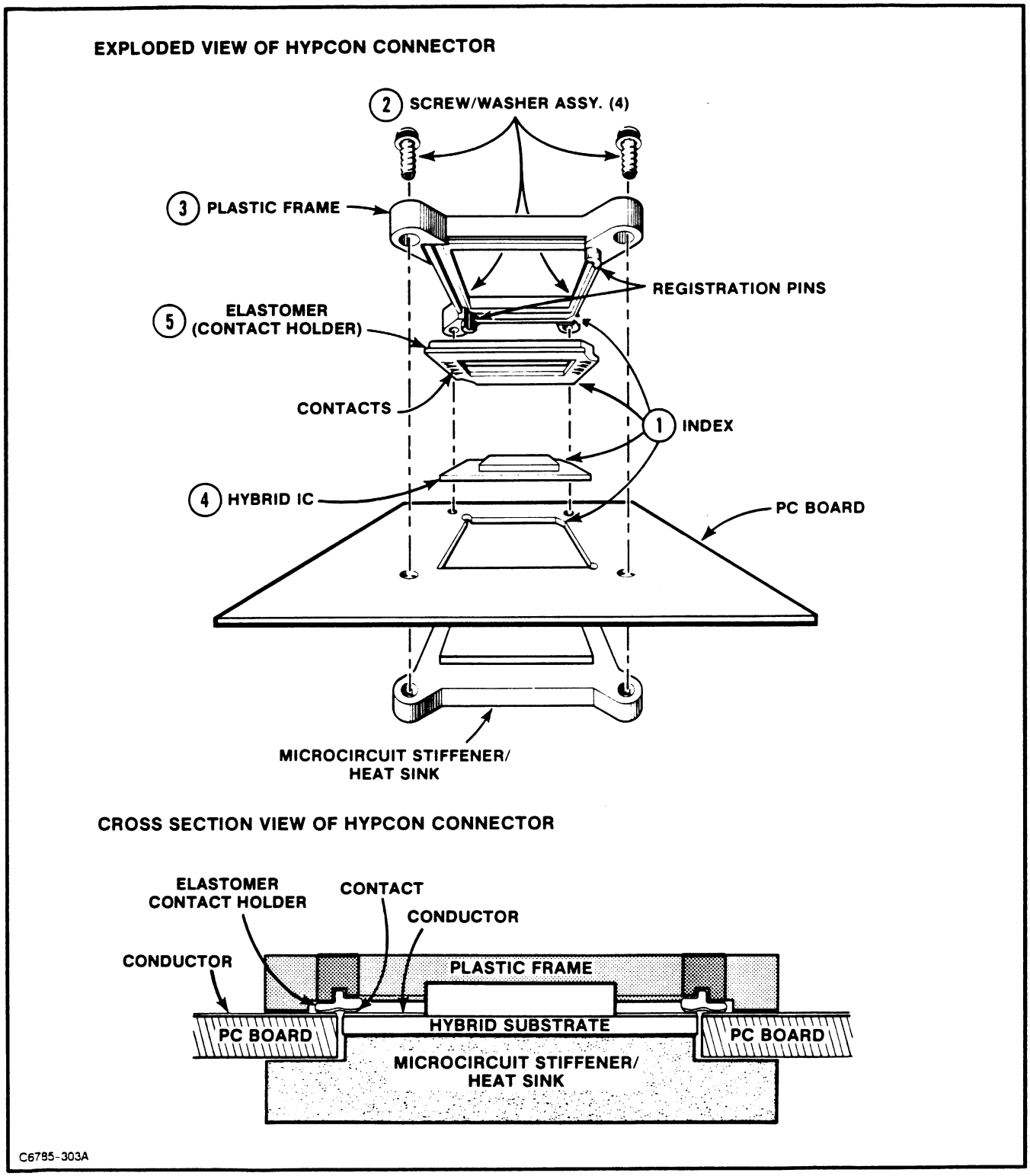


Figure 3-3. Hypcon assembly removal and replacement.

DISASSEMBLY AND REMOVAL

1. Notice the index on the circuit board (arrow) and the plastic frame (pointed tab).
2. Unscrew and remove the four screw/washer assemblies.
3. Lift the plastic frame from the board.
4. Notice the index location of the hybrid and remove the hybrid from the circuit board with the tweezers.

NOTE

Step 5 describes the removal of the elastomer from the plastic frame. This step is not necessary when replacing only the hybrid IC.

5. Notice the index location of the elastomer contact holder and remove the contact holder from the plastic frame by grasping the corner with the tweezers and then lifting up. Do not touch the gold-plated contacts with your fingers.

REASSEMBLY AND REPLACEMENT

a. Grasp a corner of the elastomer with the tweezers and place it into the plastic frame. Align the keyed corner of the elastomer with the keyed corner of the plastic frame. Tamp the elastomer into the plastic frame uniformly.

NOTE

Cleanliness is very important. Small hairs and elastomer flash under the contacts, which are almost invisible to the naked eye, will prevent good electrical contact. Most apparent failures of the hybrid are actually due to contamination of the Hypcon. Do not touch the gold-plated contacts with your fingers.

b. Place the hybrid into the square hole in the circuit board. The hybrid is keyed so that it will fit into the circuit board in only one orientation. When the back of the hybrid rests on the heat sink pedestal, the top of the hybrid should be flush with the top of the circuit board.

c. Place the plastic frame with the elastomer installed over the hybrid such that the key (pointed tab) aligns with the corner arrow on the circuit board.

d. Insert the mounting hardware and apply two inch-pounds of torque (2.3 kg-cm) to secure the connector assembly. Do not overtighten. To do so, strips the microcircuit stiffener/heat sink mounting threads.

C6785-303B

Figure 3-3 (cont). Hypcon assembly removal and replacement.

RAM IC

If the RAM IC is soldered into the board, then consult a Tektronix Service Center for recommended removal procedures. Do not solder in the replacement IC. Instead, install a 24-pin socket and plug the RAM IC into the socket.

EPROM IC

CAUTION

Do not remove the label affixed to the top of EPROMs. Removing this label will allow light into the chip, and may cause partial erasure of its data.

The EPROM IC is mounted on top of the Processor on the A1 Main board. (Refer to Fig. 3-1 for the location of this IC.)

How to Remove the EPROM IC:

1. Use Insertion-Extraction Pliers (such as General Tool's Part Number U505BG, a 28-pin type) to remove the IC. An illustration of the pliers is shown in Figure 3-4.
2. Position the pliers around the outside of the IC. Squeeze the handles to grasp the IC and slowly pull it from the socket.

CAUTION

Avoid touching the IC pins or socket contacts with your fingers. Finger oils can lessen contact reliability.

How to Install the EPROM IC:

1. Grasp the IC with the Insertion-Extraction Pliers. Check that all the IC pins are straight and evenly spaced. Do not use the IC label as an index. Look for the index on the IC body.
2. Align the index slot with that of the A1U700 Processor IC underneath it. (Refer to Fig. 3-2 for IC indexing information.)
3. Align the pins with their respective socket contacts. Slowly and evenly press the IC into its socket.

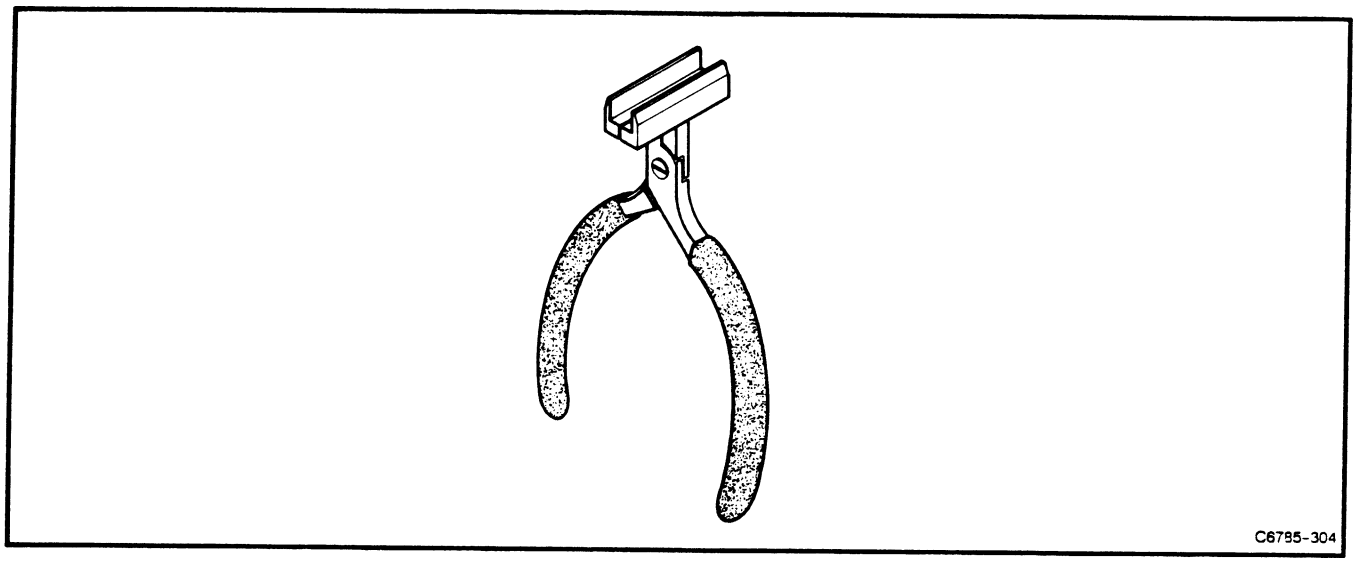


Figure 3-4. IC Insertion-Extraction Pliers.

Processor IC

The Processor IC (A1U700) is located on the A1 Main board. Refer to Figure 3-1 for its location. The EPROM IC is mounted on top of the Processor IC.

How to Remove the Processor IC:

1. Remove the EPROM IC. Follow the removal instructions given in the preceding part of this section.
2. Use Insertion-Extraction Pliers (such as General Tool's Part Number U505BG, a 28-pin type) to remove the Processor IC.
3. Position the pliers around the outside of the IC. Squeeze the handles to grasp the IC and slowly pull it from the socket.

CAUTION

Do not damage the EPROM sockets with the pliers. Avoid touching the IC pins or the socket contacts with your fingers. Finger oils can lessen contact reliability.

How to Install the Processor IC:

1. Grasp the replacement IC with the Insertion-Extraction Pliers. Check that all its pins are straight and evenly spaced.
2. Align the index slot on the IC with the corresponding index on its socket.
3. Align the IC pins with their respective socket contacts. Push down slowly and evenly on the IC to seat it.
4. Replace the EPROM IC on top of the Processor IC. Follow the EPROM replacement instructions given in the preceding part of this section.

Circuit Board and Attenuator FRU Removal

How to Remove the Front Panel

1. Unhook the return spring from the release bar and set it aside.
2. Use a Torx T-8 screwdriver to remove the four screws that fasten the front subpanel to the top and bottom frames.
3. Pull the release bar as far out of the plug-in as it will come, and leave it in that position.
4. Insert a slender, sharp-pointed tool, such as a scribe, between the front panel and the subpanel at the notch around the release bar. Gently separate the front panel from the subpanel. Use care to prevent bending the front panel.

How to Install the Front Panel

1. Check that the four screws that fasten the front subpanel to the top and bottom frames are removed.
2. Check that the release bar return spring is removed.
3. Set the plug-in on its side with the front panel facing you.
4. Pull the release bar as far out of the plug-in as it will come, and leave it in that position.
5. Position the front panel so that the notch in the bottom fits over the release bar rod, then carefully insert the four front-panel tabs into the slots in the front subpanel. (You may need to pull the top and bottom frames away from the subpanel to allow the front-panel tabs to fit between the casting and the frames.)
6. Gently snap the edges of the front panel into place around the input connectors and the outer edges of the panel.
7. Use a Torx T-8 screwdriver to install the four screws that fasten the front subpanel to the top and bottom frames.
8. Install the release bar return spring. Orient the spring so that its loop fits over the frame hook correctly (flat against the frame section).

How to Remove and Install an A2 Front Panel Board

1. Remove the front panel as outlined in "How to Remove the Front Panel."
2. Unplug the connector that provides electrical connection to the A1 Main board.

3. Use a Torx T-6 screwdriver to remove the screws that fasten the A2 Front Panel board to the front subpanel, and remove the A2 Front Panel board.

4. To replace an A2 Front Panel board, follow the preceding steps in reverse order.

How to Remove an Attenuator

The CH 1 and CH 2 Attenuators are identical.

1. Unplug the coaxial connectors from the input and output of the attenuator.

2. Use a Torx T-10 screwdriver to remove the two screws that fasten the attenuator to the A1 Main board.

3. Using care to keep it straight, unplug the attenuator from the A1 Main board. Avoid disengaging one end of the attenuator before disengaging the other end. Do not apply force to any subcomponents on the attenuator.

How to Install an Attenuator

1. Set the plug-in on its side with the pushbuttons down.

2. Align the attenuator pins with the connector on the A1 Main board, and align the attenuator frame with the holes in the A1 Main board.

3. Plug the attenuator into its connector on the A1 Main board. Do not apply force to any subcomponents on the attenuator.

4. Use a Torx T-10 screwdriver to install the two screws that fasten the attenuator to the A1 Main board.

5. Plug the coaxial connectors into the input and output of the attenuator (refer to Fig. 3-5). Care is necessary when engaging these connectors. For best results, proceed as follows:

   a. Check that the center conductor is straight. Straighten if necessary.

   b. Plug the connector straight into the receptacle.

   c. Look through the slot in the outer receptacle, and watch the center conductor enter its receptacle as you insert the connector.

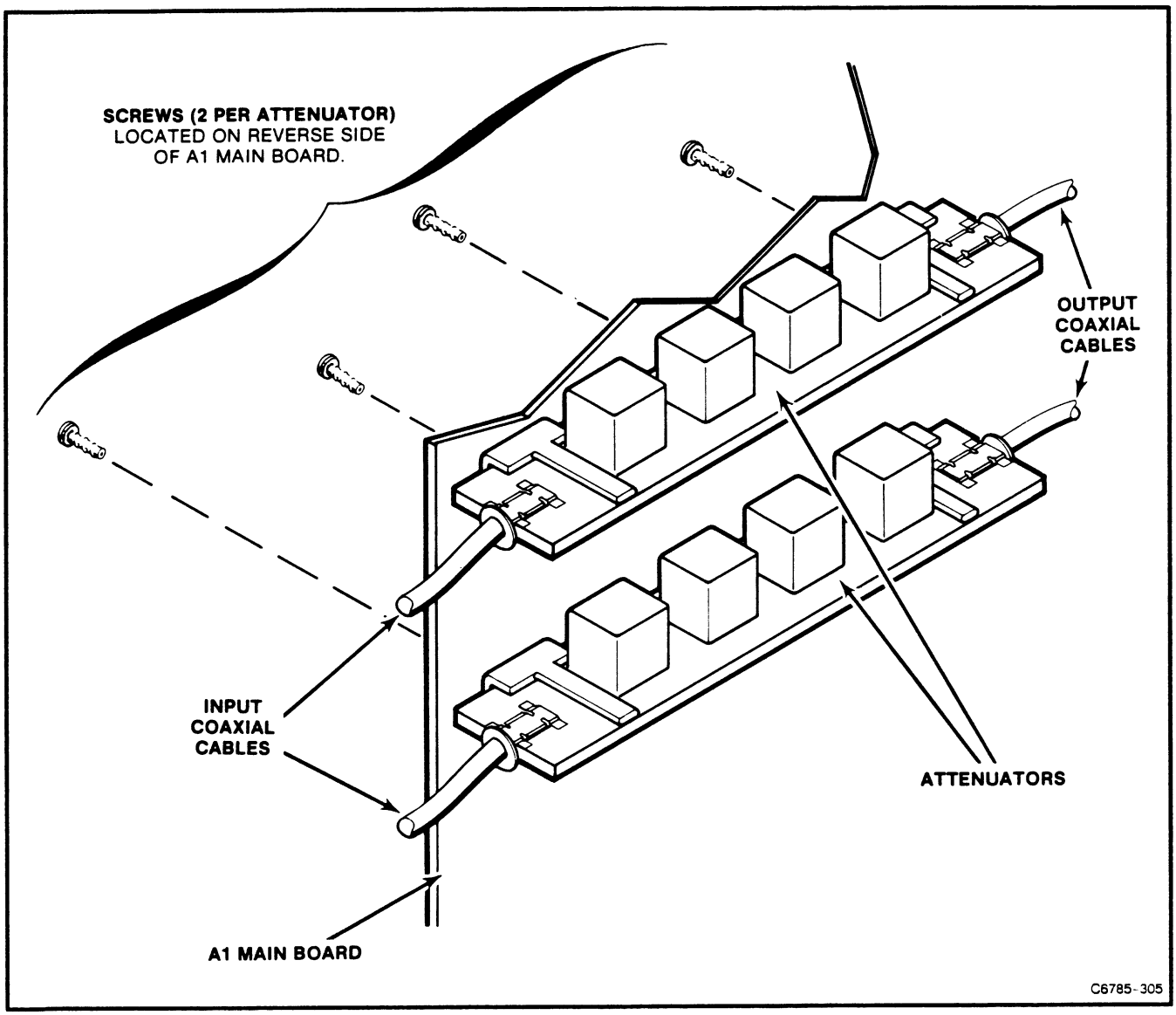


Figure 3-5. Location of the screws and parts for removal of an attenuator.

How to Remove the A1 Main Board

1. Remove the two attenuators and coaxial cables. See "How to Remove an Attenuator" in this section.
2. Unplug the cable from the A2 Front Panel board at the connector on the A1 Main board.
3. Unplug the probe information connectors from the A1 Main board: place your index finger under the metal contacts and your thumb on top, and lift the seven metal contacts out of the receptacle on the A1 Main board.
4. Use a narrow-shank, Torx T-10 screwdriver to remove the six screws and nut blocks that secure the A1 Main board to the top and bottom frames. Figure 3-6 shows a nut block.

5. Use a Torx T-15 screwdriver to remove the two screws that fasten the heat sink bracket to the A1 Main board.
6. Use a Torx T-15 screwdriver to remove the four screws that fasten the plastic rear panel to the top and bottom frames.
7. Carefully withdraw the A1 Main board from between the frames.
8. Remove the rear panel from the A1 Main board.

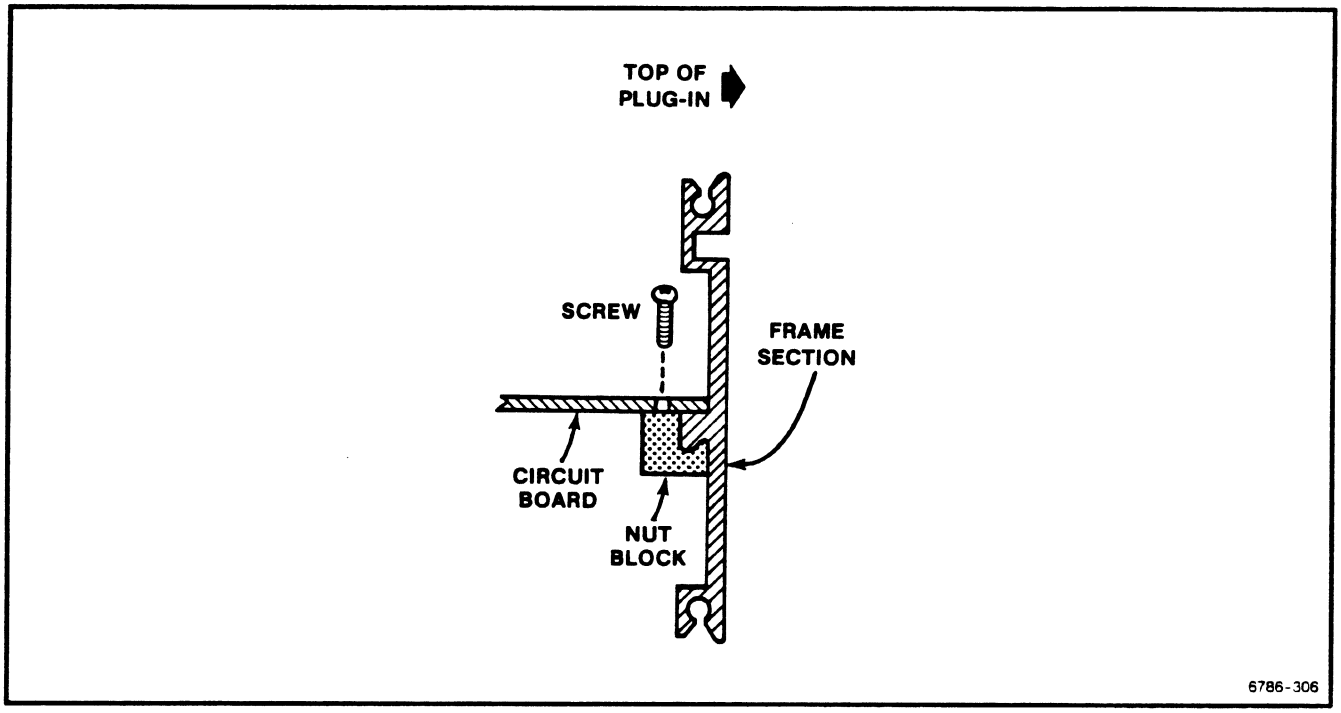


Figure 3-6. Location of a nut block securing the circuit board to the frame section.

How to Install the A1 Main Board

1. Set the plug-in on its side with the pushbuttons up. Reattach the rear panel to the replacement A1 Main board.
2. Carefully insert the A1 Main board between the frames until the plastic rear panel contacts the top and bottom frames. The board fits on the top of the center ridges on the top and bottom frames.
3. Use a Torx T-15 screwdriver to start the four screws that fasten the rear panel to the top and bottom frames.
4. Use a Torx T-15 screwdriver to install the two screws that fasten the heat sink bracket to the A1 Main board.
5. Use a Torx T-10 screwdriver to install the six screws and nut blocks that clamp the A1 Main board to the top and bottom frames.
6. Plug the probe information connectors into their receptacles on the A1 Main board.

7. Connect the cable from the A2 Front Panel board to the connector on the A1 Main board.
8. Tighten the four screws that you started in step 3.
9. Install the attenuators as outlined in "How to Install an Attenuator." Plug in the attenuator output coaxial cables through the holes in the heat sink (as shown in Fig. 3-1).
10. If the A1 Main board has been replaced, then the Unit Identification (UID) number needs to be re-entered. Refer to instructions in the "Programming the Unit Identification" section, which follows.

Programming The Unit Identification

The Unit Identification (UID) is identical to the plug-in's serial number and is stored in NV RAM. It is necessary to enter this number if the A1 Main board is replaced or if data in NV RAM becomes corrupted. If only confirmation of the UID is needed, then use the following procedure except skip step 4.

To Enter the UID, use this procedure:

1. Connect the Terminal to the mainframe's RS-232-C port. (Refer to the mainframe User's Reference Manual for instructions on setting up the RS-232-C parameters.)
2. Move the UID Term Conn Link (jumper) J611 on the A1 Main board (shown in Fig. 3-1). The jumper should be vertical in its normal position. Remove the jumper and install it horizontally.
3. Install the plug-in into any compartment. Turn the power on. Wait until the Diagnostics checks are completed.
4. At the Terminal, type the command:

   UID [Left|Center|Right]:" <Serial Number> "

   - Left|Center|Right refers to the name of the compartment.
5. At the Terminal, type the query:

   UID? [Left|Center|Right]

   Observe that the correct UID is reported.
6. Move the ON/STANDBY switch to STANDBY.
7. Remove the plug-in.
8. Return the jumper J611 on the A1 Main board to its vertical position.

Cables and Connectors

BNC Connectors

How to Remove a Connector Assembly

1. Remove the front panel as outlined in "How to Remove the Front Panel."
2. Unplug the coaxial connector from the back of the connector assembly. Figure 3-1 shows the locations of the connectors.
3. Unplug the cable from the A2 Front Panel board at the connector on the A1 Main board.
4. Unplug the probe information connectors from the A1 Main board: place your index finger under the metal contacts and your thumb on top, and lift the seven metal contacts out of the receptacle on the A1 Main board. (The probe information cable is a flat, flexible, seven-conductor cable.)
5. Use a Torx T-6 screwdriver to remove the four screws that fasten the connector assembly to the front subpanel.
6. Remove the connector assembly from the plug-in.

How to Install a Connector Assembly

1. Set the gray connector alignment ring on the connector with its index on the inside of the connector assembly. The "inside" is the side where the flat cable enters the connector assembly.
2. Insert the connector and the connector alignment ring into the hole in the front subpanel. Check that the flat cable faces the inside of the plug-in and the index on the connector alignment ring fits into the notch in the front subpanel.
3. Use a Torx T-6 screwdriver to install the four screws that fasten the connector assembly to the front subpanel.
4. Plug the probe information connector into its receptacle on the A1 Main board.
5. Plug the coaxial connector from the attenuator into the connector assembly. For best results, proceed as follows:
   a. Check that the center conductor is straight. Straighten if necessary.
   b. Plug the connector straight into the receptacle.
6. Plug the A2 Front Panel board cable connector into the A1 Main Board.
7. Install the front panel as outlined in "How to Install the Front Panel."

Multi–Pin Connectors

Arrangement of Pins in a Multi–Pin Connector

Pin 1 on a multi-pin connector is designated with a triangle (or arrowhead) on the holder. A square pad on the circuit board denotes pin 1. When a connection is made to a circuit board, the indexing of the symbol on the multi-pin holder is determined by the square pad.

A multi-pin connector is 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 circuit board.

Align the holder's plastic plug with the gap between the circuit board pins, as shown in Figure 3-7.

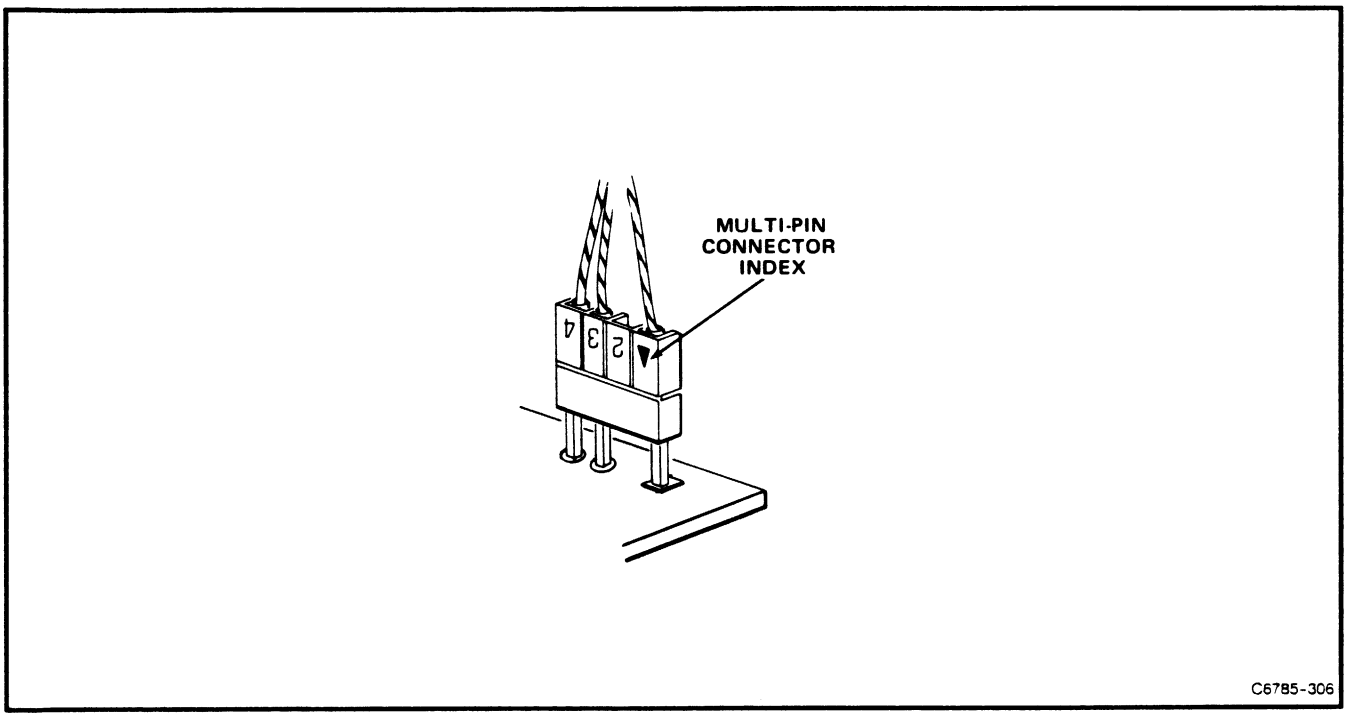


Figure 3-7. Indexing of multi-pin connectors.

Diagnostic Troubleshooting

This section provides the information necessary to troubleshoot a faulty instrument to the Field Replaceable Unit (FRU) level. FRUs are circuit boards attenuator modules, and integrated circuits or hybrids that are replaceable without soldering. The primary means for troubleshooting is to use the error index code output from the Diagnostics or Self-Tests and cross-reference them to the suspect FRU(s) in the FRU Guide tables. After an FRU is replaced, recalibration of the instrument is normally required.

Diagnostics Overview

The processor runs a set of Kernel Tests prior to the Self-Tests. If this is successful, then the Self-Tests are run to verify the functionality of each of the subsystems. Any failure causes the instrument to enter Extended Diagnostics and to display the error index code(s) in a diagnostic menu. Extended Diagnostics tests are a superset of the Self-Tests.

The Kernel Tests, Self-Tests/Extended Diagnostics, and Enhanced Accuracy mode produce and format error index codes differently, so these error index codes are covered separately.

Some of these tests that may indicate faulty FRU(s) are not run automatically during the Self-Tests (that is, some errors codes are only generated by manually selecting tests).

The next two subsections provide a quick overview of Kernel Tests and Extended Diagnostics.

For an overview of the Enhanced Accuracy mode, refer to Part 3—Check Enhanced Accuracy in Section 2, Checks and Adjustments.

Kernel Tests

Each time the front-panel ON/STANDBY switch is set to ON, the mainframe and plug-ins perform Power-Up Diagnostics on their microprocessor subsystems and Self-Test Diagnostics on all of their major circuits.

CAUTION

Turning the instrument power off during the execution of the Diagnostic tests may result in losing some or all of the non-volatile RAM data (such as stored settings, calibration constants, etc.). This could affect normal instrument operation in unpredictable ways. If this occurs, refer to Restoring Calibration Data later in this section.

After the plug-in is powered-up and the MPU has reset, the plug-in begins a sequence of test routines to determine if its kernel systems are operating properly. If any of these tests fail, then it is unlikely that the plug-in can communicate failure information to the mainframe. The flashing of a fault code on the front panel CH 1 and CH 2 LEDs indicates a particular failure. This fault code indicates which Kernel Test is failing.

The following description explains how to read the fault code:

If the plug-in Kernel Tests detect a fault, then the CH 2 LED is flashed eight times to display a fault code. Each time the CH 2 LED turns on, count the occurrences. If the CH 1 LED is lit during a cycle of the CH 2 LED, then the test corresponding to the current count accumulated is the one which failed. Refer to the timing diagram in Figure 3-8 for an example LED fault code. The timing diagram illustrates a test number 2 failure.

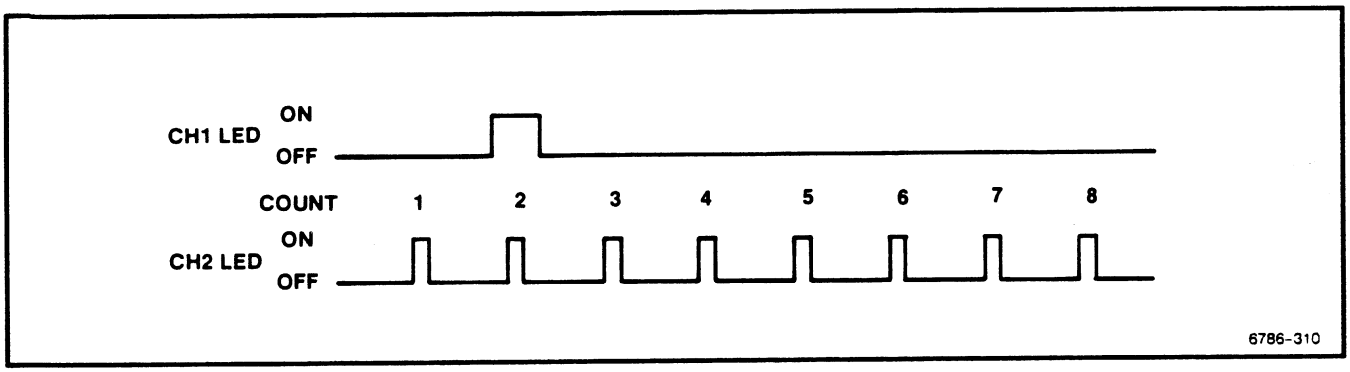


Figure 3-8. Sample LED fault code timing diagram.

The Kernel Tests are:

1. ROM Checksum Test
2. Non-volatile RAM Test
3. Housekeeper IC Test

1. The ROM Checksum Test computes a checksum of the content of the firmware ROM. This calculated checksum is then compared with a checksum stored in the ROM. If the checksums do not match, the test fails, and fault code 1 is reported. After the fault code is reported by flashing the front panel LEDs, the plug-in attempts to begin normal operation, but it is unlikely that the instrument can function properly with a bad ROM Checksum.

2. The Non-volatile RAM (NV RAM) Test verifies that the NV RAM is functioning properly. Since the NV RAM contains calibration information which must remain undamaged, this test does not alter critical data. If the testing algorithm detects a failure, then the plug-in reports a fault code of 2 and repeatedly loops the NV RAM Test. The instrument continues looping the NV RAM Test until the power is removed. Until the condition causing the NV RAM Test to fail is corrected, the mainframe does not recognize the plug-in.

   The NV RAM Test could corrupt calibration data stored in the NV RAM if the power is cycled or removed during this test. If corruption occurs, then the Calconstant Checksum is corrupted as well. Furthermore, at the next power-up, the plug-in resets the cal constants to default ROM settings and reports a Plug-in Calconstant Checksum Error during mainframe-invoked, Power-up Diagnostics. After the mainframe/plug-in system is run through an Enhanced Accuracy cycle, the plug-in is once again properly calibrated.

3. The Housekeeper IC Test verifies the functionality of the Housekeeper IC. The Housekeeper IC performs many 'housekeeping' chores of the amplifier; including channel sequencing, refreshing the analog control voltage system, latching amplifier step gain settings, and the communications with the mainframe. This test exercises this IC and records the ICs reactions using an algorithm similar to the algorithm that signature analysis uses. If the resulting signature of the Housekeeper IC does not match a known good signature, then the test fails and reports a fault code of 3. Also, the test is executed repeatedly if it fails. The instrument continues looping the Housekeeper IC Test until power is removed. Until the condition causing the Housekeeper IC Test to fail is corrected, the mainframe does not recognize the plug-in.

   After all power-on Kernel Tests have completed and successfully passed, the instrument initializes its settings and communicates with the mainframe.

Self-Test/ Extended Diagnostics

First, the plug-in must successfully power-up, initialize its settings, and establish communication with the mainframe. Then, the mainframe requests that the plug-in execute its Self-Test routines (unless the mainframe's Self-Tests are disabled, in which case all the Self-Tests are ignored). Return to normal operation or entry into the New Configuration calibration, as discussed below, indicates successful completion of the Self-Test Diagnostics. Any failures cause the instrument to display the Extended Diagnostics menu. Record the displayed error codes for the failed circuit Block(s). The user may have to step through several pages of the menu display to find all the failure codes.

The format of the error index codes is based on the Extended Diagnostics menu structure. The Extended Diagnostics menus are in a three-level hierarchy with the Block menu at the highest level. Each plug-in is one Block. A Block is broken into a number of parts or circuit areas in the Area menu, the second level. Touching the Area label at the bottom of the menu displays the Area menu for the selected Block. Each circuit Area has a Routine menu, the third level, associated with it that has one or more selectable routines. Routines are the smallest test units that are selectable and runable. This Block, Area, and Routine menu hierarchy generates the error index codes.

Extended Diagnostics error index codes are five digit codes whose first character indicates the subsystem or plug-in unit tested. The last four digits are hexadecimal (hex) numbers that indicate the Block, Area, Routine and specific failure mode. For example, R1241 is decoded as follows:

R	Right Plug-in
1	Block name - plug-in
2	Area name - Group II
4	Routine name - Checksum Probe
1	Failure Identity - specific failure mode

The subsystem character of an error index code is one of the following, and indicates the compartment in which the plug-in is installed. In the tables in this section, only the four digit failure code is listed; the prefix L, C, or R is omitted.

L	-Left
C	-Center
R	-Right

Front-panel controls are active during the Self-Test sequence and any disturbance causes a test failure.

Self-Test Diagnostics test the following:

- Attenuator relay driver
- Probe coding
- Calibration (cal) constant checksums
- Calibration (cal) constant values
- A/D and D/A converters
- Probe power fuses
- Signal path

Using the Self-Tests/Extended Diagnostics

After all Extended Diagnostic/Self-Tests have run, any resultant error index codes appear on the display next to the associated circuit block names in the Extended Diagnostics menu. Each circuit block that had a failure gives the first error encountered and the number of failures in the Block. Select the label of a failed Block, then select the Area label to get a more complete list of the error index codes in a Block. Selecting the Routine label shows the lowest level test routines in the selected Area. The currently selected Block, Area, and Routine are shown. Several operating mode selectors are available on the screen. When certain test routines are selected, some of these operating modes are unselectable.

Refer to the mainframe User's Reference manual for information on Extended Diagnostics or Extended Test menus and operation.

New Configuration Calibration

When a plug-in is first installed in a mainframe or when one is moved to a different compartment in the mainframe, the instrument is in a new configuration mode. After the instrument runs the Power-Up Diagnostics, it recalibrates itself for the new configuration. During this calibration, the message **"Powerup new configuration partial calibration occurring"** appears. If the calibration is successful (as indicated by a message), the instrument enters the normal operating mode.

Restoring Calibration Data

If the instrument power is turned off during probe calibration, self- calibration, Extended Diagnostics or other intense system activity, then some internal data may be corrupted. The display of the Extended Diagnostic menu when the power is turned on, indicates that this corruption has occurred.

If the Extended Diagnostics menu displays a Cksm Probe error (this error indicates that the power was turned off during probe calibration), then using the following procedure usually restores normal operation:

1. Note from the Extended Diagnostics menu which plug-in is at fault.
2. Exit the Extended Diagnostics menu.
3. Remove and re-install the probes on the plug-in that is at fault.
4. Repeat the calibration of these probes.
5. Run the Self-Tests and confirm that the tests pass.

If the Extended Diagnostics menu displays a Cksm Plug or any other new error, then using the following procedure usually restores normal operation:

1. Exit the Extended Diagnostic menu.
2. Wait for the self-calibration to complete and pass.
3. Run the Self-Tests and confirm that the tests pass.

Usually these procedure restore normal operation. If these procedures do not restore normal operation, then your mainframe or plug-in requires servicing.

Plug-In Memory Backup Power

The non-volatile RAM (A1U801 NV RAM) within the plug-in allows retention of the data in memory when the plug-in is removed.

The NV RAM stores system-configuration data such as the plug-in, mainframe, and probe IDs as well as the cal constants. The data that the NV RAM stores, enable the plug-in to resume Enhanced Accuracy performance from a powered-down condition, without performing a full calibration (Enhanced Accuracy) operation.

The rated lifetime of the NV RAMs integral power source is ten years. If, on system power-up, the plug-in habitually loses Enhanced Accuracy status without a system configuration change (that is, the plug-in remains plugged into the same slot in the same mainframe), then the NV RAM may require replacement.

Field Replaceable Unit (FRU) Guide

This section correlates error index codes resulting from Diagnostic tests with the hybrid, integrated circuit (IC), module, or board (FRU(s) suspected of causing each error. The FRU(s) in each category are listed in most-to-least probable cause order (assuming only one error is indicated). If any diagnostic errors occur, inspect the suspect FRU for loose connections and components. Repeat the Diagnostic test. If any diagnostic errors occur again, replace the suspect FRU(s) with a known good FRU(s). Verify that the new FRU is a correct replacement for the old FRU. If the old FRU contains firmware, then verify that new firmware version is either the same version as, or an updated version of, the old firmware version.

The error index codes are divided into three tables. A table of Kernel Test error codes, a table of Self-Test/Extended Diagnostic error indexes, and a table of Enhanced Accuracy error indexes.

Abbreviations of FRU Names

All boards are listed here with the abbreviation used in the Suspect Board FRU(s) column of the Error Index Code tables that follow:

Abbreviation	Name	Designator
Main	Main board	A1
Front	Front Panel board	A2

Abbreviations of Component and Module Names

All active components and modules are listed here with the abbreviation used in the Suspect Module, Hybrid, or IC FRU(s) column of the Error Index Code tables that follow.

Abbreviation	Name	Designator
MPU	Processor	A1U700
EPROM	Firmware	on A1U700
RAM	Memory	A1U801
HK	Housekeeper	A1U600
Att1	Attenuator, channel 1	A1AT950
Att2	Attenuator, channel 2	A1AT960
Amp1	Amplifier, channel 1	A1U310
Amp2	Amplifier, channel 2	A1U410
FUSE	Probe power fuses	A1F1001, A1F1002 A1F1003, A1F1004

Error Index Codes

This table lists the error codes possible in the Kernel Tests

Error Code	Suspect Module, Hybrid, or IC FRU(s)	Suspect Board FRU(s)
1	EPROM, MPU	Main
2	RAM	Main
3	HK, MPU	Main

This table lists the error messages possible in the Self-Tests and Extended Diagnostics.

Error Index	Suspect Module, Hybrid, or IC FRU(s)	Suspect Board FRU(s)
-1111		Main
-1121		Main
-1131[1]	RAM	Main
-1141[1]	RAM	Main
-1211		Main
-1221	FUSE	Main
-1311	HK	Main
-1811		Main
-1821		Main

[1]These error indexes may also result from the corruption of the calibration data (refer to Restoring Calibration Data earlier in this section).

This table lists the error indexes resulting from Enhanced Accuracy. Enhanced Accuracy is available after the system has a 20-minute warmup period.

Error Index	Suspect Hybrid or IC FRU(s)	Suspect Board FRU(s)
-1411	Att1	
-1421	Ampl	Main
-1431	Ampl	Main
-1441	Ampl	Main
-1451	Ampl	Main
-1461	Ampl	Main
-1471	Ampl	Main
-1481	Ampl	Main
-1491	Ampl	Main
-1511	Att1	Main
-1521		Main
-1531		Main
-1541	Att1	Main
-1551	Ampl	Main
-1561	Ampl	Main

Error Index	Suspect Hybrid or IC FRU(s)	Suspect Board FRU(s)
-1611	Att2	
-1621	Amp2	Main
-1631	Amp2	Main
-1641	Amp2	Main
-1651	Amp2	Main
-1661	Amp2	Main
-1671	Amp2	Main
-1681	Amp2	Main
-1691	Amp2	Main
-1711	Att2	Main
-1721		Main
-1731		Main
-1741	Att2	Main
-1751	Amp2	Main
-1761	Amp2	Main

Fuse Troubleshooting

Failure code 1221 indicates that one or more probe power fuses are defective.

Refer to Figure 3-1 (FRU locator) for fuse locations.

To find a defective fuse, remove the plug-in from the mainframe, and use a Multimeter to check for continuity across each fuse. Replace all defective fuses. Then, install the plug-in in the mainframe and verify that the diagnostic error does not reappear.

The most likely cause of a blown fuse is a short circuit applied at the front-panel TEKPROBE® input connector. If a newly installed fuse blows with nothing connected at the TEKPROBE® input connector, then look for a short circuit on the A1 Main board or on the flexible circuit connecting the A1 Main board to the TEKPROBE® input connector.

Section 4
Theory of Operation

This section describes and illustrates (refer to Fig. 4-1) the plug-in block diagram; including signal flow and control flow. This section also discusses the power supplies for the plug-in.

Block Diagram Description

Signal Flow

The CH 1 and CH 2 Amplifier circuits are identical, therefore this section only describes the CH 1 Amplifier.

The signal display begins with the application of a signal directly to the CH 1 input connector (usually with a probe) and proceeds as follows:

CH 1 input connector → CH 1 Attenuator →

→ CH 1 Aux Signal
CH 1 Amplifier → CH 1 Trigger Signal
→ CH 1 Display Signal

The input coupling mode is either AC, DC, or Off. In the AC and DC coupling modes, the input signal is coupled to the CH 1 Attenuator. In the Off coupling mode, the signal path is open.

During self-calibration, the mainframe supplies the signal to the CH 1 Attenuator.

The CH 1 Attenuator contains resistive dividers, capacitive dividers, ac coupling capacitors, and relays. The CH 1 Amplifier provides gain switching and bandwidth limit filters.

The plug-in contains a microprocessor (MPU) that communicates with the mainframe. The MPU also constantly monitors the input Overload Sense and the Probe Data communication lines. The operation of the MPU is through the internally stored program in its read only memory (ROM). The MPU stores the plug-in calibration (cal) constants in random access memory (RAM). A battery backs-up memory, therefore, the internal cal constants are not lost upon power-down. Also, when powering-down, the mainframe stores the oscilloscope's setting. When the system re-powers, the mainframe restores and transmits these settings to the plug-in.

The MPU communicates with the mainframe through a peripheral IC called the Housekeeper. The Housekeeper converts the 8-bit data bytes from the MPU into a serial data signal. This signal is sent to the mainframe. Conversely, the Housekeeper converts the serial data signal from the mainframe into 8-bit data bytes for the MPU to read. The MPU stores the channel switching sequence in the Housekeeper. The Housekeeper also updates the analog control voltages.

The MPU uses an analog-to-digital (A/D) converter to read the value of the Overload Sense and Probe Data lines. The A/D converter is also used in the Self-Tests.

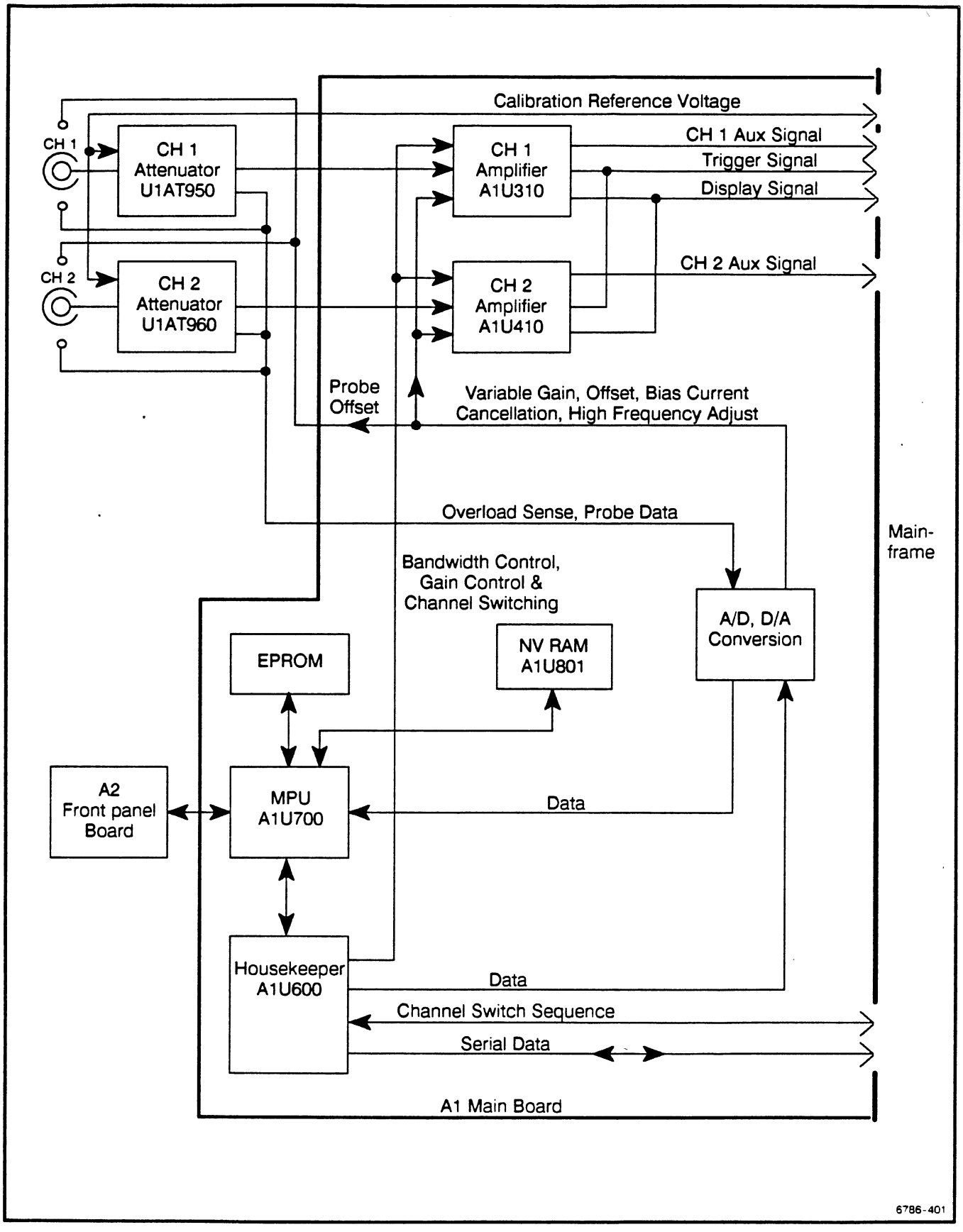


Figure 4-1. 11A52 Two-Channel Amplifier.

The MPU reads the front-panel pushbuttons. The MPU tells the mainframe when a front-panel button is pushed. Pushing a button, selects that button's channel. The mainframe then tells the plug-in what action to take (for example, display the selected channel and turn on that channel's respective front-panel LED).

Control Flow

Under the control of the mainframe's channel switch sequencing signals, the Housekeeper sequentially turns a channel on or off. The MPU and Housekeeper control the settings of the amplifier and the attenuator.

Power

The mainframe supplies all the power to the plug-in.

REPLACEABLE PARTS

PARTS ORDERING INFORMATION

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

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

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

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

ITEM NAME

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

FIGURE AND INDEX NUMBERS

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

INDENTATION SYSTEM

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

1 2 3 4 5	*Name & Description*
Assembly and/or Component	
Attaching parts for Assembly and/or Component	
**** 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 in the same indentation as the item it mounts, while the detail parts are indented to the right. Indented items are part of, and included with, the next higher indentation. The separation symbol - - - * - - - indicates the end of attaching parts.

ABBREVIATIONS

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
01536	TEXTRON INC CAMCAR DIV SEMS PRODUCTS UNIT	1818 CHRISTINA ST	ROCKFORD IL 61108
06383	PANDUIT CORP	17301 RIDGELAND	TINLEY PARK IL 60477
22599	AMERACE CORP ESNA DIV	15201 BURBANK BLVD SUITE C	VAN NUYS CA 91411-3532
75915	LITTELFUSE INC	800 E NORTHWEST HWY	DES PLAINES IL 60016
80009	TEKTRONIX INC	4900 S W GRIFFITH DR P O BOX 500	BEAVERTON OR 97077
83385	MICRODOT MFG INC GREER-CENTRAL DIV	3221 W BIG BEAVER RD	TROY MI 48098
91260	CONNOR SPRING AND MFG CO	1729 JUNCTION AVE	SAN JOSE CA 95112
93907	TEXTRON INC CAMCAR DIV	600 18TH AVE	ROCKFORD IL 61101
TK1326	NORTHWEST FOURSLIDE INC	5858 WILLOW LANE	LAKE OSWEGO OR 97034
TK1831	PACIFIC HYBRID MICROELECTRONICS INC	7790 SW NIMBUS AVE BLDG 10	BEAVERTON OR 97005

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	366-0600-00			2	PUSH BUTTON:0.269 X 0.409,ABS	80009	366-0600-00
-2	366-1058-00			1	KNOB:GRAY,0.625 X 0.255 X 0.485	80009	366-1058-00
					(ATTACHING PARTS)		
-3	214-1095-00			1	PIN,SPRING:0.187 L X 0.094 OD,STL,CD PL	22599	52-022-094-0187
					(END ATTACHING PARTS)		
-4	105-0076-04			1	RELEASE BAR,LCH:PLUG-IN UNIT	80009	105-0076-04
-5	214-1280-00			1	SPRING,HLCPS:0.14 OD X 1.126 L,TWIST LOOP	91260	ORDER BY DESCR
-6	214-1054-00			1	SPRING,FLAT:0.825 X 0.322,SST	TK1326	ORDER BY DESCR
-7	105-0075-00			1	BOLT,LATCH:	80009	105-0075-00
-8	333-3350-00			1	PANEL,FRONT:	80009	333-3350-00
					(ATTACHING PARTS)		
-9	211-0392-00			4	SCREW,MACHINE:4-40 X 0.25,FLH,82 DEG,STL	80009	211-0392-00
					(END ATTACHING PARTS)		
-10	348-0235-00			2	SHLD GSKT,ELEK:FINGER TYPE,4.734 L	80009	348-0235-00
-11	386-5219-00			1	SUBPANEL,FRONT:	80009	386-5219-00
-12	426-2061-00			1	FR SECT,PLUG-IN:LOWER,ALUMINUM	80009	426-2061-00
					(ATTACHING PARTS)		
-13	211-0392-00			2	SCREW,MACHINE:4-40 X 0.25,FLH,82 DEG,STL	80009	211-0392-00
					(END ATTACHING PARTS)		
-14	334-3540-00			1	MARKER,IDENT:MARKED WARNING	80009	334-3540-00
-15	131-3589-00			2	CONN ASSY,ELEC:FRONT PNL	80009	131-3589-00
					(ATTACHING PARTS)		
-16	211-0413-00			8	SCREW,MACHINE:2-56 X 0.375,FLH,82 DEG,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-17	354-0654-00			2	RING,CONN ALIGN:BNC	80009	354-0654-00
-18	174-0205-00			2	CABLE ASSY,RF:50 OHM COAX,2.6 L	80009	174-0205-00
-19	119-2214-00			2	ATTENUATOR ASSY:750MHZ,50 OHM	TK1831	119-2214-00
					(ATTACHING PARTS)		
-20	211-0304-00			4	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL,T9 TORX	01536	ORDER BY DESCR
					(END ATTACHING PARTS)		
-21	670-9336-00			1	CIRCUIT BD ASSY:FRONT PANEL	80009	670-9336-00
					(SEE A2)		
					(ATTACHING PARTS)		
-22	211-0413-00			2	SCREW,MACHINE:2-56 X 0.375,FLH,82 DEG,STL	93907	ORDER BY DESCR
					(END ATTACHING PARTS)		
-23	174-0159-00			1	CA ASSY,SP,ELEC:6,26 AWG,3.0 L,RIBBON	80009	174-0159-00
-24	334-3438-00			1	MARKER,IDENT:MARKED TURN OFF POWER	80009	334-3438-00
-25	214-1061-00			1	CONTACT,ELEC:GROUNDING,CU BE	80009	214-1061-00
-26	426-2060-00			1	FR SECT,PLUG-IN:UPPER,ALUMINUMN	80009	426-2060-00
					(ATTACHING PARTS)		
-27	211-0392-00			2	SCREW,MACHINE:4-40 X 0.25,FLH,82 DEG,STL	80009	211-0392-00
					(END ATTACHING PARTS)		
-28	337-1064-12			2	SHIELD,ELEC:SIDE FOR PLUG-IN UNIT	80009	337-1064-12
-29	670-9404-00	B010100	B010345	1	CIRCUIT BD ASSY:MAIN	80009	670-9404-00
	670-9404-01	B010346		1	CIRCUIT BD ASSY:MAIN	80009	670-9404-01
					(SEE A1)		
-30	156-2962-00			1	.MICROCKT,DGTL:NMOS,MICROCOMPUTER,8 BIT W/	80009	156-2962-00
					.SOCKET,EPROM		
-31	160-4010-03			1	.MICRICKT,DGTL:HMOS,16385 X 8 EPROM,PRGM	80009	160-4010-03
-32	165-2129-02			2	.MICROCKT,LINEAR:VERTICAL PREAMP	80009	165-2129-02
-33	131-3511-00			2	.CONTACT,ELEC:1.22 CM FLAT HYPCON	80009	131-3511-00
-34	156-2625-00			1	.MICROCKT,DGTL:NMOS,CUSTOM,SENESCHAL	80009	156-2625-00
-35	156-2671-00			1	.MICROCKT,DGTL:CMOS,2048 X 8 SRAM MDL W/	80009	156-2671-00
					.INTEGRAL BATTERY DS1220,24		
-36	159-0253-00			2	.FUSE,CRTG:0.250A,125V,FAST,SUBMINIATURE	75915	251.250 T & R T1
-37	159-0235-00			2	.FUSE,WIRE LEAD:0.75A,125V,FAST	80009	159-0235-00
-38	220-0022-00			6	NUT BLK:0.4 X 0.25 X 0.33,4-40 THRU,NI SIL	80009	220-0022-00
					(ATTACHING PARTS)		
-39	211-0304-00			6	SCR,ASSEM WSHR:4-40 X 0.312,PNH,STL,T9 TORX	01536	ORDER BY DESCR
					(END ATTACHING PARTS)		
-40	174-0206-00			2	CABLE ASSY,RF:50 OHM COAX,11.25 L	80009	174-0206-00
-41	343-0549-00			1	STRAP,TIEDOWN,E:0.091 W X 4.0 L,ZYTEL	06383	PLT1M
-42	407-3363-00			1	BRACKET,HEAT SK:ALUMINUM	80009	407-3363-00
					(ATTACHING PARTS)		
-43	211-0711-00			2	SCR,ASSEM WSHR:6-32 X 0.25,PNH,STL,TORX,T15	01536	ORDER BY DESCR
					(END ATTACHING PARTS)		
-44	386-5296-00			1	PANEL,REAR:	80009	386-5296-00
					(ATTACHING PARTS)		

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-45	213-0904-00			4	SCREW,TPG,TR:6-32 X 0.5,PNH,STL (END ATTACHING PARTS)	83385	ORDER BY DESCR
					STANDARD ACCESSORIES		
	070-6114-00			1	MANUAL,TECH:USERS,11A52	80009	070-6114-00
	070-6698-00			1	PROCEDURE:INCOMING INSPECTION,11A52	80009	070-6698-00
					OPTIONAL ACCESSORIES		
	070-6786-00			1	MANUAL,TECH:SERVICE REF,11A52	80009	070-6786-00

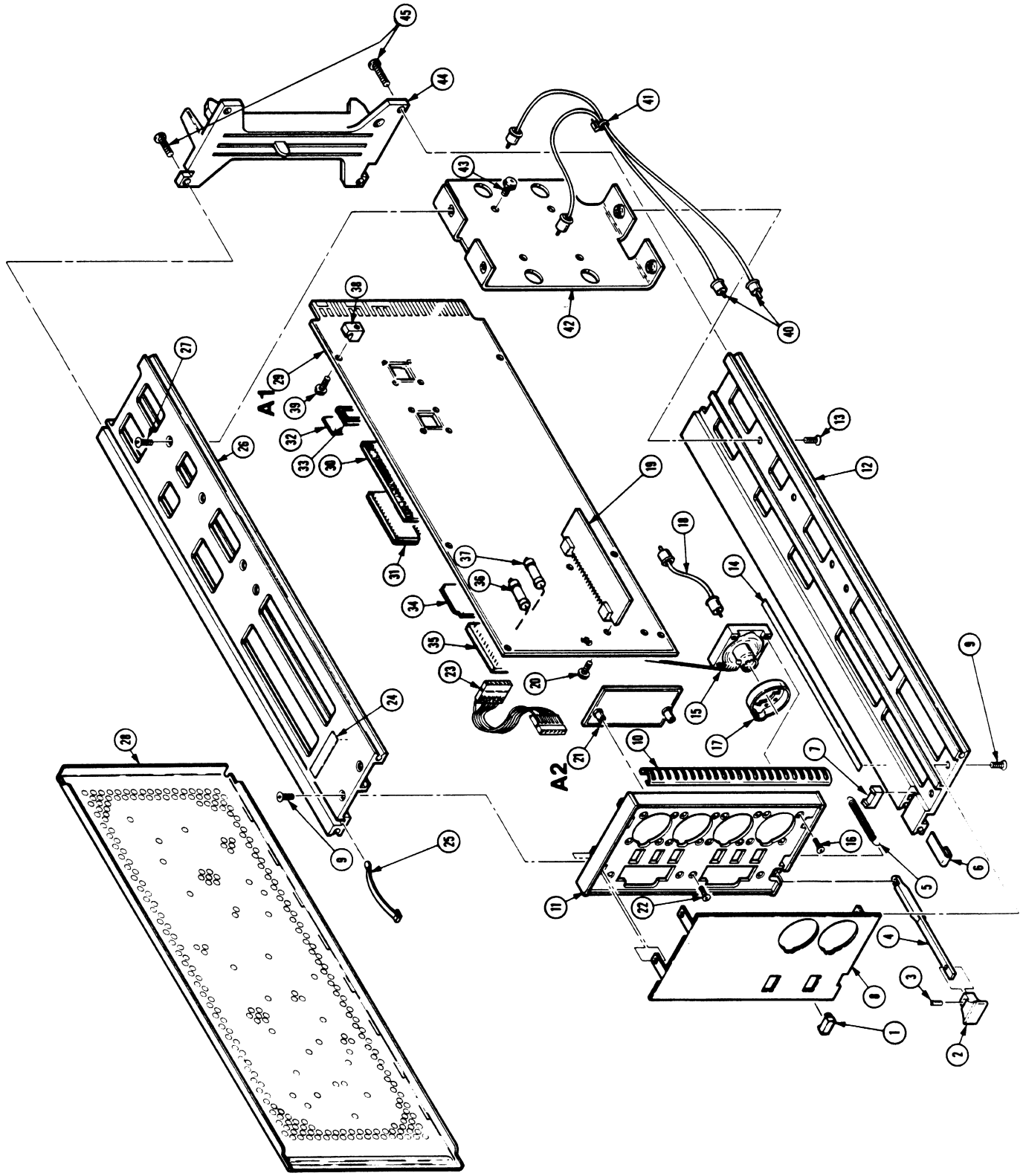


FIG.1 EXPLODED
11A52

MANUAL CHANGE INFORMATION

At Tektronix, we continually strive to keep up with latest electronic developments by adding circuit and component improvements to our instruments as soon as they are developed and tested.

Sometimes, due to printing and shipping requirements, we can't get these changes immediately into printed manuals. Hence, your manual may contain new change information on following pages.

A single change may affect several sections. Since the change information sheets are carried in the manual until all changes are permanently entered, some duplication may occur. If no such change pages appear following this page, your manual is correct as printed.

SEND TO: TEKTRONIX, INC.
LAB INSTRUMENTS MARKETING SUPPORT
P.O. BOX 500, DEL STA 39-327
BEAVERTON, OREGON 97077

11000-SERIES OSCILLOSCOPE PROBLEM REPORT

A INSTRUMENT CONFIGURATION:

Instrument	Section	ROM (Version)	ID # (Serial Number)

Option Information

B
COMPANY NAME: _____
USER: _____
ADDRESS: _____
CITY: _____ STATE: _____ ZIP: _____
PHONE: _____ EXTENSION: _____

SUBMITTED BY: _____ DATE: _____

C
REASON FOR REPORT
☐ Hardware/Mechanical Problem
☐ Software/Firmware Problem
☐ Documentation Problem
☐ Suggested Enhancement

IS THE PROBLEM REPRODUCIBLE?
☐ Yes ☐ No ☐ Intermittent

D
SYSTEM DESCRIPTION: (Hardware, software, firmware and host related to the problem)

E
DESCRIPTION OF PROBLEM:

LIST ENCLOSURES:

Tektronix
COMMITTED TO EXCELLENCE

001-0731-00D

Instructions For Completing The Problem Report

I. Please type or print clearly. Use a separate Problem Report (PR) for each problem.

II. SECTION A

Fill in the instrument configuration table, including all plug-in units, modules, and probes installed in the oscilloscope. The information can be found in one of the menus under the UTILITY major menu.

Instrument: Write the instrument name (e.g., 11301, 11401, 11A32, etc.).

Section (Microprocessor Subsystem): If the instrument has more than one section write the section name. For plug-ins, write in which mainframe slot they are located (e.g., left, center, right).

ROM (Version): Write the rom version number for each instrument and section. Instruments with more than one section will have more than one version number.

ID# (Serial Number): Write the serial number for each instrument. At the factory the ID number is programmed to be the instrument's serial number. If this value has been changed, please write the serial number physically attached to the instrument (mainframes: front panel, plug-in units: top rail).

III. SECTION B

Use the complete company mailing address. Include the name and phone number of the person reporting the error. Also, be sure to fill in the name of the person submitting the PR.

IV. SECTION C

Check the reason for the report and whether the problem is reproducible. We cannot fix a problem when we cannot reproduce the problem condition.

V. SECTION D

Give a complete description of the system configuration on which the problem occurred. Include related peripherals, interfaces, options, special switch and/or strap settings and operating system.

VI. SECTION E

Describe the problem completely. Include any information which might help in evaluating the error with the PR. If you have determined a procedure to avoid the error condition, please include this procedure. If this problem prevents you from accomplishing any useful work with the product, please state this fact. Be sure to include with the PR any information (programs, listings, hard copies, etc.) which will help us duplicate your problem.

VII. SECTION F

This section is for use by Tektronix Lab Instruments Marketing Support personnel. DO NOT WRITE IN THIS SPACE.

VIII. Mail **all** copies of the Problem Report to:

TEKTRONIX, INC.
LAB INSTRUMENTS MARKETING SUPPORT
P.O. BOX 500, DEL STA 39-327
BEAVERTON, OREGON 97077

INTERNAL USE ONLY
(DO NOT WRITE BELOW THIS LINE)

	DATE RECEIVED .....
	IR # .....

PR LOG