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Service Manual

Tektronix

SD-14
Sampling Head

070–8285–01

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

Please check for change information at the rear of this manual.

First Printing: May 1993

Instrument Serial Numbers

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

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

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

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Table of Contents

List of Figures ..... **iii**

List of Tables ..... **v**

General Information

General Information **1-1**

Introduction **1-1**

Safety Summary **1-2**

Installing and Removing the Sampling Head **1-4**

Packing for Shipment **1-7**

Operating Environment **1-8**

Checks and Adjustments

Checks and Adjustments **2-1**

Test Equipment **2-3**

Using These Procedures **2-5**

Conventions in this Manual 2-5

Initialized and Stored Settings 2-5

Menu Selections and Measurement Techniques 2-5

Setup Illustrations 2-6

Procedure 1 Power On **2-8**

Procedure 2 Rise Time **2-10**

Procedure 3 Aberrations **2-13**

Procedure 4 Offset/Sampling Repetition Rate **2-17**

Procedure 5 Linearity/Gain **2-22**

Procedure 6 Displayed Noise **2-28**

Procedure 7 Time Delta **2-30**

Maintenance

Maintenance **3-1**

Preventive Maintenance **3-1**

Periodic Electrical Checks 3-1

Static-Sensitive Device Classification 3-1

Exchanging Sampling Heads 3-3

Removing and Replacing the Sampling Head Internal Circuitry 3-4
Changing the Sampling Head Identification Number 3-6

Theory of Operation

Theory of Operation 4-1
System Functional Overview 4-1
Offset Null and Offset Gain 4-2

Replaceable Parts

Replaceable Parts 5-1
Parts Ordering Information 5-1
Using the Replaceable Parts List 5-2

List of Figures

Figure 1-1: Sampling Head Compartments in an 11801B and a CSA 803A 1-4
Figure 1-2: Installing a Sampling Head in an Instrument 1-6
Figure 2-1: Locations of Controls and Connectors on Mainframe Instruments 2-7
Figure 3-1: Removing and Replacing the Sampling Head Internal Circuitry 3-4
Figure 3-2: A5 Time Base/Controller Board Jumper Location 3-6
Figure 4-1: SD-14 Block Diagram 4-1
Figure 5-1: Exploded View of the SD-14 Sampling Head 5-4

List of Tables

Table 1-1: Mainframe Executive Processor and Time Base/ Controller Firmware Versions Compatible with the SD-14 1-5
Table 2-1: Measurement Limits and Specifications 2-1
Table 2-2: Test Equipment 2-3
Table 2-3: Aberration Measurement Limits 2-13
Table 2-4: Measurement Limits for Offset 2-19
Table 2-5: Data for Calculation of Gain and Linearity 2-27
Table 3-1: Relative Susceptibility to Electrostatic Discharge (ESD) . . 3-2

General Information

General Information

This section gives all the information needed to apply power to the SD-14 Sampling Head.

Safety information as well as information on installing and removing the sampling head, packaging for shipment, and environmental conditions such as operating temperature is included here.

Introduction

The *SD-14 Sampling Head Service Manual* is designed for use by qualified service personnel. It contains information necessary to check and maintain the SD-14 Sampling Head.

The SD-14 Sampling Head is a two-channel, probe-equipped sampling head that can be installed in the 11800 Series Digital Sampling Oscilloscopes, the SM-11 Multi-Channel Unit, and the CSA 803 Series Communications Signal Analyzers.

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 Manuals

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

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

Terms on Equipment

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

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

Symbols in Manuals



Static Sensitive Devices

Symbols on Equipment



DANGER
High Voltage



Protective
ground (earth)
terminal



ATTENTION
Refer to
manual

Grounding the Instrument

The sampling head is grounded through the grounding conductor of the oscilloscope's power cord. To avoid electric shock, plug the power cord into a properly wired receptacle before connecting to the product input or output terminal. A protective-ground connection, by way of the grounding conductor in the 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 the sampling head in an atmosphere of explosive gasses.

Installing and Removing the Sampling Head

The SD-14 Sampling Head slides into the one of the front-panel compartments of an 11800 Series Digital Sampling Oscilloscope or CSA 803 Series Communications Signal Analyzer. Figure 1-2 shows the front panel of the 11801B and CSA 803A instruments and the locations of the sampling head compartments.

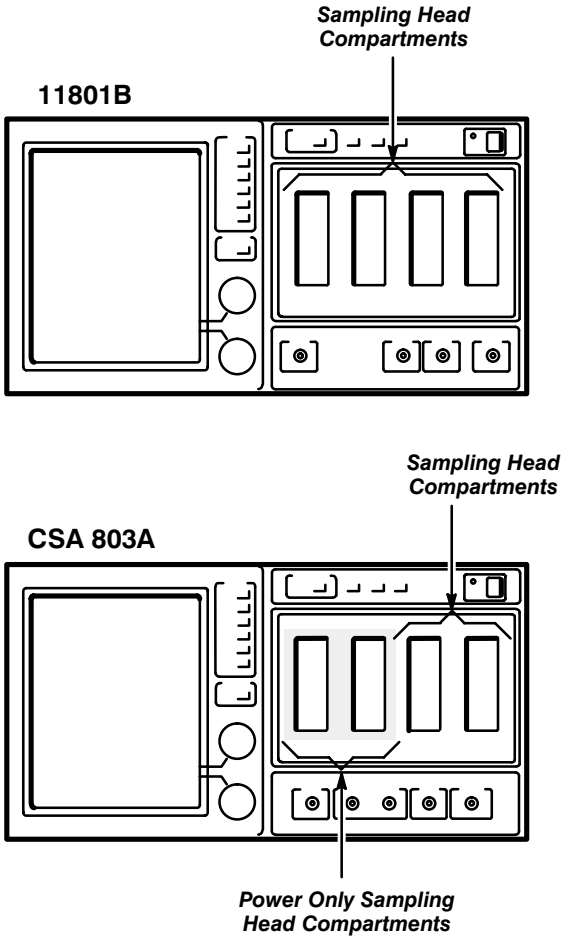


Figure 1-1: Sampling Head Compartments in an 11801B and a CSA 803A

The mainframe instrument must have firmware compatible with the SD-14. Table 1-1 shows the mainframe Executive Processor (EXP) and Time Base Controller (TBC) firmware version required in order to operate the SD-14.

Table 1-1: Mainframe Executive Processor and Time Base/ Controller Firmware Versions Compatible with the SD-14

Mainframe Instrument	Firmware Version for SD-14 Operation
11801, 11802	10.00 or newer
11801A or CSA 803	3.00 or newer
11801B or CSA 803A	4.00 or newer

At least one sampling head must be installed in an 11800 Series or CSA 803 Series instrument to sample signals.

CAUTION

To prevent damage to the sampling head or instrument, never install or remove a sampling head when the instrument's PRINCIPAL POWER SWITCH is ON (powered-on).

With the ON/STANDBY switch set to STANDBY, place the sampling head in a compartment and slowly push it in with firm pressure. Once the sampling head is seated, turn the lock-down screw to tighten the sampling head into place.

To remove the sampling head from an instrument, set instrument's ON/STANDBY switch to STANDBY. Turn the lock-down screw, and then slowly pull out the sampling head.

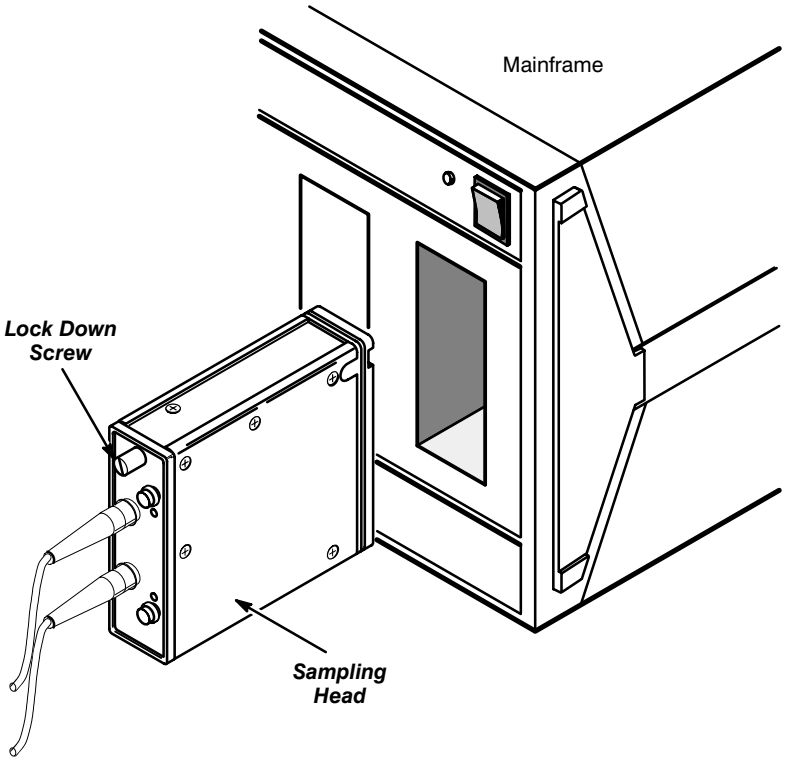


Figure 1-2: Installing a Sampling Head in an Instrument

Packing for Shipment

If possible, save and reuse the original carton and packaging to package the sampling head when shipping it by commercial transportation. Attach protective covers to the probe inputs.

Attach a tag to the sampling head if it is shipped to your local Tektronix service center for service or repair. Include the following information on the tag:

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

Package the sampling head as follows, if the original package is not available or is not fit for use:

- ☐ **Step 1:** Attach protective covers to the probe inputs.
- ☐ **Step 2:** Obtain a corrugated cardboard carton with inside dimensions at least six inches (15 cm) greater than the sampling head dimensions. Use a carton with a bursting test strength of at least 200 pounds per square inch.
- ☐ **Step 3:** Coil and wrap the probes separately from the head with antistatic sheeting or its equivalent.
- ☐ **Step 4:** Fully wrap the sampling head with antistatic sheeting, or its equivalent, to protect the finish.
- ☐ **Step 5:** Tightly pack the probe package alongside the head.
- ☐ **Step 6:** Tightly pack dunnage or urethane foam between the carton and the sampling head to cushion the sampling head on all sides. Allow three inches of packing on each side.
- ☐ **Step 7:** Seal the carton with shipping tape or with industrial staples.
- ☐ **Step 8:** 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 sampling head life.

Operating Temperature

Operate the sampling head where the ambient temperature is between 0° C and +50° C. Store the sampling head in ambient temperatures from −40° C to +75° C. After storage at temperatures outside the operating limits, allow the chassis to reach the operating temperature range before applying power.

Enhanced Accuracy of the instrument is available after a 20-minute warm-up period. After entry into Enhanced Accuracy, the instrument reverts to non-enhanced accuracy if the internal instrument temperature changes more than ±5° C or if the sampling head is removed from the instrument.

Checks and Adjustments

Checks and Adjustments

This section contains procedures to check the specifications and measurement limits listed in Table 2-1. The Specification or Measurement Limit is listed at the beginning of each procedure as well. These procedures contain only check steps, since the SD-14 Sampling Head has no internal adjustments.

The procedures in this section provide a logical sequence of checks for performing a comprehensive performance verification procedure to verify that the sampling head meets specifications. To functionally test the sampling head, perform the procedures in Table 2-1 that have a “yes” in the Functional Test column.

Refer to the *SD-14 Sampling Head User Manual* for more information about specifications and sampling head operation. Refer to Table 2-2 for information concerning test equipment used in the setups.

Table 2-1: Measurement Limits and Specifications

Procedure Number and Description	Measurement Limit	Specification	Functional Test
Procedure 1 Power-On		none	yes
Procedure 2 Rise Time	≤140 ps	140 ps max	no
Procedure 3 Aberrations	+13% −28%, distal to 1.5 ns	+12% −25% typical, distal to 1.5 ns	no
	+1.5% −3.5%, 1.5 ns to 4 ns	+1% −3% typical, 1.5 ns to 4 ns	
	±2.5%, 4 ns to 30 ns	±2% typical, 4 ns to 30 ns	
	±1.5% after 30 ns	±1% typical after 30 ns	
Procedure 4 Offset/ Sampling Repetition Rate			no
Offset		±(20 mV + 1%)	
Zero offset	±20 mV max		no
Offset accuracy			
±2.5 V	±45 mV max		
±3.5 V	±55 mV max		
Offset change with repetition rate	±5 mV max	±5 mV max	

Table 2-1: Measurement Limits and Specifications (Cont.)

Procedure Number and Description	Measurement Limit	Specification	Functional Test
Procedure 5 Linearity/ Gain			no
Linearity	±0.5% of dynamic range (35 mV)	±0.5% of dynamic range (35 mV)	
Gain	±2.5%	±2.5%	
Procedure 6 Displayed Noise	≤8 mV_{RMS}	8 mV_{RMS} max	no
Procedure 7 Time Delta		Adjustable to within 10 ps coincidence	
	350 ps range	350 ps total adjustment range	

Test Equipment

Table 2-2 lists test equipment suggested for use with these procedures. Procedure steps are based on the test equipment examples listed, but other equipment with equivalent specifications may be substituted. Test results, setup information, and related connectors and adapters may be altered by the use of different equipment.

Table 2-2: Test Equipment

Description	Minimum Specification	Examples of Applicable Test Equipment
11800 Series Oscilloscope or CSA 803 Series Communications Signal Analyzer	Tektronix digital sampling oscilloscope	Tektronix 11801/A/B, 11802 Digital Sampling Oscilloscope Tektronix CSA 803 or CSA 803A Communications Signal Analyzer
Pulse Generator	1 ns rise time, 5 V output, 10 Hz to 250 MHz frequency range	Tektronix PG 502 Pulse Generator with a TM 500 Series Power Module
Time Mark Generator	1 ns through 5 s markers in a 1−2−5 sequence, at least 5 parts in 10^7 accuracy	Tektronix TG 501A Time Mark Generator with a TM 500 Series Power Module
Calibration Generator	DC output, 0.5% accuracy 1 V output amplitude	Tektronix PG 506A Calibration Generator with a TM 500 Series Power Module
Calibration Step Generator		Tektronix 067−1338−0X Calibration Step Generator (where X represents either a 0, 1, 2, 3, 5, or 6; depending on the power supply appropriate for your country. Refer to Section 5, *Replaceable Parts*)
System Controller	Any compatible controller with MS DOS and a serial port configured for COM 1	IBM compatible PC with terminal emulation software
Voltage Source		DATA PRECISION DP8200
Calibration fixture	4 mm probe tip adapter	Tektronix Part 013−0271−00 (optional accessory for SD-14)
Adapter, SMA connectors	female SMA compatible	Tektronix Part 015−1012−00
Adapter, SMA to BNC (2 required)	male SMA to female BNC	Tektronix Part 015−0554−00

Table 2-2: Test Equipment (Cont.)

Description	Minimum Specification	Examples of Applicable Test Equipment
Attenuator, 10X	20 dB attenuation, 50 Ω, male SMA to female SMA, 1% at DC	Tektronix Part 015−1003−00
Calibration Head		Tektronix Part 067−1413−00
50 Ω Termination, SMA connectors	Impedance 50 Ω, male SMA connector	Tektronix Part 015−1022−00
50 Ω Termination, BNC connectors	Impedance 50 Ω, BNC connectors	Tektronix Part 011−0049−01
Short Circuit Termination, SMA connectors	male SMA compatible	Tektronix Part 015−1020−00
SMA 'T' Connector	female SMA to male SMA tee	Tektronix Part 015−1016−00
Coaxial Cable, 50 Ω (2 required)	50 Ω, 36-inch, male BNC connectors	Tektronix Part 012−0482−00
Serial Cable	10-ft RS-232-C Cable	Tektronix Part 012−0911−00
Wrist Strap		Tektronix Part 006−3415−01
Static Control Mat		Tektronix Part 006−3414−00
Needle-Nose Pliers		
POZIDRIV Screwdriver	P1 tip	

Using These Procedures

Each procedure begins with a setup illustration that shows the test equipment and how to connect it. Refer to Table 2-2 for an example of the test equipment for each procedure.

Conventions in this Manual

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 instrument and sampling head.
- **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 sampling head.

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

Initialized and Stored Settings

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 procedures causing erroneous or confusing results.

Menu Selections and Measurement Techniques

Details on measurement techniques and instructions for making menu selections are generally not included in this manual. Comprehensive descriptions of menus and instrument features are located in the *User Manual* for your instrument and the *SD-14 Sampling Head User Manual*.

Setup Illustrations

You can use any 11800 Series Digital Sampling Oscilloscope or the CSA 803 Series Communications Signal Analyzer as the mainframe instrument in these procedures. A “Mainframe Instrument” is shown in each procedure; the exact location of connectors on your mainframe instrument may differ from that shown in the illustration.

In particular, the 11802 Oscilloscope and CSA 803 Series Communications Signal Analyzer have only two sampling head acquisition compartments, as compared to four in the 11801 Series Oscilloscopes. Locations of controls and connectors on each instrument are shown in Figure 2-1.

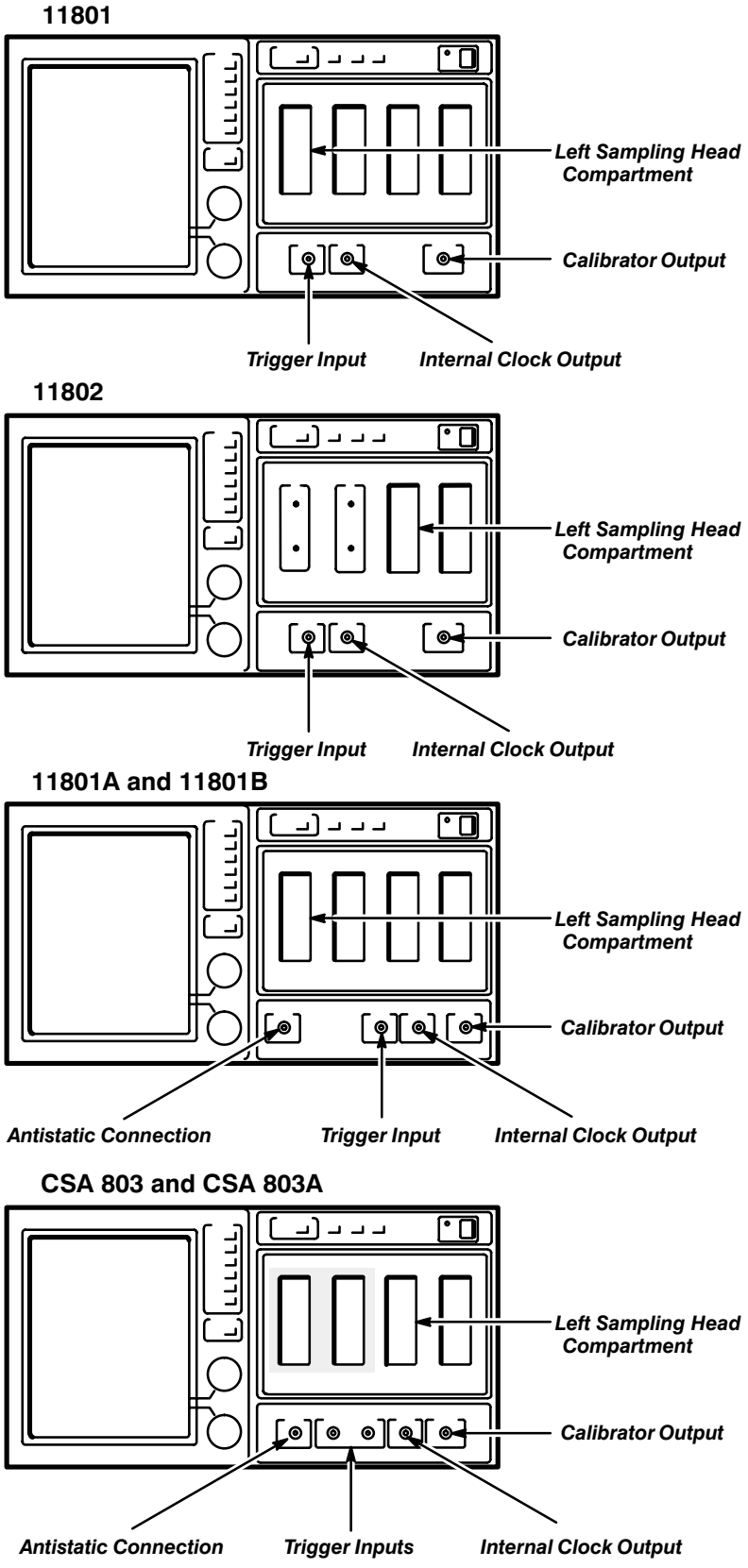


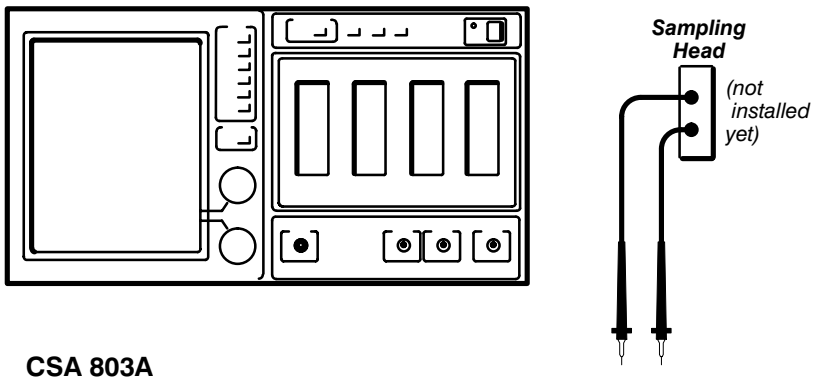
Figure 2-1: Locations of Controls and Connectors on Mainframe Instruments

Procedure 1 Power On

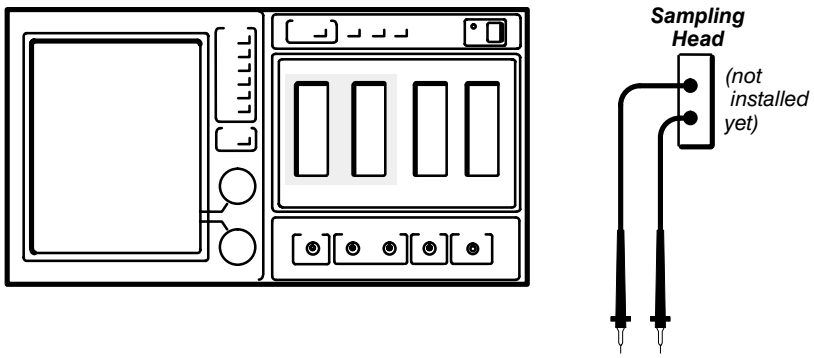
Perform this procedure within the ambient temperature range of +18° C to +28° C.

Setup to Power-On

11801B



CSA 803A



Procedure to Power-On

☐ **Step 1:** Set the following in the order listed:

Sampling Head
Not installed yet
Instrument Mainframe
ON/STANDBY switch . . . . . STANDBY

☐ **Step 2:** Install the SD-14 sampling head in the left sampling head compartment.

☐ **Step 3:** With the instrument's rear panel PRINCIPAL POWER SWITCH set to OFF, connect the instrument to a suitable power source.

☐ **Step 4:** Set the rear panel PRINCIPAL POWER SWITCH to ON and then set the instrument's front panel ON/STANDBY switch to ON.

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

☐ **Step 5:** Power-on the following test equipment, so that it is warmed up with the instrument to be tested (for a complete list of test equipment, see Table 2-2):

- Calibration generator
- Calibration step generator
- Time mark generator
- Pulse generator
- Voltage source

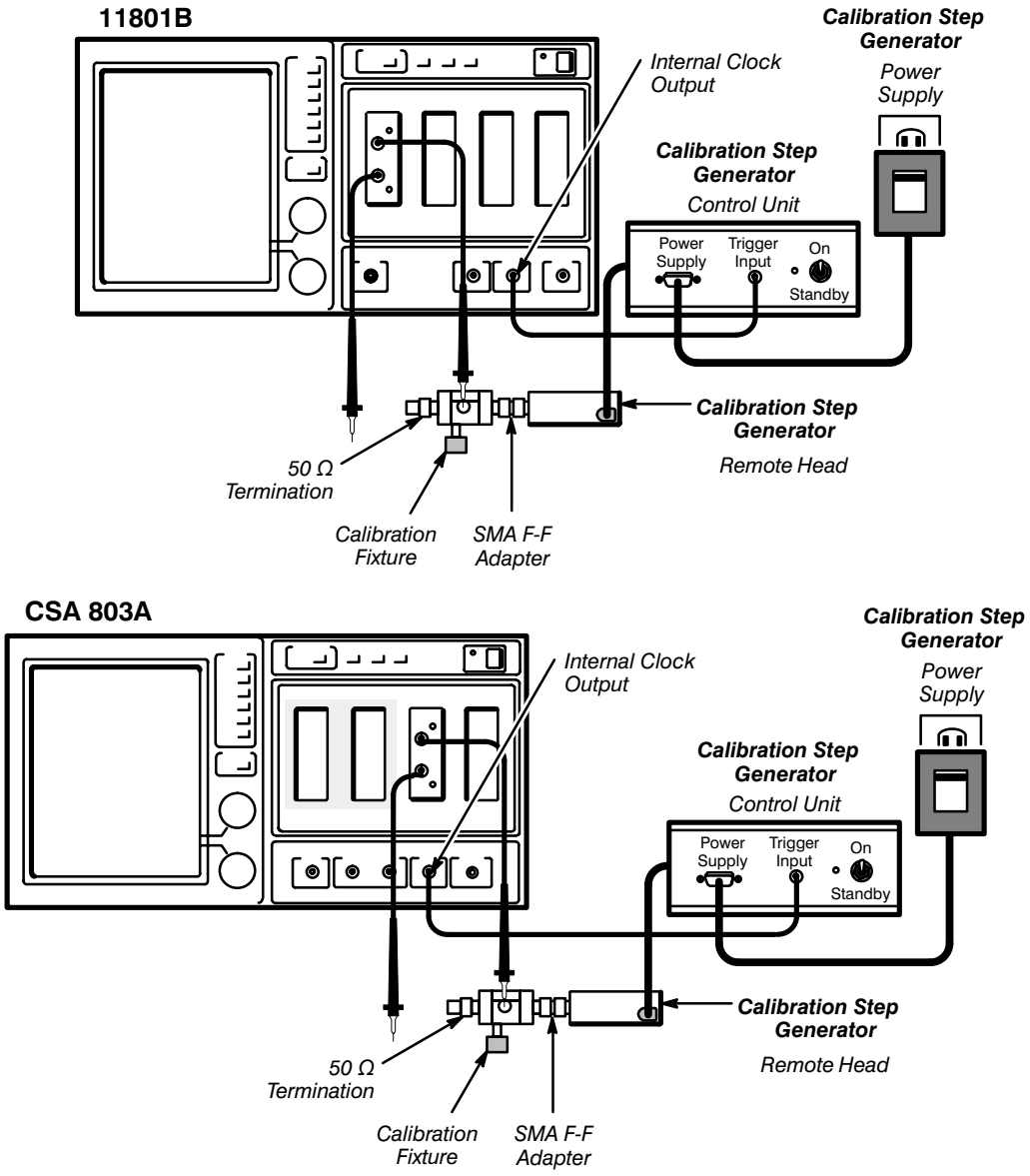
Procedure 2 Rise Time

This procedure shows the setup and lists the steps to check the rise time.

Specifications

The specification for the SD-14 Sampling Head rise time is 140 ps or less.

Setup to Check Rise Time



Procedure to Check Rise Time

☐ **Step 1:** Initialize the instrument settings, then make the following settings in the order listed:

Sampling Head
CH 1 SELECT CHANNEL On/Off . . . . . On
Instrument Mainframe
ENHANCED ACCURACY button (11801/2) . . . . . press
UTILITY button (11801A/B, CSA 803 Series) . . . . . press
Enhanced Accuracy (11801A/B, CSA 803 Series) . . . . touch
Calibrate All pop-up menu . . . . . **Recall Defaults**
TRIGGER button . . . . . press
Source . . . . . **Internal Clock**
Calibration step generator
ON/STANDBY switch . . . . . ON

☐ **Step 2:** Press the AUTOSET button.

☐ **Step 3:** Press the WAVEFORM button and then touch **Horizontal Desc**.

☐ **Step 4:** Touch **Main Record Length** and then set **Main Record Len** to 5120 using the top knob.

☐ **Step 5:** Touch **Acquire Desc** in the Waveform major menu.

☐ **Step 6:** Set **Average N** to **On** and then touch **Set Avg N**.

☐ **Step 7:** Set **Average N** to 128 with the top knob.

☐ **Step 8:** Touch the horizontal (↔) icon and then select **Main Size** in the knob menu.

☐ **Step 9:** In the **Main Size** pop-up menu use the keypad to set the **Main Size** to 400 ns/div.

☐ **Step 10:** Touch **Main Pos** and then **Set to Min** in the **Numeric Entry & Knob Res** pop-up menu.

☐ **Step 11:** Press the MEASURE button.

☐ **Step 12:** Touch **Measurements** and then **Rise** in the **Measurements** pop-up menu.

☐ **Step 13:** Touch **Rise** in the Measure major menu and then set **Tracking** to **Off** in the **Rise** pop-up menu.

☐ **Step 14:** Set the **Main Size** to 5 ns/div.

☐ **Step 15:** Touch **Baseline** in the **Rise** pop-up menu.

☐ **Step 16:** Touch a blank portion of the screen to exit this menu.

☐ **Step 17:** Set the **Baseline** (bottom knob) to the average of the bottom of the pulse 10 ns before the step.

- ☐ **Step 18:** Touch the horizontal (↔) icon and then set the **Main Pos** so that the step is at the left-most edge of the screen.
- ☐ **Step 19:** Set the **Main Size** to 100 ps/div.
- ☐ **Step 20:** Set the **Main Pos** so that the step is approximately centered on the screen.
- ☐ **Step 21:** Touch **Rise** in the Measure major menu and read the **Mean:** value from the **Rise** pop-up menu.
- ☐ **Step 22:** *Check* that the SD-14 Sampling Head rise time is ≤140 ps.

Procedure 3 Aberrations

This procedure shows the setup and lists the steps to check acquisition aberrations.

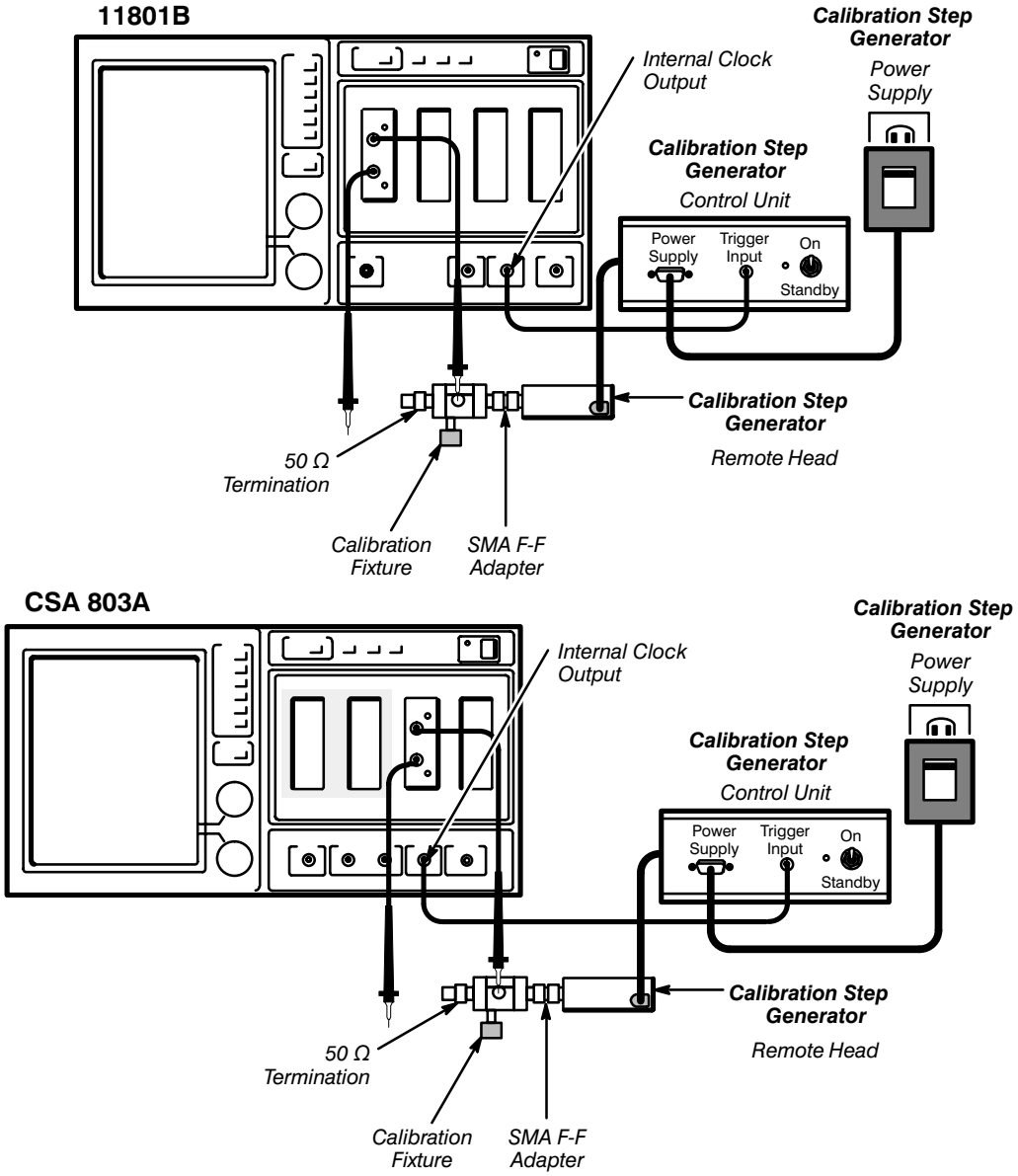
Measurement Limits

Table 2-3 lists the measurement limits for acquisition aberrations.

Table 2-3: Aberration Measurement Limits

Time Difference from the Rising Edge of Waveform	Aberration Measurement Limits
Distal to 1 ns	−28% ≤ aberration ≤ +13%
1.5 ns to 4 ns	−3.5% ≤ aberration ≤ +1.5%
4 ns to 30 ns	−2.5% ≤ aberration ≤ +2.5%
≥ 30 ns	−1.5% ≤ aberration ≤ +1.5%

Setup to Examine Acquisition Aberrations



Procedure to Examine Acquisition Aberrations

☐ **Step 1:** Initialize the instrument settings, then make the following settings in the order listed:

Sampling Head
CH1 SELECT CHANNEL On/Off . . . . . On
Instrument Mainframe
ENHANCED ACCURACY button (11801/2) . . . . . press
UTILITY button (11801A/B, CSA 803 Series) . . . . . press
Enhanced Accuracy (11801A/B, CSA 803 Series) . . . . touch
Calibrate All pop-up menu . . . . . **Recall Defaults**
TRIGGER button . . . . . press
Source . . . . . **Internal Clock**
Calibration Step Generator
ON/STANDBY switch . . . . . ON

☐ **Step 2:** Press the WAVEFORM button and then touch **Acquire Desc**.

☐ **Step 3:** Set **Average N** to **On** and then touch **Set Avg N**.

☐ **Step 4:** Set **Average N** to 128 using the top knob.

☐ **Step 5:** Press the AUTOSET button.

☐ **Step 6:** Touch the horizontal (↔) icon and then select **Main Pos** from the knob menu.

☐ **Step 7:** In the **Main Size** pop-up menu, set the **Main Size** to 400 ns/div.

☐ **Step 8:** Set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ **Step 9:** Touch the vertical (↕) icon and then set the **Vert Offset:M1** so that the average of the top of the pulse from 400 ns after the step to the right edge of the screen is at the horizontal centerline.

☐ **Step 10:** Set the **Vert Size: M1** to 20 mV/div.

☐ **Step 11:** Touch **Vert Offset: M1** and then **Fine** in the **Numeric Entry & Knob Res** pop-up menu.

☐ **Step 12:** Set **Vert Offset: M1** so that the average of the top of the pulse from 400 ns after the step to the right edge of the screen is at the horizontal centerline.

Write down this **Vert Offset: M1** value for use later in this procedure (Step 20).

☐ **Step 13:** Touch the horizontal (↔) icon and then set the **Main Size** to 150 ps/div.

☐ **Step 14:** Set **Main Pos** so that the 90% level of the step (distal) is at the left edge of the display. The trace should cross the left edge at 1.25 divisions (−25 mV) below the horizontal centerline of the display.

☐ **Step 15:** *Examine* that the magnitude of the maximum positive aberration is ≤1.625 vertical divisions above the horizontal centerline (+13% of the step amplitude).

☐ **Step 16:** *Examine* that the magnitude of the maximum negative aberration is ≤3.5 vertical divisions below the horizontal centerline (−28% of the step amplitude).

☐ **Step 17:** Delete the trace: in the knob menu, select **Remove**/**Clr Trace 1**, then select **Remove Trace 1** in the pop-up menu.

☐ **Step 18:** Select the **DefTra** icon and touch the following pop-up menu selectors, in order, to define the trace:

Avg(, **Smooth(**, **Mainframe** *(11801 Series only)*, **1** *(under **Mainframe**)*, **,** , **31**, **)**, **)**, **Enter Desc**.

☐ **Step 19:** In the main menu area, touch **Acquire Desc**. In the pop-up menu, select **Set Avg N**, then use the knobs to set **Avg N** to **64**.

☐ **Step 20:** Touch the vertical (↕) icon and then set **Vert Offset:M1** to the value you wrote down in Step 12.

☐ **Step 21:** Set **Vert Size:M1** to 5 mV/div.

☐ **Step 22:** Touch the horizontal (↔) icon and then set the **Main Size** to 400 ps/div. *Do not adjust the horizontal position.*

☐ **Step 23:** *Examine* that the magnitude of the maximum positive aberration that occurs after 3.75 horizontal divisions from the graticule edge is ≤0.75 vertical divisions above the horizontal centerline (+1.5% of the step amplitude).

☐ **Step 24:** *Examine* that the magnitude of the maximum negative aberration that occurs after 3.75 horizontal divisions from the graticule edge is ≤1.75 vertical divisions below the horizontal centerline (−3.5% of the step amplitude).

☐ **Step 25:** Set the **Main Size** to 3 ns/div. *Do not adjust the horizontal position.*

☐ **Step 26:** *Examine* that the magnitude of the maximum positive and negative aberrations that occur after 1.33 horizontal divisions from the graticule edge is ≤1.25 vertical divisions from the horizontal centerline (±2.5% of the step amplitude).

☐ **Step 27:** Set the **Main Size** to 30 ns/div. *Do not adjust the horizontal position.*

☐ **Step 28:** *Examine* that the magnitude of the maximum positive and negative aberrations that occur after 1 horizontal division from the graticule edge is ≤1.25 vertical divisions from the horizontal centerline (±2.5% of the step amplitude).

Procedure 4 Offset/Sampling Repetition Rate

This procedure shows the setup and lists the steps to examine offset and check offset with repetition rate.

Measurement Limits

The measurement limits for the offset are:

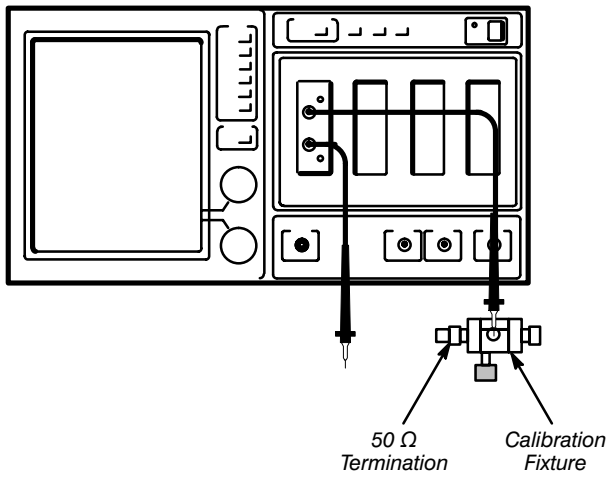
- ±20 mV at 0 V probe offset
- ±45 mV at ±2.5 V probe offset
- ±55 mV at ±3.5 V probe offset

Specifications

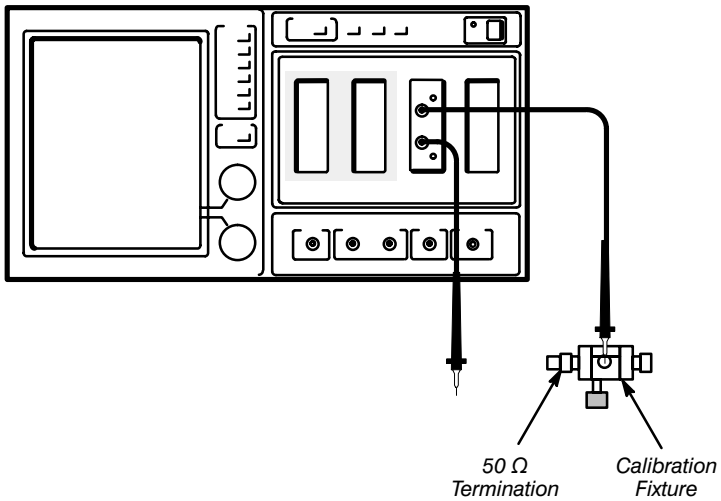
The specification for the offset change with repetition rate is ±5 mV.

Setup to Examine Offset

11801B



CSA 803A



Procedure to Examine Offset

☐ **Step 1:** Initialize the instrument settings, then make the following settings in the order listed:

Sampling Head
- CH 1 SELECT CHANNEL On/Off . . . . . On

Instrument Mainframe
- TRIGGER button . . . . . press
  - **Source** . . . . . **Internal Clock**
- ENHANCED ACCURACY button (11801/2) . . . . . press
- UTILITY button (11801A/B, CSA 803 Series) . . . . . press
  - **Enhanced Accuracy** (11801A/B, CSA 803 Series) . . . . touch
  - **Calibrate All** pop-up menu . . . . . **Recall Defaults**

☐ **Step 2:** Press the WAVEFORM button then select **Acquire Desc** in the major menu.

☐ **Step 3:** In the pop-up menu, select **Average N** to turn on averaging and then select **Set Avg N**.

☐ **Step 4:** Use the upper knob to set the **Average N** value to **32**.

☐ **Step 5:** Press the UTILITY button and touch **Enhanced Accuracy** (11801A/B and CSA 803 Series) or press the ENHANCED ACCURACY button (11801/2).

☐ **Step 6:** Touch **Offset** in the Enhanced Accuracy menu.

☐ **Step 7:** Touch **Automatic Calibrate** in the **Offset** pop-up menu and follow the instructions on the instrument display.

Check Offset

Repeat steps 8 through 14 for each row in Table 2-4.

☐ **Step 8:** Touch the vertical ( ) icon.

☐ **Step 9:** Enter the vertical size setting shown in Table 2-4. Touch the **Vert Size: M1** selector, enter the value from the **Vertical Size Setting** column, and then touch **Enter** in the **Numeric Entry & Knob Res** pop-up menu.

☐ **Step 10:** Enter the vertical offset setting shown in Table 2-4. Touch the **Vert Offset: M1** selector, enter the value from the **Vertical Offset Setting (V)** column, and then touch **Enter** in the **Numeric Entry & Knob Res** pop-up menu.

☐ **Step 11:** Press the MEASURE button.

☐ **Step 12:** Touch **Measurements** and then touch **Mean** in the **Measurements** pop-up menu.

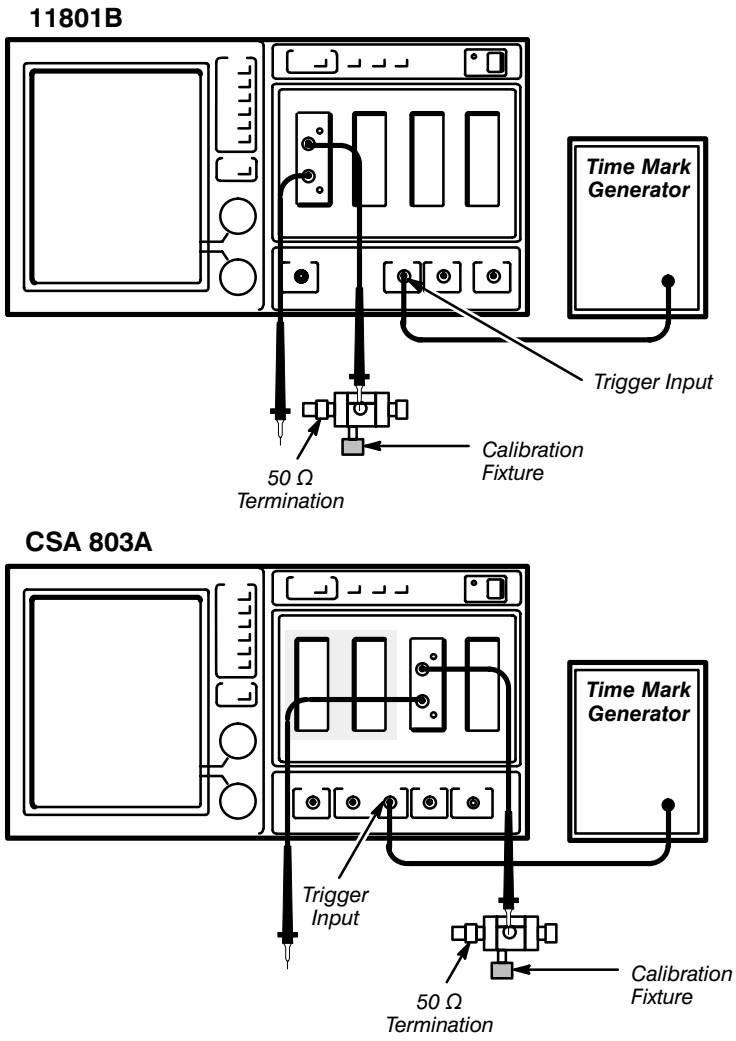
☐ **Step 13:** Touch **Mean** in the Measure major menu and then set **Data Interval** to **whole zone** in the **Mean** pop-up menu.

☐ **Step 14:** *Check* that **Mean** is within the limits shown in the **Measurement Limits** column of Table 2-4.

Table 2-4: Measurement Limits for Offset

Vertical Offset Setting (V)	Vertical Size Setting	Measurement Limits
0 V	20 mV/div	0 V ±20 mV
+2.5 V	560 mV/div	0 V ±45 mV
−2.5 V	560 mV/div	0 V ±45 mV
+3.5 V	780 mV/div	0 V ±55 mV
−3.5 V	780 mV/div	0 V ±55 mV

Setup to Check Offset Change with Repetition Rate



Procedure to Check Offset Change with Repetition Rate

☐ **Step 1:** Initialize the instrument settings, then make the following settings in the order listed:

Sampling Head

CH 1 SELECT CHANNEL On/Off . . . . . On

Instrument Mainframe

ENHANCED ACCURACY button (11801/2) . . . . . press

UTILITY button (11801A/B, CSA 803 Series) . . . . . press

Enhanced Accuracy (11801A/B, CSA 803 Series) . . . . touch

Calibrate All pop-up menu . . . . . **Recall Def**

Time Mark Generator

Marker (sec) . . . . . 0.2 µs

NOTE

Skip Step 2 if your Mainframe is a CSA 803 Series.

- ☐ **Step 2:** *(11800 Series only.)* Press the TRIGGER button and select **Source**. From the pop-up menu, select **Coupling DC**.
- ☐ **Step 3:** In the main menu area, touch **Level**.
- ☐ **Step 4:** Set the **Trig Level** until a trace appears.
- ☐ **Step 5:** Touch the vertical (↕) icon and then set the **Vert Size: M1** to 20 mV/div.
- ☐ **Step 6:** Set **Vert Offset: M1** so that the trace is vertically centered on the screen.
- ☐ **Step 7:** Set the time mark generator's marker setting to 10 ms.
- ☐ **Step 8:** Press the WAVEFORM button and then touch **Acquire Desc**.
- ☐ **Step 9:** Set **Average N** to **On** and then touch **Set Avg N**.
- ☐ **Step 10:** Set **Average N** to **8** with the top knob.
- ☐ **Step 11:** Wait until the **Acquire Desc** selector in the WAVEFORM major menu shows that eight averages have been completed.
- ☐ **Step 12:** Press the MEASURE button.
- ☐ **Step 13:** Touch **Measurements** and then **Mean** in the **Measurements** pop-up menu.
- ☐ **Step 14:** Touch **Compare & References** in the MEASURE major menu.
- ☐ **Step 15:** Touch **Save Current Meas Values as References** and then set **Compare** to **On**.
- ☐ **Step 16:** Set the time mark generator's marker setting to 5 ms.
- ☐ **Step 17:** Wait until the **Acquire Desc** selector in the WAVEFORM major menu shows that eight averages have been completed.
- ☐ **Step 18:** *Check* that Δ**Mean** (offset with a repetition rate) is 0 V ±5 mV.
- ☐ **Step 19:** Continue to decrease the time mark generator's marker setting and repeat Step 18 for each setting down to 0.1 µs.
- ☐ **Step 20:** Press the CH 2 SELECT CHANNEL button.
- ☐ **Step 21:** Disconnect the CH 1 probe from the fixture and connect CH 2.
- ☐ **Step 22:** Repeat steps 5 through 19 for CH 2.

Procedure 5 Linearity/Gain

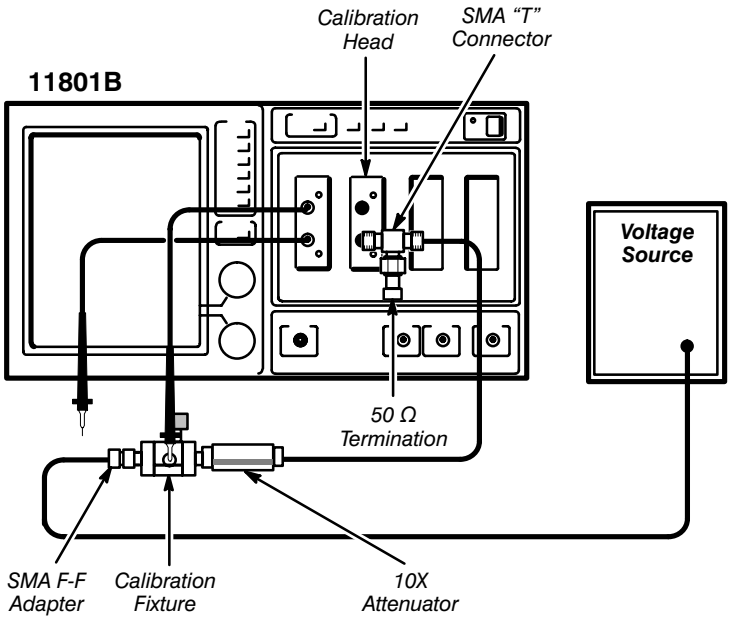
This procedure shows the setup and lists the steps to check linearity and gain.

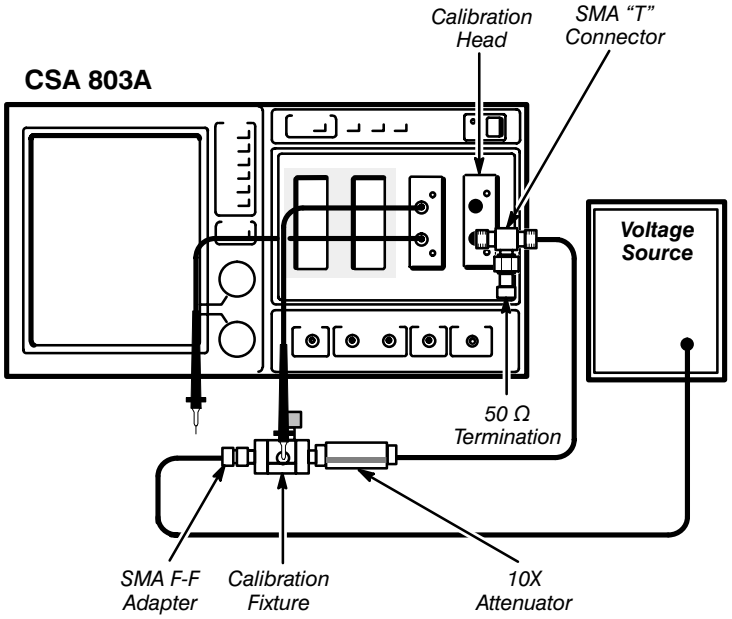
Specifications

The specification for gain is ±2.5% maximum.

The specification for linearity is ≤35 mV deviation.

Setup to Examine Linearity/Gain of Mainframe





Procedure to Examine Linearity/Gain

☐ **Step 1:** Initialize the instrument settings, then make the following settings in the order listed:

Instrument Mainframe
- TRIGGER button . . . . . press
  - **Source** . . . . . **Internal Clock**
- ENHANCED ACCURACY button (11801/2) . . . . . press
- UTILITY button (11801A/B, CSA 803 Series) . . . . . press
  - **Enhanced Accuracy** (11801A/B, CSA 803 Series) . . . . touch
  - **Calibrate All** pop-up menu . . . . . **Recall Defaults**

☐ **Step 2:** Touch the **DefTra** icon and touch the following selectors in the pop-up menu, in order, to define the trace as **M4**:

Mainframe *(11801 Series only),* **4** *(under* ***Mainframe****),* **Enter Desc**

☐ **Step 3:** On the Mainframe, touch the vertical (↕) icon then set **Vertical Offset** to **0 V** using the knob or pop-up keypad menu.

☐ **Step 4:** Press the MEASURE button then select **Measurements** from the main menu.

☐ **Step 5:** From the Measurements pop-up menu, select **Mean**.

For each row in Table 2-5 (on page 2-27), perform the following steps:

☐ **Step 6:** Set the Voltage Source to the value shown in the **V_{in} (V)** column.

☐ **Step 7:** At the Mainframe, touch the vertical (↕) icon and then select **Vert Size:M4** from the knob menu.

☐ **Step 8:** In the **Vert Size:M4** pop-up menu, enter the vertical size setting shown in Table 2-5.

NOTE

Do not adjust the vertical offset; it should remain at 0 V.

☐ **Step 9:** Enter the value displayed in **Mean** in the **Mainframe Alone x/10** column in Table 2-5. Multiply this value by 10 (to account for the attenuator) and enter the result in the **x** column. This value will be used in calculating the gain and linearity of the SD-14.

Repeat steps 6 through 9 for the next row in Table 2-5. When you have filled in the entire **Mainframe Alone x/10** column and the **x** column, proceed to Step 10.

☐ **Step 10:** Delete the **M4** trace: select **Remove**/**Clr Trace M4** in the knob menu then select **Remove Trace M4** from the pop-up menu.

☐ **Step 11:** Press the **CH 1** button on the SD-14 sampling head to display the trace on channel 1 of the sampling head.

☐ **Step 12:** Repeat steps 4 and 5.

For each row in Table 2-5, perform the following steps:

☐ **Step 13:** Set the Voltage Source to the value shown in the **V_{in} (V)** column.

☐ **Step 14:** At the Mainframe, touch the vertical (⇕) icon and then select **Vert Size:M1** from the knob menu.

☐ **Step 15:** In the **Vert Size:M1** pop-up menu, enter the vertical size setting shown in Table 2-5.

☐ **Step 16:** Enter the value displayed in **Mean** in the **Mainframe with SD-14 y** column in Table 2-5.

Repeat steps 13 through 16 for the next row in Table 2-5. When you have filled in the entire **Mainframe with SD-14** column, proceed to the next part, *Calculate the Gain and Linearity*.

Calculate the Gain and Linearity

The gain of the SD-14 is equal to the slope of a regression line of the paired measurement readings in Table 2-5, with the **x** values plotted along the X axis, and the **Mainframe with SD-14 y** values plotted along the Y axis. The linearity of the SD-14 is the maximum deviation of these points from their best linear regression fit.

The slope, or gain, is calculated as:

$$b = \frac{m\sum xy - \sum x \sum y}{m\sum x^2 - \left(\sum x\right)^2}$$

Where:

b is the gain
m is the number of sample points (in this case, 17)
x is the value in the **x** column
y is the value in the **Mainframe with SD-14 y** column

The y intercept for the best-fit straight line is:

$$a = \frac{\sum y - b \sum x}{m}$$

Where:

a is the intercept
b is the gain
m is the number of sample points (in this case, 17)
x is the value in the **x** column
y is the value in the **Mainframe with SD-14 y** column

Once the gain and intercept are known, the "ideal" y values (representing the results for a head with perfect linearity), can be calculated as:

$$y_{ideal} = a + bx$$

The individual deviations from the straight line are:

$$Dev = abs[\ y - y_{ideal}\ ]$$

☐ **Step 17:** Fill out the **x²** and **xy** columns and total the **x**, **y**, **x²**, and **xy** columns at the bottom of Table 2-5.

☐ **Step 18:** Calculate the gain, *b*:

$$b = \frac{17 \sum xy - \sum x \sum y}{17 \sum x^2 - \left(\sum x\right)^2}$$

Where:

$\sum x$ is the value at the bottom of the **x** column
$\sum y$ is the value at the bottom of the **Mainframe with SD-14 y** column
$\sum x^2$ is the value at the bottom of the **x²** column
$\sum xy$ is the value at the bottom of the **xy** column

☐ **Step 19:** *Check* that the gain, *b*, is between .975 and 1.025.

☐ **Step 20:** Calculate the y intercept, *a*:

$$a = \frac{\sum y - b \sum x}{17}$$

Where:

b is the gain from Step 18
$\sum x$ is the value at the bottom of the **x** column
$\sum y$ is the value at the bottom of the **Mainframe with SD-14 y** column

☐ **Step 21:** For each row in Table 2-5, calculate the y_{ideal} value:

$$y_{ideal} = a + bx$$

Where:
a is the intercept from Step 20
b is the gain from Step 18
x is the value in the **x** column

☐ **Step 22:** For each row in Table 2-5, calculate the difference between the actual *y* value (from the **Mainframe with SD-14 y** column) and the ideal y_{ideal} value:

$$Dev = abs\left[y - y_{ideal} \right]$$

Where:
y is the value in the **Mainframe with SD-14 y** column
y_{ideal} is the result found in Step 21

Check that the **Dev** value calculated for each row is $\leq$ 35 mV.

Calculation Table for This Procedure

Use this table to record calculations and results for this section. (You may want to photocopy this page.)

Table 2-5: Data for Calculation of Gain and Linearity

	Mainframe Alone			Mainframe with SD-14						
V_{in} (V)	Vert Size (mV/div)	x/10	x	Vert Size (mV/div)	y	x^2	xy	Y_{ideal} (a+bx)	Dev $\lvert y - y_{ideal} \rvert$	Limit
−3.75	83			830						35 mV
−3.5	78			780						35 mV
−3.0	67			670						35 mV
−2.5	56			560						35 mV
−2.0	44			440						35 mV
−1.5	33			330						35 mV
−1.0	22			220						35 mV
−0.5	20			200						35 mV
0	20			200						35 mV
0.5	20			200						35 mV
1.0	22			220						35 mV
1.5	33			330						35 mV
2.0	44			440						35 mV
2.5	56			560						35 mV
3.0	67			670						35 mV
3.5	78			780						35 mV
3.75	83			830						35 mV
Totals:										
			↑ $\sum x$		↑ $\sum y$	↑ $\sum x^2$	↑ $\sum xy$			

$$a = \frac{\sum y - b \sum x}{17}$$

$$b = \frac{17 \sum xy - \sum x \sum y}{17 \sum x^2 - \left(\sum x\right)^2}$$

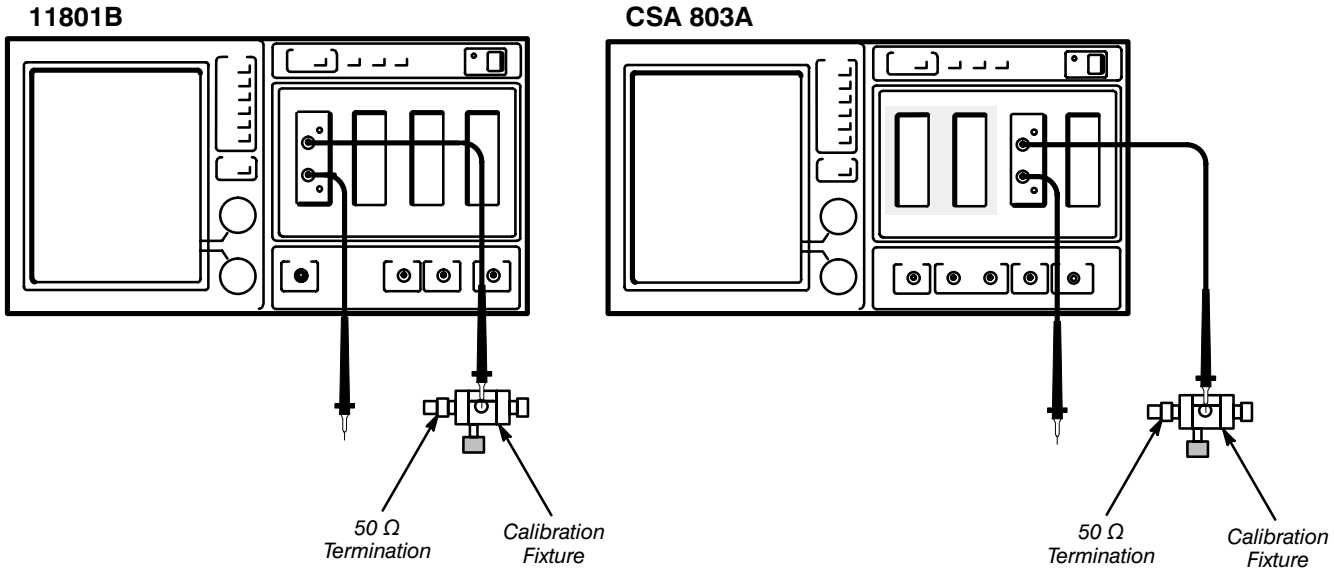
Procedure 6 Displayed Noise

This procedure shows the setup and lists the procedures to check displayed noise from the sampling head.

Measurement Limits

The measurement limit for displayed noise is 8 mV_{RMS} maximum.

Setup to Examine Displayed Noise



Procedure to Examine Noise

☐ **Step 1:** Initialize the instrument settings, then make the following settings in the order listed:

Sampling Head
- CH 1 SELECT CHANNEL On/Off . . . . . On

Instrument Mainframe
- TRIGGER button . . . . . press
  - **Source** . . . . . **Internal Clock**
- ENHANCED ACCURACY button (11801/2) . . . . . press
- UTILITY button (11801A/B, CSA 803 Series) . . . . . press
  - **Enhanced Accuracy** (11801A/B, CSA 803 Series) . . . . touch
  - **Calibrate All** pop-up menu . . . . . **Recall Defaults**

☐ **Step 2:** Press the WAVEFORM button and then touch **Acquire Desc.**

☐ **Step 3:** Set **Average N** to **On**.

☐ **Step 4:** Press the AUTOSET button.

☐ **Step 5:** Touch the vertical (↕) icon. Set the **Vert Size: M1** to 20 mV/div.

☐ **Step 6:** Touch **Def Tra** at the top of the screen.

☐ **Step 7:** In the **Vertical Description** pop-up menu, touch the following selectors in the order given:

Mainframe *(11801 Series only)*, **1** *(under **Mainframe**)*, **–**, **Avg (**, **Mainframe** *(11801 Series only)*, **1** *(under **Mainframe**)*, **)**, **Enter Desc**

☐ **Step 8:** Press the MEASURE button and then touch **Measurements**.

☐ **Step 9:** Touch **RMS** in the **Measurements** pop-up menu and then **RMS** in the MEASURE major menu.

☐ **Step 10:** Set **Data Interval** to **whole zone** in the **RMS** pop-up menu.

☐ **Step 11:** *Examine* that **RMS** is $\leq$8 mV.

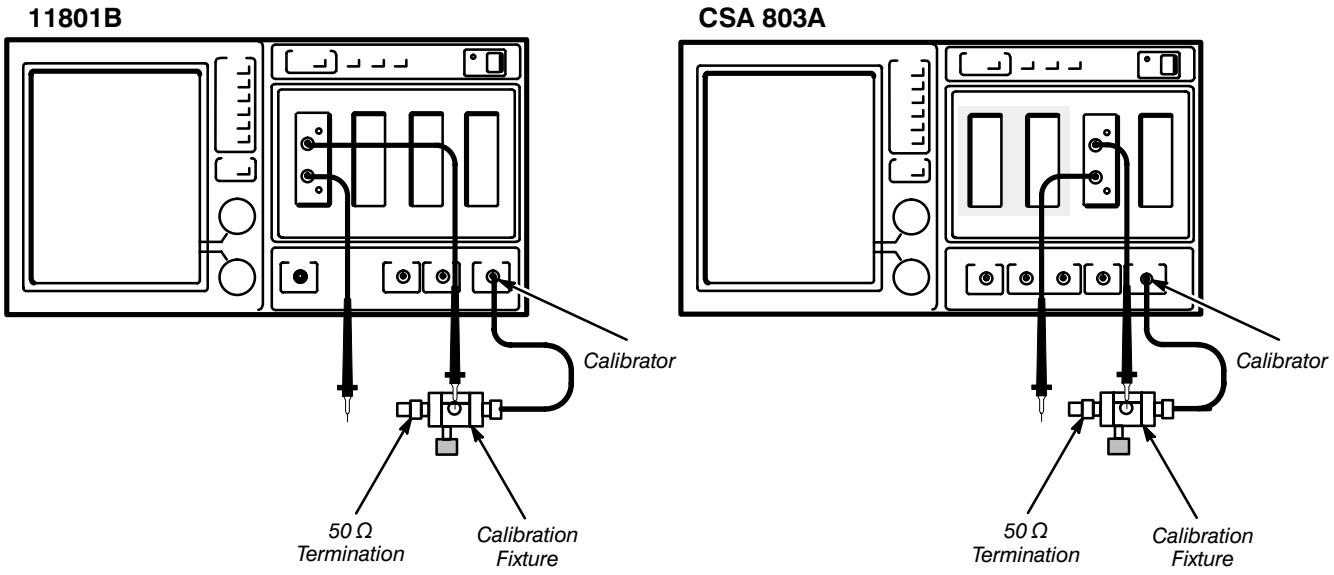
Procedure 7 Time Delta

This procedure shows the setup and lists the steps to check time delta.

Specifications

Time delta is adjustable over a 350 ps range.

Setup to Check Time Delta



Procedure to Check Time Delta

☐ **Step 1:** Initialize the instrument settings, then make the following settings in the order listed:

Sampling Head
- CH 1 SELECT CHANNEL On/Off . . . . . On

Instrument Mainframe
- UTILITY button (11801A/B, CSA 803 Series) . . . . . press
- ENHANCED ACCURACY button (11801/2) . . . . . press
  - **Calibrate All** pop-up menu . . . . . **Recall Defaults**
- TRIGGER button . . . . . press
  - **Source** . . . . . **Internal Clock**

Calibration Step Generator
- ON/STANDBY switch . . . . . ON

☐ **Step 2:** Press the AUTOSET button.

☐ **Step 3:** Press the WAVEFORM button and then touch **Horizontal Desc**.

☐ **Step 4:** Under **Horizontal Reference Point**, select **Center**.

- ☐ **Step 5:** Touch **Main Record Length** and then set **Main Record Len** to 5120 using the top knob.
- ☐ **Step 6:** Touch **Acquire Desc** in the Waveform major menu.
- ☐ **Step 7:** Set **Average N** to **On** and then touch **Set Avg N**.
- ☐ **Step 8:** Set **Average N** to **128** with the top knob.
- ☐ **Step 9:** Touch the horizontal (↔) icon and then set the **Main Size** to 200 ps/div.
- ☐ **Step 10:** Touch the vertical (↕) icon and then set the **Vertical Size** to 50 mV/div.
- ☐ **Step 11:** Press the STORE/RECALL button and then select **Store Trace** in the major menu area.
- ☐ **Step 12:** Note the **Next Storage:** notation at the top of the **Store Trace** pop-up menu for use in Step 22 and then touch the **Trace 1** selector in the pop-up menu.
- ☐ **Step 13:** Disconnect the CH 1 probe from the calibrator.
- ☐ **Step 14:** Connect the CH 2 probe to the calibrator and press the CH 2 SELECT CHANNEL button to display the CH 2 trace.
- ☐ **Step 15:** Press AUTOSET.
- ☐ **Step 16:** Touch the horizontal (↔) icon and then set the **Main Size** to 200 ps/div.
- ☐ **Step 17:** Touch the vertical (↕) icon and then set the **Vertical Size** to 50 mV/div.
- ☐ **Step 18:** Press the WAVEFORM button and then touch **Acquire Desc** in the Waveform major menu.
- ☐ **Step 19:** Set **Average N** to **On** and then touch **Set Avg N**.
- ☐ **Step 20:** Set **Average N** to **128** with the top knob.
- ☐ **Step 21:** Press the CH 1 SELECT CHANNEL button twice to remove that trace from the Mainframe display.
- ☐ **Step 22:** Recall the trace you stored in Step 12. Press the STORE/RECALL button, select **Recall Trace** in the Store/Recall major menu, and then select the STO # trace that matches the **Next Storage:** number you noted in Step 12.
- ☐ **Step 23:** Press the CH 2 SELECT CHANNEL button to select the live trace.
- ☐ **Step 24:** Press the MEASURE button.
- ☐ **Step 25:** Touch **Measurements** and then **PropDelay** in the **Measurements** pop-up menu.

☐ **Step 26:** Touch **PropDelay** in the major menu area and select **Stored 1** (as the delayed trace for the measurement) from the pop-up menu.

☐ **Step 27:** Press the WAVEFORM button and select **Sampling Head Fnc's** from the major menu area.

☐ **Step 28:** Select **Channel Delta Delay** from the **Sampling Head Fnc's** pop-up menu.

☐ **Step 29:** Select **Channel Delta Delay** from the knob menu and use the keypad to enter **0**.

☐ **Step 30:** Press the MEASURE button.

☐ **Step 31:** Select **Compare & References** in the major menu area.

☐ **Step 32:** From the **Compare & References** pop-up menu, select **Save Current Meas Values as References**.

☐ **Step 33:** From the **Compare & References** pop-up menu, select **Compare** (the status readout should show **On**). Select **Exit** to remove the pop-up menu.

The **PropDelay** readout in the major menu now shows a value close to 0.

☐ **Step 34:** Set Channel Delta Delay to +100%. Press the WAVEFORM button, select **Sampling Head Fnc's** from the major menu area, then select **Channel Delta Delay** from the **Sampling Head Fnc's** pop-up menu and use either knob to set **Channel Delta Delay** to **100**.

☐ **Step 35:** Select **Remove**/**Clr Trace 2** and then select **Clear Trace 2** in the pop-up menu, to clear the average buffer.

☐ **Step 36:** Press the MEASURE button.

☐ **Step 37:** *Check* that the **PropDelay** (comparison) readout is between 0 ps and −175 ps.

☐ **Step 38:** Set Channel Delta Delay to −100%. Press the WAVEFORM button, select **Sampling Head Fnc's** from the major menu area, then select **Channel Delta Delay** from the **Sampling Head Fnc's** pop-up menu and use either knob to set **Channel Delta Delay** to **−100**.

☐ **Step 39:** Select **Remove**/**Clr Trace 2** and then select **Clear Trace 2** in the pop-up menu, to clear the average buffer.

☐ **Step 40:** Press the MEASURE button.

☐ **Step 41:** *Check* that the **PropDelay** (comparison) readout is between 0 ps and +175 ps.

Maintenance

Maintenance

This section contains information for performing preventive maintenance and procedures for exchanging faulty sampling heads, removing and replacing sampling head internal circuitry, and changing the sampling head identification number.

Preventive Maintenance

Preventive maintenance performed regularly can prevent the breakdown and may improve reliability of the instrument or sampling head. The severity of the environment to which the sampling head is subjected determines the frequency of maintenance.

Periodic Electrical Checks

To ensure accurate measurements, perform periodic electrical checks of the instrument and sampling head after each 2,000 hours of operation or every 24 months if used infrequently. Procedures to perform periodic electrical checks are given in Section 2, *Checks and Adjustments*.

Static-Sensitive Device Classification



Static discharge can damage any semiconductor component in the instrument or sampling head. To prevent damage from static discharge, follow all precautions listed in this section.

The instrument and sampling head contain 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:

- ☐ **Step 1:** Minimize handling of static-sensitive components.
- ☐ **Step 2:** Transport the sampling heads in their original containers and store the sampling heads on a metal surface or conductive foam. Transport the sampling heads with protective covers on the probes. Label any package that contains static-sensitive assemblies or components.

- ☐ **Step 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 workstation by qualified service personnel. Use a static control mat and wrist strap.
- ☐ **Step 4:** Clear the work station surface of anything that can generate or hold a static charge.
- ☐ **Step 5:** Keep the component leads shorted together whenever possible.
- ☐ **Step 6:** Pick up components by the body, never by the leads.
- ☐ **Step 7:** Do not slide the components over any surface.
- ☐ **Step 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 Electrostatic Discharge (ESD)

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

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

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

Exchanging Sampling Heads

If a sampling head fails any of the parts in Section 2, *Checks and Adjustments*, then you should exchange it for a properly functioning head.

Sampling head exchanges can be made with either your local Tektronix service center or the Central Tektronix Exchange Center in Beaverton, Oregon.

For more information on exchanging your sampling head, refer to Module Exchange in Section 5, *Replaceable Parts*.

Removing and Replacing the Sampling Head Internal Circuitry

CAUTION

To avoid damage to the sampling head, set the instrument ON/STANDBY switch to STANDBY and remove the sampling head from the instrument before removing or replacing the internal circuitry.

Perform the following procedures to remove and replace the internal circuitry in the sampling head. See Figure 3-1.

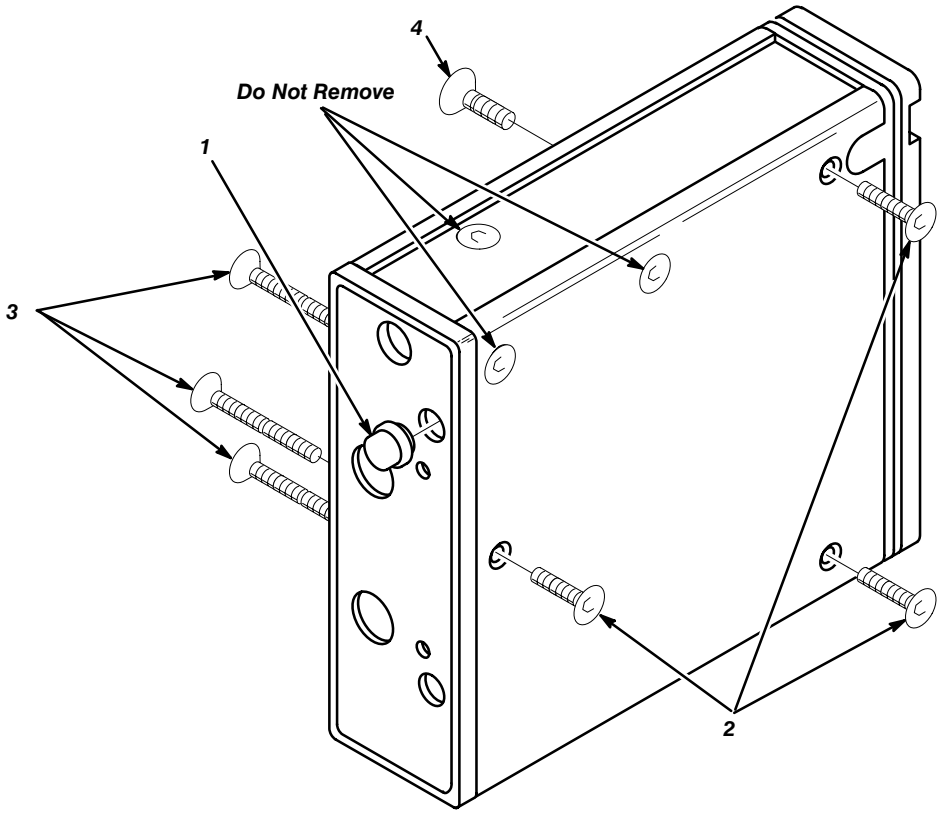


Figure 3-1: Removing and Replacing the Sampling Head Internal Circuitry

- ☐ **Step 1:** Remove the SELECT CHANNEL On/Off buttons by gently pulling on the plastic knobs with small needle-nose pliers. (1)
- ☐ **Step 2:** Remove the three small Pozidriv screws shown on the button/light side of the sampling head casing (2), and the four small Pozidriv screws on the probe cable side of the sampling head casing (3, 4). Do not remove the three screws marked *Do Not Remove*.
- ☐ **Step 3:** Gently pull the front panel away from the unit until it is free from the cable strain reliefs.
- ☐ **Step 4:** Slide the blue instrument casing over the cables, front panel, and probes and remove. Do not unplug the probes from the sampling head.
- ☐ **Step 5:** Install the gray shipping casing in the reverse sequence that was used for removing the blue casing. Note that there are two lengths of 2-56 screws, and they must be installed correctly. Do not overtighten the 4-40 screw.
- ☐ **Step 6:** Return the internal circuitry (the circuit board and attached probes) for sampling head exchange or repair.
- ☐ **Step 7:** To replace the internal circuitry, follow the removal procedures in reverse order.

Changing the Sampling Head Identification Number

The following procedure allows you to change the sampling head identification number to fit the requirements of your application.

The following equipment, in addition to an 11800 Series Oscilloscope or CSA 803 Series Communications Signal Analyzer and a sampling head, is necessary to perform this procedure:

- IBM PC or any other compatible PC that has MS DOS and an RS-232-C serial port configured for COM1
- a serial cable

Procedure to change the sampling head identification number:

☐ **Step 1:** Set the instrument's PRINCIPAL POWER SWITCH to OFF. Install the short-circuit jumper across the two J860 pins on the A5 Time Base/Controller Board. The short-circuit jumpers are located on several jumper pins on the A5 Time Base/Controller board. This board is located on the bottom of the instrument and can be accessed after the bottom panel is removed. Refer to the *Service Manual* for your instrument for more information on accessing this board. See Figure 3-2 for the location of jumper J860.

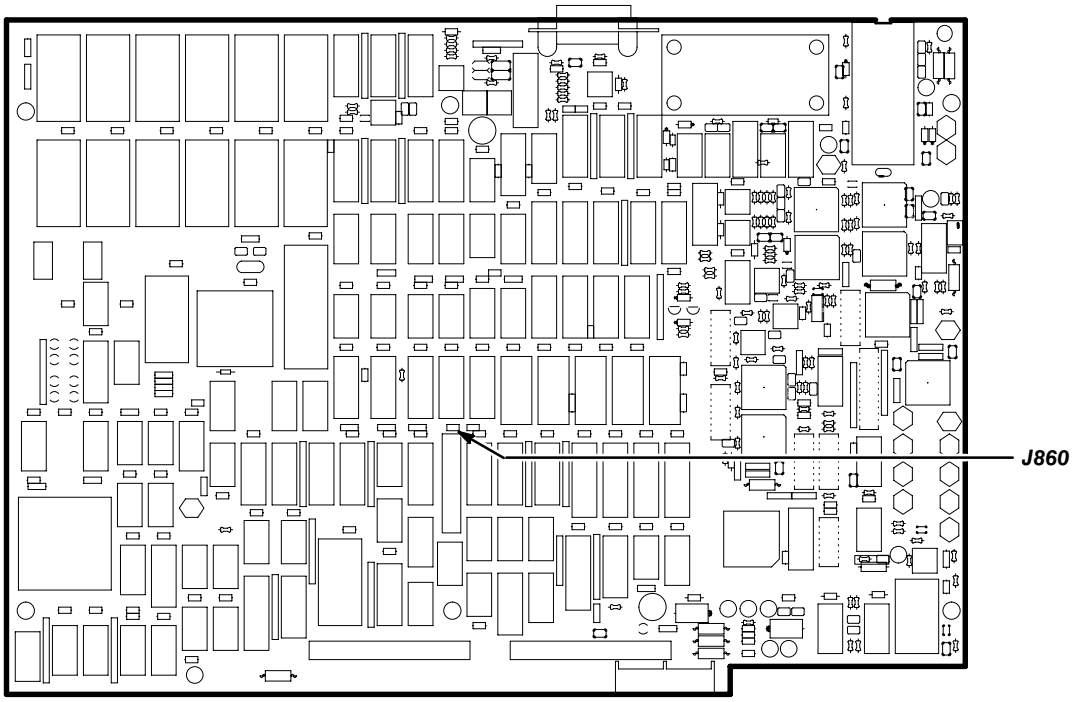


Figure 3-2: A5 Time Base/Controller Board Jumper Location

☐ **Step 2:** Boot up the PC with **MS DOS** operating.

☐ **Step 3:** Connect the serial cable to the instrument's RS-232-C port located at the rear of the instrument. Connect the other end of the cable to the COM1 port on the PC.

☐ **Step 4:** Install the sampling head in any sampling head compartment in the instrument.

☐ **Step 5:** Set the PRINCIPAL POWER SWITCH to ON and the ON/STANDBY switch to ON.

☐ **Step 6:** After the diagnostics are complete, press the UTILITY button and then select **RS-232 Parameters**.

☐ **Step 7:** Set the **Baud Rate** to **4800 Bd**, the **Parity** to **none**, and the **Stop Bits** to **1** in the **RS-232 Parameters** pop-up menu.

☐ **Step 8:** Insert the Sampling Head Utility Software floppy disk (provided with this manual) into the "A" drive of the system controller.

☐ **Step 9:** On the PC, type **a:** and then press the return or enter key.

☐ **Step 10:** Type **id** and then press the return or enter key.

The PC then displays the following message:

Make sure 11800 RS232 port is set up as follows:

Baud Rate	**4800**
Parity	**none**
Stop bits	**1**

Enter mainframe head number [1..4]

NOTE

When entering the sampling head number, the 11802 Oscilloscope and CSA 803 Series Communications Signal Analyzers have only head number 1 and head number 2. The 11801 Series Oscilloscopes have head number 1 through head number 4. The head numbers correspond to the sampling head compartments and are in ascending order (reading from left to right).

☐ **Step 11:** To enter the sampling head number: type in the correct sampling head number, and then press the return or enter key.

The PC then displays the following message:

Current ID number is: "XXXXXXXX"
Enter new ID number (8 characters max):

NOTE

The X's between the quotes represent the current ID number. Eight is the maximum number of digits allowed and one is the minimum. Any character is allowed, except a space ( ) character.

☐ **Step 12:** Enter one to eight characters for the new identification number.

The instrument will then flash the message:

Change in channel M × configuration

four times at the top of the screen.

☐ **Step 13:** Set the ON/STANDBY switch to STANDBY, and then switch it back to ON.

☐ **Step 14:** To verify the new identification number, press the UTILITY button, and then select **Identify**.

The new identification number now appears under **Mainframe Sampling Heads** in the **System Identification** pop-up menu.

Theory of Operation

Theory of Operation

The SD-14 Sampling Head is a high-performance, probe-equipped sampling head.

System Functional Overview

This section describes and illustrates the major functional blocks of the SD-14 Sampling Head (see Figure 4-1).

The sampling head has two independent probe channels, each with its own acquisition circuitry.

The strobe drive signal from the instrument controls the timing of the strobe assertion to each acquisition system. A variable delay adjustment on channel 2 guarantees sampling coincidence between the two channels or allows intentional skewing between channels.

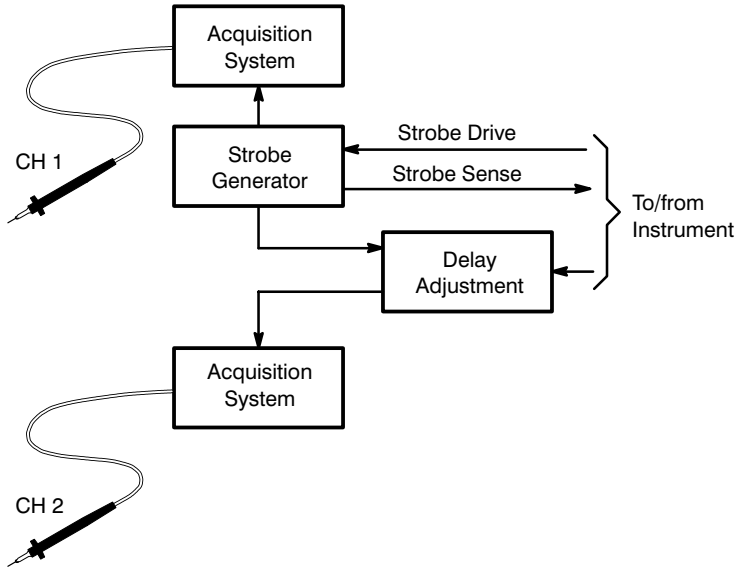


Figure 4-1: SD-14 Block Diagram

The strobe sense signal is a part of the strobe signal returned to the instrument. For calibration purposes, the instrument monitors the time duration of the strobe drive/strobe sense loop and adjusts delay inside the instrument to maintain correct strobe timing.

Offset Null and Offset Gain

The offset null adjustment removes unwanted DC offset that may be present in the sampling probe. This adjustment effectively zeroes the offset circuitry in the sampling probe so that a 0 V input signal delivers a 0 V output.

The offset gain adjustment matches the requested offset from the user to the sensitivity of the probe offset circuit.

If offset null and offset gain are not both adjusted correctly, measurements taken will be incorrect. The absolute voltage values for any cursors displayed in the trace will also be incorrect.

Replaceable Parts

Replaceable Parts

This section contains a list of the components that are replaceable for the SD-14 Sampling Head. As described below, use this list to identify and order replacement parts.

Parts Ordering Information

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

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

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

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

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

Module Replacement

The SD-14 Sampling Head is serviced by module replacement so there are three options you should consider:

- **Module Exchange.** In some cases you may exchange your module for a remanufactured module. These modules cost significantly less than new modules and meet the same factory specifications. For more information about the module exchange program, call 1−800−TEKWIDE, ext. 6630.
- **Module Repair.** You may ship your module to us for repair, after which we will return it to you.
- **New Modules.** You may purchase new replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

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

Item Names

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

Abbreviations

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

CROSS INDEX – MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
TK0433	PORTLAND SCREW CO		
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609–3320
TK1163	POLYCAST INC	9898 SW TIGARD ST	TIGARD OR 97223
TK1465	BEAVERTON PARTS MFG CO	1800 NW 216TH AVE	HILLSBORO OR 97124–6629
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077–0001

Fig. & Index No.	Tektronix Part No.	Serial No. Effective	Serial No. Dscont	Qty	Name & Description	Mfr. Code	Mfr. Part No.
5−1−1	213−0956−00			3	SCREW,MACHINE:2−56 X 0.750 FLH,82 DEG,STL	TK0433	2−56X.75 FLH,82
−2	366−0673−00			2	KNOB:0.096 ID X 0.24 OD X 0.299H	TK1163	ORDER BY DESC
−3	380−0986−00			1	HSG,SAMPLING HD:MACHINED	TK1465	ORDER BY DESC
−4	211−0101−00			1	SCREW,MACHINE:4−40 X 0.25,FLH,100 DEG,STL	TK0435	ORDER BY DESC
−5	211−0030−00			5	SCREW,MACHINE:2−56 X 0.25,FLH,STL	TK0435	ORDER BY DESC
−6	211−0087−00			3	SCREW,MACHINE:2−56 X 0.188,FLH,82 DEG	TK0435	ORDER BY DESC
	657−0084−50			1	MODULAR ASSY:SD14 FIELD REPL UNIT	80009	657008450
					ACCESSORIES		
	013−0271−00			1	ADAPTER,T TIP:SMA TO SD14,P6207,P6217	80009	013027100
	070−8285−01			1	MANUAL,TECH:SERVICE,SD14	80009	070828501
	070−8286−01			1	MANUAL,TECH:USER,SD14	80009	070828601

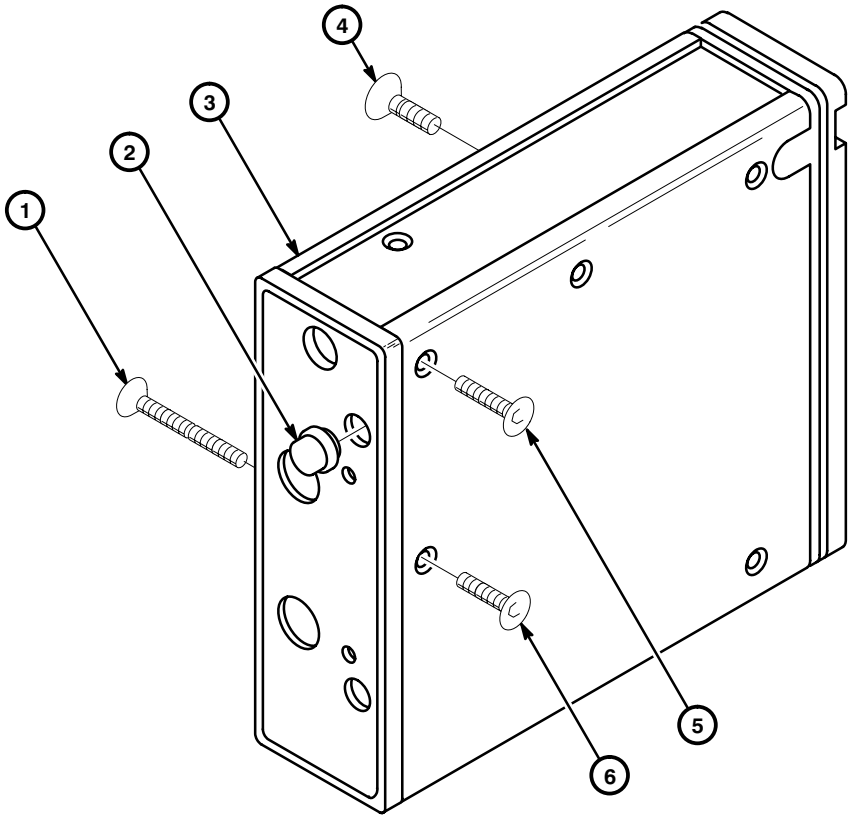


Figure 5-1: Exploded View of the SD-14 Sampling Head

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