TEK **Service Reference**

Part No. 070-7053-00
Product Group 47

THE SD-24

TDR/SAMPLING HEAD

WARNING

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

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

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Instrument Serial Numbers

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

B010000	Tektronix, Inc., Beaverton, Oregon, USA
G100000	Tektronix Guernsey, Ltd., Channel Islands
E200000	Tektronix United Kingdom, Ltd., London
J300000	Sony/Tektronix, Japan
H700000	Tektronix Holland, NV, Heerenveen, The Netherlands

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

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

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Contents

Section 2 Checks and Adjustments (cont)

Section 3 Maintenance

Section 4 Theory of Operation

Illustrations

Tables

General Information

This section gives all the information needed to apply power to the SD-24 TDR/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-24 TDR/Sampling Head Service Reference* manual is designed for use by qualified service personnel. It contains information necessary to check and maintain the SD-24 TDR/Sampling Head.

The SD-24 TDR/Sampling Head is a two-channel, 17.5 ps rise time sampling head. Each channel is also capable of generating its own TDR output pulse. The SD-24 TDR/Sampling Head is designed for use in 11800-Series Digital Sampling Oscilloscopes and in the SM-11 Multi-Channel Unit

Safety Summary

The 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

This 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

To avoid damage to the oscilloscope, set the oscilloscope's ON/STANDBY switch to STANDBY before installing or removing a sampling head.

The SD-24 TDR/Sampling Head slides into the one of the front panel compartments of the 11801 or 11802 Digital Sampling Oscilloscopes. Figure 1-1 shows the front panel of an oscilloscope and the locations of the sampling head compartments.

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 in place.

CAUTION

Never install or remove a sampling head when the ON/STANDBY switch is ON.

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 11801 or 11802 Digital Sampling Oscilloscope Service Reference manual.

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

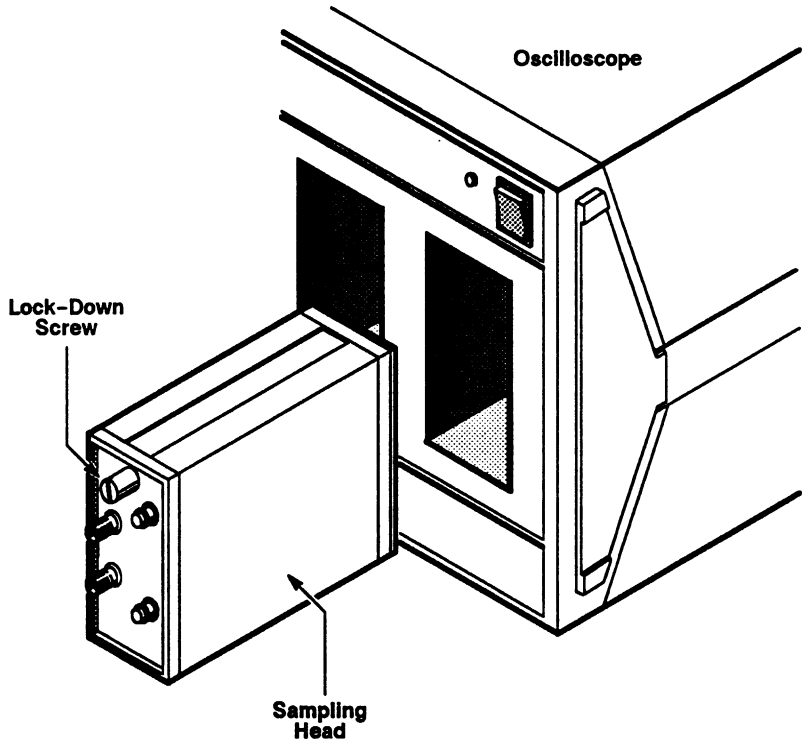


Figure 1-1 — Installing a Sampling Head In An Oscilloscope

Packaging for Shipment

If possible, save and reuse the original carton and packaging to package sampling head when shipping it by commercial transportation. Attach short circuit terminations to the sampling 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 oscilloscope and sampling head owner;
- Name of a person at your firm who can be contacted about the oscilloscope and sampling head;
- Complete oscilloscope and sampling head type and serial number; and
- 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 short circuit terminations to the sampling head 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: Fully wrap the sampling head with anti-static sheeting, or its equivalent, to protect the finish.

☐ Step 4: 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 5: Seal the carton with shipping tape or with industrial staples.

☐ Step 6: 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 air temperature is between 0° and +50°C. Store the sampling head in ambient temperatures from −40° 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 oscilloscope is available after a 20-minute warmup period. After entry into Enhanced Accuracy, the oscilloscope reverts to non-enhanced accuracy if the internal oscilloscope temperature changes more than 5°C.

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 part as well. These procedures contain only check steps, since the SD-24 TDR/Sampling Head has no internal adjustments. The parts 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 parts in Table 2-1 which have a "yes" indication in the Functional Test Column.

Refer to the *SD-24 TDR/Sampling Head Installation/User Reference* 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

Part and Description	Measurement Limit	Specification	Functional Test
Part 1 Power-On	none	none	yes
Part 2 Dot Transient Response			
250 mV with automatic calibration	≤5% error		yes
500 mV with automatic calibration	≤5% error		no
500 mV with default settings	±20% error		no
1.0 V without automatic calibration		adjusted to 100% at 1 V	no
Part 3 Offset			
Offset	±2 mV		yes
Offset change with repetition rate		±5 mV	no
Part 4 Noise (SN B020652 and above)			no
Smoothing, on	≤550 μV rms		
Smoothing, off	≤1.2 mV rms		
Part 4 Noise (SN B010651 and below)			no
Smoothing, on	≤900 μV rms		
Smoothing, off	≤2 mV rms		
Part 5 Rise Time		17.5 ps	yes

Table 2-1 — Measurement Limits and Specifications (cont)

Part and Description	Measurement Limit	Specification	Functional Test
Part 6 Acquisition Aberrations (with 067-1338-00 source)			no
0 to 300 ps	−7% to 12%		
300 ps to 5 ns	±4%		
5 ns to 100 ns	±1.2%		
100 ns and up	±0.6%		
−10 ns to −20 ps	±4%		
Part 7 Coincidence Between Channels		10 ps	no
Part 8 Maximum Signal Voltage	1% of step amplitude		no
Part 9 Isolation Between Channels		1%	no
Part 10 Output Amplitude		250 mV ±5 mV	yes
Part 11 TDR Aberrations			no
0 to 300 ps	−5% to 15%		
300 ps to 5 ns		±3%	
5 ns and up		±1%	
−10 ns to −20 ps		±3%	
Part 12 Reflected Rise Time		35 ps	no

Test Equipment

The test equipment in Table 2-2 contains suggested test equipment for use in this manual. Procedure steps are based on the test equipment examples given, but other equipment with similar specifications may be substituted. Test results, setup information, and related connectors and adapters may be altered by the use of different equipment.

Table 2-2 – Test Equipment

Description	Minimum Specification	Examples of Applicable Test Equipment
11800-Series Oscilloscope	Tektronix digital sampling oscilloscope	TEKTRONIX 11801 Digital Sampling Oscilloscope TEKTRONIX 11802 Digital Sampling Oscilloscope
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 501 Time Mark Generator with a TM 500-Series Power Module
Calibration Generator	DC output, 0.5% accuracy 1 V output amplitude	TEKTRONIX PG 506 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 COM1	TEKTRONIX PEP 301 System Controller
50 Ω Termination, SMA connectors	Impedance 50 Ω, SMA connectors	Tektronix Part 015-1022-00
50 Ω Termination, BNC connectors	Impedance, 50Ω, BNC connectors	Tektronix Part 011-0049-01
Precision Short Circuit Termination	Female 3.5 mm compatible connectors	Tektronix Part 011-0150-00
Precision 6-inch Semi-Rigid Cable	Male to male 3.5 mm compatible connectors	Tektronix Part 015-0564-00

Table 2-2 – Test Equipment (cont)

Description	Minimum Specification	Examples of Applicable Test Equipment
Short Circuit Terminators, SMA Connections (2 required)	Male SMA Connectors	Tektronix Part 015-1020-00
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
Adapter, SMA to BNC (2 required)	SMA male to BNC female	Tektronix Part 015-0554-00
Attenuator, 2X	6 dB attenuation, 50 Ω, one male and one female BNC	Tektronix Part 011-0069-02
Attenuator, 5X	14 dB attenuation, 50 Ω, one male and one female BNC	Tektronix Part 011-0060-02
Wrist Strap		Tektronix Part 006-3415-00
Static Control Mat		Tektronix Part 006-3414-00
Needle-nose pliers		
Pozidrive Screwdriver	P1 tip	

Using These Procedures

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

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 oscilloscope 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 oscilloscope as part of the setup. The **Initialize** feature, available through the UTILITY menu, presets all oscilloscope controls and functions to known values. Initializing the oscilloscope at the beginning of a step eliminates the possibility of settings from previous parts 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 oscilloscope features are located in the *11801 User Reference* manual, the*11802 User Reference* manual, and the *SD-24 TDR/Sampling Head Installation/User* manual.

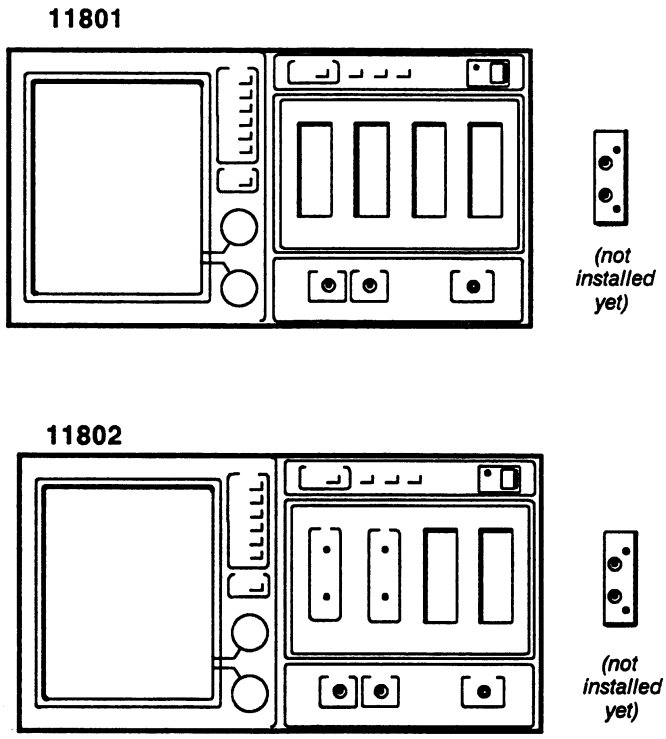
Tutorial Manual

The tutorial manuals, *Introducing the 11801 Digital Sampling Oscilloscope* and *Introducing the11802 Digital Sampling Oscilloscope*, are strongly recommended to familiarize the first-time user with 11801 and 11802 Oscilloscope controls and features.

Part 1 Power-on

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

Setup to Power-on



Setup to Power-on

Procedure to Power-on

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

Sampling head ..... Not installed yet
11801/11802 Oscilloscope
ON/STANDBY switch ..... STANDBY

☐ Step 2: Install a SD-Series sampling head in the oscilloscope's left-most compartment.

☐ Step 3: With the oscilloscope's rear panel PRINCIPAL POWER SWITCH set to OFF, connect the 11801/11802 Oscilloscope to a suitable power source.

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

When the 11801/11802 Oscilloscope 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 oscilloscope to be tested:

- Calibration generator
- Calibration step generator
- Time mark generator
- Pulse generator

A complete list of test equipment is listed in Table 2-2.

- Before doing the performance checks, allow a 20 minute warm-up for the Sampling head and test equipment.

Part 2 Dot Transient Response

This part shows the setup and lists the procedures to check the dot transient response.The dot transient response is examined at 250 mV and 500 mV with automatic calibration settings, at 500 mV with default settings, and checked at 1 V with manual calibration settings.

Measurement Limits

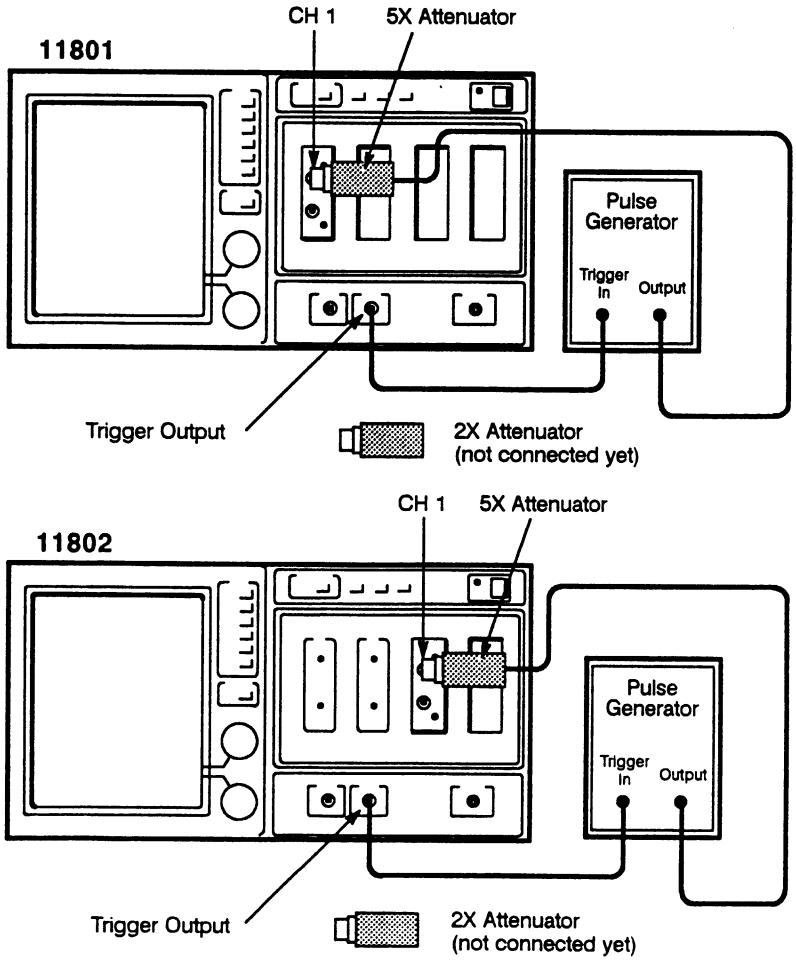
The measurement limits for the dot transient response error are:

- ≤5 % error when measured at 250 mV and 500 mV with automatic calibration settings
- 20% error when measured at 500 mV with default settings

Specifications

The specification for the dot transient response at 1 V is that the amplitude is adjustable to 100%.

Setup to Check Dot Transient Response



Setup to Check Dot Transient Response

Procedure to Check Dot Transient Response

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

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

11801/11802 Oscilloscope
- **Vert Size: M1** ..... 50 mV/division
- TRIGGER button ..... press
  - **Source** ..... **Internal Clock**
- **Main Pos** ..... **Min**
- **Main Size** ..... 20 ns/division

Pulse Generator
- Back Terminator button ..... pull out
- Trigger Source ..... External Trigger
- Output ..... square wave

Examine Dot Response at 250 mV with Automatic Calibration Settings—by performing Steps 2 through 30.

☐ Step 2: Set the pulse generator's amplitude for a 375 mV display.

☐ Step 3: Set the **Vert Offset: M1** so that the step is approximately centered on the screen.

☐ Step 4: Press the ENHANCED ACCURACY button, and then touch **Loop Gain**.

☐ Step 5: Touch **Automatic Calibrate** and then **Proceed** in the **Loop Gain Calibration** pop-up menu.

☐ Step 6: Touch **Exit** in the **Loop Gain Calibration** pop-up menu.

☐ Step 7: Set the pulse generator's amplitude for a 250 mV step display.

☐ Step 8: Press the WAVEFORM button, and then touch **Horizontal Desc**.

☐ Step 9: Touch **Main Record Length** in the **Horizontal Description** pop-up menu, and then set the top knob for a **Main Record Length** of 512.

☐ Step 10: Press the UTILITY button and then **Instr Options**.

☐ Step 11: Set **Vectored Trace** to **Off** in the **Instrument Options** pop-up menu.

☐ Step 12: Touch **Display Intensity** in the **Instrument Options** pop-up menu, and then set the top knob for **90%** intensity.

☐ Step 13: Touch **Exit**.

☐ Step 14: Touch **Cursors** on the top of the screen.

☐ Step 15: Touch **Cursor Type** and then **Horizontal Bars** in the **Cursor Type** pop-up menu.

☐ Step 16: Touch **Exit**.

☐ Step 17: Set **Cursor 1** (top knob) to the average of the bottom of the pulse before the step.

☐ Step 18: Set **Cursor 2** (bottom knob) to the top of the step.

☐ Step 19: Read **ΔV** as the peak-to-peak step amplitude, and then record this value as **V** for later use.

☐ Step 20: Press the ENHANCED ACCURACY button.

☐ Step 21: Touch **Loop Gain** and then the channel you are using in the **Loop Gain Calibration** pop-up menu.

☐ Step 22: Set the **Divide by Two Mode** to **On** in the **Loop Gain Calibration** pop-up menu.

☐ Step 23: Touch **Exit** in the **Loop Gain Calibration** pop-up menu.

☐ Step 24: Touch **Cursors** at the top of the screen.

☐ Step 25: Set **Cursor 1** to the average of the bottom of the pulse before the step.

☐ Step 26: Set **Cursor 2** to the average of the bottom of the pulse under the step.

☐ Step 27: Read **ΔV**, and then record this value as V_L for later use.

☐ Step 28: Set **Cursor 2** to the average of the top of the pulse.

☐ Step 29: Read **ΔV**, and then record this value as V_H for later use.

☐ Step 30: *Examine* that the negative dot response error $[(-V_L/V_H) \times 100\%]$ is $\leq 5\%$.

☐ Step 31: *Examine* that the positive dot response error $[100\% \times (V_H - V)/(V - V_L)]$ is $\leq 5\%$.

Examine Dot Response at 500 mV with Automatic Calibration Settings—by performing Steps 31 through 50.

☐ Step 32: Press the ENHANCED ACCURACY button.

☐ Step 33: Touch **Loop Gain**, and then set **Divide by Two Mode** to **Off** in the **Loop Gain Calibration** pop-up menu.

☐ Step 34: Touch **Exit**.

☐ Step 35: Set the **Vert Size:M1** to 100 mV/div.

☐ Step 36: Set the pulse generator's amplitude for a 500 mV step display.

☐ Step 37: Touch **Cursors** on the top of the screen.

☐ Step 38: Set **Cursor 1** to the average of the bottom of the pulse before the step.

☐ Step 39: Set **Cursor 2** to the average of the top of the pulse.

☐ Step 40: Read **ΔV** as the peak-to-peak step amplitude, and then record this value as **V** for later use.

☐ Step 41: Press the ENHANCED ACCURACY button.

☐ Step 42: Touch **Loop Gain** and then the channel number you are using in the **Loop Gain Calibration** pop-up menu.

☐ Step 43: Set **Divide by Two Mode** to **On** in the **Loop Gain Calibration** pop-up menu.

☐ Step 44: Touch **Cursors** at the top of the screen.

☐ Step 45: Set **Cursor 1** to the average of the bottom of the pulse before the step.

☐ Step 46: Set **Cursor 2** to the average of the bottom of the pulse after the step.

☐ Step 47: Read the **ΔV** value, and then record this value as V_L for later use.

☐ Step 48: Set **Cursor 2** to the average of the top of the pulse.

☐ Step 49: Read **ΔV**, and then record this value as V_H for later use.

☐ Step 50: *Examine* that the negative dot response error $[(-V_L/V_H) \times 100\%]$ is $\leq 5\%$.

☐ Step 51: *Examine* that the positive dot response error $[100\ \% \times (V_H - V)/(V - V_L)]$ is $\leq 5\%$.

Examine Dot Response at 500 mV with default settings—by performing Steps 51 through 59.

☐ Step 52: Press the ENHANCED ACCURACY button.

☐ Step 53: Touch **Loop Gain** and then **Recall Defaults** in the **Loop Gain Calibration** pop-up menu.

☐ Step 54: Touch **Exit**.

☐ Step 55: Touch **Cursors** at the top of the screen.

☐ Step 56: Set **Cursor 1** to the average of the bottom of the pulse before the step.

☐ Step 57: Set **Cursor 2** to the average of the bottom of the pulse after the step.

☐ Step 58: Read the **ΔV** value, and then record this value as V_L for later use.

☐ Step 59: Set **Cursor 2** to the average of the top of the pulse and read **ΔV**. Record this value as V_H.

☐ Step 60: *Examine* that the magnitude of the negative dot response error [(-V_L/V_H) × 100%] is ≤20%.

Check Dot Response at 1V with Manual Calibration Settings—by performing Steps 60 through 70.

☐ Step 61: Press the ENHANCED ACCURACY button.

☐ Step 62: Touch **Loop Gain**, and then set the **Divide by Two Mode** to **Off** in the **Loop Gain Calibration** pop-up menu.

☐ Step 63: Touch **Exit**.

☐ Step 64: Remove the 5X attenuator, and then connect the 2X attenuator to the channel you are using and the coaxial cable.

☐ Step 65: Set the **Vert Size:M1** to 200 mV/div.

☐ Step 66: Set the pulse generator's amplitude for a 1 V ±2% step display.

☐ Step 67: Press the ENHANCED ACCURACY button.

☐ Step 68: Touch **Loop Gain** and then the channel number you are using in the **Loop Gain Calibration** pop-up menu.

☐ Step 69: Set the **Divide by Two Mode** to **On**, and then touch **Manual Calibrate** in the **Loop Gain Calibration** pop-up menu.

☐ Step 70: Touch **Exit**.

☐ Step 71: *Check* that the amplitude of the pulse, measured from the average of the level under the pulse to the average of the top of the pulse, can be set with the manual calibration settings to be ≥1V.

☐ Step 72: Repeat steps 2 through 71 for channel 2.

Part 3 Offset

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

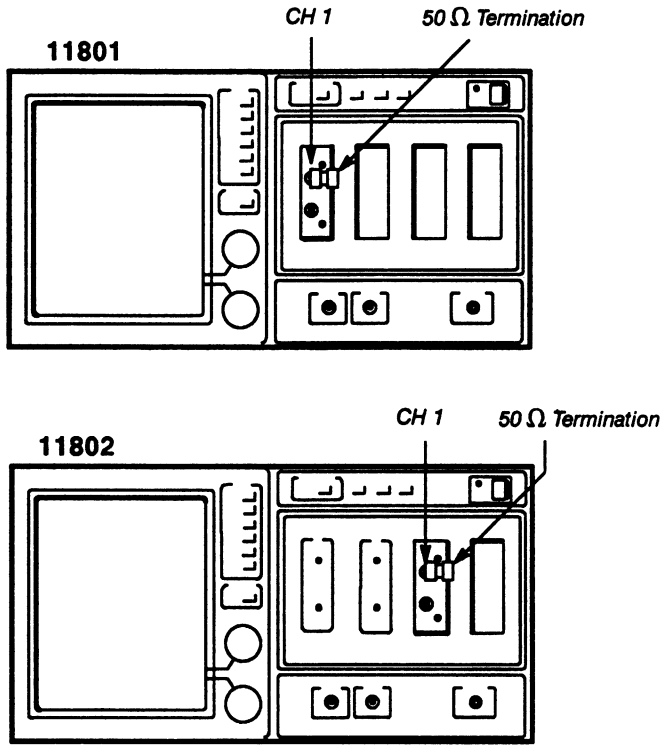
Measurement Limits

The measurement limit for the offset is ±2 mV.

Specifications

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

Setup to Examine Offset



Setup to Examine Offset

Procedure to Examine Offset

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

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

11801/11802 Oscilloscope
- TRIGGER button ..... press
  - **Source** ..... **Internal Clock**
- ENHANCED ACCURACY button ..... press
  - **Calibrate All** pop-up menu ..... **Recall Defaults**

☐ Step 2: Touch **Offset Null** in the ENHANCED ACCURACY major menu.

☐ Step 3: Touch **Manual Calibrate** in the **Offset Nulling** pop-up menu.

☐ Step 4: Touch the **Offset Null: M1**, select **0**, and then **Enter** in the **Numeric Entry & Knob Res** pop-up menu.

☐ Step 5: Touch the vertical icon, and then set **Vert Size: M1** to 50 mV/div.

☐ Step 6: Press the MEASURE button.

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

☐ Step 8: Touch **Mean** in the MEASURE major menu, and then set **Data Interval** to **whole zone** in the **Mean** pop-up menu.

☐ Step 9: *Examine* that **Mean** is 0 V ±200 mV.

☐ Step 10: Press the ENHANCED ACCURACY button, and then touch **Offset Null**.

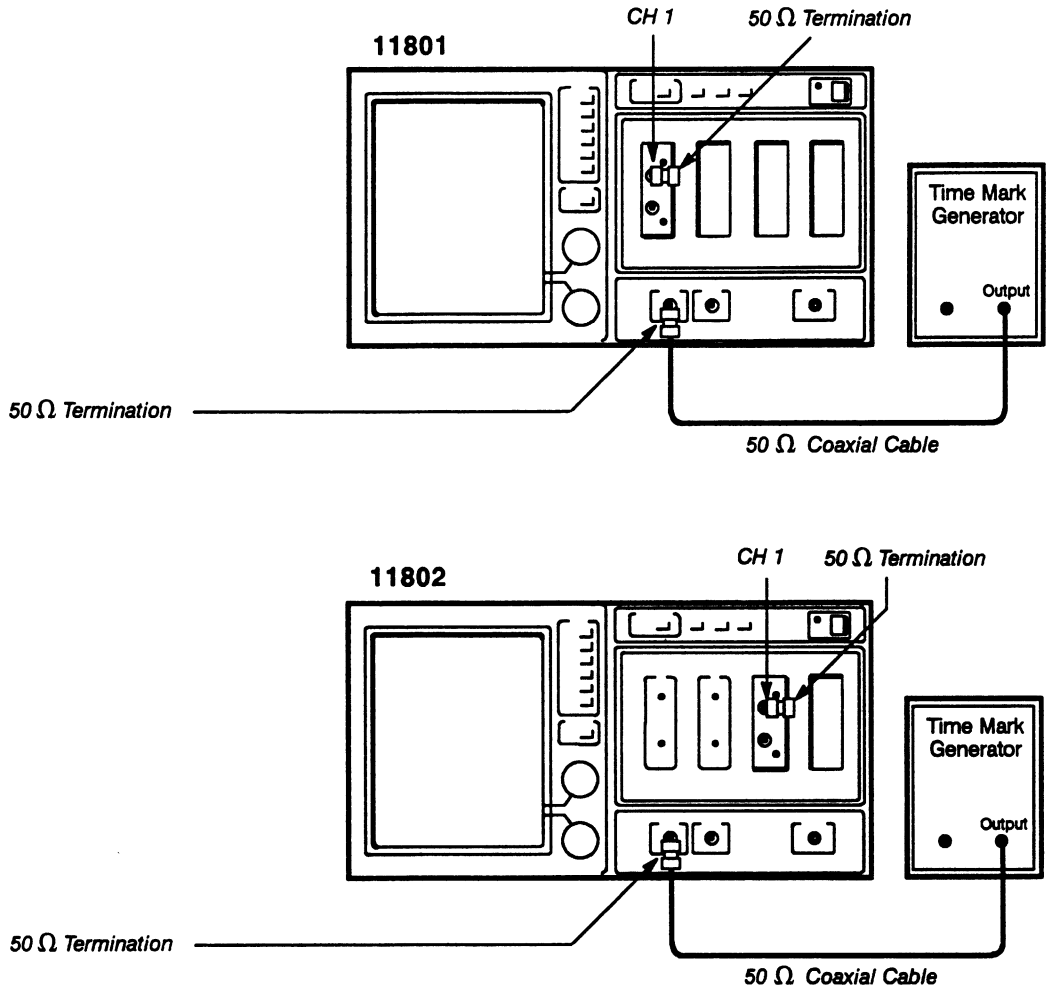
☐ Step 11: Touch **Automatic Calibrate** and then **Proceed** in the **Offset Nulling** pop-up menu.

☐ Step 12: Press the MEASURE button.

☐ Step 13: *Examine* that the **Mean** (offset) is 0 ±2 mV.

☐ Step 14: Repeat steps 2 through 13 for Channel 2.

Setup to Check Offset Change with Repetition Rate



Setup to Check Offset Change with Repetition Rate

Procedure to Check Offset Change with Repetition Rate

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

Sampling head
CH 1 SELECT CHANNEL On/Off ..... On
11801/11802 Oscilloscope
ENHANCED ACCURACY button ..... press
Calibrate All pop-up menu ..... **Recall Defaults**
Time mark generator
Marker (sec) ..... 0.2 µs

- ☐ Step 2: Press the TRIGGER button, and then touch **Level**.
- ☐ Step 3: Set the **Trig Level** until a trace appears.
- ☐ Step 4: Touch the vertical icon, and then set the **Vert Size: M1** to 2 mV/div.
- ☐ Step 5: Set **Vert Offset: M1** so that the trace is vertically centered on the screen.
- ☐ Step 6: Set the time mark generator's marker setting to 10 ms.
- ☐ Step 7: Press the WAVEFORM button, and then touch **Acquire Desc**.
- ☐ Step 8: Set **Average N** to **On**, and then touch **Set Avg N**.
- ☐ Step 9: Set **Average N** to **8** with the top knob.
- ☐ Step 10: Wait until the **Acquire Desc** selector in the WAVEFORM major menu shows that eight averages have been completed.
- ☐ Step 11: Press the MEASURE button.
- ☐ Step 12: Touch **Measurements** and then **Mean** in the **Measurements** pop-up menu.
- ☐ Step 13: Touch **Compare & References** in the MEASURE major menu.
- ☐ Step 14: Touch **Save Current Meas Values as References**, and then set **Compare** to **On**.
- ☐ Step 15: Set the time mark generator's marker setting to 5 ms.
- ☐ Step 16: Wait until the **Acquire Desc** selector in the WAVEFORM major menu shows that eight averages have been completed.
- ☐ Step 17: *Check* that **ΔMean** (offset with a repetition rate) is 0 ±5 mV.
- ☐ Step 18: Continue to decrease the time mark generator's marker setting, and repeat Step 17 for each setting down to 0.1 μs.
- ☐ Step 19: Press the CH 2 SELECT CHANNEL button.
- ☐ Step 20: Disconnect the 50 Ω termination from the CH 1 input and connect it to the CH 2 input.
- ☐ Step 21: Repeat Steps 4 through 18 for CH 2.

Part 4 Noise

This part shows the setup and lists the procedures to check noise.

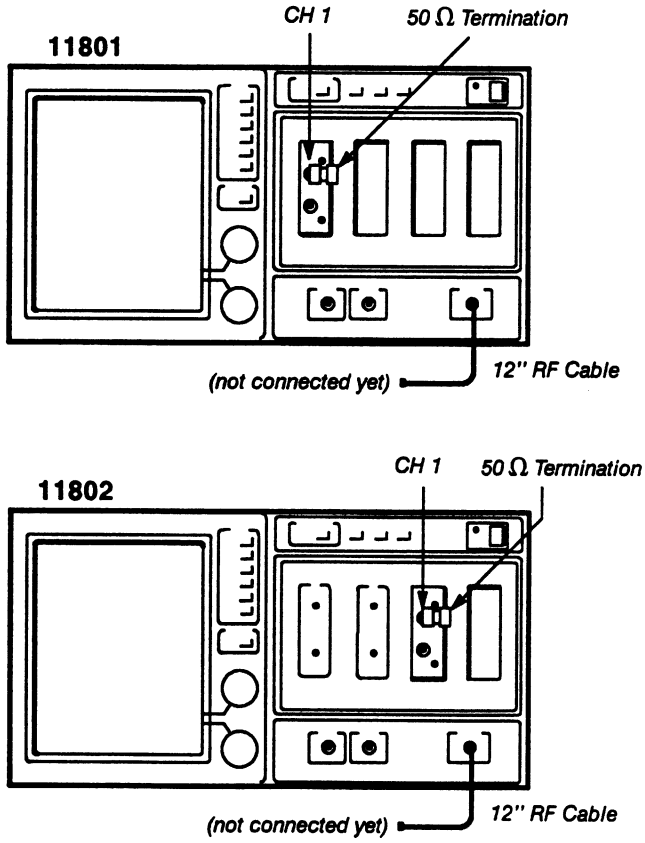
Measurement Limits (SN B020652 and above)

The measurement limit for noise is 1.2 mV without smoothing and 550 μV with smoothing.

Measurement Limits (SN B020651 and below)

The measurement limit for noise is 2 mV without smoothing and 900 μV with smoothing.

Setup to Examine Noise



Setup to Examine Noise

Procedure to Examine Noise

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

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

11801/11802 Oscilloscope
- TRIGGER button ..... press
  - **Source** ..... **Internal Clock**
- ENHANCED ACCURACY button ..... press
  - **Calibrate All** pop-up menu ..... **Recall Defaults**

☐ Step 2: Touch **Loop Gain** in the ENHANCED ACCURACY major menu.

☐ Step 3: Disconnect the 50 Ω termination from the CH 1 input and connect the CALIBRATOR to the CH 1 input through the 12 inch RF cable.

☐ Step 4: Touch the channel number you are using, **Automatic Calibrate,** and then **Proceed** in the **Loop Gain Calibration** pop-up menu.

☐ Step 5: Disconnect the CALIBRATOR from the CH 1 input and reconnect the 50 Ω termination.

☐ Step 6: Press the WAVEFORM button, and then touch **Acquire Desc.**

☐ Step 7: Set **Average N** to **On**.

☐ Step 8: Press the AUTOSET button.

☐ Step 9: Touch the vertical icon. If the **Vert Size: M1** is not at 2 mV/div, then set the **Vert Size: M1** to 2 mV/div.

☐ Step 10: Touch **Def Tra** at the top of the screen.

☐ Step 11: In the **Vertical Description** pop-up menu, touch the following selectors in the order given:

- **Mainframe**
- **1**
- **-**
- **Avg (**
- **Mainframe**
- **1**
- **)**
- **Enter Desc**

☐ Step 12: Press the MEASURE button, and then touch **Measurements**.

☐ Step 13: Touch **RMS** in the **Measurements** pop-up menu, and then **RMS** in the MEASURE major menu.

☐ Step 14: Set **Data Interval** to **whole zone** in the **RMS** pop-up menu.

☐ Step 15: *Examine* that **RMS** is ≤1.2 mV. (SN B020652 and above)
Examine that **RMS** is ≤2 mV. (SN B020651 and below)

☐ Step 16: Press the WAVEFORM button.

☐ Step 17: Touch **Sampling Head Fnc's**, and then set **Smoothing** to **On** in the **Sampling Head Functions** pop-up menu.

☐ Step 18: Press the MEASURE button.

☐ Step 19: *Examine* that the **RMS** is ≤550 μV. (SN B020652 and above)
Examine that the **RMS** is ≤900 μV. (SN B010651 and below).

☐ Step 20: Repeat steps 2 through 19 for channel 2.

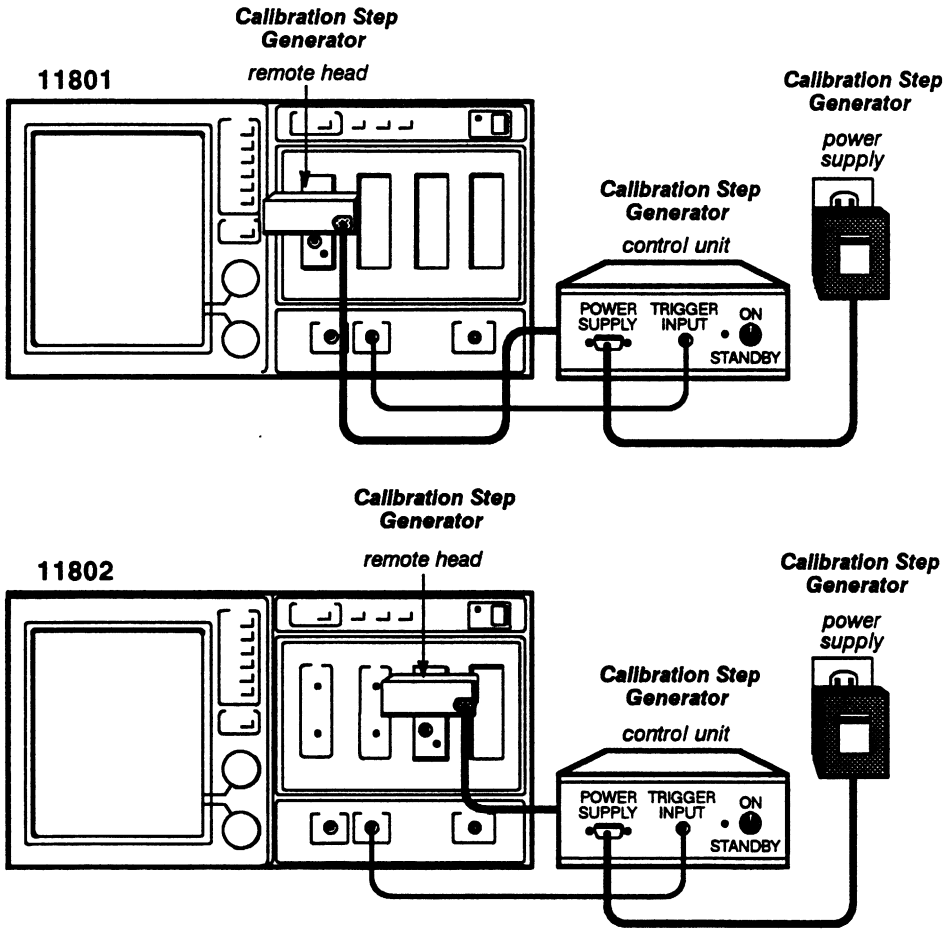
Part 5 Rise Time

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

Specifications

The specification for the sampling head rise time is 17.5 ps.

Setup to Check Rise Time



Setup to Check Rise Time

Procedure to Check Rise Time

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

Sampling head

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

11801/11802 Oscilloscope

ENHANCED ACCURACY button ..... 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: Touch **Main Record Length**,and then set **Main Record Len** to 5120 with 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 set the **Main Size** to 100 ns/div.

☐ Step 9: Touch **Main Pos** and then **Set to Min** in the **Numeric Entry & Knob Res** pop-up menu.

☐ Step 10: Press the MEASURE button.

☐ Step 11: Touch **Measurements** and then **Rise** in the **Measurements** pop-up menu.

☐ Step 12: Touch **Rise** in the MEASURE major menu, and then set **Tracking** to **Off** in the **Rise** pop-up menu.

☐ Step 13: Set the **Main Size** to 5 ns/div.

☐ Step 14: Touch **Baseline** in the **Rise** pop-up menu.

☐ Step 15: Touch a blank portion of the screen to exit this menu.

☐ Step 16: Set the **Baseline** (bottom knob) to the average of the bottom of the pulse 10 ns before the step.

☐ Step 17: Touch the horizontal icon, and then set the **Main Pos** so that the step is at the left-most edge of the screen.

☐ Step 18: Set the **Main Size** to 20 ps/div.

☐ Step 19: Set the **Main Pos** so that the step is approximately centered on the screen.

☐ Step 20: Touch **Rise** in the MEASURE major menu.

☐ Step 21: Record the **Mean**: value in the **Rise** pop-up menu for later use.

☐ Step 22: Calculate the sampling head rise time with the following formula:

$$\textit{sampling head rise time} = \sqrt{(\textbf{Mean} : \textit{value})^2 - (\textit{Calibration Step Generator rise})^2}$$

Note that Calibration Step Generation rise is read from the calibration step generator.

☐ Step 23: *Check* that the sampling head rise time is $\leq$17.5 ps.

☐ Step 24: Repeat steps 2 through 23 for channel 2.

Part 6 Acquisition Aberrations

This part shows the setup and lists the procedures to check acquisition aberrations.

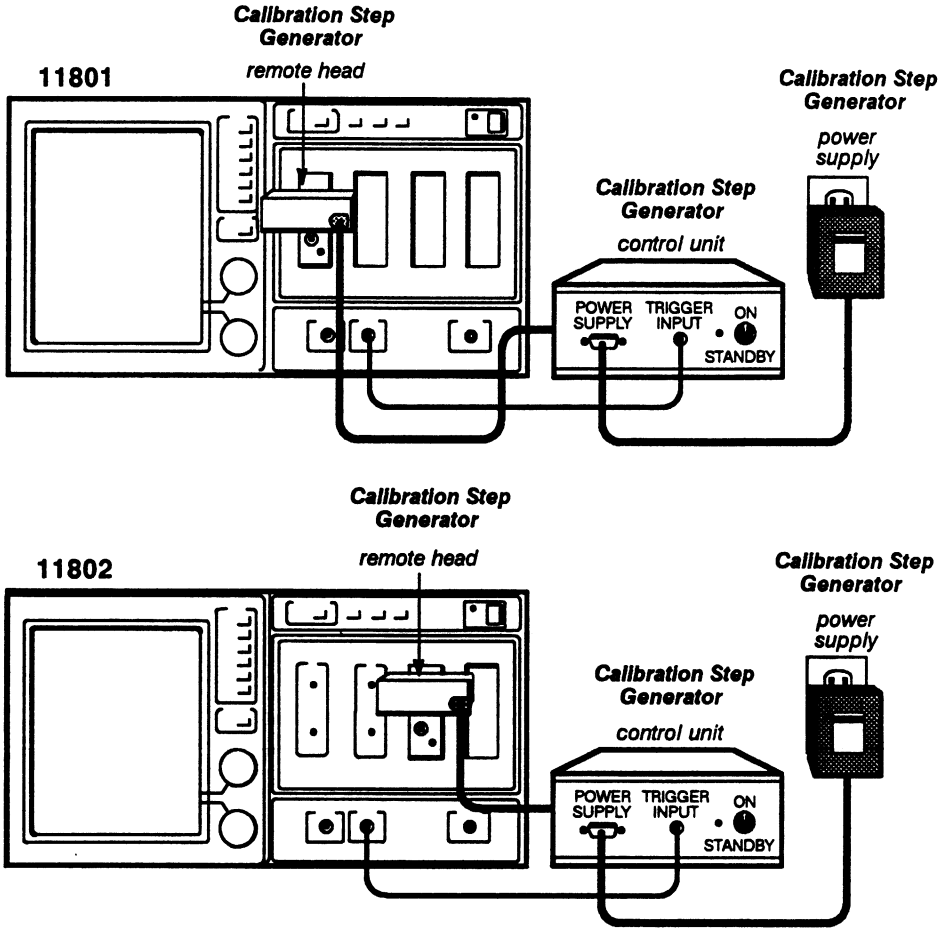
Measurement Limits

The measurement limits for acquisition aberrations are listed in Table 2-3, Aberrations Specifications.

Table 2-3 – Aberrations Specifications

Time Difference from the Rising Edge of Waveform	Minimum Specification
0 to 300 ps	-7% ≤ aberration % ≤12%
300 ps to 5 ns	-4% ≤ aberration % ≤4%
5 ns to 100 ns	-1.2% ≤ aberration % ≤1.2%
100 ns and up	-0.6% ≤ aberration % ≤0.6%
-10 ns to -20 ps	-4% ≤ aberration % ≤4%

Setup to Examine Acquisition Aberrations



Setup to Examine Acquisition Aberrations

Procedure to Examine Acquisition Aberrations

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

Sampling head
- CH1 SELECT CHANNEL On/Off ..... On

11801/11802 Oscilloscope
- ENHANCED ACCURACY button ..... 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 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 with the top knob.

☐ Step 5: Press the AUTOSET button.

☐ Step 6: Touch the horizontal icon, and then set the **Main Size** to 100 ns/div.

☐ Step 7: Set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 8: Touch the vertical icon, and then set the **Vert Offset:M1** so that the average of the top of the pulse from 100 ns after the step to the right edge of the screen is at the horizontal centerline.

☐ Step 9: Set the **Vert Size: M1** to 2 mV/div.

☐ Step 10: Touch **Vert Offset: M1** and then **Fine** in the **Numeric Entry & Knob Res** pop-up menu.

☐ Step 11: Set **Vert Offset: M1** so that the average of the top of the pulse from 100 ns after the step to the right edge of the screen is at the horizontal centerline.

☐ Step 12: *Examine* that the magnitude of the maximum positive and negative aberration occurring 100ns after the step is $\leq$0.75 vertical divisions from the horizontal centerline (0.6% of the step amplitude).

☐ Step 13: Touch the horizontal icon, and then set the **Main Size** to 10 ns/div.

☐ Step 14: Set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 15: *Examine* that the magnitude of the maximum positive and negative aberration occurring 5 ns to 100 ns after the step is $\leq$1.5 vertical divisions from the horizontal centerline (1.2% of the step amplitude).

☐ Step 16: Set the **Main Size** to 500 ps/div and then the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 17: *Examine* that the magnitude of the maximum positive and negative aberration occurring 300 ps to 5 ns after the step is $\leq$5.0 vertical divisions from the horizontal centerline (4.0% of the step amplitude).

☐ Step 18: Touch the horizontal icon, and then set the **Main Size** to 500 ns/div.

☐ Step 19: Touch the vertical icon, and then set the **Vert Size:M1** to 10 mV/div.

☐ Step 20: Set the **Vert Offset:M1** so that the average of the top of the pulse from 100 ns after the step to the right edge of the screen is at the horizontal centerline.

☐ Step 21: Touch the horizontal icon, and then set the **Main Size** to 50 ps.

☐ Step 22: Set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 23: *Examine* that the magnitude of the maximum positive aberration occurring in the first 300 ps after the step is ≤3.0 vertical divisions from the horizontal centerline (12% of the step amplitude).

☐ Step 24: *Examine* that the magnitude of the maximum negative aberration occurring in the first 300 ps after the step is ≤1.75 vertical divisions from the horizontal centerline (7% of the step amplitude).

☐ Step 25: Touch the **Main Pos** selector and then **Set to Min** in the **Numeric Entry and Knob Res** pop-up menu.

☐ Step 26: Set the **Main Size** to 10 ns/div.

☐ Step 27: Touch the vertical icon, and then set **Vert Offset:M1** so that the average of the bottom of the pulse 10 ns before the step is at the horizontal centerline.

☐ Step 28: Touch the horizontal icon, and then set the **Main Size** to 1 ns/div.

☐ Step 29: Set the **Main Pos** so that the rising edge of the step is at the right-most edge of the screen.

☐ Step 30: *Examine* that the magnitude of the maximum positive and negative aberration occurring 10 ns to 500 ps before the 10% point of the step is ≤1.0 vertical divisions from the horizontal centerline (4% of the step amplitude)

☐ Step 31: Set the **Main Size** to 50 ps/div and then the **Main Pos** so that the rising edge of the step is at the right-most edge of the screen.

☐ Step 32: *Examine* that the magnitude of the maximum positive and negative aberration occurring 500 ps to 20 ps before the 10% point of the step is ≤1.0 vertical divisions from the horizontal centerline (4% of the step amplitude)

☐ Step 33: Repeat steps 2 through 32 for channel 2.

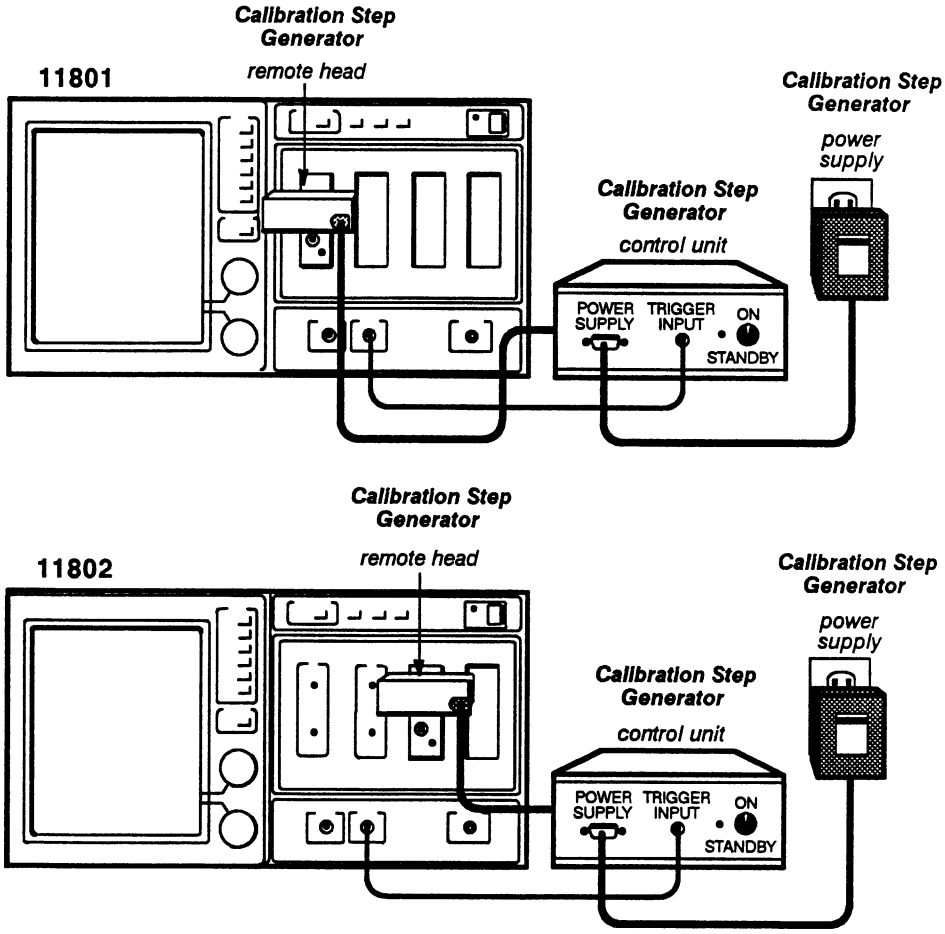
Part 7 Coincidence Between Channels

This part shows the setup and lists the procedures to check the coincidence between channels.

Specifications

The specification for the coincidence between channels is 10 ps.

Setup to Check Coincidence Between Channels



Setup to Check Coincidence Between Channels

Procedure to Check Coincidence Between Channels

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

Sampling head

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

11801/11802 Oscilloscope
ENHANCED ACCURACY button ..... 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: Touch **Main Record Length**, and then set **Main Record Len** to 1024 with 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 64 with the top knob.

☐ Step 8: Disconnect the calibration step generator remote head from CH 1, connect it to CH 2, and then press the CH 2 SELECT CHANNEL On/Off button.

☐ Step 9: Press AUTOSET.

☐ Step 10: Select the horizontal icon, and then set the **Main Size** to 10 ps/div.

☐ Step 11: Touch **Acquire Desc**, and then set **Average N** to **On** in the **Acquire Description** pop-up menu.

☐ Step 12: Touch **Exit**.

☐ Step 13: Set the **Main Pos** so that the step is approximately centered on the screen.

☐ Step 14: Press the STORE/RECALL button.

☐ Step 15: Touch **Trace 2** in the **Store Trace** pop-up menu.

☐ Step 16: Touch **Recall Trace** in the STORE/RECALL major menu.

☐ Step 17: Touch **STO 1** in the **Recall Stored Trace** pop-up menu.

☐ Step 18: Disconnect the calibration step generator remote head from CH 2, connect it to CH 1, and then press the CH 1 SELECT CHANNEL On/Off button.

☐ Step 19: Press the MEASURE button.

☐ Step 20: Touch **Measurements** and then **Prop Delay** in the **Measurements** pop-up menu.

☐ Step 21: Touch **Prop Delay** in the MEASURE major menu and then **Trace 3** in the **Prop Delay** pop-up menu.

☐ Step 22: *Check* that the magnitude of the **Prop Delay** is $\leq$10 ps.

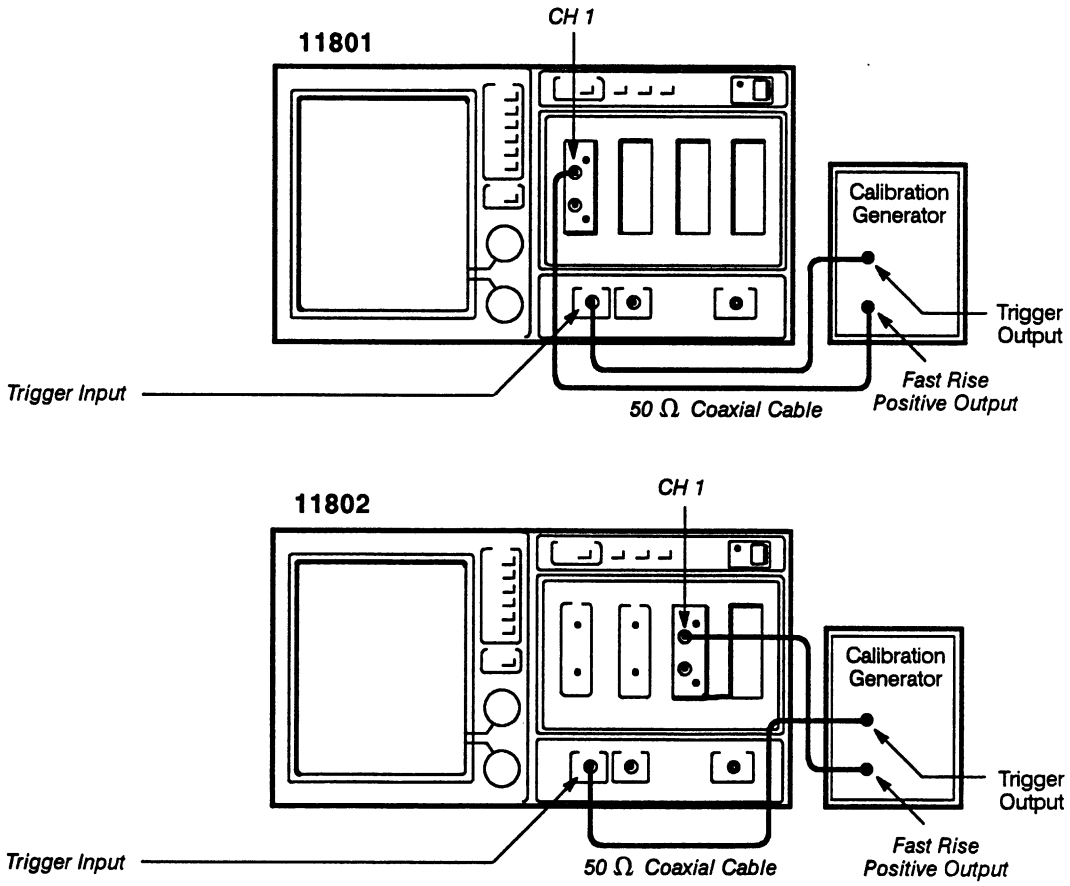
Part 8 Maximum Signal Voltage

This part shows the setup and lists the procedure to examine the maximum signal voltage.

Measurement Limit

The measurement limit for the maximum signal voltage is 1% of the step amplitude.

Setup to Examine Maximum Signal Voltage



Setup to Examine Maximum Signal Voltage

Procedure to Examine Maximum Signal Voltage

☐ Step 1: nitialize the oscilloscope settings, then make the following settings in the order listed:

Sampling head
CH 1 SELECT CHANNEL On/Off ..... On
11801/11802 Oscilloscope
ENHANCED ACCURACY button ..... press
Calibrate All pop-up menu ..... **Recall Defaults**
TRIGGER button ..... press
Slope ..... -
Main Size ..... 5 µs/div
Calibration generator
Amplitude ..... maximum amplitude
Period ..... 10 µs
Var adjustment ..... mid range

☐ Step 2: Touch the vertical icon, and then set the **Vert Offset: M1** so that the waveform is vertically centered on the screen.

☐ Step 3: Set the calibration generator's amplitude so that it displays a 1 V peak-to-peak square wave.

☐ Step 4: Touch the horizontal icon, and then set the **Main Size** to 500 ns/div.

☐ Step 5: Set the **Main Pos** so that the positive-going step is near the left-most edge of the screen (within 1/2 division).

☐ Step 6: Press the WAVEFORM button.

☐ Step 7: Touch **Acquire Desc**, and then set **Average N** to **On** in the **Acquire Description** pop-up menu.

☐ Step 8: Touch **Set Avg N**,and then set **Average N** to 128 with the top knob.

☐ Step 9: Touch the vertical icon, and then set the **Vert Offset: M1** so that the average of the top of the pulse 500 ns after the step is on the horizontal centerline.

☐ Step 10: Set **Vert Size:M1** to 5 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 500 ns after the step is on the horizontal centerline.

☐ Step 13: Set the **Main Size** to 200 ns/div.

☐ Step 14: *Examine* that the magnitude of the maximum positive and negative aberration from 200 ns to 800 ns from the rising edge of the step is $\leq$2 vertical divisions from the horizontal centerline (1% of the step amplitude).

☐ Step 15: Touch the horizontal icon, and then set the **Main Size** to 20 ns/div.

☐ Step 16: Set the **Main Pos** so that the step is near the left-most edge of the screen (within 1/2 division)

☐ Step 17: *Examine* that the magnitude of the maximum positive and negative aberration from 10 ns to 200 ns from the rising edge of the step is $\leq$2 vertical divisions from the horizontal centerline (1% of the step amplitude).

☐ Step 18: Repeat all of Part 8 for CH 2.

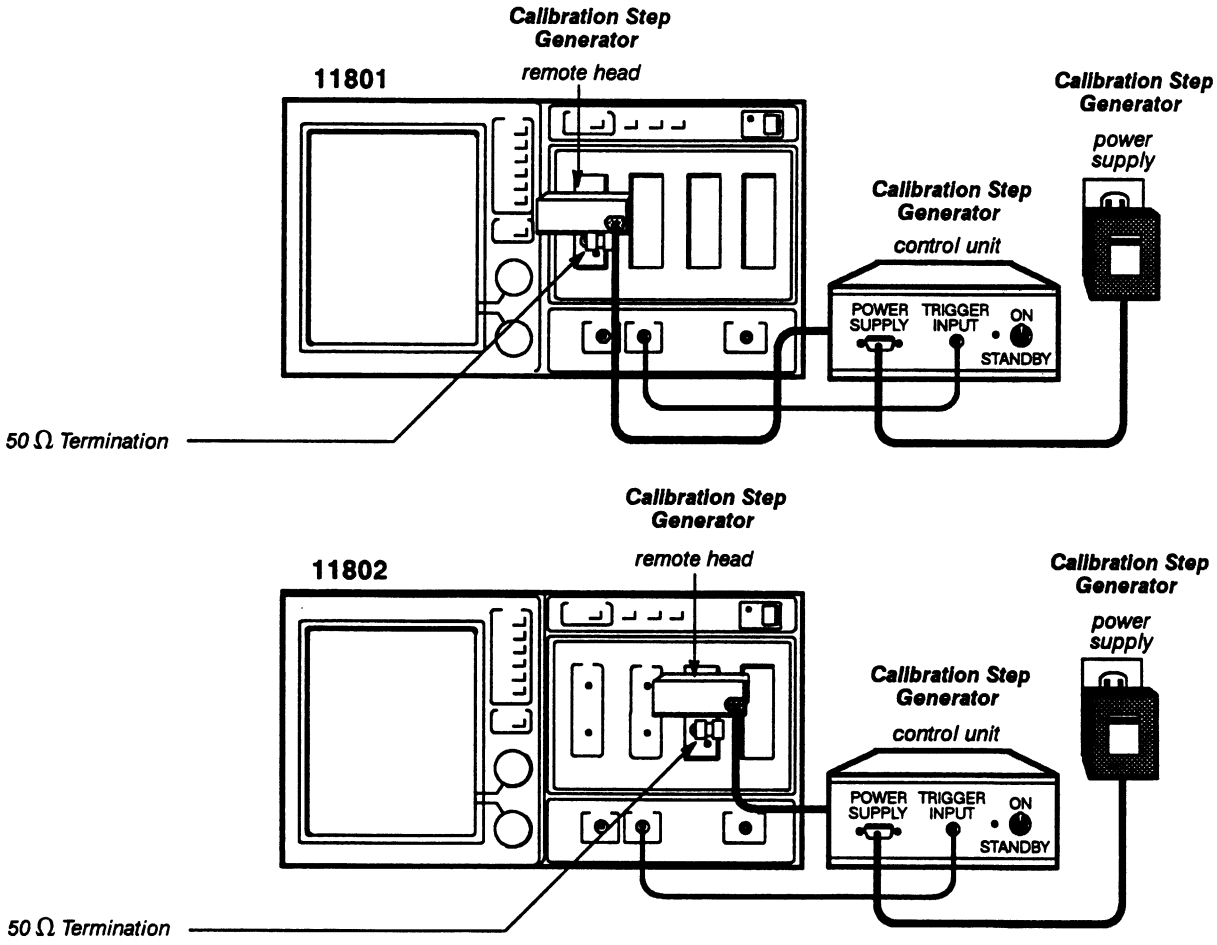
Part 9
Isolation Between Channels

This part shows the setup and lists the procedures to check the isolation between channels.

Specifications

The measurement limit for the isolation between channels is 1%.

Setup to Check Isolation Between Channels



Setup to Check Isolation Between Channels

Procedure to Check Isolation Between Channels

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

Sampling head

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

11801/11802 Oscilloscope
ENHANCED ACCURACY button ..... 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: Touch the horizontal icon, and then set the **Main Size** to 200 ps/div.

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

☐ Step 5: Touch **Main Record Length,** and then set **Main Record Len** to 1024 with 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** in the **Acquire Description** pop-up menu.

☐ Step 8: Set **Average N** to 1024 with the top knob.

☐ Step 9: Press the CH 2 SELECT CHANNEL button on the sampling head.

☐ Step 10: Touch the vertical icon, and then set the **Vert Size: M2** to 2 mV/div.

☐ Step 11: Touch **Acquire Desc** in the WAVEFORM major menu, and then set **Average N** to **On**.

☐ Step 12: Wait until the **Acquire Desc** selector in the WAVEFORM major menu shows that 1024 averages have been completed.

☐ Step 13: Touch the MEASURE button.

☐ Step 14: Touch **Measurements** and then **Peak-Peak** in the **Measurements** pop-up menu.

☐ Step 15: Record the CH 2 **Peak-Peak** measurement for later use.

☐ Step 16: Press the CH 1 SELECT CHANNEL button.

☐ Step 17: Touch **Measurements** and then **Peak-Peak** in the **Measurements** pop-up menu.

☐ Step 18: Record the CH 1 **Peak-Peak** measurement for later use.

☐ Step 19: *Check* that (CH 2 **Peak-Peak**/CH 1 **Peak-Peak**) $\times 100\% \leq 1\%$.

☐ Step 20: Disconnect the calibration step generator remote head from CH 1 and the 50 Ω termination from CH 2. Connect the calibration step generator to CH 2, connect the 50 Ω termination to CH 1, and then press the CH 2 SELECT CHANNEL On/Off button.

☐ Step 21: Press the AUTOSET button.

☐ Step 22: Touch the horizontal icon, and then set the **Main Size** to 200 ps/div.

- ☐ Step 23: Press the CH 1 SELECT CHANNEL button.
- ☐ Step 24: Press the AUTOSET button.
- ☐ Step 25: Press WAVEFORM button.
- ☐ Step 26: Wait until the **Acquire Desc** selector in the WAVEFORM major menu shows that 1024 averages have been completed.
- ☐ Step 27: Press the MEASURE button.
- ☐ Step 28: Touch **Measurements** and then **Peak-Peak** in the **Measurements** pop-up menu.
- ☐ Step 29: Record the CH 1 **Peak-Peak** measurement for later use.
- ☐ Step 30: Press the CH 2 SELECT CHANNEL button.
- ☐ Step 31: Record the CH 2 **Peak-Peak** measurement for later use.
- ☐ Step 32: *Check* that (CH 1 **Peak-Peak**/CH2 **Peak-Peak**) $\times$ 100% $\leq$1%.

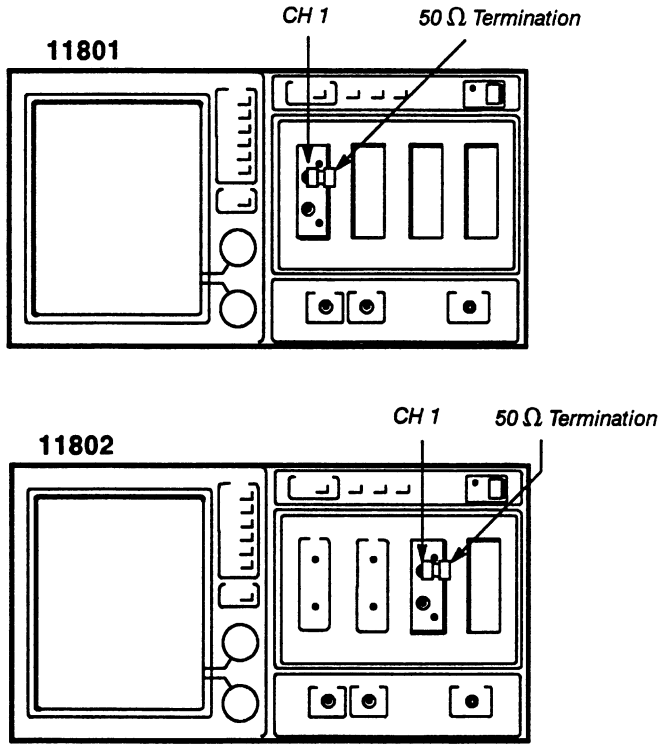
Part 10
Output Amplitude

This part shows the setup and lists the procedures to check the output amplitude.

Specifications

The specification for the output amplitude is 250 mV ±5 mV.

Setup to Check Output Amplitude



Setup to Check Output Amplitude

Procedure to Check Output Amplitude

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

Sampling head
CH 1 SELECT CHANNEL On/Off ..... On
11801/11802 Oscilloscope
ENHANCED ACCURACY button ..... press
Calibrate All pop-up menu ..... **Recall Defaults**
TRIGGER button ..... press
Source ..... **Internal Clock**

☐ 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 64 with the top knob.
- ☐ Step 5: Touch **Sampling Head Fnc's** in the WAVEFORM major menu, and then set the CH1 **TDR** to **On**.
- ☐ Step 6: Press the AUTOSET button.
- ☐ Step 7: Touch the horizontal icon, and then set the **Main Size** to 100 ns/div.
- ☐ Step 8: Touch **Main Pos** and then **Min** in **Main Pos** pop-up menu.
- ☐ Step 9: Press the ENHANCED ACCURACY button, and then touch **TDR Amplitude**.
- ☐ Step 10: Touch **Automatic Calibrate** and then **Proceed** in the **TDR Amplitude** pop-up menu.
- ☐ Step 11: Touch **Cursors** at the top of the screen.
- ☐ Step 12: Touch **Cursor Type** and then **Horizontal Bars**.
- ☐ Step 13: Touch **Exit** to exit this menu.
- ☐ Step 14: Set **Cursor 1** (top knob) to the average of the base of the pulse.
- ☐ Step 15: Set **Cursor 2** to the average of the top of the pulse 100 ns after the step.
- ☐ Step 16: *Check* that **ΔV** is 250 mV ±5 mV.
- ☐ Step 17: Press the WAVEFORM button.
- ☐ Step 18: Touch **Sampling Head Fnc's**, and then set the **TDR Polarity** to **-** in the **Sampling Head Functions** pop-up menu.
- ☐ Step 19: Touch **Exit** to exit this menu.
- ☐ Step 20: Touch the vertical icon and set the **Vert Offset: M1** so that the step is centered on the screen.
- ☐ Step 21: Touch **Cursors** at the top of the screen.
- ☐ Step 22: Set **Cursor 1** (top knob) to the average of the base of the pulse.
- ☐ Step 23: Set **Cursor 2** to the average of the top of the pulse 100 ns after the step.
- ☐ Step 24: *Check* that ΔV is -250 mV ±5 mV.
- ☐ Step 25: Repeat all of Part 10 for CH 2.

Part 11 TDR Aberrations

This part shows the setup and lists the procedures to check the TDR aberrations.

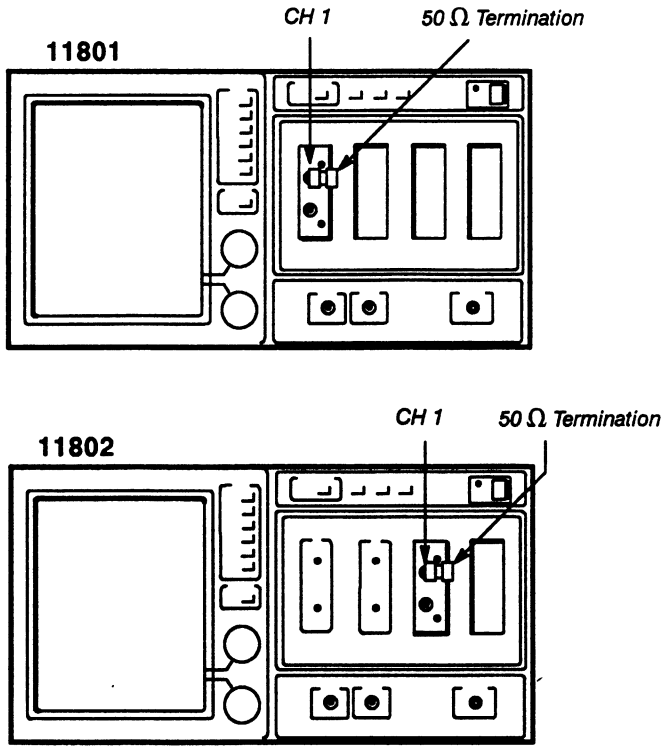
Specifications

The specifications for TDR aberrations are listed in Table 2-4, Aberrations Specifications.

Table 2-4 – Aberrations Specifications

Time Difference from the Rising Edge of Waveform	Minimum Specification	Measurement Limit
0 to 300 ps		- 5% ≤ aberration % ≤15%
300 ps to 5 ns	- 3% ≤ aberration % ≤3%	
5 ns and up	-1% ≤ aberration % ±1%	
-10 ns to -20 ps	-3% ≤ aberration % ≤3%	

Setup to Check TDR Aberrations



Setup to Check TDR Aberrations

Procedure to Check TDR Aberrations

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

Sampling head
CH1 SELECT CHANNEL On/Off ..... On
11801/11802 Oscilloscope
ENHANCED ACCURACY button ..... press
Calibrate All pop-up menu ..... **Recall Defaults**
TRIGGER button ..... press
Source ..... **Internal Clock**

☐ 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 with the top knob.

☐ Step 5: Touch **Sampling Head Fnc's** in the WAVEFORM major menu, and then set the CH 1 **TDR** to **On** in the **Sampling Head Functions** pop-up menu.

☐ Step 6: Press the ENHANCED ACCURACY button, and then touch **TDR Amplitude**.

☐ Step 7: Touch **Automatic Calibrate** and then **Proceed** in the **TDR Amplitude** pop-up menu.

☐ Step 8: Press the AUTOSET button.

☐ Step 9: Touch the horizontal icon, and then set the **Main Size** to 100 ns/div.

☐ Step 10: Set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 11: Touch the vertical icon, and then set the **Vert Offset:M1** so that the average of the top of the pulse 100 ns after the step is at the horizontal centerline.

☐ Step 12: Set the **Vert Size: M1** to 2 mV/div.

☐ Step 13: Touch **Vert Offset: M1** and then **Fine** in the **Numeric Entry & Knob Res** pop-up menu.

☐ Step 14: Set **Vert Offset: M1** so that the average of the top of the pulse 100 ns after the step is at the horizontal centerline.

☐ Step 15: Touch the horizontal icon, and then set the **Main Size** to 10 ns/div.

☐ Step 16: Set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 17: *Check* that the magnitude of the maximum positive and negative aberration occurring 5 ns after the step to the right edge of the screen is $\leq$1.25 vertical divisions from the horizontal centerline (1% of the step amplitude).

☐ Step 18: Set the **Main Size** to 500 ps/div, and then set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 19: *Check* that the magnitude of the maximum positive and negative aberration occurring 300 ps to 5 ns after the step is $\leq$3.75 vertical divisions from the horizontal centerline (3% of the step amplitude).

☐ Step 20: Touch the horizontal icon, and then set the **Main Size** to 500 ns/div.

☐ Step 21: Touch the vertical icon, and then set the **Vert Size:M1** to 10 mV/div.

☐ Step 22: Set the **Vert Offset:M1** so that the average of the top of the pulse 100 ns after the step is at the horizontal centerline.

☐ Step 23: Touch the horizontal icon, and then set the **Main Size** to 50 ps/div.

☐ Step 24: Set the **Main Pos** so that the rising edge of the step is at the left-most edge of the screen.

☐ Step 25: *Examine* that the magnitude of the maximum positive aberration occurring in the first 300 ps after the 90% point of the step is $\leq$3.75 vertical divisions from the horizontal centerline (15% of the step amplitude).

☐ Step 26: *Examine* that the magnitude of the maximum negative aberration occurring in the first 300 ps after the 90% point of the step is ≤1.25 vertical divisions from the horizontal centerline (5% of the step amplitude).

☐ Step 27: Set the **Main Size** to 2 ns/div.

☐ Step 28: Touch the **Main Pos** selector and then **Set to Min** in the **Numeric Entry and Knob Res** pop-up menu.

☐ Step 29: Touch the vertical icon, and then set **Vert Offset:M1** so that the average of the bottom of the pulse 10 ns before the step is at the horizontal centerline.

☐ Step 30: Touch the horizontal icon, and then set the **Main Size** to 1 ns/div.

☐ Step 31: Set the **Main Pos** so that the rising edge of the step is at the right-most edge of the screen.

☐ Step 32: *Check* that the magnitude of the maximum positive and negative aberration occurring 10 ns to 500 ps before the 10% point of the step is ≤1.0 vertical divisions from the horizontal centerline (4% of the step amplitude).

☐ Step 33: Set the **Main Size** to 50 ps/div and then the **Main Pos** so that the rising edge of the step is at the right-most edge of the screen.

☐ Step 34: *Check* that the magnitude of the maximum positive and negative aberration occurring 500 ps to 20 ps before the 10% point of the step is ≤1.0 vertical divisions from the horizontal centerline (4% of the step amplitude)

☐ Step 35: Press the WAVEFORM button.

☐ Step 36: Touch **Sampling Head Fnc's**, and then set the **TDR Polarity** to - in the **Sampling Head Functions** pop-up menu.

☐ Step 37: Repeat Steps 2 through 36.

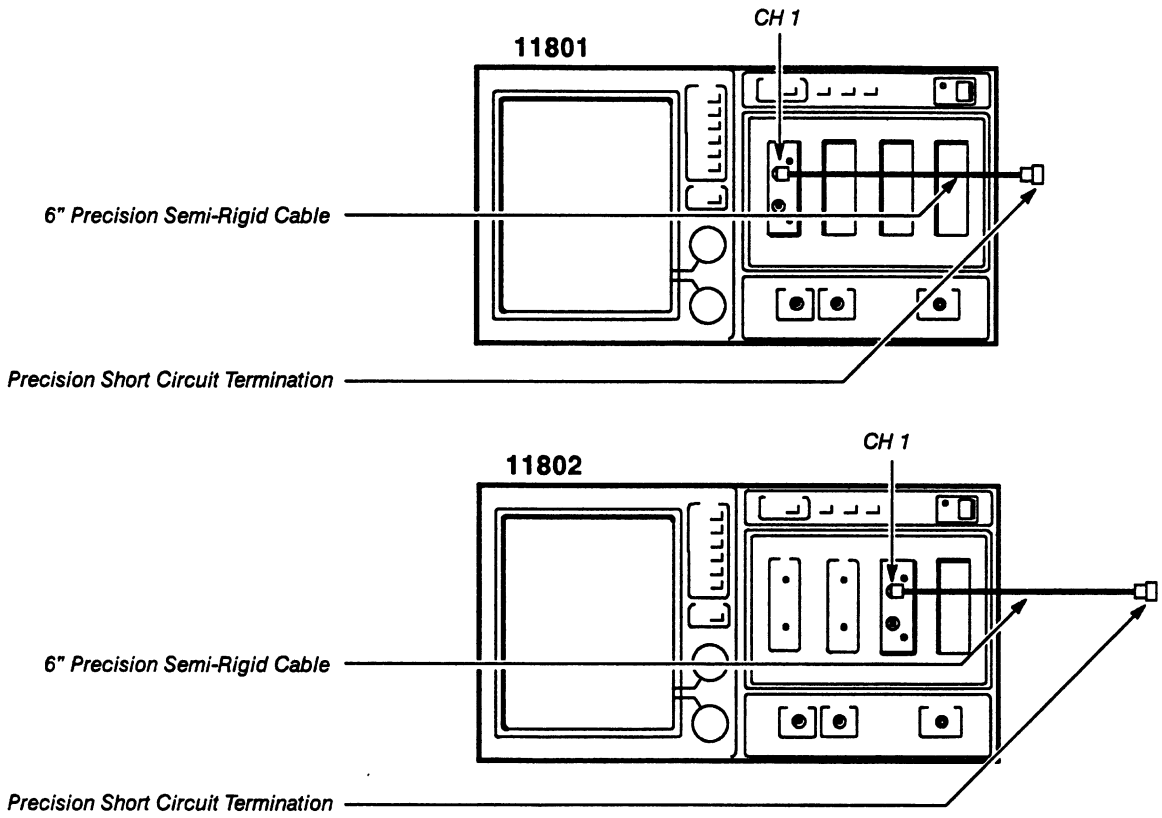
Part 12
Reflected Rise Time

This part shows the setup and lists the procedures to check the reflected rise time.

Specifications

The specification for the reflected rise time is 35 ps.

Setup to Check Reflected Rise Time



Setup to Check Reflected Rise Time

Procedure to Check Reflected Rise Time

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

Sampling head
CH 1 SELECT CHANNEL On/Off ..... On
11801/11802 Oscilloscope
ENHANCED ACCURACY button ..... press
Calibrate All pop-up menu ..... **Recall Defaults**
TRIGGER button ..... press
Source ..... **Internal Clock**

- ☐ 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 with the top knob.
- ☐ Step 5: Touch **Sampling Head Fnc's** from the WAVEFORM major menu, and then set the CH1 **TDR** to **On**.
- ☐ Step 6: Press the AUTOSET button.
- ☐ Step 7: Touch the horizontal icon, and then set the **Main Size** to 5 ns/div.
- ☐ Step 8: Touch the **Main Pos** selector and then **Set to Min** in the **Numeric Entry and Knob Res** pop-up menu.
- ☐ Step 9: Press the MEASURE button, and then touch **Measurements**.
- ☐ Step 10: Touch **Fall** in the **Measurements** pop-up menu and then **Fall** in the MEASURE major menu.
- ☐ Step 11: Set **Tracking** to **Off**, and then touch **Topline** in the **Fall** pop-up menu.
- ☐ Step 12: Touch **Topline** in the MEASURE major menu and then **Fine** in the **Numeric Entry & Knob Res** pop-up menu.
- ☐ Step 13: Set the **Topline** (top knob) so that it is 250 mV above the **Baseline**.
- ☐ Step 14: Touch the horizontal icon, and then set the **Main Pos** so that the reflection step is at the left-most edge of the screen.
- ☐ Step 15: Set the **Main Size** to 20 ps/div and then the **Main Pos** to center reflection step on the screen.
- ☐ Step 16: *Check* that **Fall** (reflected rise time) is $\leq$35 ps.
- ☐ Step 17: Press the WAVEFORM button.
- ☐ Step 18: Touch **Sampling Head Fnc's**, and then set the **TDR Polarity** to - in the **Sampling Head Functions** pop-up menu.
- ☐ Step 19: Touch **Exit**.
- ☐ Step 20: Repeat Steps 6 through 16 for a negative TDR pulse. Note that all **Fall** selections must be replaced with **Rise** selections for a negative TDR pulse.
- ☐ Step 21: Repeat steps 2 through 20 for channel 2.

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 or forestall the breakdown of the oscilloscope or sampling head and may improve reliability. The severity of the environment to which the sampling head is subjected determines the frequency of maintenance.

Exterior – loose dust accumulated on the outside of the oscilloscope or sampling head can be removed with a soft cloth or small brush. The brush is particularly useful for dislodging dirt in and around the sampling head connector and front-panel switches.

Periodic Electrical Checks

To ensure accurate measurements, perform periodical electrical checks on the oscilloscope 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

CAUTION

Static discharge can damage any semiconductor component in the oscilloscope or sampling head.

The oscilloscope 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 and store the sampling heads in their original containers on a metal surface, or conductive foam. Transport the sampling heads with short circuit terminations on the inputs. 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 work station by qualified service personnel. We recommend the use of the static control mat and wrist strap.
- ☐ Step 4: Allow nothing capable of generating or holding a static charge on your work station surface.

☐ 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 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 Ω.)

Exchanging Sampling Heads

If a sampling head does not pass any of the parts in Section 2, Checks and Adjustments, of this manual, then it may be exchanged for a new sampling head.

Sampling head exchanges can be made with either your local Tektronix service center or with 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 oscilloscope ON/STANDBY switch to STANDBY and remove the sampling head from the oscilloscope before removing or replacing the internal circuitry.

Perform the following procedures to remove and replace the internal circuitry in the sampling head.

- ☐ Step 1: Remove the SELECT CHANNEL On/Off button by gently pulling on the plastic cap with a small needle-nose pliers.
- ☐ Step 2: Remove the three small Pozidrive screws on each side of the sampling head's casing (see Fig. 3-1).
- ☐ Step 3: Remove the front panel and the casing from the internal circuitry.
- ☐ Step 4: Install the internal circuitry into the gray shipping casing.
- ☐ Step 5: Return the internal circuitry (the circuit board and attached carrier) for sampling head exchange or repair.
- ☐ Step 6: To replace the internal circuitry, follow the removal procedures in reverse order.

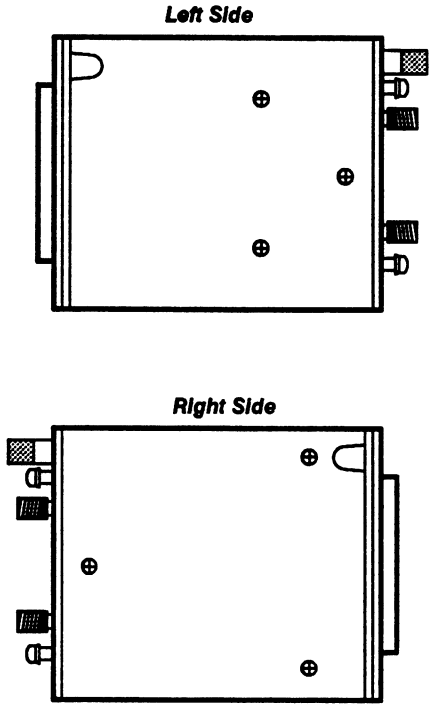


Figure 3-1 *—Sampling Head Screw Locations*

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 and an SD-24 TDR/Sampling Head, is necessary to perform this procedure:

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

Procedure to Change the Sampling Head Identification Number:

☐ Step 1: With the oscilloscopes PRINCIPAL POWER SWITCH set to OFF, install one of the black, plastic short-circuit jumpers across the two J860 pins on the A5 Time Base Controller Board. These 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 oscilloscope, and can be accessed once the bottom panel is removed. Refer to the *11801 or 11802 Digital Sampling Oscilloscope Service Reference* manual under Section 3, Maintenance for more information on accessing this board. See Figure 3-2 for the location of jumper J860.

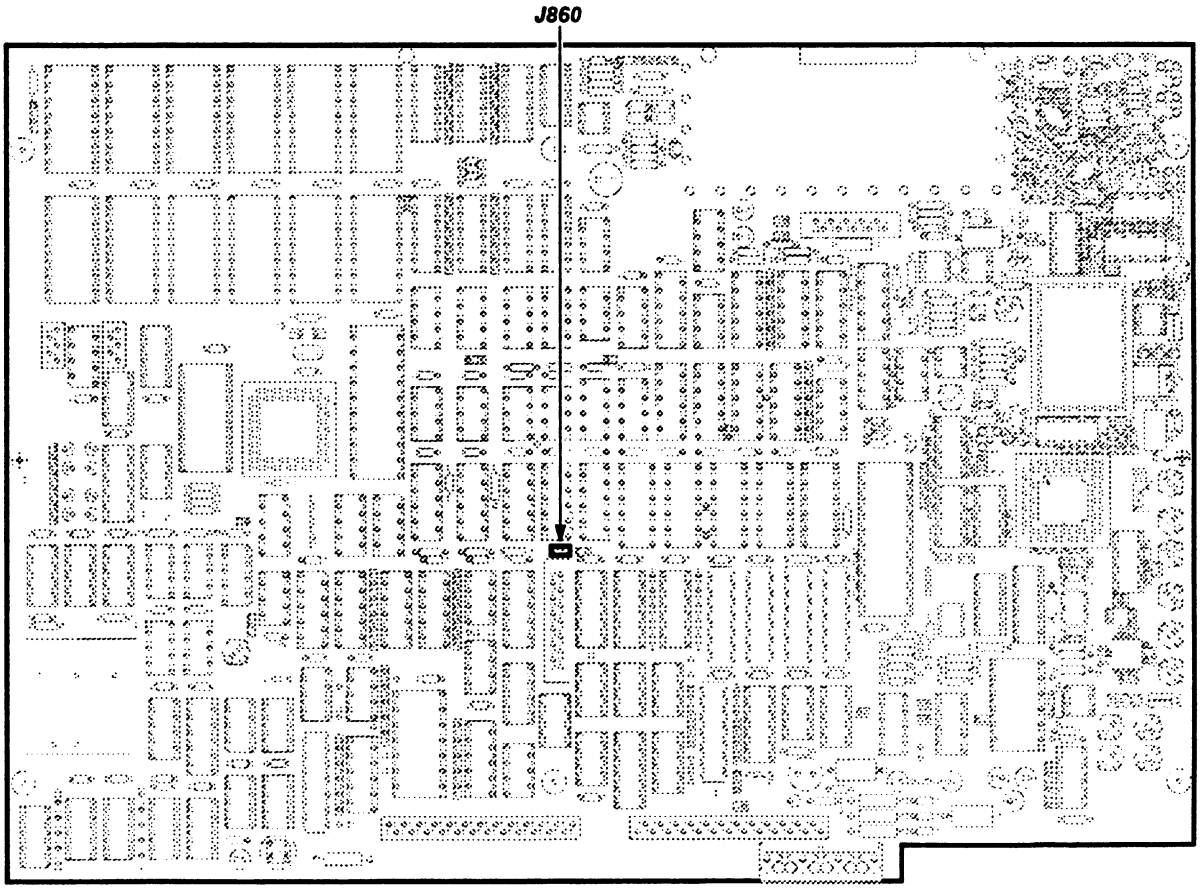


***Figure 3-2** — A5 Time Base Controller Board Jumper Location*

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

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

☐ Step 4: Install the SD-24 TDR/Sampling Head in any sampling head compartment in the oscilloscope.

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

☐ Step 9: Insert the Sampling Head Utility Software floppy disk (provided in the front of this manual) into the "A" drive of the system controller.

☐ 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 mainframe sampling head number, the 11802 Oscilloscope only has head number 1 and head number 2. The 11801 Oscilloscope has head number 1 through head number 4. The head numbers correspond to the sampling head compartments, and these numbers 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 oscilloscope 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 touch **Identify**.

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

☐ Step 15: Remove the black plastic jumper J860 that was installed in Step 1.

Theory of Operation

The SD-24 TDR/Sampling Head is a two-channel, 17.5 ps rise time sampling head. Each channel is also capable of generating its own Time Domain Reflectometry (TDR) output pulse.

When used in the acquisition mode (that is, with the TDR step generator turned off) each channel functions as a normal sampling input. Both channels are strobed simultaneously from a single strobe generator contained within the sampling head, so time coincidence between the two channels is stable. Loop gain and zeroing can be calibrated electronically by the oscilloscope with some user interaction.

In the TDR mode, a fast rise time step is generated internally for each channel and applied to the input signal path for that channel. The acquisition portion of the sampling head is still functional for monitoring the primary pulse and its reflected components. The sampling head provides two self contained TDR channels. The polarity of the output pulse can be selected independently for each channel. This allows differential or common mode testing of two coupled lines as well as independent testing of isolated lines.

System Functional Overview

This section describes and illustrates the major functional blocks of the SD-24 TDR/Sampling Head (see Fig. 4-1).

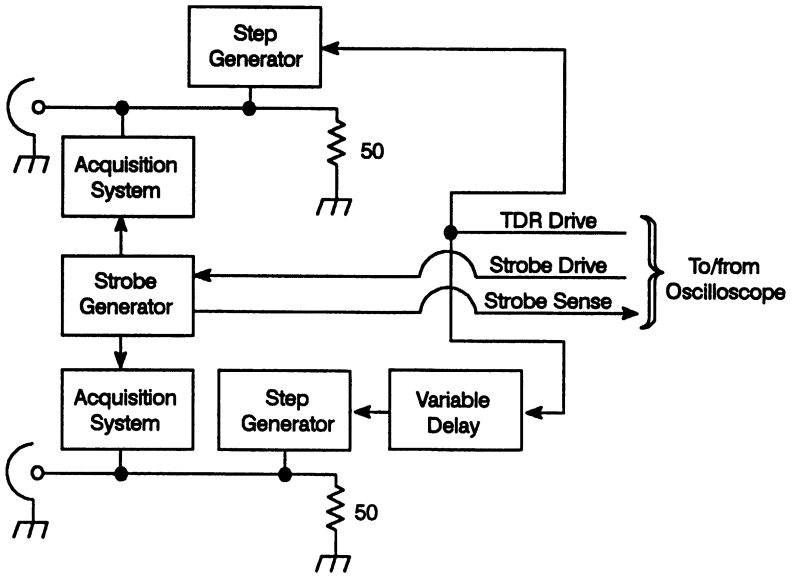


Figure 4-1 *— SD-24 TDR/Sampling Head Block Diagram*

The SD-24 TDR/Sampling Head has two independent channels; each has its own acquisition and step generation circuitry. The strobe drive signal from the oscilloscope controls the timing of the strobe assertion to each acquisition system. The strobe generator in the sampling head is common to both channels, guaranteeing sampling coincidence between the two channels.

The step generators can assert a negative-going or positive-going step independently. Using both channels, you can perform differential and common mode TDR and two-port, time-domain network analysis.

The TDR drive pulse triggers the internal step generators to assert either the positive or negative transition of the TDR step signal.

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

The acquisition rise time is 17.5 ps or less. The displayed TDR incident rise time is 28 ps or less. The combined acquisition rise time is 28 ps or less.To ensure proper timing between the two step outputs, the second channel is equipped with a variable delay.

TDR Step Generation

The step generator circuitry consists fundamentally of an adjustable current source and a diode switch. Initially, before the step, the diode switch is biased to conduct current to the output. When the diode switch opens, the step occurs. Figure 4-2 shows the switch and the current source.

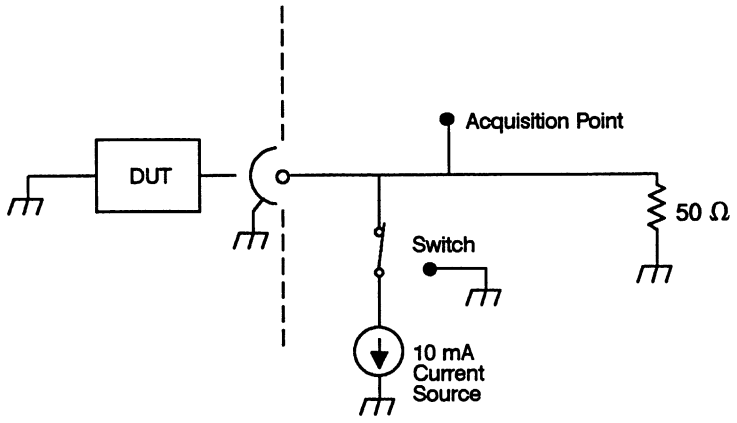


***Figure 4-2** — Step Generator Simplified Schematic Diagram*

Because of architecture of the step generator, the output voltage of the step depends on the DC resistance to ground of the device under test (DUT).

Operation With a Short Circuit

Initially, the diode switch is conducting -10 mA. When the step generator output is shorted, the resistance to ground is 0 Ω and the output voltage is 0 V (see 1 in Fig. 4-3).

When the diode switch opens (reverse-biased), apparent resistance to ground at the acquisition point (and at the channel connector) is 25 Ω: because the internal termination resistance is in parallel with the 50 Ω connector impedance (that is, (50 Ω × 50 Ω)/(50 Ω + 50 Ω) =25 Ω). The voltage at the acquisition point rises to +250 mV (see 2 in Fig. 4-3).

However, as soon as the transition propagates to the short in the DUT, the termination resistance is 0 Ω and the voltage level returns to 0 V. The time displayed from the first transition to the second transition is the propagation time for a signal to travel from the acquisition point to the short in the DUT and then back to the acquisition point.

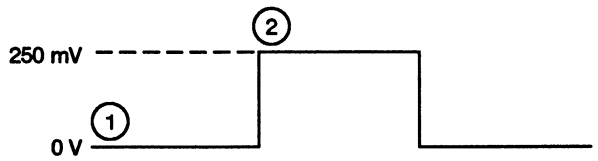


***Figure 4-3** — Step Generator With a Shorted Output*

Operation With a 50 Ω Load

Initially, the diode switch is conducting. When the step generator output is connected to a 50 Ω load, the resistance to ground at the acquisition point is 25 Ω: because the internal 50 Ω impedance is in parallel with the 50 Ω load (and again, (50 Ω × 50 Ω)/(50 Ω + 50 Ω) =25 Ω)). The 10 mA current source supplies -250 mV to the acquisition point (see 1 in Fig. 4-4).

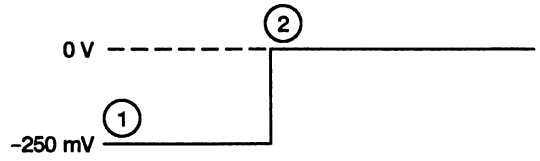


***Figure 4-4** — Step Generation With a 50 Ω Load*

When the diode switch opens (reverse-biased), the return path to ground is broken and the acquisition point rises to 0 V. The matched impedance allows the acquisition point to remain at 0 V (see 2 in Fig 4-4).

Operation With an Open Circuit

Initially, the diode switch is conducting. When the step generator output is open, the resistance to ground at the acquisition point is 50 Ω: because of the internal 50 Ω impedance. The -10 mA current source supplies -500 mV to the acquisition point, as an initial condition (see 1 in Fig. 4-5).

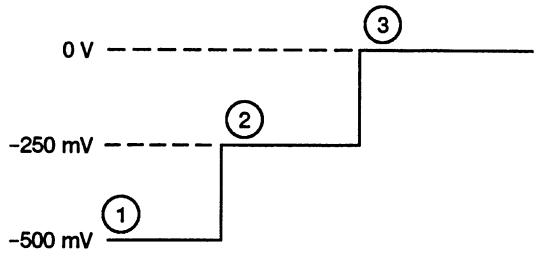


Figure 4-5 — Step Generation With a 50 Ω Load

When the diode switch opens (reverse-biased), apparent resistance to ground at the acquisition point (and at the channel connector) is 25 Ω, because the 50 Ω internal circuit impedance is in parallel with the 50 Ω connector impedance (that is, (50 Ω × 50 Ω)/(50 Ω + 50 Ω) =25 Ω). This causes the acquisition point to rise to -250 mV (see 2 in Fig. 4-5).

The transition propagates to the open in the DUT and is reflected back to the acquisition point, causing the voltage at the acquisition point to rise to 0 mV (see 3 in Fig. 4-5). At the acquisition point, the time displayed from the first step to the second step is the propagation time from the acquisition point to the open in the device under test and back.

TDR Amplitude

Using the SD-24 TDR/Sampling Head's internal step generator with the acquisition channel you can perform TDR measurements. You can also adjust the amplitude of the TDR step.

The TDR step amplitude setting is highly stable and insensitive to temperature variations. Usually, it is not necessary to adjust this parameter very frequently.

The SD-24 TDR/Sampling Head contains non-volatile memory that stores two values for the TDR amplitude adjustment: the factory default value and the user value.

Loop Gain

Loop gain determines the sampling head's ability to accurately follow an input voltage change that occurs between two adjacent samples. How accurately the sampling head output follows the input signal is termed as the dot transient response.

When loop gain is unity (1), the first sample value acquired after an input voltage change accurately reflects the voltage change, indicating a good dot transient response (see Fig. 4-6).

If loop gain is adjusted too low, then the value of first sample value acquired after an input voltage change will be between the value of the last sample and the new voltage.

If loop gain is adjusted too high, then the value of the first sample acquired after the input voltage change will be greater than the new voltage level.

Figure 4-6 shows the displayed trace results for the three loop gain conditions.

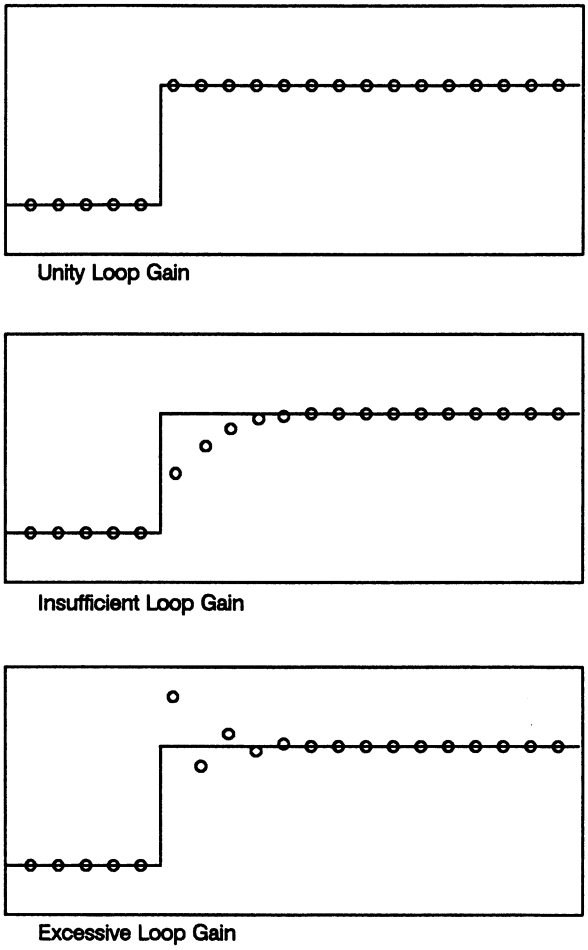


***Figure 4-6** — Displayed Trace With Three Loop Gain Settings*

Offset Null

The offset null adjustment removes unwanted DC offset that may be present in the sampling head. This adjustment effectively zeroes the sampling head so that an input signal with 0 V of amplitude delivers a 0 V output.

If offset null is not adjusted correctly, then measurements taken at the oscilloscope will be incorrect. The absolute voltage values for any cursors displayed on the trace will be incorrect as well.

Replaceable Parts

This section contains a list of the components that are replaceable for the SD-24 TDR/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 be come 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
- Intrument 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-24 TDR/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, extension BVJ5799.
- **Module Repair.** You may ship your module to us for repair, after which we will return it to you.
- **New Modules.** You may purchase new replacement modules in the same way as other replacement parts.

Using the Replaceable Parts List

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

Item Names

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

Indentation System

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

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 in dented to the right. Indented items are part of, and included with, the next higher indentation. Attaching parts must be purchased separately, unless otherwise specified.

Abbreviations

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

CROSS INDEX - MFR. CODE NUMBER TO MANUFACTURER

Mfr. Code	Manufacturer	Address	City, State, Zip Code
13047	MAURY MICROWAVE CORP	8610 HELMS AVE	CUCAMONGA CA 91730-4520
18203	ENGELMANN MICROWAVE DIV DIV OF KDI ELECTRONICS INC	60 S JEFFERSON RD	WHIPPANY NJ 07981-1001
20944	WILTRON CO	490 JARVIS DR	MORGAN HILL CA 95037-2809
80009	TEKTRONIX INC	14150 SW KARL BRAUN DR PO BOX 500	BEAVERTON OR 97077-0001
93459	WEINSCHEL ENGINEERING CO INC	1 WEINSCHEL LANE	GAITHERSBURG MD 20877
TK0435	LEWIS SCREW CO	4300 S RACINE AVE	CHICAGO IL 60609-3320
TK2270	HUBER AND SUHNER INC	500 WEST CUMMINGS PARK	WOBURN MA 01801

Fig. & Index No.	Tektronix Part No.	Serial/Assembly No. Effective	Dscont	Qty	12345 Name & Description	Mfr. Code	Mfr. Part No.
1-1	366-0673-00			2	KNOB:0.096 ID X 0.24 OD X 0.299 H	80009	366-0673-00
-2	334-7070-00			1	LABEL:FRONT PANEL	80009	334-7070-00
-3	333-3427-01			1	PANEL,FRONT: (ATTACHING PARTS)	80009	333-3427-01
-4	211-0087-01			3	SCREW,MACHINE:2-56 X 0.188,FLH,82 DEG,STL	TK0435	ORDER BY DESCR
-5	211-0088-00			3	SCREW,MACHINE:2-56 X 0.281,FLH,82 DEG,STL (END ATTACHING PARTS)	TK0435	ORDER BY DESCR
-6	380-0831-00			1	HSG,SMPLG HEAD:ALUMINUM	80009	380-0831-00
	657-0057-50	B010100	B020651	1	MODULAR KIT:SD24,EXCHANGE MODULAR ASSY	80009	657-0057-50
	657-0057-51	B020652		1	MODULAR ASSY:SD24,FIELD REPLACEABLE UNIT (EXCHANGE ITEM)	80009	657-0057-51
					STANDARD ACCESSORIES		
	015-1020-00			2	TERM,COAXIAL:SHORT CIRCUIT,SMA	18203	T182DS
	070-7052-00			1	MANUAL,TECH:USERS INSTALLATION,SD24	80009	070-7052-00
	070-7053-00			1	MANUAL,TECH:SERVICE REF,SD24	80009	070-7053-00
					OPTIONAL ACCESSORIES		
	011-0148-00			1	TERM,COAX:50+/-0.1 OHM,PRECISION 3.5MM,MALE ,26.5 GHZ	80009	011-0148-00
	011-0149-00			1	TERM,COAX:50 OHM,26.5 GHZ,PRECISION 3.5MM,F EMALE,CONNECTOR	20944	28KF50
	011-0150-00			1	TERM,COAX:SHORTING,40GHZ,APC,3.5MM	13047	360D
	011-0151-00			1	TERM,COAX:SHORTING,40GHZ,APC,3.5MM	13047	360B
	011-0152-00			1	ATTEN COAX:50 OHM,6DB,26.5GHZ	20944	41KB-6
	011-0153-00			1	ATTEN COAX:50 OHM,20DB,26.5GHZ	20944	41KB-20
	015-0549-00			1	ADPTR,ELEC:MALE TO FEMALE,SMA	93459	MODEL 1588
	015-0550-00			1	ADPTR,APC,ELEC:3.5MM,FEMALE TO FEMALE	13047	8021-A
	015-0551-00			1	ADPTR,APC,ELEC:3.5MM,MALE TO MALE	13047	8021B
	015-0552-00			1	ADPTR,APC,ELEC:3.5MM,MALE TO FEMALE	13047	8021C
	015-0553-00			1	ADPTR,SMA,ELEC:MALE TO FEMALE,SLIDE ON MALE	80009	015-0553-00
	015-0557-00			1	POWER DIVIDER:DC-26.5 GHZ,APC 3.5	20944	K240B
	015-0558-00			1	TERMINATOR,ELEC:10 X 20DB,DC TO 10 GHZ	80009	015-0558-00
	015-0561-00			1	CA DLY,COAX:50 OHM,4NS,W/CONN,SMA,MALE,EACH END	80009	015-0561-00
	015-0562-00			1	CA DLY,COAX:50 OHM,1NS,W/CONN,SMA,MALE,EACH END	TK2270	4114-23091010
	015-0563-00			1	CA DLY,COAX:50 OHM,2NS,W/CONN,APC 3.5MM,COM PATIBLE ,MALE ,EACH END	TK2270	4114-23182828
	015-0564-00			1	CA DLY,COAX:50 OHM,500PS,W/CONN,APC 3.5MM,C OMPATIBLE,MALE,EACH END,0.085 SEMI RIGID	20944	K120-6
	020-1693-00			1	COMPONENT KIT:	80009	020-1693-00
	067-1338-00			1	FIXTURE,CAL:11801,SAMPLING HEAD CAL UNIT (STANDARD)	80009	067-1338-00
	067-1338-01			1	FIXTURE,CAL:11801,SAMPLING HEAD CAL (EUROPEAN)	80009	067-1338-01
	067-1338-02			1	FIXTURE,CAL:11801,SAMPLING HEAD CAL (UNITED KINGDOM)	80009	067-1338-02
	067-1338-03			1	FIXTURE,CAL:11801,SAMPLING HEAD CAL (AUSTRALIAN)	80009	067-1338-03
	067-1338-05			1	FIXTURE,CAL:11801,SAMPLING HEAD CAL (SWISS)	80009	067-1338-05
	067-1338-06			1	FIXTURE,CAL:SAMPLING HEAD CAL UNIT,JAPANESE (JAPANESE)	80009	067-1338-06

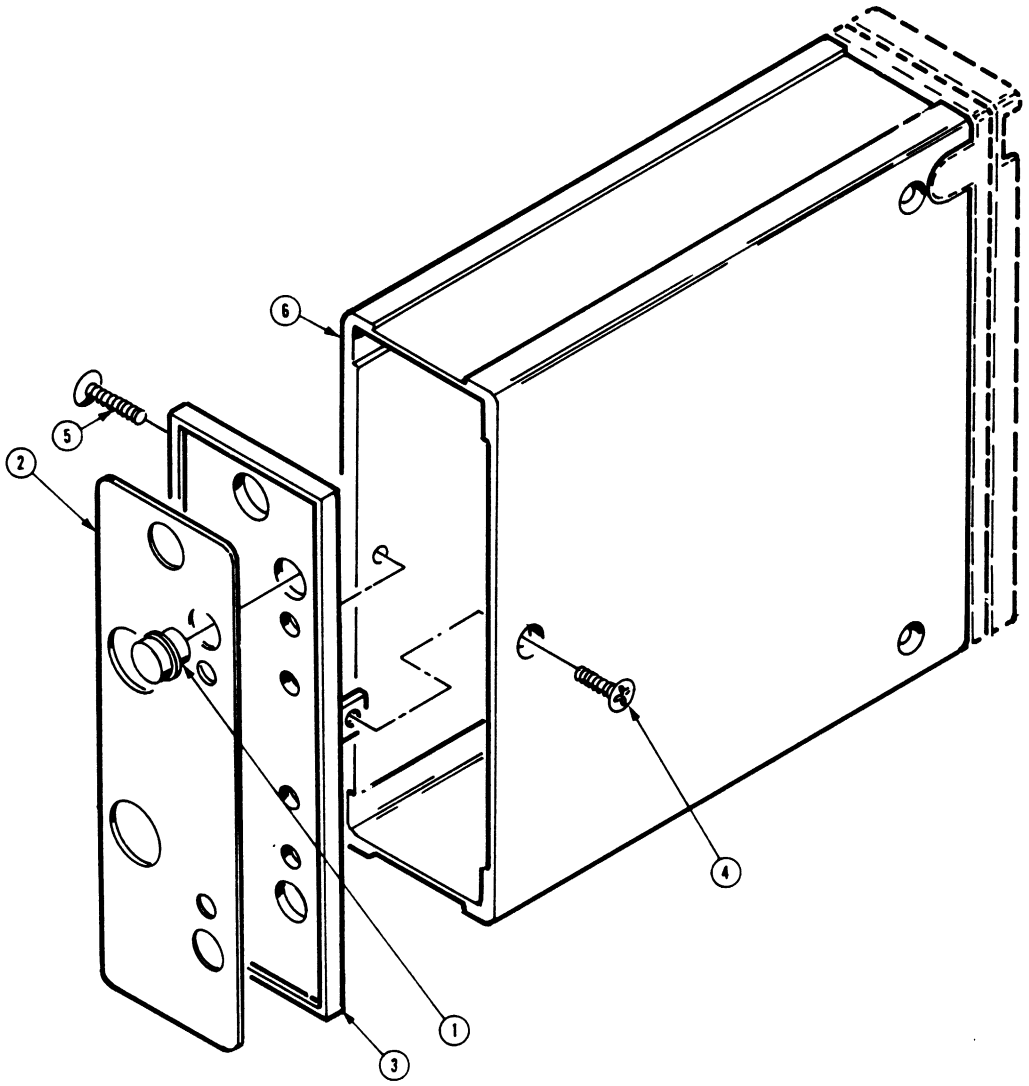


FIG. 1 EXPLODED
SD-24 Service Reference Manual

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

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