User Manual

Tektronix

HDST1
HD-SDI Stress Test Module

070-A880-51

www.tektronix.com

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General Safety Summary

Review the following safety precautions to avoid injury and prevent damage to this product or any products connected to it.

Only qualified personnel should perform service procedures.

To avoid potential hazards, use this product only as specified.

Injury Precautions

Avoid Electric Overload. To avoid electric shock or fire hazard, do not apply a voltage to a terminal that is outside the range specified for that terminal.

Product Damage Precautions

Do Not Operate With Suspected Failures. If you suspect there is damage to this product, have it inspected by qualified service personnel.

Symbols and Terms

Terms in this Manual. These terms may appear in this manual:

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

CAUTION. *Caution statements identify conditions or practices that could result in damage to this product or other property.*

Terms on the Product. These terms may appear on the product:

DANGER indicates an injury hazard immediately accessible as you read the marking.

WARNING indicates an injury hazard not immediately accessible as you read the marking.

CAUTION indicates a hazard to property including the product.

Symbols on the Product. The following symbols may appear on the product:

DANGER
High Voltage

Protective Ground
(Earth) Terminal

ATTENTION
Refer to Manual

Double
Insulated

Certifications and Compliances

Refer to the specifications section for a listing of certifications and compliances that apply to this product.

Preface

This manual describes the capabilities, specifications, operation, and installation of the HDST1 HD-SDI Stress Test module.

About This Manual

This manual is composed of the following sections:

- *Getting Started* contains product description, accessories list, and functional check procedure.
- *Operating Basics* tells how to control the HDST1 module through the windowed menu interface in conjunction with the front panel.
- *Syntax and Commands* defines the syntax used in command descriptions, list of all command subsystems, and describes all programming commands.
- *Appendices* provides additional information including the Specifications and hardware installation procedures.

Related Manuals

The following documents are also available.

- The *HDST1 HD-SDI Stress Test Module Service Manual* describes how to service the module. This optional manual must be ordered separately.
- The *TG2000 Signal Generation Platform User Manual* describes how to use the TG2000 Platform. It also contains information about SCPI commands, programming structure, and status and events for the platform. Some of this information applies to all generator modules, including the HDST1 module. This manual is a standard accessary to the TG2000 Platform mainframe.
- The *TG2000 Signal Generation Platform Service Manual* describes how to service the mainframe to the module level and provides general information about servicing generator modules. This optional manual must be ordered separately.
- A module user manual is included with each optional module. Contact your Tektronix Representative for a list of the available generator and special function modules.

Contacting Tektronix

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Technical support	Email: techsupport@tektronix.com 1-800-833-9200, select option 3* 6:00 a.m. – 5:00 p.m. Pacific time

*** This phone number is toll free in North America. After office hours, please leave a voice mail message.**
Outside North America, contact a Tektronix sales office or distributor; see the Tektronix web site for a list of offices.

Getting Started

Getting Started

This section contains the following information:

- Product description
- Accessories
- Option
- Functional Check

Product Description

The HDST1 HD-SDI Stress Test module is designed to be installed in the TG2000 Signal Generation Platform. The TG2000 Platform must be running version 2.2 or later firmware.

The module is an HD stress test module which provides HDTV interface stressing functions. The module contains the following features:

- Amplitude and duty cycle of the output signal, jitter amplitude and frequency, and error rate are adjustable in real-time from the front panel.
- Cable simulator of 20 m and 100 m
- Error insertion
- Calibration signal output
- Full remote control using GPIB or RS-232C interface

Accessories

Table 1–1 lists the standard and optional accessories for the HDST1 module.

Table 1–1: Standard and Optional accessories

Accessory	Type of accessory	Part number
HDST1 HD-SDI Stress Test Module User Manual	Standard	070-A880-XX
T-10 Torx Tip	Standard	003-1604-XX
Screws (2 ea)	Standard	211-0725-XX
TG2000 Signal Generation Platform Firmware Upgrade Kit	Standard	020-A051-XX
HDST1 HD-SDI Stress Test Module Service Manual	Optional	070-A881-XX

Option

This subsection describes the option available for the HDST1 module. The following option is available:

Option D1 (Test data report)

Option D1 (Test Data Report)

A calibration test data report will be provided with the HDST1 module when this option is specified.

Functional Check

The following procedure determines whether the module is operating correctly. If you are not familiar with the operation of the module, it may be helpful to refer to Figure 2–1 on page 2–1 while performing these procedures.

Required Equipment

The following equipment is required for the functional check:

- HDTV serial digital video signal generator
- HDTV waveform monitor
- Two 75 Ω BNC cables
- 75 Ω terminator

Procedure

1. Install the module into the TG2000 Platform mainframe using the installation procedures beginning on page C–3.
2. Power on the TG2000 Signal Generation Platform. The platform runs a self test on all modules.
3. To determine if the self test was successful, push the **Module** button. Check the display for the icon that represents the HDST1 module that you are inspecting.
4. Use the 75 Ω BNC cable to connect the output connector on the HDTV serial digital video signal generator and the **INPUT** connector on the HDST1 module.
5. Use the 75 Ω BNC cable to connect the **STRESS OUT** connector on the HDST1 module and the input connector on the HDTV waveform monitor.
6. Use the 75 Ω terminator to terminate the other loop-through connector on the HDTV waveform monitor.
7. Set the HDTV waveform monitor to view the eye pattern.
8. Touch the **HDST1** icon on the display. The **Module Parameters** window appears.
9. Touch the **Signals** icon to select **Enabled**.
10. Check that an eye pattern is displayed on the HDTV waveform monitor.
11. Touch the **SDI** icon. The **SDI Parameters** window appears.
12. Use the Navigation arrow keys to select **Amplitude**.
13. Turn the knob clockwise or counter clockwise and check that the amplitude of the eye pattern is changed.
14. Touch the **Reset** button to reset the amplitude to the default value.

Operating Basics

Functional Overview

This section provides an overview of the HDST1 module. If you are not familiar with the operation of the TG2000 Signal Generation Platform, refer to the *TG2000 Signal Generation Platform User Manual* before reading this section.

Basic Module Operations

Figure 2–1 shows the menu structure for basic module operations.

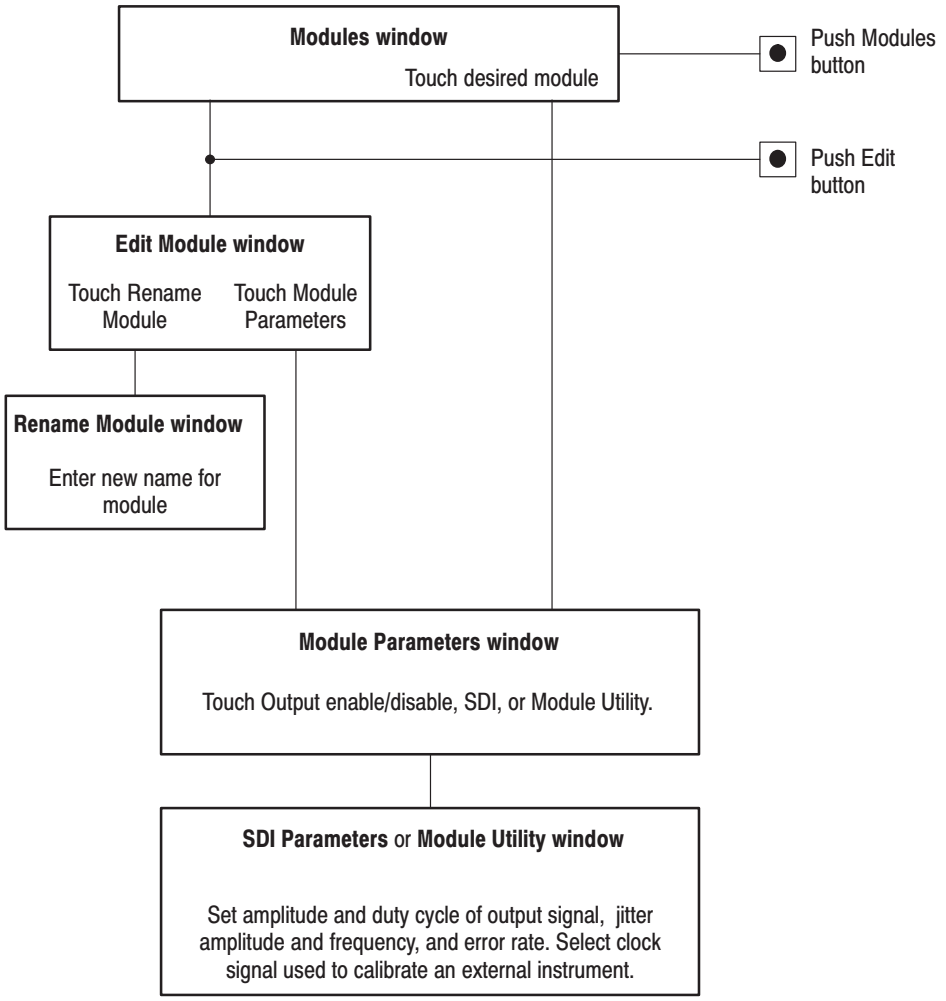


Figure 2–1: Menu structure for the HDST1 module

Rear-panel Connectors

The HDST1 module has the following six connectors:

- **INPUT**: Use this connector to input a 1.485 Gbps (or 1.485/1.001 Gbps) serial digital signal.

NOTE. *A color bar signal is recommended for the serial digital signal. If using special test signals such as a check field (pathological) signal for input, you may not perform appropriate stress testing.*

- **STRESS OUT**: Use this connector to output a serial digital signal for stress tests. The signal parameters can be changed from a window menu and the front panel controls. In addition, this connector can be used to output a clock signal for calibrating an external equipment.
- **20m IN**: Input connector for cable extension stress testing of 20 m.
- **20m OUT**: Output connector for cable extension stress testing of 20 m.
- **100m IN**: Input connector for cable extension stress testing of 100 m.
- **100m OUT**: Output connector for cable extension stress testing of 100 m.

Online Help

Push the front-panel **HELP** button to display a help window. The help window describes the window you were using when you pushed HELP.

Operating Procedures

This section is organized into the following main topics:

- Power on the mainframe and select the module
- Module parameters

Refer to Figure 2–1 on page 2–1 for the menu structure.

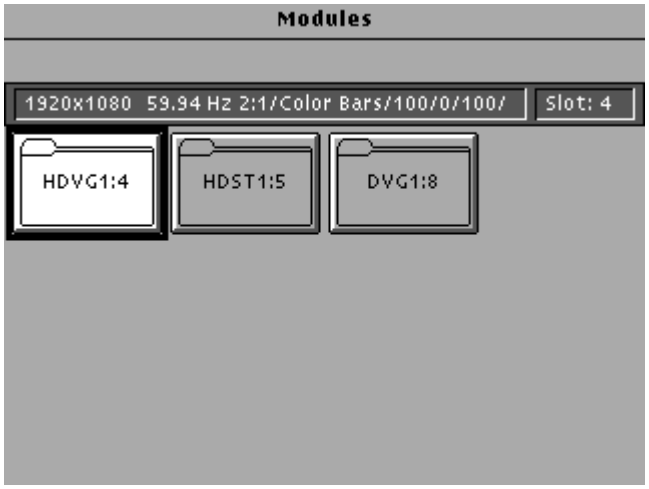
Power On and Select the Module

After the module is installed in the mainframe, and the mainframe is installed in the rack or other location where it will be used, power on the mainframe, and select the module by following these steps:

1. Set the rear-panel power switch to the **ON** position.
2. Press the front-panel **POWER** switch if necessary.
3. Wait for a few seconds as the mainframe executes confidence tests on the mainframe and modules. Check for any error messages that might appear.
4. When self tests are complete, the instrument displays icons representing the generator modules. If an installed module is not represented, refer to *Troubleshooting* in the *HDST1 HD-SDI Stress Test Module Service Manual*.

***NOTE**. The illustrations in these procedures show the factory default name (HDST1:X where X represents the slot number in which the module is installed). However, because you can rename the module, your icons may display a different name. Refer to the* TG2000 Signal Generation Platform User Manual *for information about editing the module name.*

5. Since you have just powered on the platform, the Modules window is displayed. To open this window at other times, push the **Modules** button.



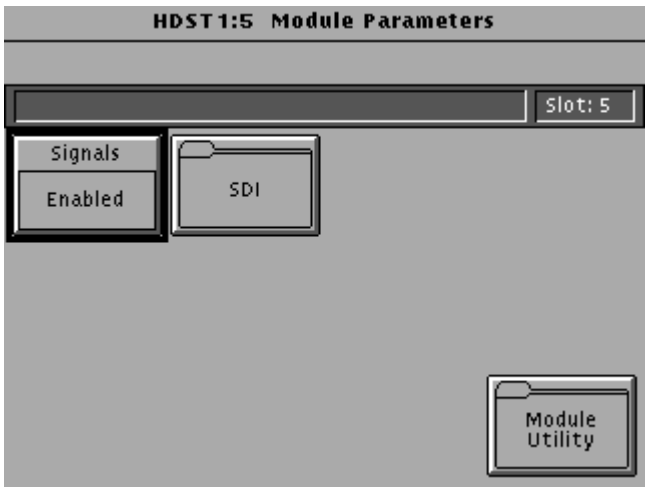
6. Touch the module icon on the display. The Module Parameters window appears.

Module Parameters

The following procedures discuss windows that are accessed through the Module Parameters window, shown below.

To enter the Module Parameters window for the HDST1 module, follow these steps:

1. Select the HDST1 module, if not already selected. The Module Parameters window appears, as shown below.



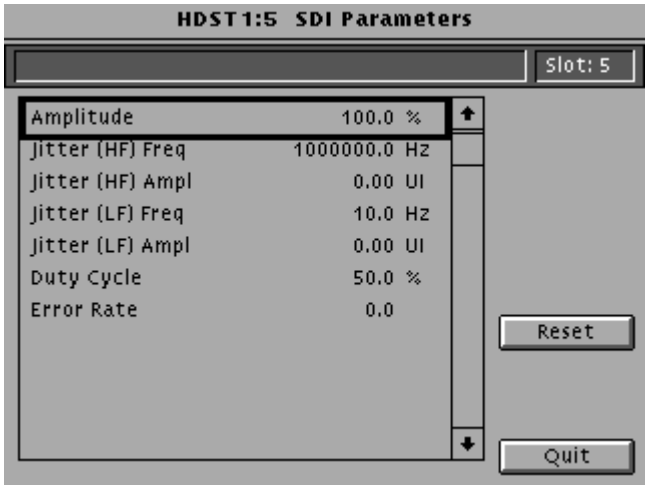
2. Another way to access this window is as follows:
   a. Push the **Modules** button.
   b. Ensure that the module is highlighted.
   c. Push the **Edit** button.
   d. Touch **Module Parameters**.

SDI Parameters

You can adjust the SDI parameters such as signal amplitude, duty cycle, jitter amplitude and frequency, and error rate.

To change the SDI parameters, follow these steps:

1. In the Module Parameters window, shown on page 2–5, touch **SDI**.
2. The SDI Parameters window opens, as shown below.



3. Use the Navigation arrow keys to select the parameter you want to change. You can set the following SDI parameters:
   - **Amplitude**: Sets the amplitude of the output signal. You can set the value from 10% to 130% in 1% steps.
   - **Jitter [HF] Freq**: Sets the frequency of the high-frequency jitter added to the output signal. You can set the value from 0.1 Hz to 10 MHz in 0.1 Hz steps.
   - **Jitter [HF] Ampl**: Sets the amplitude of the high-frequency jitter added to the output signal. You can set the value from 0.00 UI (unit interval) to 1 UI in 0.01 UI steps.
   - **Jitter [LF] Freq**: Sets the frequency of the low-frequency jitter added to the output signal. You can set the value from 0.1 Hz to 10 kHz in 0.1 Hz steps.
   - **Jitter [LF] Ampl**: Sets the amplitude of the low-frequency jitter added to the output signal. You can set the value from 0.00 UI (unit interval) to 20 UI in 0.01 UI steps.
   - **Duty Cycle**: Sets the duty cycle of the output signal. You can set the value from 40% to 60% in 0.1% steps.

- **Error Rate**: Sets the quantity of errors (error rate) inserted into the output signal. You can set the value from 0.0 errors/second to 120 errors/second in 0.1 errors/second steps.

4. Enter a value using the knob or keypad.
5. If you want to reset all the parameters to the default value, touch **Reset**.
6. Touch **Quit** to exit the window.

Enable/Disable the Output Signal

To enable or disable the module output, follow these steps:

1. Select the module, if not already selected. The Module Parameters window (shown on page 2–5) appears.
2. Touch the **Output** icon to toggle the state of the module's output signal.
3. Touch **Quit** to exit.

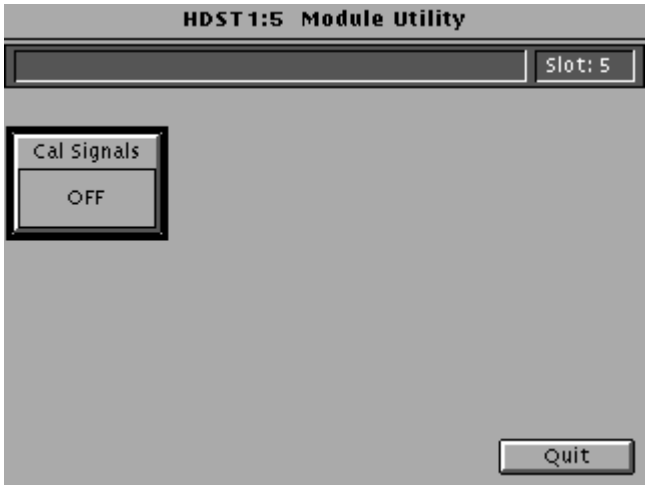
Module Utility

You can output a clock signal that can be used to calibrate external equipment.

***NOTE**. The calibration signal can be output when the error rate setting in the SDI parameters window is set to more than or equal to 0.1.*

To output the calibration signal, follow these steps:

1. In the Module Parameters window, shown on page 2–5, touch **Module Utility**.
2. The Module Utility window opens, as shown below.



3. Touch the **Cal Signals** icon to select **4.6 MHz Clock**.
4. Touch **Quit** to exit the window.

Syntax and Commands

Syntax

This section contains information on the Standard Commands for Programmable Instruments (SCPI) and the programming structure you can use to program your HDST1 module.

Programming Model

Specific conditions must exist before programming commands will affect the test signal generated by a module.

Addressing Module Test Signals

The following two steps must be performed before the test module will respond to signal parameter commands:

1. Select the module using the `:INSTrument:SELect` command before executing any commands. Some of the commands used by the HDST1 module are shared by several modules and will be accepted without a reported error.
2. Enable the module using the `:OUTPut:STATe ON` command. The output state of the module must be enabled before test signal parameters can be changed.

Command Arguments

Many commands will accept either string or numeric arguments. For example: a boolean argument can either be “1” or “ON”.

Signal parameter commands that have a :STEP node can accept either a numeric value or they can accept a string argument that refers to the :STEP increment.

Signal parameter commands with a :STEP node will accept the following strings in addition to a numeric value:

UP. Use this argument to increase the parameter value one increment as defined by the :STEP value.

DOWN. Use this argument to decrease the parameter value one increment as defined by the :STEP value.

MINimum. Use this argument to set the parameter value to the minimum acceptable value.

MAXimum. Use this argument to set the parameter value to the maximum acceptable value.

DEFault. Use this argument to set the parameter value to the default value.

Query Arguments

If you send a query with no argument, the response is the current value. You can also use MINimum, MAXimum, and DEFault as arguments for queries whose command form can use these arguments (refer to the command syntax for the specific command). Instead of returning the current value, queries using these arguments return the following information:

MINimum. Use this argument to return the minimum acceptable value.

MAXimum. Use this argument to return the maximum acceptable value.

DEFault. Use this argument to return the default value.

Argument Example

The following series of commands and arguments demonstrate the effect of each:

1. `Enter :INSTrument:SELect "HDST1:#"` to select the stress test module located in the slot number indicated by the "#" symbol.
2. `Enter :OUTPut:STATe ON` to output the test signal.
3. `Enter :OUTPut:SERial:AMPLitude DEFault` to set the amplitude of the output signal to 100 percent.
4. `Enter :OUTPut:SERial:AMPLitude:STEP 10` to set the step increment to 10 percent.
5. `Enter :OUTPut:SERial:AMPLitude DOWN` to change the amplitude of the output signal to 90 percent.
6. `Enter :OUTPut:SERial:AMPLitude 50` to change the amplitude of the output signal to 50 percent.
7. `Enter :OUTPut:SERial:AMPLitude MAXimum` to change the amplitude of the output signal to 130 percent.
8. `Enter :OUTPut:SERial:AMPLitude MINimum` to change the amplitude of the output signal to 10 percent.

9. `Enter :OUTPut:SERial:AMPLitude UP` to change the amplitude of the output signal to 20 percent.

10. `Enter :OUTPut:SERial:AMPLitude? MAXimum` to querie the maximum amplitude of the output signal (not the current amplitude). The query returns the value of 130 percent, which is the maximum amplitude allowable.

SCPI Commands and Queries

SCPI is a standard created by a consortium that provides guidelines for remote programming of instruments. These guidelines provide a consistent programming environment for instrument control and data transfer. This environment uses defined programming messages, instrument responses, and data format across all SCPI instruments, regardless of manufacturer. The HDST1 module uses a command language based on the SCPI standard.

The SCPI language is based on a hierarchical or tree structure (see Figure 3–1) that represents a subsystem. The top level of the tree is the root node; it is followed by one or more lower-level nodes.

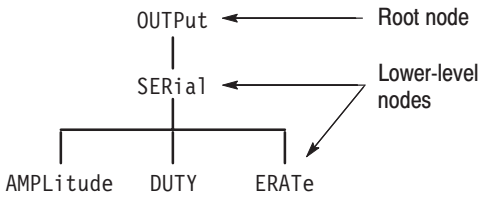


Figure 3–1: Example of SCPI subsystem hierarchy

You can create commands and queries from these subsystem hierarchy trees. Commands specify actions for the instrument to perform. Queries return measurement data and information about parameter settings.

For more information on SCPI commands, programming structure, and TG2000 Signal Generation Platform status and events, refer to the *TG2000 Signal Generation Platform User Manual*.

Functional Command Groups

This section describes the commands in general categories. The module uses only the output (:OUTPut) commands.

Items followed by question marks are queries; items without question marks are commands. Some items in this section have a question mark in parentheses (?) in the command header section; this indicates that the item can be both a command and a query.

Output

Use these commands to set the parameters for the output signal of the module.

Table 3–1: :OUTPut commands

Command	Description
:OUTPut:STATe(?)	Set or query module output
:OUTPut:SERial:AMPLitude(?)	Set or query output amplitude
:OUTPut:SERial:AMPLitude:STEP(?)	Set or query output amplitude step size
:OUTPut:SERial:DUTY(?)	Set or query output duty cycle
:OUTput:SERial:ERATe(?)	Set or query error rate
:OUTput:SERial:JITTer:HF:AMPLitude(?)	Set or query high-frequency jitter amplitude
:OUTput:SERial:JITTer:HF:AMPLitude:STEP(?)	Set or query high-frequency jitter amplitude step size
:OUTput:SERial:JITTer:HF:FREQuency(?)	Set or query high-frequency jitter frequency
:OUTput:SERial:JITTer:HF:FREQuency:STEP(?)	Set or query high-frequency jitter frequency step size
:OUTput:SERial:JITTer:LF:AMPLitude(?)	Set or query low-frequency jitter amplitude
:OUTput:SERial:JITTer:LF:AMPLitude:STEP(?)	Set or query low-frequency jitter amplitude step size
:OUTput:SERial:JITTer:LF:FREQuency(?)	Set or query low-frequency jitter frequency
:OUTput:SERial:JITTer:LF:FREQuency:STEP(?)	Set or query low-frequency jitter frequency step size

:OUTPut Commands

Use these commands to control the output parameters of the module. These include jitter amplitude and frequency.

***NOTE**. The module must be selected with the INSTrument:SELect command prior to using these commands.*

Command Tree

```
:OUTPut
   :STATe                  <boolean>
   :SERial
      :AMPLitude           <numeric_value>
         :STEP             <numeric_value>
      :DUTY                <numeric_value>
      :ERATe               <numeric_value>
      :JITTer
         :HF
            :AMPLitude     <numeric_value>
               :STEP       <numeric_value>
            :FREQuency     <numeric_value>
               :STEP       <numeric_value>
         :LF
            :AMPLitude     <numeric_value>
               :STEP       <numeric_value>
            :FREQuency     <numeric_value>
               :STEP       <numeric_value>
```

:OUTPut:STATe(?)

Use this command to set or query the state of the HDST1 module output signal.

Syntax

```
:OUTPut:STATe <boolean>
:OUTPut:STATe?
```

Parameters

Command	Query response
<boolean> = ON or 1, OFF or 0	1, 0

Default Value

ON

Errors and Events

None

Dependencies

None

Examples

Command: `:OUTP:STAT ON`

Query: `:OUTP:STAT?`

Response: 1

Related Commands

None

:OUTPut:SERial:AMPLitude(?)

Use this command to set or query the amplitude of the output signal. The units are a percent of the 800 mV amplitude.

Syntax

```
:OUTPut:SERial:AMPLitude <numeric_value>
:OUTPut:CIRCle:AMPLitude?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
UP, DOWN, MIN, MAX, DEF	

Default Value

100

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:AMPL 90`

Query: `:OUTP:SER:AMPL?`

Response: `90.0`

Related Commands

:OUTPut:SERial:AMPLitude:STEP

:OUTPut:SERial:AMPLitude:STEP(?)

Use this command to set or query UP/DOWN step value of the amplitude of the output signal. The units are percent.

Syntax

```
:OUTPut:SERial:AMPLitude:STEP <numeric_value>
:OUTPut:SERial:AMPLitude:STEP?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
MIN, MAX, DEF	

Default Value

1

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:AMP:STEP 10`

Query: `:OUTP:SER:AMP:STEP?`

Response: `10.0`

Related Commands

:OUTPut:SERial:AMPLitude

:OUTPut:SERial:DUTY(?)

Use this command to set or query the duty cycle of the output signal. The units are percent.

Syntax

```
:OUTPut:SERial:DUTY <numeric_value>
:OUTPut:SERial:DUTY?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
MIN, MAX, DEF	

Default Value 50.0

Errors and Events –200 Execution error

Dependencies None

Examples

Command: `:OUTP:SER:DUTY 60`

Query: `:OUTP:SER:DUTY?`

Response: `60.0`

Related Commands None

:OUTPut:SERial:ERATe(?)

Use this command to set or query the quantity of errors (error rate) inserted into the output signal. The units are errors/second.

Syntax

```
:OUTPut:SERial:ERATe <numeric_value>
:OUTPut:SERial:ERATe?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
MIN, MAX, DEF	

Default Value 0.0

Errors and Events –200 Execution error

Dependencies None

Examples

Command: `:OUTP:SER:ERAT 10`

Query: `:OUTP:SER:ERAT?`

Response: `10.0`

Related Commands None

:OUTPut:SERial:JITTer:HF:AMPLitude(?)

Use this command to set or query the amplitude of the high-frequency jitter added to the output signal. The units are unit intervals (UI).

Syntax

```
:OUTPut:SERial:JITTer:HF:AMPLitude <numeric_value>
:OUTPut:SERial:JITTer:HF:AMPLitude?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
UP, DOWN, MIN, MAX, DEF	

Default Value

0.0

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:JITT:HF:AMPL .5`

Query: `:OUTP:SER:JITT:HF:AMPL?`

Response: `0.5`

Related Commands

:OUTPut:SERial:JITTer:HF:AMPLitude:STEP

:OUTPut:SERial:JITTer:HF:AMPLitude:STEP(?)

Use this command to set or query UP/DOWN step value of the amplitude of the high-frequency jitter. The units are unit intervals (UI).

Syntax

```
:OUTPut:SERial:JITTer:HF:AMPLitude:STEP <numeric_value>
:OUTPut:SERial:JITTer:HF:AMPLitude:STEP?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
MIN, MAX, DEF	

Default Value

0.01

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:JITT:HF:AMPL:STEP .1`

Query: `:OUTP:SER:JITT:HF:AMPL:STEP?`

Response: `0.1`

Related Commands

:OUTPut:SERial:JITTer:HF:AMPLitude

:OUTPut:SERial:JITTer:HF:FREQuency(?)

Use this command to set or query the frequency of the high-frequency jitter added to the output signal. The units are Hertz.

Syntax

```
:OUTPut:SERial:JITTer:HF:FREQuency <numeric_value>
:OUTPut:SERial:JITTer:HF:FREQuency?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
UP, DOWN, MIN, MAX, DEF	

Default Value

1000000.0

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:JITT:HF:FREQ 100`

Query: `:OUTP:SER:JITT:HF:FREQ?`

Response: `100.0`

Related Commands

:OUTPut:SERial:JITTer:HF:FREQuency:STEP

:OUTPut:SERial:JITTer:HF:FREQuency:STEP(?)

Use this command to set or query UP/DOWN step value of the frequency of the high-frequency jitter. The units are Hertz.

Syntax

```
:OUTPut:SERial:JITTer:HF:FREQuency:STEP <numeric_value>
:OUTPut:SERial:JITTer:HF:FREQuency:STEP?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
MIN, MAX, DEF	

Default Value

0.01

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:JITT:HF:FREQ:STEP .1`

Query: `:OUTP:SER:JITT:HF:FREQ:STEP?`

Response: `0.1`

Related Commands

:OUTPut:SERial:JITTer:HF:AMPLitude

:OUTPut:SERial:JITTer:LF:AMPLitude(?)

Use this command to set or query the amplitude of the low-frequency jitter added to the output signal. The units are unit intervals (UI).

Syntax

```
:OUTPut:SERial:JITTer:LF:AMPLitude <numeric_value>
:OUTPut:SERial:JITTer:LF:AMPLitude?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
UP, DOWN, MIN, MAX, DEF	

Default Value 0.1

Errors and Events –200 Execution error

Dependencies None

Examples

Command: `:OUTP:SER:JITT:LF:AMPL .5`

Query: `:OUTP:SER:JITT:LF:AMPL?`

Response: `0.5`

Related Commands :OUTPut:SERial:JITTer:LF:AMPLitude:STEP

:OUTPut:SERial:JITTer:LF:AMPLitude:STEP(?)

Use this command to set or query UP/DOWN step value of the amplitude of the low-frequency jitter. The units are unit intervals (UI).

Syntax

```
:OUTPut:SERial:JITTer:LF:AMPLitude:STEP <numeric_value>
:OUTPut:SERial:JITTer:LF:AMPLitude:STEP?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
MIN, MAX, DEF	

Default Value

0.01

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:JITT:LF:AMPL:STEP .1`

Query: `:OUTP:SER:JITT:LF:AMPL:STEP?`

Response: `0.1`

Related Commands

:OUTPut:SERial:JITTer:LF:AMPLitude

:OUTPut:SERial:JITTer:LF:FREQuency(?)

Use this command to set or query the frequency of the low-frequency jitter added to the output signal. The units are Hertz.

Syntax

```
:OUTPut:SERial:JITTer:LF:FREQuency <numeric_value>
:OUTPut:SERial:JITTer:LF:FREQuency?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
UP, DOWN, MIN, MAX, DEF	

Default Value

10.0

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:JITT:LF:FREQ 1000`

Query: `:OUTP:SER:JITT:LF:FREQ?`

Response: `1000.0`

Related Commands

:OUTPut:SERial:JITTer:LF:FREQuency:STEP

:OUTPut:SERial:JITTer:LF:FREQuency:STEP(?)

Use this command to set or query UP/DOWN step value of the frequency of the low-frequency jitter. The units are Hertz.

Syntax

```
:OUTPut:SERial:JITTer:LF:FREQuency:STEP <numeric_value>
:OUTPut:SERial:JITTer:LF:FREQuency:STEP?
```

Parameters

Command	Query response
<numeric_value> = <NRf>	<NR2>
MIN, MAX, DEF	

Default Value

0.1

Errors and Events

–200 Execution error

Dependencies

None

Examples

Command: `:OUTP:SER:JITT:LF:FREQ:STEP 10`

Query: `:OUTP:SER:JITT:LF:FREQ:STEP?`

Response: `10.0`

Related Commands

:OUTPut:SERial:JITTer:LF:AMPLitude

Appendices

Appendix A: Specifications

Table A–1 lists the Electrical specifications for the HDST1 module. Refer to the *TG2000 Signal Generation Platform User Manual* for a list of Environmental specifications. Table A–2 lists the certification and compliances.

***NOTE**. The electrical specifications listed in Table A–1 are valid after performing the module self calibration. If an ambient temperature varies more than 3 °C, be sure to perform the module self calibration to meet the specifications. Refer to the* TG2000 Signal Generator Platform User Manual *for a description of how to perform the module self calibration.*

Table A–1: Electrical specifications

Characteristic	Performance requirements	Reference information
Input		
Number of outputs	1	BNC
Signal	HD-SDI (serial digital interface)*	1.485 Gbps or 1.485/1.001 Gbps, 800 mVp-p ± 10%
Return Loss	< –15 dB < –10 dB	≤ 742.5 MHz ≤ 1.485 GHz
Stress output		
Number of outputs	1	BNC
Amplitude range	80 mV to 1040 mV	10% to 130% of 800 mV
Amplitude resolution	1%	
Amplitude error	< 5%	Measured at 800 mV, 4.64 MHz square wave
Duty cycle variable range	40% to 60%	
Duty cycle resolution	1%	
Rise and fall time	< 270 ps	20% to 80%
Overshoot, typical	< 10%	Measured from 90% to 110% of 800 mV amplitudes (measured with Tektronix CSA8000, 80E03, and Anritsu 12N75B)
Return loss	< –15 dB	≤ 1.485 GHz

*** A color bar signal is recommended for the HD-SDI signal. If you use special test signals such as a check field (pathological) signal for input, you may not perform appropriate stress testing.**

Table A–1: Electrical specifications (cont.)

Characteristic	Performance requirements	Reference information
High frequency jitter		
Amplitude	0 UI to 1 UI	
Resolution	0.01 UI	
Amplitude error, typical	< 0.1 UI	Measured at 1 UI, ≤ 1 MHz
	< 0.1 UI + 5%	Measured at 1 UI, ≤ 5 MHz
	< 0.1 UI + 10%	Measured at 1 UI, ≤ 10 MHz
Frequency	0.1 Hz to 10 MHz	
Waveform		Sine wave 2nd harmonic: ≤ –15 dB 3rd harmonic: ≤ –15 dB
Low frequency jitter		
Amplitude	0 UI to 20 UI	
Resolution	0.01 UI	
Amplitude error, typical	< 0.1 UI + 1%	Measured at 8 UI, ≤ 1 kHz
	< 0.1 UI + 5%	Measured at 8 UI, ≤ 5 kHz
	< 0.1 UI + 10%	Measured at 8 UI, ≤ 10 kHz
Frequency	0.1 Hz to 10 kHz	
Waveform		Sine wave 2nd harmonic: ≤ –20 dB 3rd harmonic: ≤ –20 dB
Error insertion		
Error rate	0 to 120 errors/s	Errors are generated by bit inverted.
Error rate resolution	0.1 error/s	
Cable simulator 1		
Number of connectors	2 (IN and OUT)	BNC
Cable type		L-5CFB
Cable length		20 m
Attenuation error	± 1 dB	–1.9 dB @ 220 MHz
	± 1 dB	–2.9 dB @ 470 MHz
	± 1 dB	–3.8 dB @ 770 MHz
	± 2 dB	–5.1 dB @ 1300 MHz
Return loss	< –15 dB	≤ 1.485 GHz
Cable simulator 2		
Number of connectors	2 (IN and OUT)	BNC

Table A–1: Electrical specifications (cont.)

Characteristic	Performance requirements	Reference information
Cable type		L-5CFB
Cable length		100 m
Attenuation error	± 1 dB	–9.6 dB @ 220 MHz
	± 1 dB	–14.7 dB @ 470 MHz
	± 1 dB	–19.1 dB @ 770 MHz
	± 2 dB	–26.0 dB @ 1300 MHz
Return loss	< –15 dB	≤ 1.485 GHz

Table A–2: Certifications and compliances

Category	Standard or description
EC Declaration of Conformity – EMC	EC Council EMC Directive 89/336/EEC, amended by 93/68/EEC; EN55103-1/2: EMC Product Family Standard for Audio, Video, Audio-Visual, and Entertainment Lighting Control Apparatus for Professional Use Environment: E4 EN 55103-1 Emissions: EN 55103-1, Annex A — Radiated Magnetic Field Emissions EN 55022, Class A[1] — Radiated and Conducted EN 61000-3-2 — Power Line Harmonics EN 55103-2 Immunity: EN 55103-2, Annex A — Radiated Magnetic Field Immunity IEC 61000-4-2 — Electrostatic Discharge Immunity IEC 61000-4-3 — Radiated RF Electromagnetic Field Immunity IEC 61000-4-4 — Electrical Fast Transient/Burst Immunity IEC 61000-4-5 — Surge Immunity IEC 61000-4-6 — Conducted Disturbance Induced by RF Field Immunity IEC 61000-4-11 — Voltage Dips, Short Interruptions and Voltage Variations Immunity
Australia/New Zealand Declaration of Conformity – EMC	Conforms with the following standards in accordance with the Electromagnetic Compatibility Framework: AS/NZS 3548 — Information Technology Equipment
FCC	FCC 47 CFR Part 15, Subpart B, Class A

1 The performance of the TG2000 is degraded to the E4 environment for radiated emissions only when operating with the combinations of HDVG1 and HDST1 in an HD-SDI stress test application.

Appendix B: SCPI Conformance Information

All commands in the HDST1 module are based on SCPI Version 1994.0. Table B–1 lists all commands supported by the module. The columns to the right show whether a command is defined in the SCPI 1994.0 Standard or not.

Table B–1: SCPI Conformance information

Command						Defined in SCPI 1994.0	Not defined in SCPI 1994.0
OUTPut	SERial	AMPLitude(?)					✓
			STEP(?)				✓
		DUTY(?)					✓
		ERATe(?)					✓
		JITTer	HF	AMPlitude(?)			✓
					STEP(?)		✓
				FREQuency(?)			✓
					STEP(?)		✓
			LF	AMPLitude(?)			✓
					STEP(?)		✓
				FREQuency(?)			✓
					STEP(?)		✓
	STATe(?)					✓	

Appendix C: Installation

This section covers module installation and module removal. Before beginning the procedures, read the *Service Safety Summary* and *Preventing Component Damage* sections.

***NOTE**. The HDST1 module is only available in the TG2000 Platform mainframe with firmware version 2.2 or later. If the firmware version of your TG2000 is 2.1 or earlier, you need to upgrade the firmware to 2.2 and later using the TG2000 Signal Generation Platform Firmware Upgrade Kit provided with the module. Refer to the* TG2000 Firmware Upgrade Kit Instructions *for the procedures.*

Service Safety Summary

Only qualified personnel should perform service procedures. Read this *Service Safety Summary* and the *General Safety Summary* before performing any service procedures.

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

Disconnect Power. To avoid electric shock, disconnect the main power by means of the power cord or, if provided, the power switch.

Use Care When Servicing With Power On. Dangerous voltages or currents may exist in this product. Disconnect power, remove battery (if applicable), and disconnect test leads before removing protective panels, soldering, or replacing components.

To avoid electric shock, do not touch exposed connections.

Preventing Component Damage

CAUTION. *Electrostatic discharge (ESD) can damage components on this module and mainframe. To prevent ESD or other component damage, follow the steps below when installing, removing, or handling modules:*

1. Wear a grounded antistatic wrist strap to discharge the static voltage from your body while installing or removing modules from the TG2000 Platform mainframe.
2. Transport and store the modules in a static-protected bag or container.
3. Do not slide the module over any surface.
4. Handle modules as little as possible.
5. Do not touch module components or connector pins.
6. Do not use any devices capable of generating or holding a static charge in the work area where you remove, install, or handle modules.
7. Avoid handling modules in areas that have a floor or work-surface covering capable of generating a static charge.
8. Do not remove the module circuit board assembly from the shield. The shield is an important stiffener which prevents damage to surface-mount components.

Module Installation

WARNING. *The following servicing instructions are for use only by qualified personnel. To avoid injury, do not perform any servicing other than that stated in the operating instructions unless you are qualified to do so. Refer to the* General Safety Summary *at the front of the manual and the* Service Safety Summary *on page C–1, before performing any service.*

A T-10 torx tip screwdriver is the only tool you need to install the module. A T-10 torx tip is supplied with the module.

To install the module into the TG2000 Platform mainframe, perform these steps:

1. Set the TG2000 Platform mainframe rear-panel power switch to off. Unplug the power cord.
2. Select the slot you will use to install the module. Table C–1 lists the slot restrictions. Figure C–1 shows a sample configuration with slot numbers.

Table C–1: Module slot assignments

Module	Slots in which the module can be installed
AGL1 Genlock module	Slot 2 or 3
AVG1 Generator module	Slots 2 through 10
AWVG1 Generator module	Slots 2 through 10
BG1 Generator module	Slots 2 through 10
Clock module	Slot 1
CPU module	Slot 11
DVG1 Generator module	Slots 2 through 10
GP1 GPIB Interface module	Slot 10
HDST1 module	Slots 2 through 10
HDVG1 Generator module	Slots 2 through 10

CAUTION. *The TG2000 Platform mainframe can handle a maximum of one HDST1 module. Exceeding this quantity could cause excessive heat which could damage the product and could result in fire.*

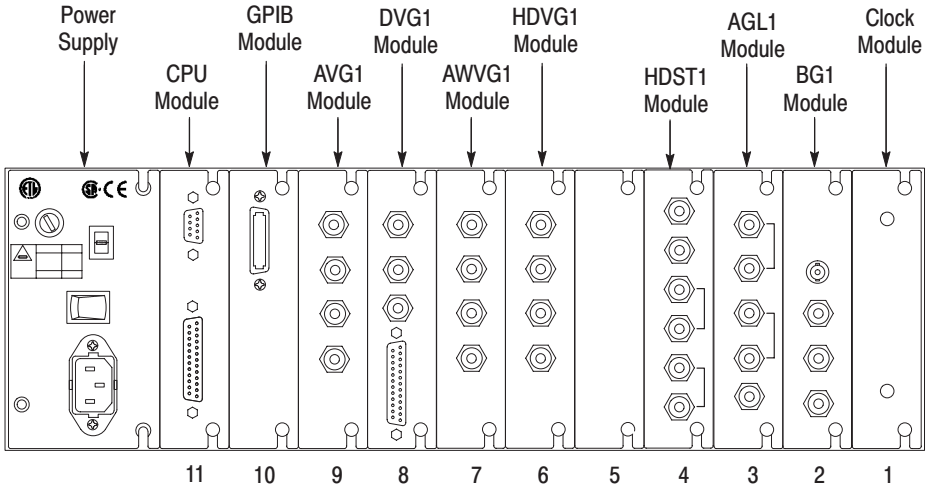


Figure C–1: Rear panel slot numbering

WARNING. *To avoid a shock hazard, always remove the power cord before removing the top cover. Failure to remove the power cord can result in serious injury or death.*

3. Refer to Figure C–2 and remove or loosen all screws to remove the top cover.

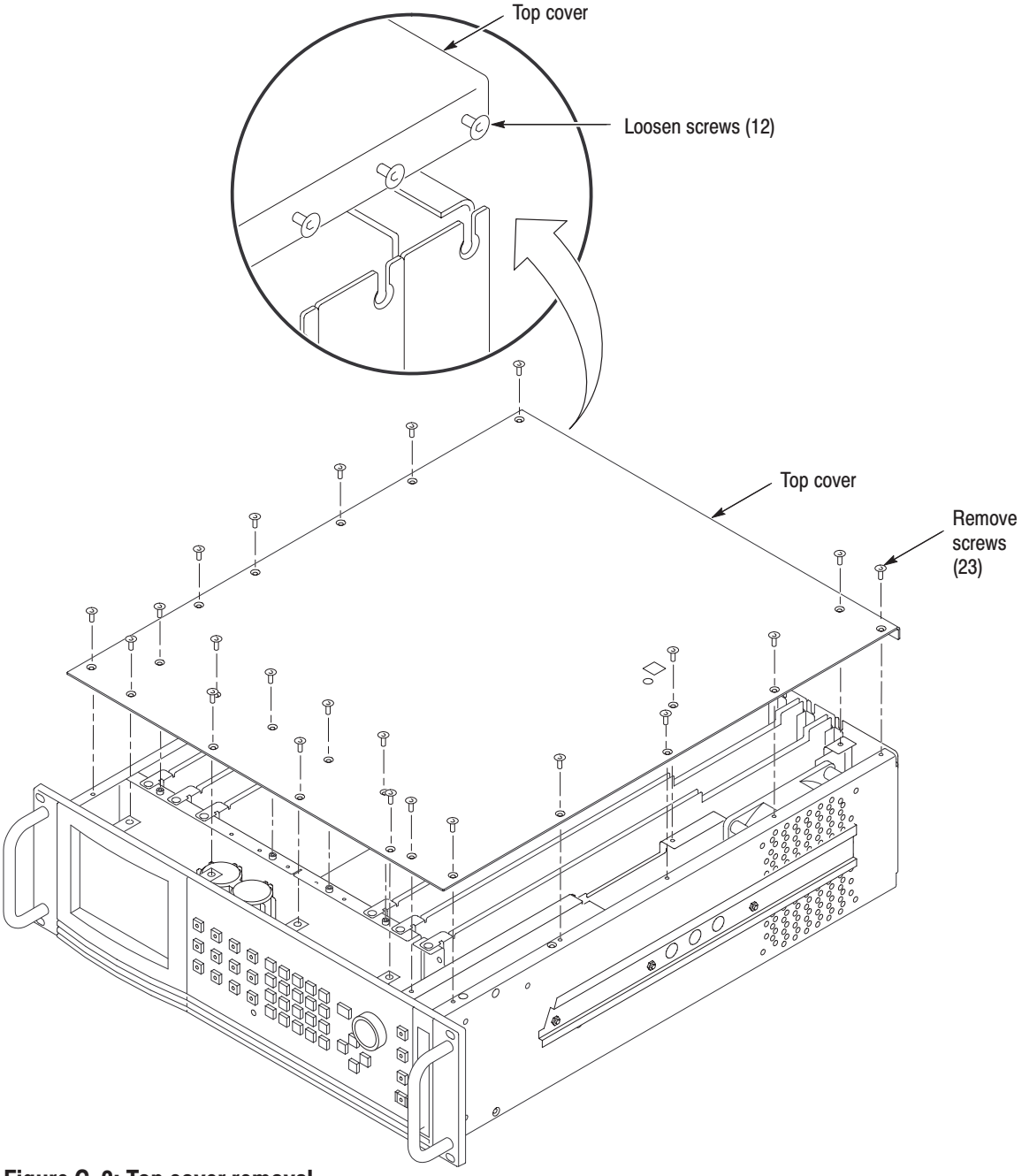


Figure C–2: Top cover removal

4. Remove the appropriate rear panel as shown in Figure C–3. Loosen, but do not remove the bottom screw. You will use it later to secure the module.

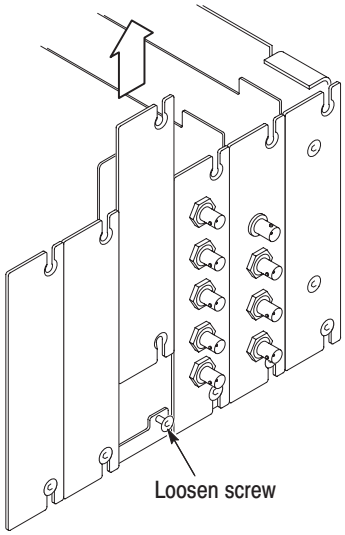


Figure C–3: Removing the rear panel

5. While ensuring correct alignment of the module flange as shown in Figure C–4, lower the module into the desired slot as shown in Figure C–5.

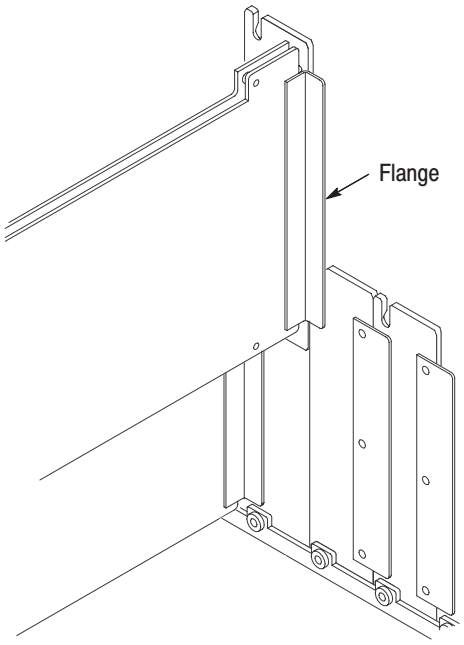


Figure C–4: Module flange

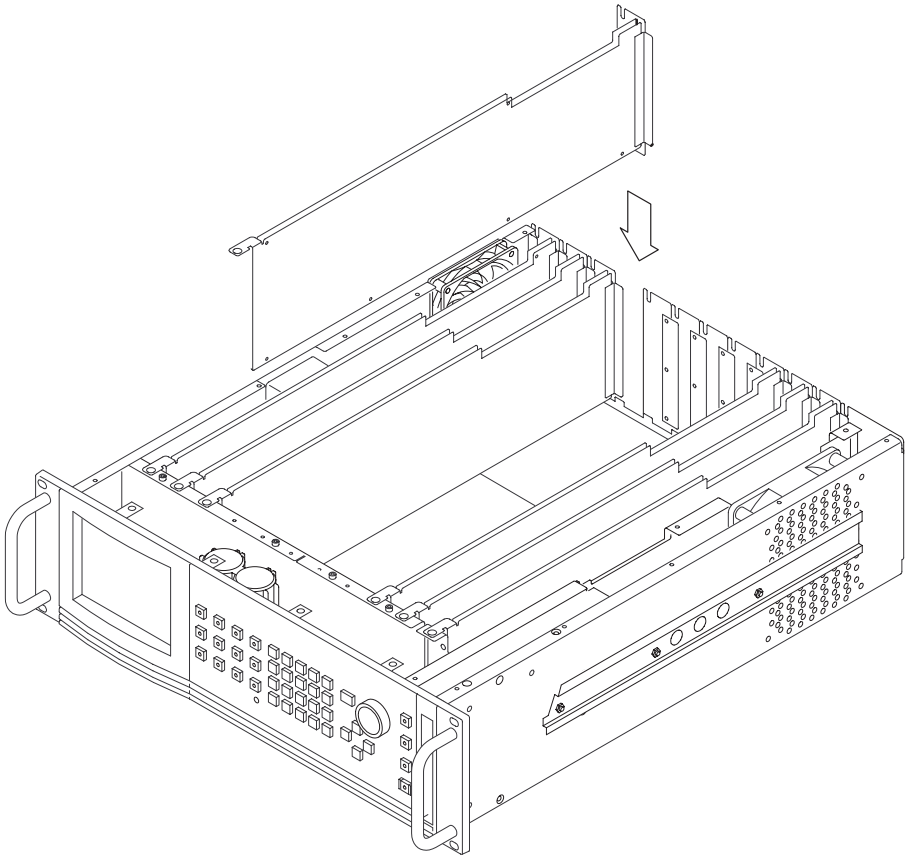


Figure C–5: Installing the module

6. Ensure that the connectors on the Backplane board and the module exactly match before seating the module.

CAUTION. *The connectors must exactly match before you attempt to press the module firmly in place. If the connectors do not match you could bend a pin that could damage the module, mainframe, or both when power is applied.*

7. Press down evenly on the module until it is firmly in place.
8. Insert and tighten the top screw, which is supplied with your module, as shown in Figure C–6.
9. Tighten the rear-panel screw.

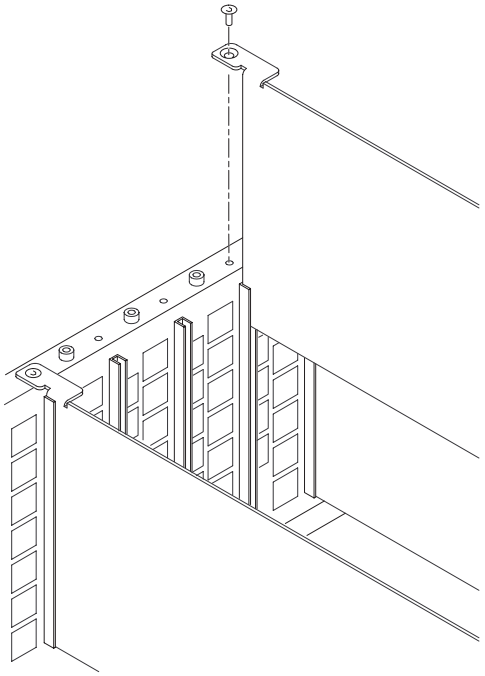


Figure C–6: Top screw

10. Replace the top cover.

11. Insert and tighten all top cover screws.

12. Plug in the instrument power cord.

13. Power on the mainframe by setting the rear-panel power switch to ON and pressing the front-panel power switch.

14. Wait for the instrument to perform self tests.

Module Removal

A T-10 torx tip screwdriver is the only tool you need to remove the module. A T-10 torx tip is supplied with the module.

To remove the module, follow these steps:

1. Turn off the platform by pressing the front-panel On/Standby switch and switching the rear panel power switch to OFF.

2. Unplug the power cord.

WARNING. *To avoid a shock hazard always unplug the power cord before removing the top cover. Failure to unplug the power cord can result in serious injury or death.*

3. Remove all top-cover screws and remove the top cover. See Figure C–2 on page C–5.
4. Remove the appropriate rear panel as shown in Figure C–3 on page C–6. Loosen, but do not remove the bottom screw. You will use it later to secure the rear panel.
5. Refer to Figure C–6 on page C–8 and remove the top screw.
6. Remove the module. To leave the slot empty, proceed to step 8 of this procedure.
7. To install a module in the empty slot, proceed to *Module Installation* on page C–3.
8. To ensure proper cooling and adherence to EMI shielding requirements, install a blank panel to cover any empty slots in the rear panel. A spare blank panel is included in the TG2000 Platform mainframe accessories kit.
9. Tighten the screws on the blank rear panel.
10. Reinstall the top cover and insert and tighten all top cover screws.

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