



SIGNAL GENERATOR HARDWARE USER MANUAL

HARDWARE PLATFORMS FOR THE SPIRENT RANGE OF NAVIGATION SIMULATOR PRODUCTS

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1 General

Note: The term “simulator” refers to a configured arrangement of signal generators, computer controllers and ancillary items.

Where relevant, this document gives interconnect drawings between one or two current Spirent signal generators and the SimGEN controller or Host PC.

This document includes representative interconnection drawings for simulators using three, or more, GSS8000-series signal generators, it may not show your specific simulator.

For simulators using multiple signal generators with Spirent interconnection or distribution units, ancillaries (such as Agilent signal generators) and one, or more, computer controllers, Spirent provides a custom interconnection drawing that shows all interconnection details.

Spirent reserves the right to supply simulator elements that may be superficially and visually different to those shown in an interconnection drawing, but which provide equivalent or better performance.

1.1 This issue

Issue	Date	Description
1-40	July 2016	Bugz: 13194: Add reboot details to 8000 Trigger-Immediate and Delayed

1.2 Important safety information



NOTICE

Failure to observe the ratings and safety information in this document may result in hazardous operation

This section gives safety information that is applicable to all Spirent's multiple-constellation signal generators. The chapter for each signal generator gives specific safety information. Spirent recommends you read all safety information in this section and the chapter for your signal generator before using your signal generator.

Previously, Spirent prepared Product Safety notices for its signal generators see Table 1-1. Spirent now provides safety information for each current signal generator in this user manual. Spirent recommends you read the safety information for your signal generator before using it.

Table 1-1 Product safety notices

Products	Section
GSS6560 (superseded)	L.1
GSS4150	L.2
All other STR/GSS series signal generators	L.3
GSS5060 (superseded)	L.4

You must follow all safety instructions detailed in this document before operating your signal generator or performing routine calibration.

Do not use your signal generator if it appears damaged. Completely isolate the signal generator from the ac mains supply by removing the plug from the ac power outlet. Inspect the signal generator and contact Spirent.

Do not drop the signal generator. Do not expose the signal generator to excessive vibration.

Refer to the manufacturer's documentation for safety information on third-party equipment that Spirent supplies with this signal generator (such as the Host PC or a computer).

1.2.1 Hazardous voltages

SAFETY WARNINGS



Do not operate your signal generator with any panel removed

To completely isolate mains power from the signal generator remove the plug from the mains socket. The mains socket should be close to the signal generator and readily accessible by the user

Only suitably trained and qualified personnel should service this signal generator.

There are no user serviceable parts in this signal generator.

1.2.2 Earth (ground) connection



SAFETY WARNING

You must connect this signal generator to mains earth (ground)

Note for users in countries with IT power distribution systems: You must connect your signal generator, the SimGEN controller and any associated ac-mains operated equipment that Spirent supplies, to an earth (ground) that is independent of the earth (ground) the ac mains provides.

1.2.3 Lifting the signal generator



CAUTION - HEAVY

The product datasheet, see Table 2-1 and Table 2-2 details the weight of each signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

1.2.4 AC power - rated current

Note: The Chapter detailing each signal generator contains specific electrical safety information

Table 1-2 gives the rated currents of all Spirent multiple-channel signal generators in this user manual. Spirent recommends you confirm these ratings with the latest issue of the relevant product datasheet see Table 2-1 and Table 2-2.

Table 1-2 Rated current of signal generators

Signal Generator	Maximum rated current, A (100 to 120V ac 48 to 62 Hz)	Maximum rated current, A (206 to 264V ac 48 to 62 Hz)
Current signal generators		
GSS4150	0.6	0.3
GSS6700	0.6	0.3
GSS7790	4	2
GSS8000-series single- and dual-output	4	2
Superseded signal generators		
GSS5060	0.6	0.3
GSS6560	0.6	0.3
GSS4750	4	2

Signal Generator	Maximum rated current, A (100 to 120V ac 48 to 62 Hz)	Maximum rated current, A (206 to 264V ac 48 to 62 Hz)
STR4780	4	2
STR4790	4	2
GSS7700	4	2
GSS7800	4	2
GSS7900	4	2

The above table includes superseded Spirent signal generators. Although not available as new product, Spirent continues to provide support to customers using these signal generators. You can find information on these signal generators in the Appendices of this document.

1.2.4.1 Fuse rating

Only replace fuse with an approved fuse of the same type and rating.

Fuses fitted to the ac power inlet are labelled "TxxAH 250VAC" where:

T: Time lag

xxA: Fuse rating in Amps

H: High rupture current

250VAC: Voltage rating

1.2.5 Replacement mains cable assembly



SAFETY WARNING

You must connect the signal generator to mains earth (ground).

You must ensure replacement mains cable assemblies meet or exceed the requirements in Table 1-3.

Spirent supply appropriate, approved, mains cable assemblies with each signal generator. Any replacement cable assembly must carry appropriate national approvals see Table 1-3.

Table 1-3 Requirements for signal generator ac power cable

Component	Requirements
Signal generator connector	Appropriate approval to IEC320 Mandatory - earth (ground) connection
Cable	Two-core plus earth (ground) ac power cable National mains cable approval Rating - see Table 1-2

Component	Requirements
Mains plug	To fit local ac power plus earth (ground) outlets National approval for mains plugs Mandatory - earth (ground) connection
Fuse in mains plug (where fitted)	National approval for mains plug fuses Rating - see Table 1-2

1.2.6 Lithium cells

SAFETY WARNING



The signal generator contains one or more Lithium cells, which are toxic if damaged and the contents exposed.

If you incorrectly replace Lithium cells there is a danger of Explosion

Replace only with the same or equivalent type recommended by the manufacturer.

Some signal generator cards may use Lithium cells. If the Lithium cell fails, the data it helps retain will be lost and you will be unable to use your signal generator. You must return the signal generator to Spirent for replacement of the Lithium cell and for restoration of lost data.

1.2.7 Operating and storage temperature range

Do not operate or store your signal generator outside the ranges given in Table 1-4.

Table 1-4 Operating and storage temperature range

Temperature	Range
Operating	10 to 40°C (50 to 104°F)
Storage	-40 to 60°C (-40 to 140°F)

1.2.8 Specific warnings for two, or more, signal generators

Spirent recommends you read the following sections if your system uses the same ac power outlet to provide mains power to the system.

For example, the system may include:

- Two, or more, Spirent signal generators
- One, or more, Controller (SimGEN or SimINERTIAL)
- One, or more, monitors

Together with additional items in the system, for example:

- A distribution unit
- An Ethernet switch
- Ancillary items, such as test equipment (for example, an oscilloscope and / or spectrum analyser) that are permanently or temporarily connected to the signal generator(s)

1.2.8.1 Protective conductor current

DANGER



The sum of the protective conductor currents for a system comprising two, or more, Spirent signal generators, a Spirent Controller and monitor can exceed 3.5 mA

Note: Protective conductor current is current flowing, during normal operation, in the earth (ground) conductor of the ac power cable of all equipment that is not double-insulated. Protective conductor current is due to electrical leakage in the equipment, often from filters and components intended to reduce EMC to acceptable limits.

Where a system of Spirent signal generators and ancillary equipment (see above) is connected to the ac mains at a single outlet, Spirent recommend you estimate the total protective conductor current of your system by assigning an individual protective conductor current of 1 mA to each item of ac powered equipment and summing these currents. Where the total protective conductor current of your system exceeds 3.5 mA, Spirent recommends you ensure the ac distribution system and the connectors and outlet(s) supplying ac power to the system are capable of safely operating at this protective conductor current. You may need the services of a professionally qualified electrician to perform this assessment.

1.2.8.2 AC distribution system

DANGER



Ensure you connect ALL equipment used with a system to the same phase of the ac power distribution system

NEVER connect any part of a system to a different phase or to a power outlet with an unknown phase

NEVER connect test equipment or ancillary items that will be used with a system, or used near it, to a different phase or to a power outlet with an unknown phase

Note: The phase-to-phase voltage in a two-, or three-, phase ac distribution system exceeds the phase to neutral voltage.

Ensure you always use the same phase to provide ac power to a system, including all ancillaries that you may connect to it or use near it. Using different phases to power equipment in a system will lead to hazardous phase-to-phase voltages. You may need the services of a professionally qualified electrician to determine the phases of the outlets you want to use.

1.2.8.3 Total rated current for a system

Note:

1) 'System' refers to a combination of Spirent signal generators, Controllers, monitors and associated test equipment for a specific test or customer requirement

2) Since January 2012, Spirent Interconnect Drawings state the total rated current for the system

Where a single ac power outlet provides ac power for a system, Spirent recommends you sum the rated currents of all equipment connected to this outlet to estimate the total rated current of your system. You must ensure the ac distribution system, and the connectors and outlet(s) supplying ac power to the system are capable of safely operating at this rated current. You may need the services of a professionally qualified electrician to perform this assessment.

1.3 Disposal

Follow all current local and national toxic waste disposal requirements.

Do not incinerate the signal generator it may contain PTFE and / or Beryllium Oxide, which would emit toxic fumes. The signal generator may contain Lithium cells. Follow the disposal instructions prepared by the Lithium cell manufacturer.

Refer to the manufacturer of the PC / SimGEN controller for disposal details.

1.4 Referenced documents

- a) NATO Standard Agreement STANAG 4294 Issue 1.
- b) ICD-GPS-200.
- c) DGP00686AAA: SimGEN User Manual.
- d) RTCA DO-246A and B: GNSS Based precision Approach Local Area Augmentation System (LAAS)-Signal-In-Space ICD.
- e) DGP00792AAA: SimREMOTE User Manual.
- f) ID/GAL/0258/GLI Galileo Signal in Space ICD
- g) DGP00856AAA SimGEN Software User Manual - Galileo appendix for authorised users
- h) DGP00782AAA SimMCODE User Manual
- i) DGP00921AAA M Code SDS hardware and software User Manual
- j) DGP01032AAA GSS8000 interconnections - appendix to DGP703
- k) DGP01074AAA GSS6700 using SimREPLAY and SimREPLAYplus User Manual
- l) DGP00864AAA SimPRS User Manual
- m) DCS0024A Updating Simulator Compact Flash Cards
- n) DCS0030A Upgrading Intel Processor Firmware
- o) DCS0032A Upgrading Small Chassis Simulator Firmware
- p) DCS0038A Updating GSS6300 GSS6700 Simulator Firmware or FPGA
- q) DCS0038B Upgrading GSS6300 GSS6700 Simulator Features

1.5 Copyright notices

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1.6 Signal generator resolution and software resolution

Generally, Spirent's SimGEN, SimREPLAY and SimREPLAYplus software has better resolution of parameters such as power level than the signal generator it is controlling. Typically, the signal generator can resolve power level to one tenth of a decibel (0.1 dB). The latest issue of the signal generator product specification contains resolution details.

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2 Introduction

Note: In July 2008, Spirent made obsolete the MS-series of Customer Calibration specifications and introduced the DCS-series for all customer servicing and calibration specifications. Spirent recommends you calibrate your signal generator using the appropriate DCS specification.

This document gives information about Spirent's range of multiple-channel signal generators and accompanies the SimGEN Software User Manual, reference c); and the SimREPLAY / SimREPLAYplus user manual, reference j). Depending on your simulator, these references give initial system set-up, hardware configuration selection and all aspects of scenario generation and control.

2.1 Spirent signal generators

Note: You must be an authorised user to use Galileo's Commercial, Safety of Life or Public Regulated Services. Users of SimGEN up to version 2.90 must use the dongle Spirent supplies. Users of SimGEN version 2.91 onwards must remove any Galileo dongle and, before using these Galileo services, install the licence file Spirent supplies onto their SimGEN Controller.

This user manual does not describe single-channel signal generators.

Table 2-1 and Table 2-2 give the product and calibration specifications and a description of each signal generator in this user manual.

Table 2-3 details superseded signal generators.

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Table 2-1 Spirent multiple-channel signal generators - “small chassis”*Note: “Small-chassis” refers to the relative size of the signal generator.*

Signal Generator	Product datasheet	Customer calibration	Firmware / FPGA upgrade	Galileo	GLONASS	GPS	Comment
GSS6700	MS3066 to MS3068	See section 3.3	References o), p) and q)	E1	L1	L1	See Chapter 3 Supports SimREPLAY, SimREPLAYplus or SimGEN
GSS4150	MS3014	See section 4.3	Reference o)	-	-	-	See Chapter 4 LAAS VHF Data Broadcast Generator

Table 2-2 Current Spirent multiple-channel signal generators - “large chassis”*Note: “Large chassis” refers to the relative size of the signal generator.*

Signal Generator	Product datasheet	Customer calibration	Firmware / FPGA upgrade	Galileo	GLONASS	GPS	Comment
GSS7790	MS3025	DCS0003D (was MS3032)	References m) and n)	-	-	Multiple output L1, L2	See Chapter 5 C/A Code P(Y) Code M Noise / AES-M Code
GSS8000-series single output	MS3057	DCS0004A (was MS3059)	References m) and n)	L1, E5, E6	L1, L2	L1, L2, L5	See Chapter 6
GSS8000-series dual output	MS3058	DCS0004A (was MS3060)	References m) and n)	-	-	L1, L2	See Chapter 6

Table 2-3 Superseded Spirent multiple-channel signal generators

Signal Generator	Product datasheet	Customer calibration	Comment
GSS5060	MS3003	See section C.3	See Appendix C Previously used in the Spirent PLTS system, initially superseded by the GSS6560, now superseded by the GSS6700
GSS6560	MS3003	See section D.3	See Appendix D. Previously used in the Spirent PLTS system, superseded by the GSS6700
GSS4750	MS3007	DCS0002B (was MS3016)	See Appendix E. Initially superseded by the 7700 and now the GSS8000 series.
STR4760	MS3006	DCS0002C (was MS2983)	See Appendix F. Initially superseded by the 7700 and now the GSS8000 series.
STR4780	MS3009	DCS0002D (was MS2982)	See Appendix G. Superseded by the GSS8000 series
STR4790	MS3010	DCS0002E (was MS2988)	See Appendix H. Superseded by the GSS7790
GSS7700	MS3017	DCS0003A (was MS3022)	See Appendix I. Variant A and B are both superseded by the GSS8000 series
GSS7800	MS3043 MS3047 MS3031	DCS0003E (was MS3050)	See Appendix J. Superseded by GSS8000 series
GSS7900	MS3040	DCS0003F (was MS3054)	See Appendix K. Superseded by GSS8000 series

Table 2-3 details the range of superseded Spirent signal generators. Although not available as new product, Spirent continues to provide support to customers using these signal generators. You can find information on these signal generators in the Appendices of this document.

3 GSS6700

One GSS6700 signal generator generates up to twelve channels each of three constellations as follows:

BeiDou B1, GLONASS L1 and GPS L1 signals,
or Galileo E1, GLONASS L1 and GPS L1 signals

using Spirent's SimGEN, SimREPLAY or SimREPLAYplus software. The signal generator uses a hardware license for each constellation and you can easily purchase and apply new licenses without returning the signal generator to Spirent.

Rear-panel connectors let you phase-lock the signal generator to an external reference signal, trigger it from an external start pulse and synchronise it to external equipment using the rear-panel 1PPS input. Rear-panel connectors also provide an output from the internal 10 MHz reference and 1PPS synchronisation signals.

3.1 Front panel

Figure 3-1 shows the GSS6700 front panel. Table 3-1 describes the front panel indicators and connector.

Figure 3-1 GSS6700 front panel



Table 3-1 GSS6700 front panel

Indicator	Type	Description
POWER	LED	ON when connected to ac power and the internal power supply is operating
HEALTH	LED	ON - operating normally Flashing - highlights is an error, as follows: 1 Hz flashing: BITE error 4 Hz flashing: FATAL error 3 flash repeating sequence at 4 Hz (3 flashes and one "no flash" every second): Ext Ref phase lock acquisition period
ACTIVE	LED	ON - simulation in progress Flashing - waiting for an external trigger at TRIG IN connector on rear panel

Connector	Type	Description
Primary RF Output	Co-axial type N	Simulated GNSS output

3.2 Rear panel



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Note: The Mon/Cal port is DC isolated to 50 V. All other rear panel ports are not DC isolated.

Figure 3-2 shows the GSS6700 rear panel. Table 3-2 describes the rear panel connectors.

Figure 3-2 GSS6700 rear panel



Table 3-2 GSS6700 rear panel connectors

Connector label	Type	Description
RS-232	9-way D type	Spirent use only
MON CAL	SMA female	Provides a high level RF output
AUX OUTPUTS	25-way D-type	See Table 3-3
OPTIONAL AUX I/P	(none)	Used with a Spirent factory-fitted option
EXPANSION PORT	7-way Fischer type 103	Used for Multi-box interconnection, see section 3.5
NOT USED	n/a	Not used
HOST PC	USB type B connector	Control and data connection to the 6700 Controller. Note: Not suitable for ATE applications
TRIG IN	BNC	Use to start a run using an external trigger signal. TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ω input impedance Section 3.6 shows timing details.

Connector label	Type	Description
EXT REF IN	BNC	Note: For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-1.
10 MHz OUT	BNC	Output for the signal generator's internal reference OCXO
Power	IEC	AC power in, ac power switch and fuses For safety information see section 3.2

The product datasheet, see Table 2-1, gives further details of each rear-panel connector.

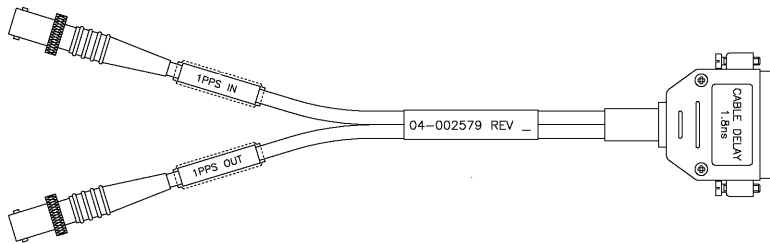
Table 3-3 GSS6700 EXPANSION PORT 25 way connector pin-out

Notes:

- 1) Input signals marked * are 50-Ohm terminated.
- 2) Output signals marked * are 50-Ohm drive capable.

Pin	Function
1	1PPS IN* Use to synchronize the signal generator to an external system, see section 3.6 TTL level compatible.
2	1PPS OUT * Independent of Doppler setting TTL level compatible, nominal pulse width 100 ms
3 to 13	Not connected
14	Ground for 1PPS IN
15	Ground for 1PPS OUT
16, 19, 20	Not connected
17, 18, 21 to 25	Ground

Spirent supplies cable assembly, part number 04-002579 see Figure 3-3, with each GSS6700 signal generator. When connected to the Auxiliary Output port, this cable provides 1PPS IN and 1PPS OUT at female BNC connectors. Spirent marks each cable assembly with its delay time.

Figure 3-3 Auxiliary Output port cable

3.2.1 Mains power inlet



SAFETY WARNING

GSS6700 signal generators use double-pole / Neutral fusing.



SAFETY WARNING

You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

Note: The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate.



SAFETY WARNING

GSS6700 serial numbers 9355 onwards use IEC inlets with double-pole / Neutral fusing.



SAFETY WARNING

You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed

**NOTICE**

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS6560 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: *The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.*

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate.

Only suitably trained and qualified personnel should service this signal generator.

There are no user serviceable parts in this signal generator.

3.2.2 Cooling fan

**NOTICE**

Failure to keep the filters clean can result in permanent damage to the signal generator.
Periodically wash the fabric dust filter (if fitted) in clean water.

A cooling fan sucks air from inlet holes at the front edge of the base of the signal generator through the signal generator to the exhaust grille on the rear panel. Do not cover or restrict the inlet holes or exhaust grille; severe internal damage could result due to overheating. Periodically inspect the fan blades through the exhaust grille and remove excess dust using a vacuum cleaner.

The inspection interval will depend upon the environment in which the signal generator is situated; Spirent recommends you examine the fan at monthly intervals to determine a normal inspection interval.

A thermal sensor will shut down the signal generator if its internal temperature exceeds a pre-determined value. If the signal generator unexpectedly shuts down, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed

3.2.3 Model and serial numbers

The signal generator model and serial numbers are located on the signal generator rear panel. The model number consists of 'MODEL' followed by eight alpha-numeric characters, for example 'MODEL: ABCD-0123'.

Depending on the signal generator type, the serial number may consist of 'S/N' followed by four-digits or eight-digits, for example: 'S/N: 0123' or 'S/N: 01234567'.

Always quote the model number and the serial number when discussing your signal generator with Spirent.

3.3 Calibration



Use anti-static handling precautions during calibration

The GSS6700 employs digital architecture to produce accurate and stable signals. Spirent recommends you calibrate the internal 10 MHz reference oscillator and the power level annually.

If your simulator comprises two, or more signal generators, you must individually calibrate each signal generator.

3.3.1 10 MHz reference calibration

Note: The GSS6700 internal frequency reference is within Spirent's specifications when you use the signal generator horizontally or vertically. However, if you use your signal generator with the vertical mounting kit permanently installed, Spirent recommends you perform the 10 MHz reference calibration with the signal generator in the vertical position.

This calibration requires a calibrated frequency counter capable of measuring 10.00 MHz with at least ten-digit accuracy, for example an HP53131A. The frequency counter should be locked to a frequency standard accurate to $< \pm 1 \times 10^{-9}$, for example an HP5065A Rubidium standard.

You can use a less accurate standard if you are willing to accept reduced frequency accuracy for your signal generator.

3.3.1.1 Procedure

- a) (only for simulators using two, or more, signal generators) Before calibrating the 10 MHz reference oscillator, you must prevent the Auxiliary signal generator(s) from locking and / or synchronising to the Master signal generator by disconnecting all cables from the Master signal generator to the Auxiliary signal generator(s).
- b) Turn on the GSS6700 and the frequency counter.
- c) Allow at least 30 minutes for the signal generator's internal oscillator to stabilise.
- d) Attach the frequency counter to the 10 MHz OUT BNC connector on the rear panel.
- e) Remove the 'Calibration Void if Broken' label covering the '10 MHz Ref Cal' adjustment port.
- f) Set the frequency adjustment potentiometer to achieve a frequency reading of $10 \text{ MHz} \pm 0.02 \text{ Hz}$.
- g) Fit an appropriate calibration label over the '10 MHz Ref Cal' adjustment port.
- h) (only for simulators using two, or more, signal generators and if you are not performing a Power Calibration) Before using your simulator, you must reconnect the cables from the Master signal generator to the Auxiliary signal generator(s) you removed in step a).

This concludes reference frequency calibration.

3.3.2 Power calibration within PosApp

Notes:

1) The calibration algorithm employs the best constellation for power calibration from the constellations for which you have licences. Spirent recommends you set your power meter to measure at 1583 MHz (all constellations are within 22 MHz of this frequency).

2) If you use two GSS6700 signal generators, you must calibrate the Master and Auxiliary signal generators while connected together.

Power level calibration requires either SimGEN running on a SimGEN controller, or SimREPLAY or SimREPLAYplus, running on the 6700 Controller; and a calibrated RF power meter capable of measuring the frequency and power range shown in Table 3-4, for example an HP E4418B.

Table 3-4 RF power meter requirement

Measured power range, dBm	Calibration offset range, dB
-50 to -30	-7.31 to +3.96

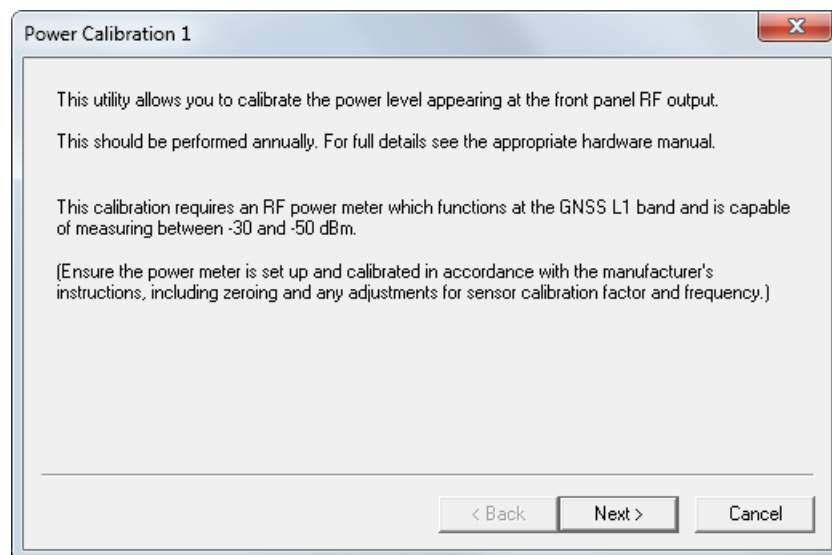
Before using the power meter to calibrate the signal generator, ensure you correctly set any frequency sensitive power meter parameters.

3.3.2.1 Procedure

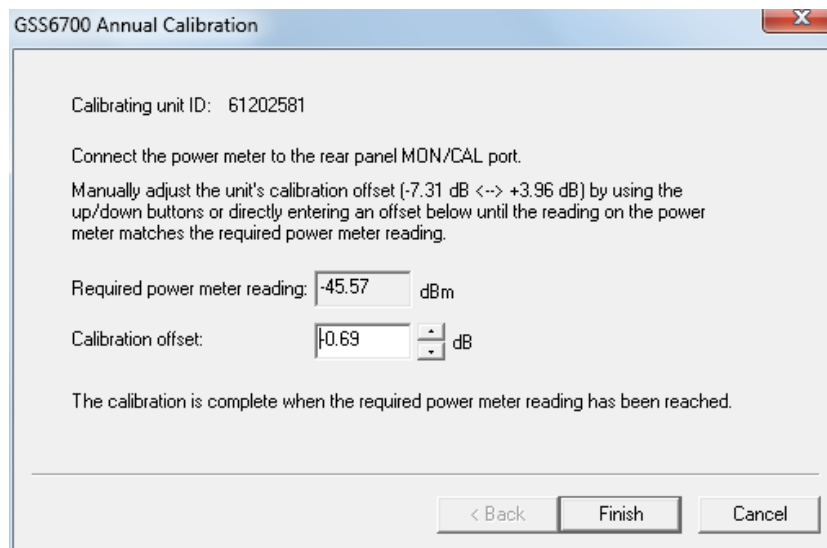
Note: If your simulator uses two, or more, GSS6700 signal generators, you must follow step a) in the procedure below before starting Power calibration

- a) (only for simulators using two, or more, signal generators) Before performing a Power calibration, you must disconnect the coaxial cable from the OPTIONAL AUX I/P port on the Auxiliary signal generator at the MON/CAL port on the Master signal generator see Figure 3-11.
To ensure the Auxiliary signal generator locks to the Master signal generator you must keep the Auxiliary cable connected, see Figure 3-11.
- b) For single signal generators, remove the SMA termination from the signal generator MON / CAL port connector on the rear panel. Retain for later replacement.
- c) Connect the 6700 Controller to a suitable AC power outlet and switch on.
- d) Wait until Windows has finished loading.
- e) Connect your signal generator to your 6700 Controller (or SimGEN Controller).
- f) Run PosApp.
- g) Use **Tools-Change Hardware configuration** and select the configuration you want to calibrate. You must select the correct configuration, as the power utility will only calibrate the signal generators in the configuration you select.
- h) Start the Power calibration utility by selecting the menu item **Tools-6700 Utilities-Power calibration**
- i) The utility guides you through the stages of power calibration.
- j) Connect your RF power meter to AC mains, turn on and allow it to warm up for the recommended period.
- k) Follow the RF power meter manufacturer's instructions to zero and calibrate the power meter before use.
- l) Select your signal generator then click **Calibrate** to see the dialog in Figure 3-4.

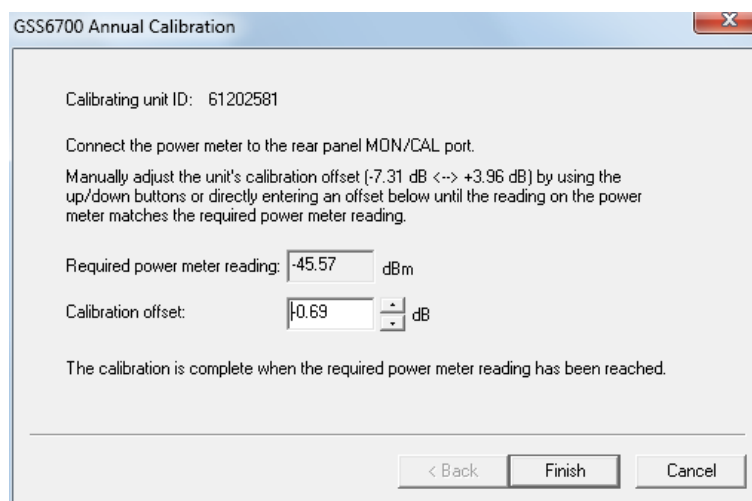
Figure 3-4 GSS6700 Power Calibration - 1



- m) Click Next to view the first stage, which advises you to allow the signal generator temperature to stabilise by running it for at least thirty minutes before calibration, see Figure 3-5.

Figure 3-5 GSS6700 Power Calibration - 2

- n) After 30 minutes, click **Next**, and follow the instruction sin the dialog, see Figure 3-6.

Figure 3-6 GSS6700 Power Calibration - 3

- o) Enter a value in **Calibration** (within the allowed calibration offset range).
- p) You need to match the RF power meter reading with the value shown in Required power meter by changing the value you enter in Calibration.
- q) Click **Finish** when you have successfully matched the RF power meter reading with the value shown in **Required power meter reading**.
- r) When the calibration is complete, if your configuration includes a second signal generator, select it now and repeat the calibration process
- s) For single signal generator, replace the SMA termination on the MON / CAL port.
- t) Replace the SMA termination on the MON / CAL port.
- u) Ensure you correctly torque the SMA termination.
- v) For two signal generators, connect the coaxial cable from the OPTIONAL AUX I/P port on the Auxiliary signal generator to the MON/CAL port on the Master signal generator, see Figure 3-11.

This concludes power calibration.

3.3.3 Power calibration using a stand-alone utility

Notes:

- 1) This utility does not need a licence file or sig_gen.txt file. You can run this utility from any PC running Windows 7 (32-bit or 64-bit) that has at least one USB 1.1 (or greater) port. This document does not describe installing the utility on a Windows 7 PC.
- 2) The calibration algorithm employs the best constellation for power calibration from the constellations for which you have licences. Spirent recommends you set your power meter to measure at 1 583 MHz (all constellations are within 22 MHz of this frequency).
- 3) If you use two, or more, GSS6700 signal generators, you must individually calibrate each signal generator.

Power level calibration using the stand-alone utility, GSS6x00_Power_cal.exe, requires you:

- Install the executable file for the utility on any Windows 7 (32-bit or 64-bit) PC
- Use a calibrated RF power meter capable of measuring at 1 583 MHz over the power range shown in Table 3-5, for example an HP E4418B.

Table 3-5 RF power meter requirement

Measured power range, dBm	Calibration offset range, dB
-50 to -30	-7.31 to +3.96

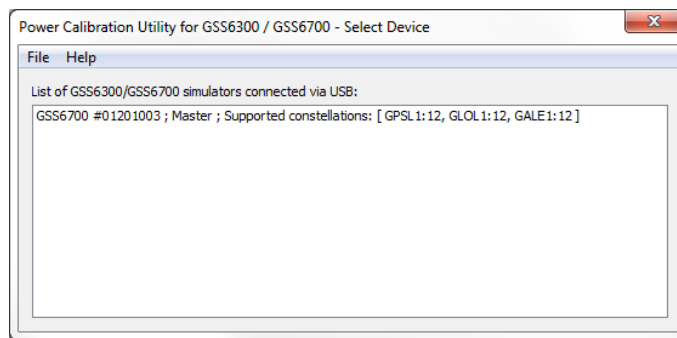
Before using the power meter to calibrate the signal generator, ensure you correctly set any frequency sensitive power meter parameters.

3.3.3.1 Procedure

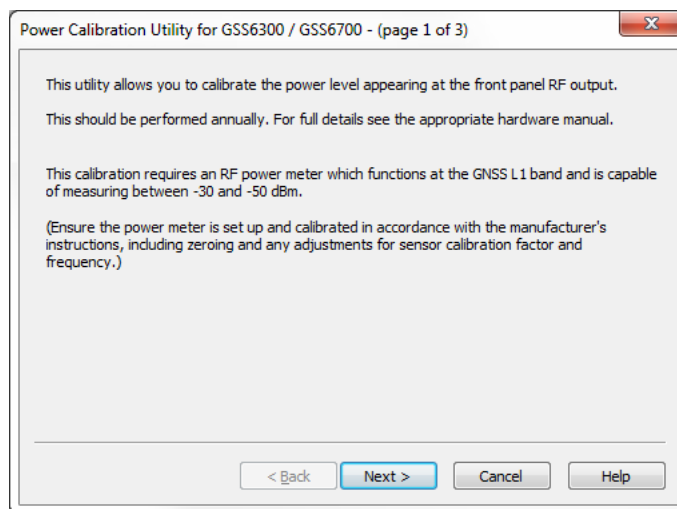
First, install the utility on a Windows 7 PC. For convenience, Spirent recommends you place a shortcut to this utility on the desktop.

To perform a power calibration on a single signal generator:

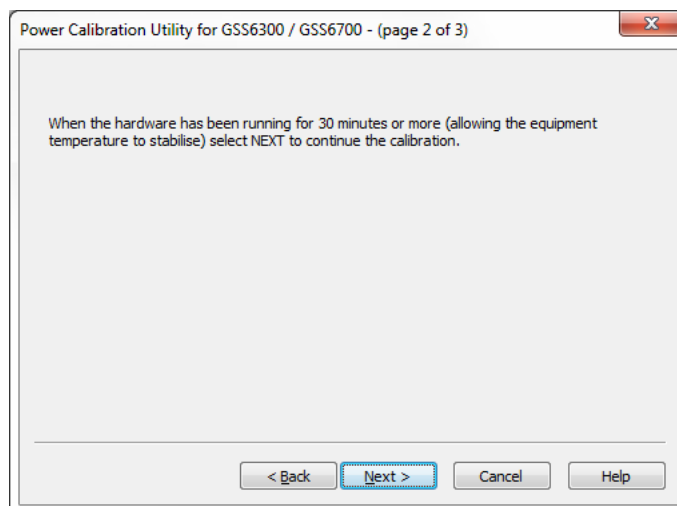
- a) Remove the SMA termination from the signal generator MON / CAL port on the rear panel. Retain the termination for later replacement.
- b) Connect the signal generator to the Windows PC.
- c) Connect the signal generator to a suitable AC power outlet and switch on at the rear panel switch, see section 3.2, page 3-2
- d) Run the power calibration utility. The utility guides you through the stages of power calibration of the signal generator.
- e) Connect your RF power meter to AC power, switch on and allow it to warm up for the recommended period.
- f) Follow the RF power meter manufacturer's instructions to zero and calibrate the power meter before use.
- g) Connect the RF power meter sensor to the MON / CAL port.
- h) In the power calibration utility **Select Device** dialog, select the signal generator you want to calibrate, see Figure 3-7.

Figure 3-7 Select device dialog

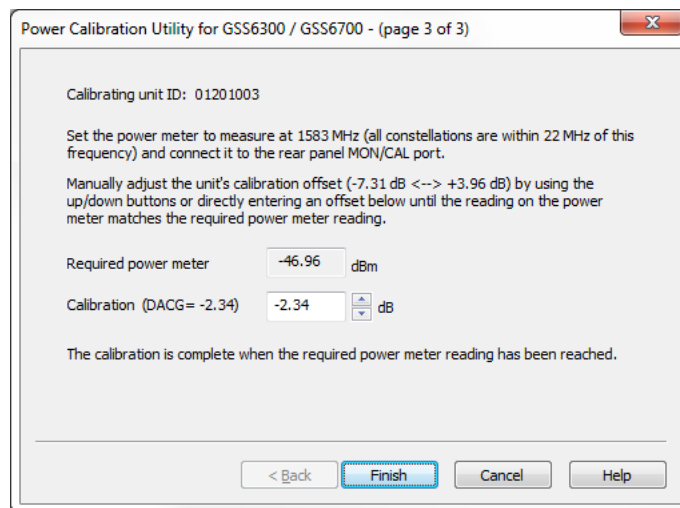
- i) This window opens, see Figure 3-8.

Figure 3-8 Power calibration - page 1 of 3

- j) Click **Next** to view the first stage, which advises you to allow the signal generator temperature to stabilise by running it for at least thirty minutes before calibration, see Figure 3-9.

Figure 3-9 Power calibration - page 2 of 3

- k) After thirty minutes, click **Next** and follow the instructions in the dialog, see Figure 3-10.

Figure 3-10 Power calibration - page 3 of 3

- l) Type a value in **Calibration** within the allowed calibration offset range of +3.96 to -7.31 dB. Notice if you type a number higher than +3.96, the utility uses +3.96; and if you type a number lower than -7.31, the utility uses -7.31. The number following DACG (-2.34 in the figure above) shows the value, in dB, the utility applies. Notice the utility applies this number as you type, you do not need to press ENTER. Alternatively, use the up and down arrows.
- m) You need to match the RF power meter reading with the value shown in **Required power meter** by changing the value you enter in **Calibration**.
- n) Click **Finish** when you have successfully matched the RF power meter reading with the value shown in **Required power meter**.
- o) Remove the RF power meter sensor from the MON / CAL port.
- p) Replace the SMA termination on the MON / CAL port.
- q) Ensure you correctly torque the SMA termination.
- r) If you use two, or more, signal generators you must individually calibrate each signal generator by following this procedure.

This concludes power calibration for a single signal generator.

3.4 Connection to the 6700 Controller

Notes:

- 1) Install the latest version of Spirent's SimGEN, or SimREPLAY / SimREPLAYplus, software on the 6700 Controller before connecting the GSS6700 to the 6700 Controller.
- 2) Ensure the Power and Health indicators of the GSS6700 are not flashing and remain continuously lit before running the GSS6700.

Use the USB interface to control the GSS6700 from the 6700 Controller; or the RS232, or IEEE-488, interface to control the 6700 controller (and the GSS6700) using a remote PC.

See reference j) for details on using and controlling the GSS6700.

First:

- a) Turn on the 6700 Controller
- b) Wait for it to load Windows

After Windows has started

- a) Connect your GSS6700 signal generator to the 6700 Controller see Table 3-6.
- b) Use the ac power cable to connect your GSS6700 to a suitable ac power outlet.
- c) Switch on your GSS6700.
- d) Start Spirent's PosApp software.

Table 3-6 Single GSS6700 interconnection table

Connection type	From	To
USB cable assembly (USB type A to USB type B)	USB port on 6700 Controller	GSS6700 USB port "Host PC"

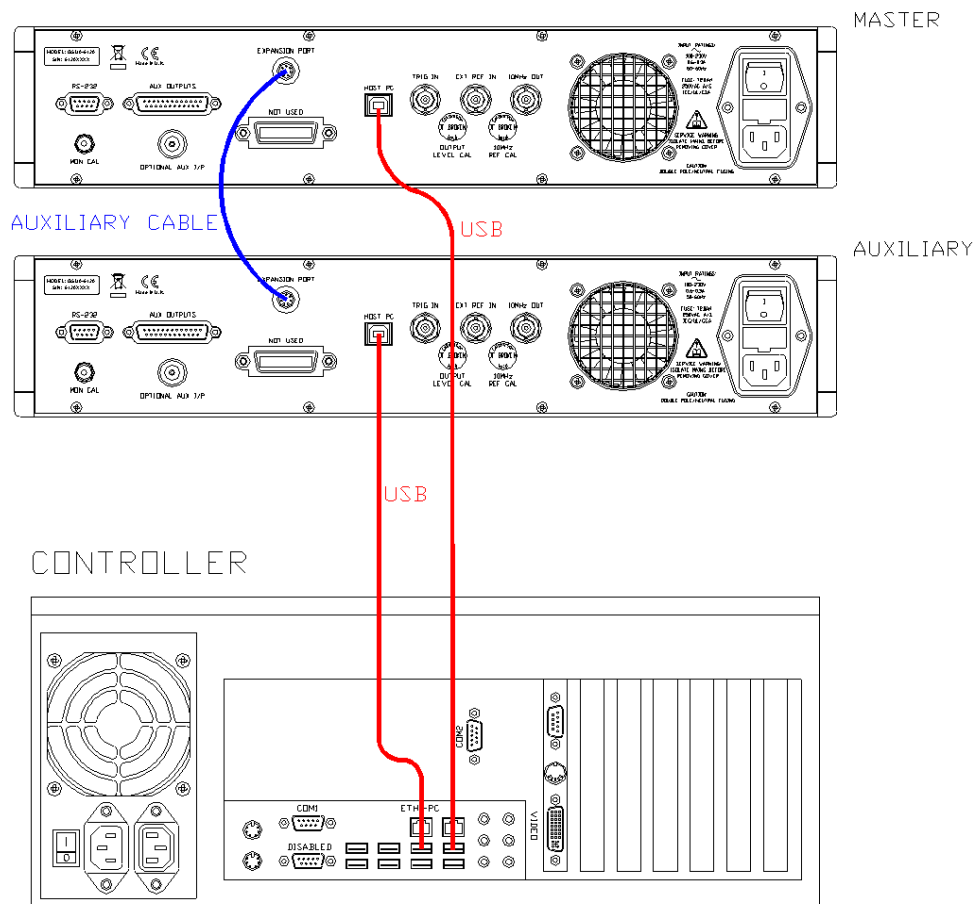
3.5 Using up to four GSS6700 signal generators with up to four outputs

Spirent can factory configure up to four GSS6700 signal generators to form a multiple RF output simulator that can simulate scenarios with, for example, four independent vehicles each with a single antenna, or one vehicle with four independent antennas.

To configure two GSS6700 signal generators for two output operation, follow the set-up shown in Figure 3-11 and Table 3-7. Figure 3-12 and Table 3-8 detail three signal generators for three output operation and Figure 3-13 and Table 3-9 detail four signal generators for four output operation.

In all simulators using more than one signal generator you must designate one GSS6700 signal generator as the 'Master' and designate each of the remaining GSS6700 signal generators as 'Auxiliary'. The Master signal generator supplies each Auxiliary with a 10 MHz reference and a 1PPS synchronisation pulse, ensuring all signal generators effectively act as one signal source.

You need SimGEN to run more than one GSS6700 signal generators with multiple RF outputs.

Figure 3-11 Two GSS6700, dual-output, interconnection diagram**Table 3-7 Two GSS6700, dual-output, interconnection table**

Connection type	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 1 port	GSS6700 Master, USB port 'Host PC'
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 2 port	GSS6700 Auxiliary, 6700 Controller USB port 'Host PC'
Auxiliary cable (Special to Spirent)	GSS6700 Master, Expansion port	GSS6700 Auxiliary, Expansion port

Figure 3-12 Three GSS6700, three output interconnection diagram

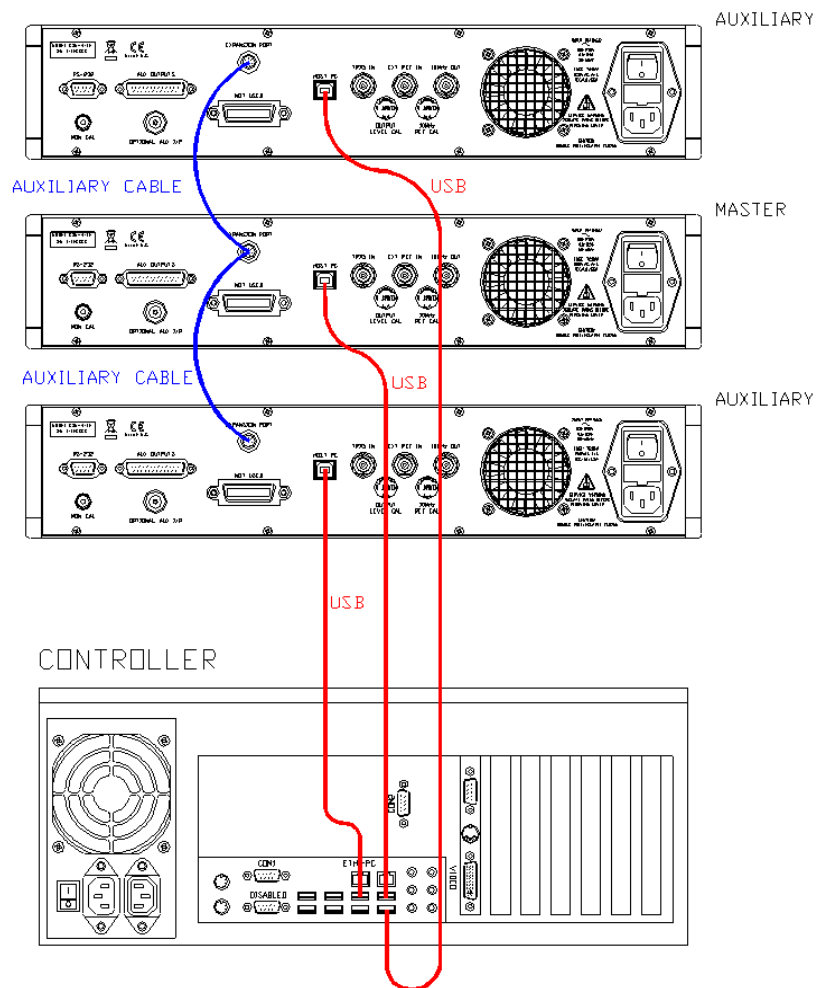


Table 3-8 Three GSS6700, three output interconnection table

Connection	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 1 port	GSS6700 Auxiliary 1, 6700 Controller USB port 'Host PC'
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 2 port	GSS6700 Master, 6700 Controller USB port 'Host PC'
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 3 port	GSS6700 Auxiliary 2, 6700 Controller USB port 'Host PC'
Auxiliary cable (Special to Spirent)	GSS6700 Master, Expansion port	GSS6700 Auxiliary 1, Expansion port; and GSS6560 Auxiliary 2, Expansion port

Table 3-9 GSS6700 four-box, four output interconnection table

Connection	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 1 port	GSS6700 Auxiliary 1, 6700 Controller USB port 'Host PC'
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 2 port	GSS6700 Auxiliary 2, 6700 Controller USB port 'Host PC'
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 3 port	GSS6700 Master, 6700 Controller USB port 'Host PC'
USB cable assembly (USB type A to USB type B)	SimGEN controller or 6700 Controller, USB 4 port	GSS6700 Auxiliary 3, 6700 Controller USB port 'Host PC'
Auxiliary cable (Special to Spirent)	GSS6700 Master, Expansion port	GSS6700 Auxiliary 1, Expansion port; and GSS6700 Auxiliary 2, Expansion port; and GSS6700 Auxiliary 3, Expansion port

3.5.1 Operating points

Note: The Master signal generator must always be present in any “multi-box” configuration. The Master signal generator has a sticker on its rear panel.

The following list gives points to observe when using more than one signal generator in a “multi-box” configuration.

- To operate in “multi-box” mode you must set your hardware configuration using **Tools-Change Hardware Configuration**.
- Spirent creates your hardware configuration during factory installation. If your hardware configuration does not exist, contact Spirent Applications Support.
- In a configuration using multiple GSS6700 signal generators, if the second, third or fourth signal generator provides an Auxiliary output, those signal generator will possess an auxiliary hardware key. Signal generators with auxiliary hardware keys can only operate in multiple signal generator mode and cannot operate as “standalone” signal generators.
- To ensure Spirent's PosApp software correctly launches, ensure your Master signal generator is running and connected to the Controller.
- Only the Master signal generator supports EXT REF IN, 1PPS IN and TRIG IN.
- You can operate a system with three or four signal generators as a two signal generator simulator without disconnecting the third or fourth signal generator.
- When you configure a three or four signal generator simulator, you can only designate one signal generator as the Master.
- When you configure a three or four signal generator simulator, you must connect the auxiliary cables as shown in Figure 3-12 and Figure 3-13.

3.6 Using two GSS6700 signal generators with a combined RF output

Notes:

- 1) The Auxiliary signal generator provides the combined RF output. Use the 1PPS output (see Table 3-3) from the Auxiliary signal generator to provide all external timing.
- 2) Some early implementations of two signal generators provided the combined RF output from the Master signal generator. If your combined RF output is from the Master signal generator, contact Spirent Global Services.

The configuration in Figure 3-14 can provide BeiDou B1, Galileo E1, GLONASS L1 and GPS L1 signals at a single RF port from two (suitably licenced) GSS6700 signal generators running SimGEN, SimREPLAYplus or SimREPLAY. When using two GSS6700 signal generators in this way, the Master signal generator provides BeiDou B1, GLONASS L1 and GPS L1 signals, with the Auxiliary providing the Galileo E1 signal.

You must identify the “Master” GSS6700 signal generator and the remaining “Auxiliary” GSS6700 signal generator, as the combined RF output is from the Auxiliary front panel RF output port. The Master signal generator supplies the Auxiliary with a 10 MHz reference and a 1PPS synchronisation pulse, ensuring all signal generators effectively act as one signal source.

Figure 3-14 Single combined output from two GSS6700 signal generators

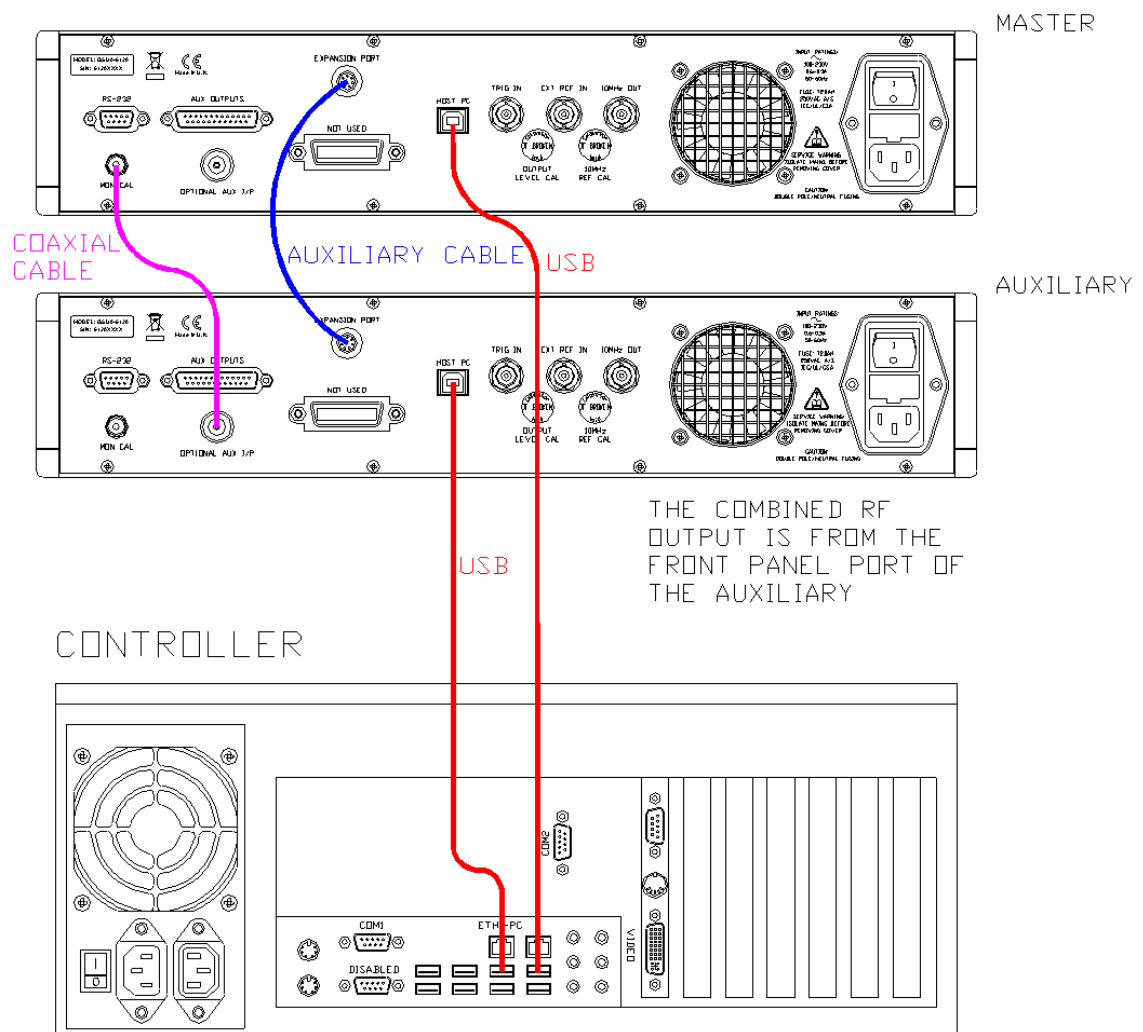


Table 3-10 GSS6700 single combined output interconnection table

Connection type	From	To
USB cable assembly (USB type A to USB type B)	REPLAY controller or 6700 Controller, USB 1 port	GSS6700 Master, USB port 'Host PC'
USB cable assembly (USB type A to USB type B)	REPLAY controller or 6700 Controller, USB 2 port	GSS6700 Auxiliary, 6700 Controller USB port 'Host PC'
Auxiliary cable (Special to Spirent)	GSS6700 Master, Expansion port	GSS6700 Auxiliary, Expansion port
RF Coaxial cable	GSS6700 Master, MON CAL port	GSS6700 Auxiliary, OPTIONAL AUX I/P port

3.7 Synchronising from external equipment

Note:

- 1) The 1PPS input impedance is 50-Ohms. The pulse width of incoming signals should be ≥ 120 ns.
 - 2) The use of TRIG IN (Immediate Trigger Mode) together with 1PPS IN is inappropriate, as both would be attempting to control the timer. However, you can use TRIG IN (Delayed Trigger Mode) with 1PPS IN.
 - 3) For two signal generator, single-output simulators only, the reference 1PPS signal is from the Auxiliary signal generator.
- All other simulators use the reference 1PPS signal from the Master signal generator.

The GSS6700 signal generator incorporates input and output signal ports which can be used in various ways to synchronise time between the GSS6700 signal generator and the remainder of the system. This section describes how to use the 1PPS IN and/or TRIG IN inputs to achieve synchronisation.

The GSS6700 signal generator maintains time internally by means of a time counter, clocked by an internal 10 MHz clock. Operations always start on a one-second rollover of this timer.

The timer may be synchronised to an external system before starting an operation by applying a rising edge to the 1PPS IN rear panel input.

You can start operations either by appropriate timing of the Run command (**Trigger Mode: Disabled**); or by selecting **Delayed Trigger Mode** and applying a rising edge to the TRIG IN input. Both cause the operation to start on the next one-second rollover of the timer.

Alternatively, you can select **Immediate Trigger Mode**, which forces the timer to a point just before the one-second rollover and freezes it until a rising edge is detected on the TRIG IN input, the operation starts running after a short delay.

If coarse synchronisation to your system is sufficient, you can use the methods described above with no additional considerations. However, certain fixed delays, and uncertainties of the order of 100 ns will exist.

To achieve precise synchronisation you must supply the GSS6700 with an external 10 MHz frequency reference and observe certain timing requirements between the 1PPS IN and/or TRIG IN signals and the EXT REF IN signal. The following sections detail these requirements.

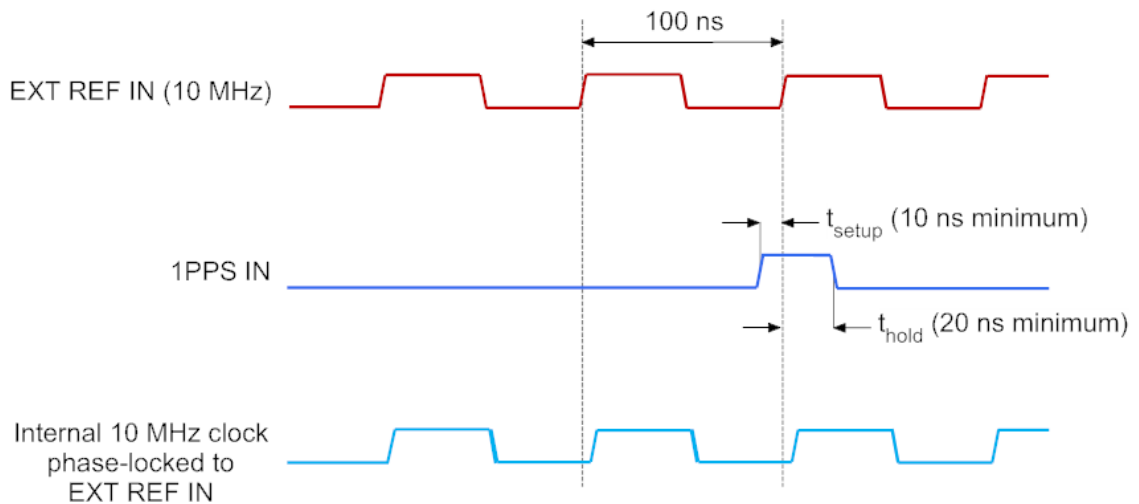
3.7.1 1PPS in

Notes

- 1) Alignment of 1PPS OUT does not occur immediately after detection of 1PPS IN, but one second after.
- 2) During a simulation, the 1PPS IN input is disabled.

Figure 3-15 shows the timing requirements you need for the RF output from the signal generator to be within 100 ns from run to run.

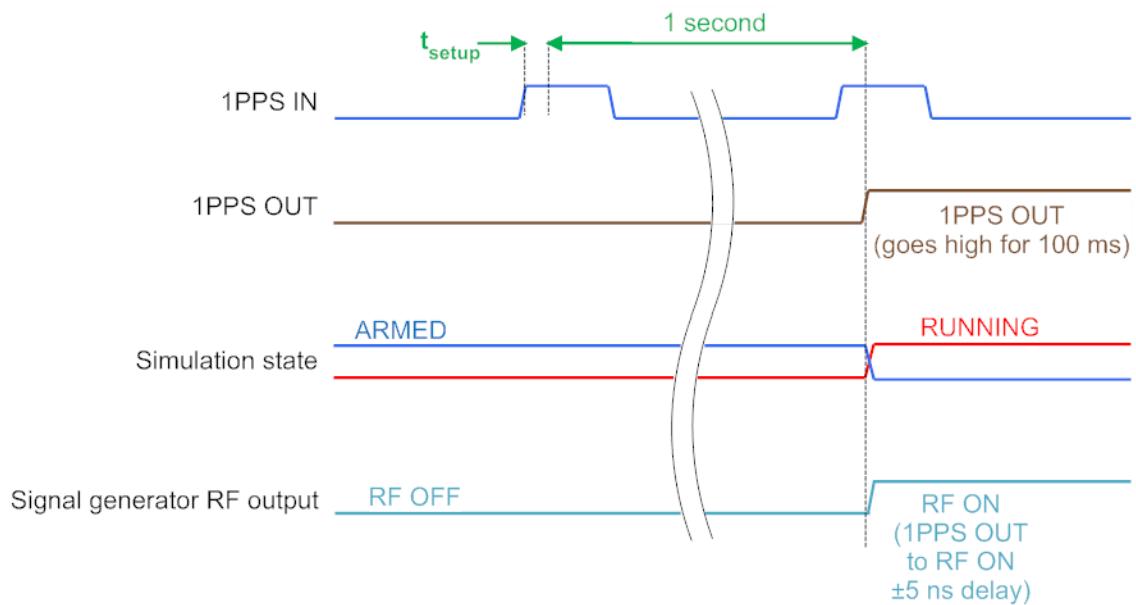
Figure 3-15: Timing of 1PPS IN and EXT REF IN



The EXT REF IN signal may be a square wave as shown (for example, a TTL/CMOS signal) or a sinusoid. Irrespective of the input waveform, the timing reference point is the ac zero-crossing of the signal.

The 1PPS IN pulse must start (t_{setup}) at least 10 ns before the ac zero-crossing point of the EXT REF IN waveform (but not within 20 ns of the previous leading edge) and remain high (t_{hold}) for at least 20 ns after the ac zero-crossing point. The 1PPS IN pulse must have a pulse width no less than 30 ns (minimum values for $t_{\text{setup}} + t_{\text{hold}}$), and can remain high after 30 ns.

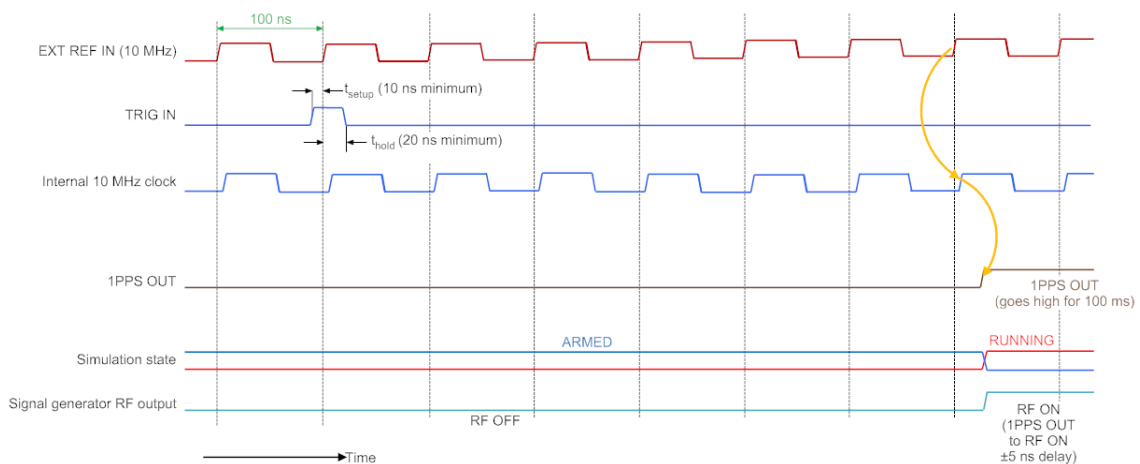
As long as you meet these timing requirements, the RF signal timing, see Figure 3-16 will be fixed and repeatable, with respect to EXT REF IN, every time you run a simulation.

Figure 3-16: Timing of RF output and 1PPS OUT

3.7.2 TRIG IN - Immediate mode

Note: If you stop the scenario and your simulator does not provide an input to the signal generator TRIG IN port, you must restart your signal generator before you can restart the scenario.

When using trigger mode Immediate, the timing requirements for the rising edge of TRIG IN with respect to EXT REF IN are the same as for the 1PPS IN input (that is, $t_{\text{setup}} = 10$ ns, $t_{\text{hold}} = 20$ ns). However, before the simulation starts, there is a delay of six, 10 MHz clock cycles after recognizing the trigger, see Figure 3-17.

Figure 3-17: Timing requirements for TRIG IN (immediate mode) and resulting start timing

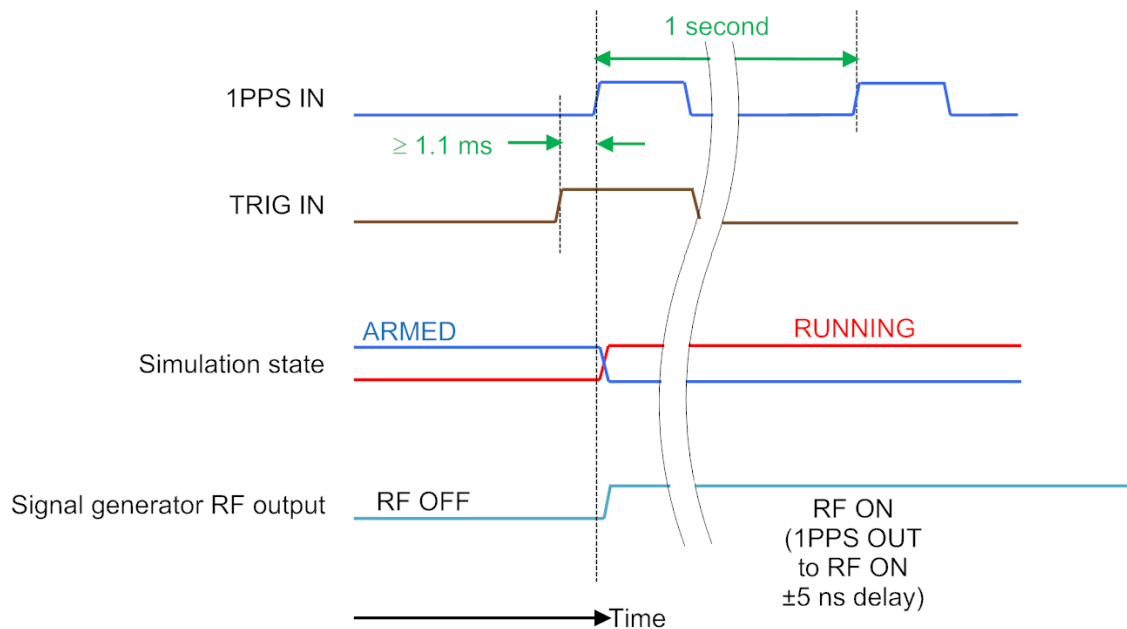
3.7.3 TRIG IN - Delayed mode

Note: If you stop the scenario and your simulator does not provide an input to the signal generator TRIG IN port, you must restart your signal generator before you can restart the scenario.

Alternatively if an external trigger is unavailable, Spirent recommends using one of the TIMER output ports in 1PPS mode connected to the TRIG IN port.

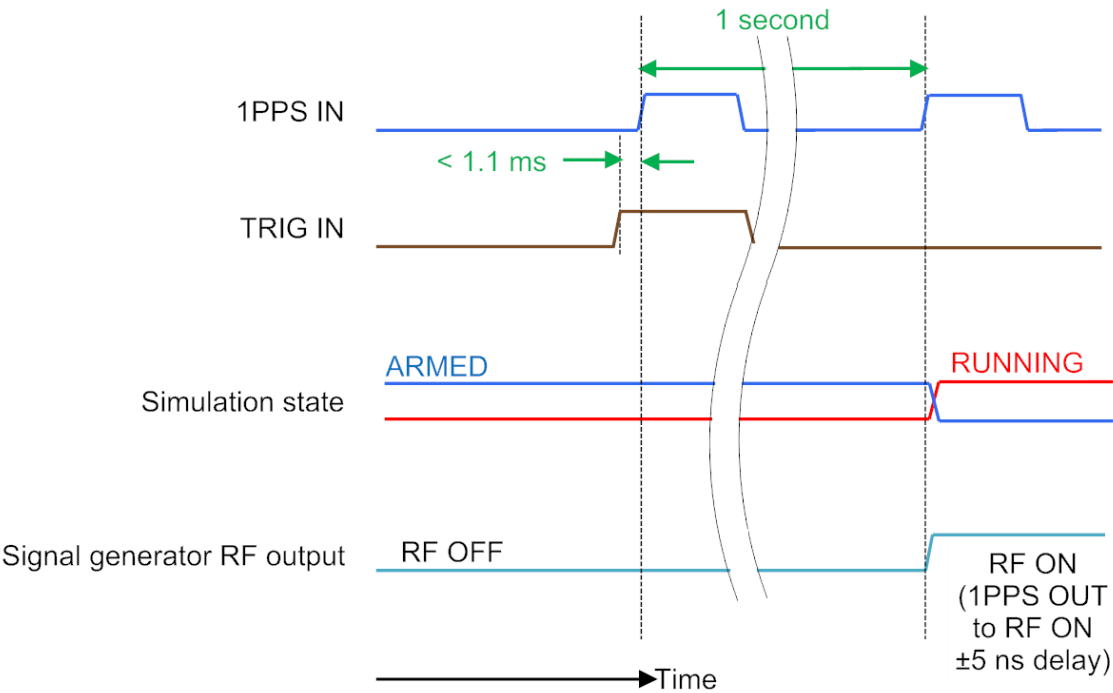
To start on a defined 1PPS event in trigger mode Delayed, the rising edge of TRIG IN must occur at least 1.1 milliseconds before the 1PPS event, see Figure 3-18.

Figure 3-18: GSS6700 Delayed trigger mode with TRIG IN over 1.1 milliseconds



If the rising edge of TRIG IN is under 1.1 milliseconds before the 1PPS event, the signal generator will start on the next 1PPS, giving a one second delay, see Figure 3-19.

Figure 3-19: GSS6700 Delayed trigger mode with TRIG IN under 1.1 milliseconds



3.8 Configuring for remote control using IEEE-488

Table 3-11 detail the interconnections for configuring the 6700 Controller (or SimGEN controller) to use the IEEE-488 bus with a second PC for remote control operation.

You can start the remote simulation by:

- ➔ Software Start - no external trigger required
- ➔ Immediate Start - after applied external trigger pulse.
- ➔ Delayed start - on next 1PPS after applied external trigger pulse

Table 3-11 GSS6700 remote control operation - interconnection table

Connection type	From	To
USB cable assembly (USB type A to USB type B)	6700 Controller (or SimGEN controller) USB port	GSS6700 Host PC USB port 'Host PC'
IEEE-488 cable assembly	6700 Controller (or SimGEN controller) IEEE-488 card	Remote PC IEEE-488 card
BNC cable assembly	Remote PC, either: Timer card, TRIGGER OUT (new cable assembly); or Timer card, OUTPUT (old cable assembly)	GSS6700, TRIG IN connector

Connection type	From	To
BNC cable assembly	Remote PC, either: Timer card, new adaptor, 1PPS IN; or Timer card, old adaptor, INPUT	GSS6700, 1PPS OUT connector

Select the mode you want to use with the remote command TR,n (SimGEN users, see the SimREMOTE user manual, reference e): SimREPLAY / SimREPLAYplus users see reference k)) and apply the external trigger pulse (if required) at the TRIG IN port. Reference e) details the optional Timer cable assembly.

Section 3.6 gives trigger-mode timing details.

3.8.1 Recommended interconnecting cables for remote operation

For optimum EMC performance when operating remotely using IEEE-488 or RS232, Spirent recommends using interconnection cables meeting the specifications in Table 3-12.

Each interconnecting cable must be less than three metres long.

Table 3-12 Interconnect cable specification

Cable type	Description
RS-232	DB9 male to female cable assembly Wired straight through with 360° foil plus braid screen termination at both ends
IEEE-488	Standard IEEE-488 cable assembly 360° foil plus braid screen termination at both ends

3.9 Mounting the signal generator

Note: To ensure adequate ventilation when bench-mounted, you must fit the feet Spirent supplies to the base of the signal generator, or use the vertical mounting kit.

When using one or more GSS6700 signal generators in a rack, you must:

- Ensure at least 10 mm clearance underneath each signal generator for ventilation
- Apply the operating temperature range of the signal generator, see Table 1-4, to the rack internal temperature range.
- Ensure you do not exceed the maximum ambient temperature rating for the signal generator shown in Table 1-4.

3.9.1 Vertically mounting the GSS6700

Note: The vertical mounting kit uses M3 screws with Torx (star-drive) heads. You will need a T10 Torx driver (for example, Britool TPK10, not provided) to install the vertical mounting kit. To avoid stripping threads, Spirent recommends you do not exceed the specified tightening torques.

Spirent provides a vertical mounting kit with each GSS6700. Figure 3-20 shows one of the two plates in the kit. Each plate has two feet and two M3 fixings.

Figure 3-20 Vertical mount kit

Install the vertical mount kit onto your signal generator as follows:

- a) Remove the ac power lead and all interconnecting leads before proceeding.
- b) Place the signal generator on its feet, in front of you, so you can see its front panel.
- c) Turn the signal generator so it rests on its right-hand side panel see Figure 3-21. The front panel RF-output port will be nearest the bench-top.

Figure 3-21 Vertical mount kit - fitting - 1

- d) (Optional) Remove each of the four feet from the base of the signal generator by removing the M3 fixing. Support the signal generator to ensure it does not topple.
- e) If you remove the feet and their fixings, retain them for future use.
- f) Locate the four M3 fixings (circled in Figure 3-22) securing the upper-most side panel.

Figure 3-22 Vertical mount kit - fitting - 2

- g) Remove these fixings and retain for future use. Do not remove the side panel.
- h) Locate the vertical mounting kit.
- i) Orient the plates on the signal generator as shown in Figure 3-23.
- j) Locate the four, M3 fixings Spirent supplies with the vertical mount kit.
- k) Secure the plates to the signal generator using these fixings in the threaded, side panel fixing holes.
- l) Tighten each M3 fixing to a maximum torque of 1.0 N.m.

Figure 3-23 Vertical mount kit - fitting - 3

m) Turn the signal generator so it is standing vertically, Figure 3-24

Figure 3-24 Vertically mounted GSS6700

n) Replace the ac power lead and all interconnecting leads.

3.10 Connectivity and specifications

Spirent supplies the latest issue of the GSS6700 product datasheet see Table 2-1, on the SimREPLAY/SimREPLAYplus and SimGEN installation CD. Refer to it for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification

d) Environmental specification

3.10.1 EMC and safety compliance

For the signal generator

The GSS6700 complies with the Low Voltage Directive 2006/95/EC by application of the harmonised standard EN60950-1:2006 "Information technology equipment. Safety. General requirements".

The GSS6700 complies with the EMC Directive 2004/108/EC by application of the following harmonised standard: EN61326-1:2006 "Electrical Equipment for Measurement, Control and Laboratory Use – EMC Requirements".

For the 6700 Controller system

The computer system shall comply with appropriate, equivalent, EMC and Safety standards.

4 GSS4150

The GSS4150 signal generator supports a single LAAS VHF channel. Spirent's SimGEN software directly controls the GSS4150 using a USB link. In normal operation, the GSS4150 works in conjunction with a Spirent GPS Multi-channel simulator.

This chapter gives a detailed review of connectivity, signal specification, calibration and inter-unit configuration of the GSS4150.

4.1 Front panel

Figure 4-1 and Table 4-1 describe the front panel of the GSS4150. Section 4.5 gives a detailed breakdown of the specifications associated with each of these functions.

Figure 4-1 GSS4150 front panel

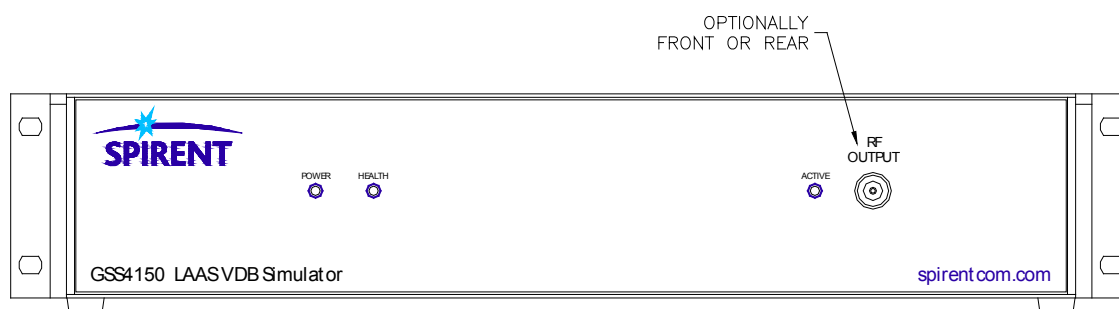


Table 4-1 GSS4150 front panel features

Name	Type	Description
POWER	LED	ON when power is connected and the internal power supply is operational.
HEALTH	LED	ON unless the internal monitoring detects an error, then 1 Hz Flashing: BITE error. 4 Hz Flashing: FATAL error. 3 Flash repeating sequence at 4 Hz (3 flashes and one "no flash" every second): Ext Ref phase lock acquisition period
ACTIVE	LED	ON after selecting LAAS definition-Signal sources file-General-VHF output in the SimGEN Scenario contents window and a scenario is running. Flashes when waiting for an external trigger signal on rear panel TRIG IN.
Primary RF Output (Optionally on rear panel)	'N' Type connector	Provides a composite LAAS VHF signal

4.2 Rear panel



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Figure 4-2 and Table 4-2 describe the rear panel of the GSS4150. Section 4.5 gives a detailed breakdown of the specifications associated with each of these functions.

Figure 4-2 GSS4150 rear panel

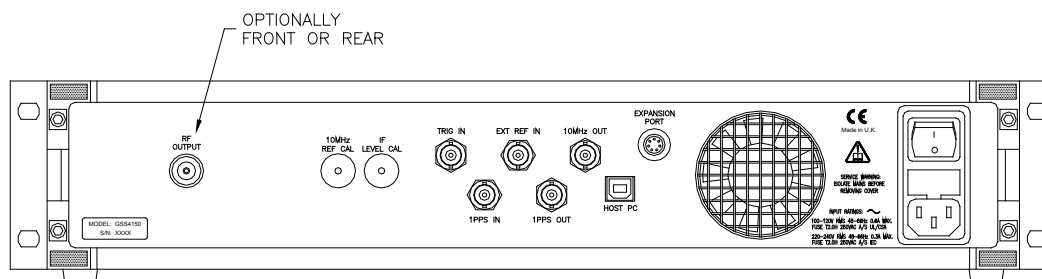


Table 4-2 GSS4150 rear panel features

Connector	Type	Description
JAMMER PORT	N Type female connector	Input port for externally supplied interference signals
PRIMARY RF OUTPUT PORT (optional)	N Type female connector	Provides a composite LAAS VHF signal
10MHz REF CAL	N/A	Calibration port for internal 10 MHz Reference (see section 4.3.1)
IF LEVEL CAL	N/A	Adjustment port for calibration of power level (see section 4.3.2)
EXPANSION PORT	7-way Fischer type 103	Used for Multi-box interconnection (see section 4.4)
TRIG IN	BNC	Start a simulation using the rising edge of an external trigger signal. TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ω input impedance Section 3.6 shows timing details
10 MHz OUT	BNC	Internal reference output

Connector	Type	Description
EXT REF IN	BNC	Use to lock the signal generator to an external frequency reference. Note: For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-1. Note: For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-1.
1PPS IN	BNC	External system synchronisation input. TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ω input impedance Section 3.6 shows timing details
1PPS OUT	BNC	External system synchronisation output TTL output level: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V into 50 Ω load Rising edge synchronised with 1 s epoch in GPS time
HOST PC	USB downstream connector	Control and data connection to the SimGEN controller or Host PC
Power in switch and fuse	IEC	Mains supply ac power in

4.2.1 Mains power inlet



SAFETY WARNING

GSS4150 serial numbers 1014 onwards use IEC inlets with double-pole / Neutral fusing.



SAFETY WARNING

You must connect this signal generator to mains earth (ground)
Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible
Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS4150 at 100-120 V or 220-240 V AC 50-60 Hz

Note: *The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.*

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate

4.2.2 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator.
Periodically wash the fabric dust filter (if fitted) in clean water.

A cooling fan sucks air from inlet holes at the front edge of the base of the signal generator through the signal generator to the exhaust grille on the rear panel. Do not cover or restrict the inlet holes or exhaust grille; severe internal damage could result due to overheating. Periodically inspect the fan blades through the exhaust grille and remove excess dust using a vacuum cleaner.

The inspection interval will depend upon the environment in which the signal generator is situated; Spirent recommends you examine the fan at monthly intervals to determine a normal inspection interval.

A thermal sensor will shut down the signal generator if its internal temperature exceeds a pre-determined value. If the signal generator unexpectedly shuts down, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed

4.3 Calibration

The GSS4150 employs a digital architecture to produce accurate and stable signals and requires little calibration.

There are just two user adjustments:

- ➔ Frequency
- ➔ Power

These are both simple potentiometer adjustments. Test equipment requirements are a suitable frequency counter with a stable reference and an RF power meter respectively.

Spirent recommends you perform these calibrations yearly.

4.3.1 Reference frequency calibration

This requires a frequency counter capable of measuring 10.00 MHz with at least 10 digits of accuracy, for example an HP53131A. The frequency counter should be locked to a frequency standard accurate to $< \pm 1 \times 10^{-9}$, for example an HP5065A Rubidium standard. It is permissible to use a less accurate standard if the user is prepared to accept lower frequency accuracy for the signal generator.

- a) Turn on the GSS4150.
- b) Allow 30 minutes for the internal oscillator to stabilise.
- c) Attach the frequency counter to the 10 MHz OUT BNC connector on the rear panel.

- d) Remove the 'Calibration Void if Broken' label covering from the 10 MHz Ref Cal adjustment port see Figure 4-2.
- e) Use the frequency adjustment potentiometer to achieve a frequency reading of $10 \text{ MHz} \pm 0.02 \text{ Hz}$.
- f) Recover the 10 MHz Ref Cal port with appropriate calibration label.
- g) This concludes the reference frequency calibration.

4.3.2 Power level calibration

This requires an RF power meter capable of measuring a frequency of approximately 115 MHz at a power levels of -50 dBm, for example an HP E4418B. Ensure the power meter is calibrated according to the manufacturer's instructions, including any adjustments for sensor calibration factor and frequency.

- a) Turn on the GSS4150.
- b) Attach the RF power meter to the 'N type' Primary RF Output on the front (or rear) panel of the signal generator
- c) Allow 30 minutes for the GSS4150 to stabilise.
- d) Remove the 'Calibration Void if Broken' label covering from the IF Level Cal adjustment port see Figure 4-2.
- e) In SimGEN, select **Tools-GSS6560/5060/4150 Utilities-Annual Calibration...** and follow the on-screen instructions.
- f) Use the level adjustment potentiometer to achieve, $-41 \text{ dBm} \pm 0.05 \text{ dB}$.
- g) Re-cover the IF Level Cal port with an appropriate calibration label.
- h) This concludes the Power Level Calibration.

4.4 Connecting to a multi-channel GPS simulator

You can connect the GSS4150 to either a GSS8000 signal generator (or the superseded STR4760 or GSS7700 signal generators) or a GSS6560 signal generator.

You must designate the GSS4150 as the 'Auxiliary' and for correct operation, you must apply the appropriate updates to the *sig_gen.txt* file before using your GSS4150 as the Auxiliary.

4.5 Connectivity and specifications

Spirent supplies the latest issue of the GSS4150 product datasheet see Table 2-1, on the SimREPLAY, SimREPLAYplus and SimGEN installation CD.

4.5.1 EMC and safety compliance

For the signal generator

The product complies with the Low Voltage Directive 73/23/EEC by application of the harmonised standard EN60950.

The signal generator complies with the EEC EMC Directive 89/336/EEC by application of the following harmonised standard:

EN61326-1 Electrical Equipment for Measurement, Control and Laboratory USE – EMC Requirements.

In particular, with regard to Radiated Emissions; the signal generator meets the requirements of EN61326; 1997 +A1, 1998 (Table 3 [class A])

For the computer system

The computer system shall comply with appropriate equivalent EMC and Safety standards.

4.6 Interconnection

To ensure correct operation of your system, review Figure 4-3 to Figure 4-4. The tables under these figures detail the interconnections.

Correctly position and tighten all cables and terminations.

Figure 4-3 GSS4150 to STR4760/GSS7700 interconnection diagram

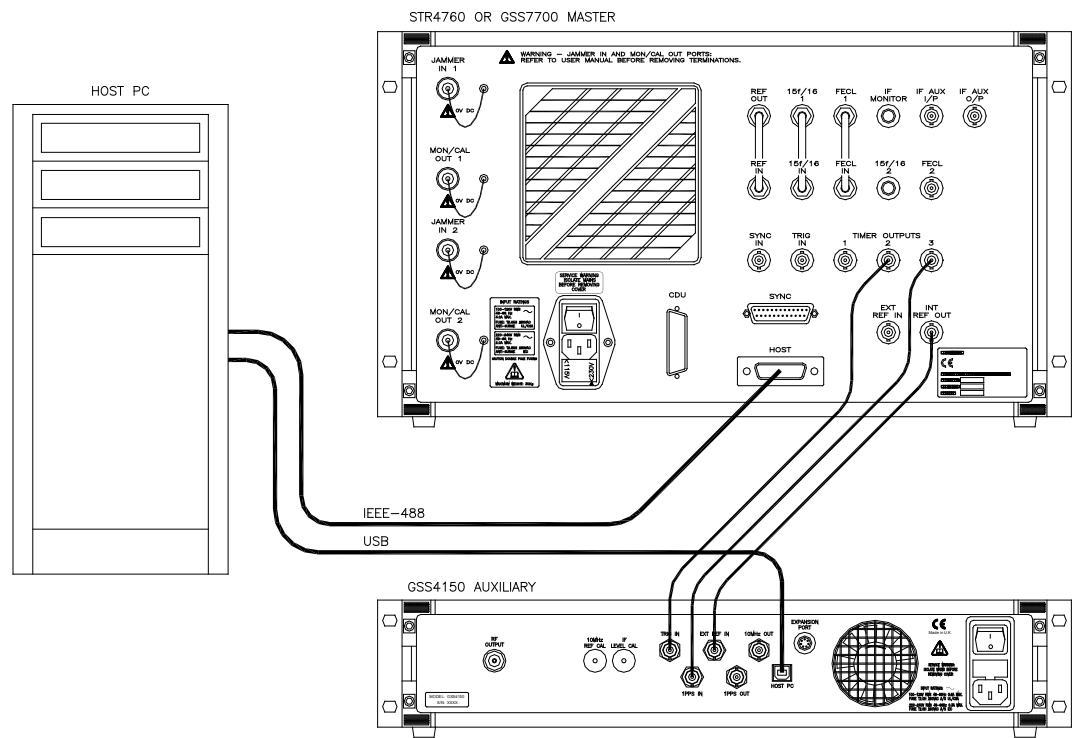
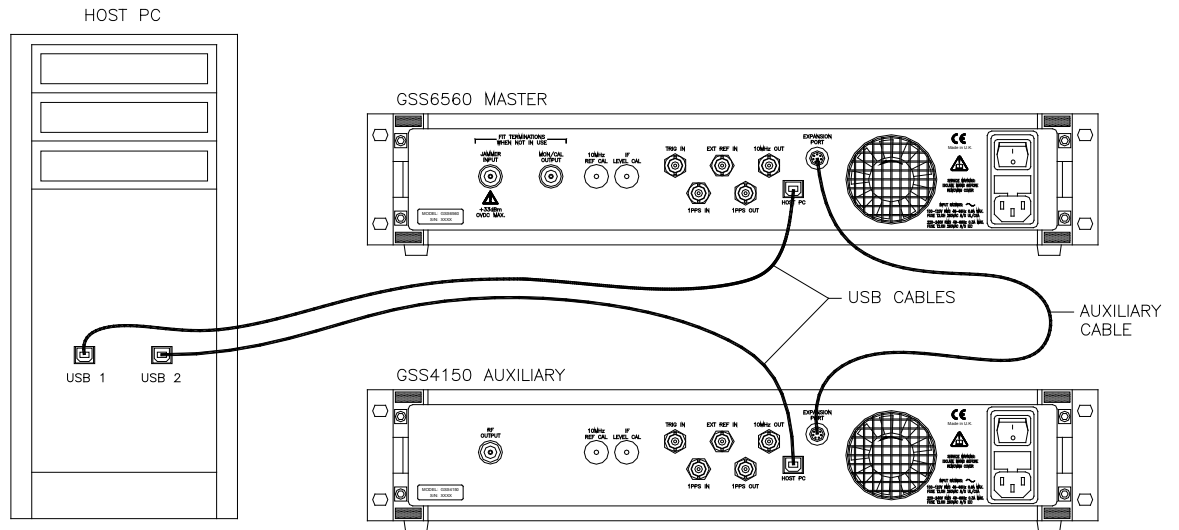


Table 4-3 GSS4150 to STR4760/GSS7700 interconnection table

Connection type	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller or Host PC, USB 1 port	GSS4150 Host PC USB port
IEEE-488 cable assembly	SimGEN controller or Host PC, IEEE-488 card	Master signal generator, HOST connector
BNC cable assembly	Master signal generator, TIMER OUTPUT 2 connector	GSS4150, TRIG IN connector
BNC cable assembly	Master signal generator, TIMER OUTPUT 3 connector	GSS4150, 1PPS IN connector
BNC cable assembly	Master signal generator, INT REF OUT connector	GSS4150, EXT REF IN connector

Figure 4-4 GSS4150 to GSS6560 interconnection diagram**Table 4-4 GSS4150 to GSS6560 interconnection table**

Connection type	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller or Host PC, USB 1 port	GSS6560 Master, Host PC USB port
USB cable assembly (USB type A to USB type B)	SimGEN controller or Host PC, USB 2 port	GSS4150 Auxiliary, Host PC USB port
Auxiliary cable (Special to Spirent)	GSS6560 Master, Expansion port	GSS4150 Auxiliary, Expansion port

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5 GSS7790

Note: All GSS7790 Variant B signal generators can support an iteration rate of 250 Hz (4 ms). However, signal generators shipped before January 2010 do not support this capability as standard. Contact Spirent for details on upgrading existing signal generators.

This chapter describes the external hardware features of the GSS7790 GPS Multi-Output signal generator.

The GSS7790 is currently available in a single variant, but see the **IMPORTANT** statement below.

Features of the GSS7790:

- Up to twelve L1 channels
- Up to twelve L2 channels
- M-Noise capability on L1 and L2, as standard
- SBAS capability, as standard
- Enhanced built-in test and monitoring
- Soft configuration of timer outputs and external reference frequency

IMPORTANT:

From December 2005, the GSS7790 uses a replacement microprocessor platform to host the system's embedded firmware. The following nomenclature denotes the two GSS7790 variants:

Variant A: Original (before December 2005) microprocessor platform

Variant B: Replacement (after December 2005) microprocessor platform

Both variants support basic GPS features. Only variant B microprocessor platforms support certain features in SimGEN v2.70 on, such as 250 Hz iteration rate. Contact Spirent Applications Support if you want to use a Variant A microprocessor platform with features introduced after SimGEN v2.70.

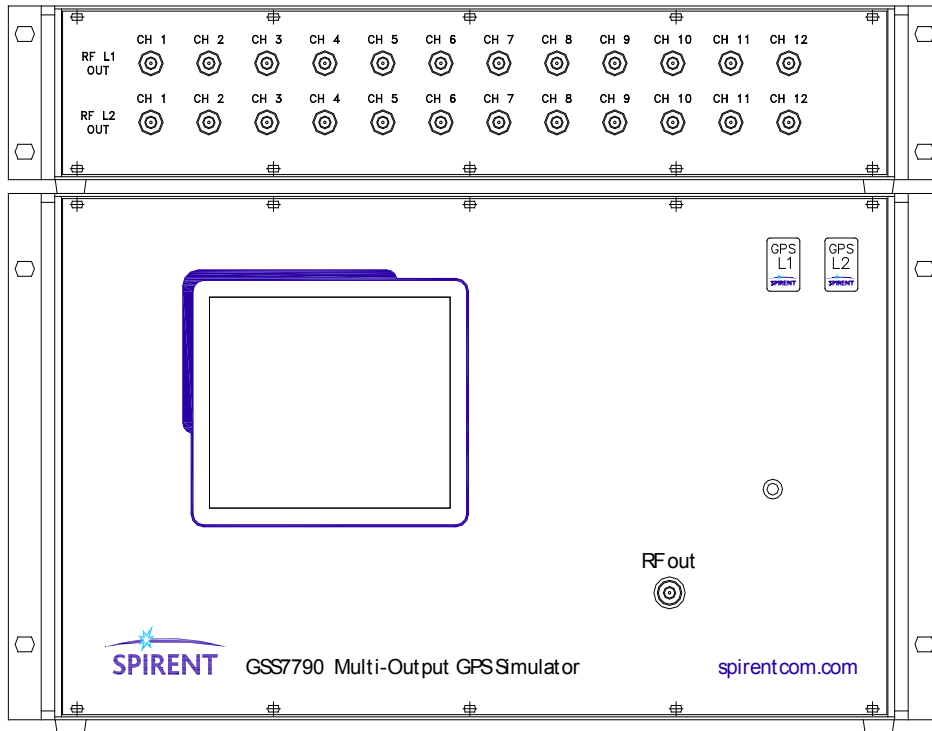
GSS7790 (Variant A and B), GSS8000-series and GSS7700 (Variant A and Variant B) signal generators limit the bandwidth of the GPS signal to 50 MHz (at -3 dB). In SimGEN, see reference c), the GPS constellation editor dialog **Signal Control-Signal Power** shows code offsets and power levels as powers of the equivalent, infinite bandwidth, signals; and shows the ratios of the in-band spectral densities. The SimGEN user manual details the decrease in total power of each signal component you will see as a result of limiting the GPS signal bandwidth to 50 MHz.

5.1 Front panel

Figure 5-1 shows the GSS7790. It consists of the IF Generator section at the bottom and the RF Upconverter section at the top.

The IF Generator front panel features the front panel display and a single, combined, RF output connector. The RF Upconverter front panel features twelve L1 and twelve L2 RF output connectors.

Figure 5-1 GSS7790 front panel



5.1.1 Front panel display

The front panel display is a 25 x 54 character, backlit, monochrome LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

While running, the display backlight is permanently on. When the signal generator has been idle for a short time, the backlight will turn off to preserve backlight life. You can manually switch on the backlight using the command LCDP1, sent using the SimGEN IEEE String Send Utility, see reference c)

Figure 5-2 shows a typical display.

Figure 5-2 GSS7790 front panel display

```

12L1 + 12L2  44°C                                < SYSTEM BITE MESSAGES >
GPIB1  CFG02M  S/N 2000                          < SYSTEM INFO MESSAGES >
CH PRN VELOCITY LEVEL CODE  PRN VELOCITY LEVEL CODE
1   2      300  20.0 P+CA .  2      300  20.0 P
2   7      170  18.1 P+CA .  7      170  18.1 P
3   9      440  10.0 P+CA .  9      440  10.0 P
4  13      669  09.5 P+CA . 13      669  09.5 P
5  15     -170  10.3 P+CA . 15     -170  10.3 P
6  18      230  10.3 P+CA . 18      230  10.3 P
7                                .
8  23     -232  10.4 P+CA . 23     -232  10.4 P
9  27      567  10.9 P+CA . 27      567  10.4 P
10 29      998  10.7 P+CA . 29      998  10.7 P
11 31     -786  10.6 P+CA . 31     -786  10.6 P
12 32     -501  10.5 P+CA . 32     -501  10.5 P
13                                .
14                                .
15                                .
16                                .
TOW  420 SUN 10:39:10.0  TOW  420 SUN 10:39:10.0
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

Note: There are LCD differences between Variant A and Variant B signal generators.

When the signal generator is first switched on, the LCD on GSS7790 (variant B) signal generators can remain blank for up to two minutes (normally less than one minute). The LCD in GSS7790 (variant A) signal generators will remain blank, after switch on, for less than ten seconds.

The following paragraphs describe the LCD fields:

nnL1 + nnL2

The number of signal generator channels available, in this case 24. When switched to dual frequency operation this field displays **nnL1** for the L1 channels, and **nnL2** for the L2 channels. When switched to dual antenna operation this field changes to **nnL1** for the Antenna 1 channels plus **nnL1** for the Antenna 2 channels.

n°C

This field gives an indication, in degrees Celsius, of the internal temperature of the signal generator, in this example 44°C. If the temperature rises above 70°C, the signal generator will automatically shut down.

SYSTEM BITE MESSAGES

Notes

1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Table 5-1 details conditions that may persist for longer than 60 seconds.

2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

This field contains BITE (Built In Test Equipment) and status messages relating to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Table 5-1 GSS7790 major system BITE messages

Message	Description
No message	No external reference connected. Hardware is functioning normally.
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
137F UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
77Fj UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
F Level Fail	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F Ref Fail	Fault in the 10.23 MHz clock oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator
F Ref Unlocked	Fault in the 10.23 MHz reference oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator. Note: It is normal for an indication of this type to persist for up to 120 seconds after switching on the signal generator.
1 PPS Tick	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

GPIB *n*

The GPIB (IEEE-488) address of the signal generator

CFG*na*

n - the current signal generator configuration

a - shows configuration as Master (M) or Auxiliary (A).

S/N*n*

The signal generator serial number

CH

Channel number

VELOCITY

Velocity being simulated. Blank for halted channel or channel not present.

Note: From Processor Firmware Issue 1-03 onwards, channel BITE is also displayed in the 'VELOCITY' field.

Whilst simulated velocity is displayed, or the field is blank, BITE is OK

Channel BITE fails are indicated as follows:

BITE *nm*

If *n* = 4, IF channel card PLL fail.

If *m* = 1 PSU monitor alarm, *m* = 2 Clock monitor alarm

For example, BITE 40 would indicate a PLL fail on the IF channel card.

LEVEL

Power level being generated relative to nominal.

Range ± 20 dB with respect to nominal levels.

Blank for halted channel or channel not present.

CODE

This field displays the currently simulated code(s).

The following code / code combinations can be displayed:

P, CA, P CA, Y, Y CA, OFF, Z, Z CA, Mn, Mp. Blank for halted channel or channel not present.

In the display

'Z' represents pseudo-Y code, 'Mn' represents M Noise and 'Mp' represents Pseudo-M code.

'+' sign shows Nav Data is being broadcast.

Two horizontal dots '..' next to either Mn or Mp show the code is modulated in the P code axis and the modulation type is Interplex.

Two vertical dots ':' next to either Mn or Mp show the code is modulated in the C/A code axis and the modulation type is Interplex.

Three horizontal dots next to either Mn or Mp show the code is modulated in the P code axis and the modulation type is Additive.

Three vertical dots next to either Mn or Mp show the code is modulated in the C/A code axis and the modulation type is Additive.

TOW

Time of week in seconds since start of GPS week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F/

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

5.1.2 IF Generator - combined RF output connector

The combined RF output connector provides a combined L1/L2 signal source and is type 'N' coaxial. For details, see the product datasheet in Table 2-2. Normally, these power levels are:

C/A Code	0 dB level: -130 dBm	range ± 20 dB
L1 P Code	0 dB level: -133 dBm	range ± 20 dB
L2 P Code	0 dB level: -136 dBm	range ± 20 dB

Each RF output port is internally DC isolated, see the product datasheet in Table 2-2. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

5.1.3 RF Upconverter - individual RF output connectors

The individual RF output connectors are type ‘SMA’ coaxial. For details, see the product datasheet in Table 2-2. Normally, these power levels are

L1 C/A Code	0 dB level: -86.76 dBm	range ± 20 dB
L1 P Code	0 dB level: -89.76 dBm	range ± 20 dB
L2 P Code	0 dB level: -88 dBm	range ± 20 dB

Each RF output port is internally DC isolated, see the product datasheet in Table 2-2. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

5.2 Rear panel

Figure 5-3 (Variant A) and Figure 5-4 (Variant B) and Table 5-2 describe the rear panel of the GSS7790.

Table 5-2 Rear panel features of GSS7790 signal generators

Port	Variant A described in section	Variant B described in section
Mains power inlet	5.2.1	5.2.1
Communication ports	5.2.2	5.2.2
Auxiliary Signal ports	5.2.3.1	5.2.3.2
MON/CAL ports	5.2.4	5.2.4
Jammer port	5.2.5	5.2.5
Cooling fans	5.2.6	5.2.6

Figure 5-3 GSS7790 (variant A) rear panel

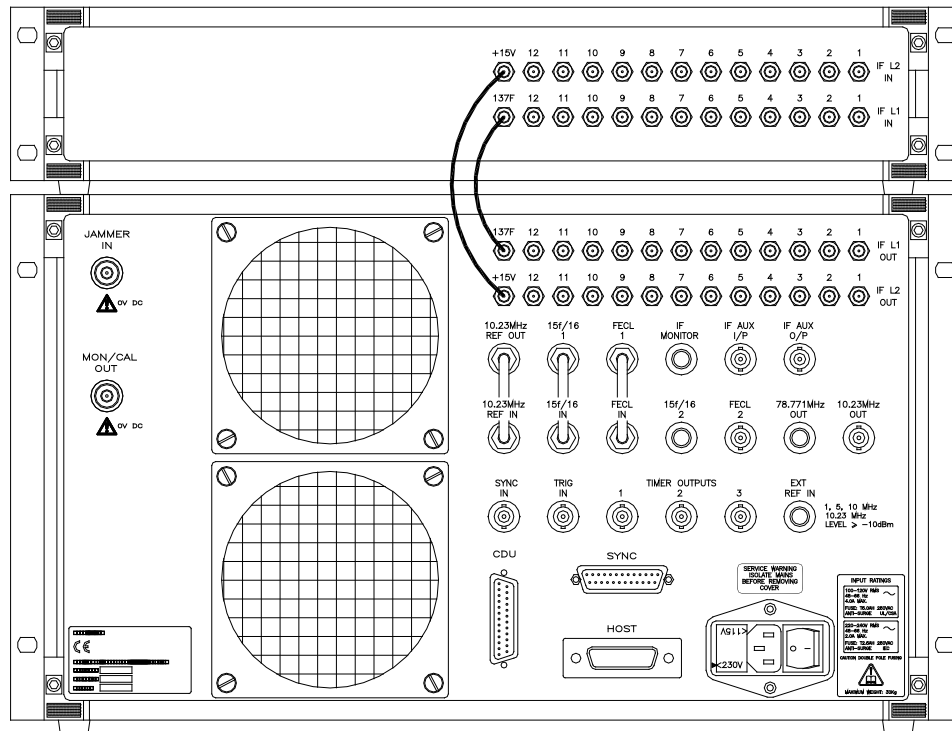
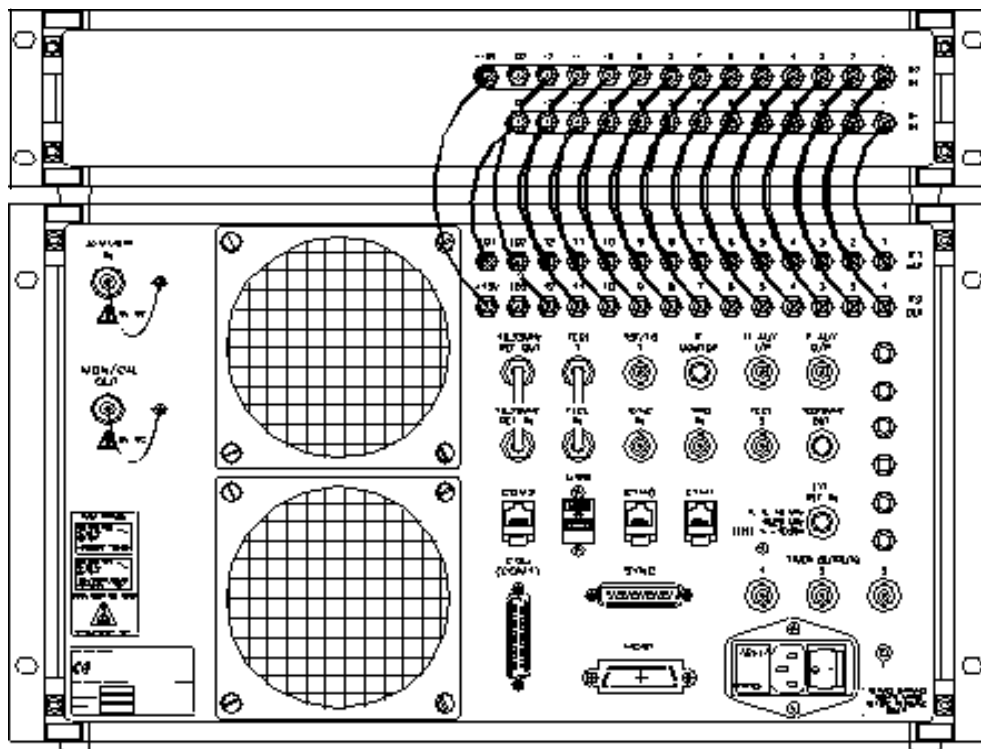


Figure 5-4 GSS7790 (variant B) rear panel



5.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS7790 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: The mains power input switches automatically between 100-120 V and 220-240 V operation. If the mains voltage selector on the mains inlet is incorrectly set, no damage will occur.

This signal generator uses dual-pole/Neutral fusing (a fuse of the same type and rating is fitted to both the phase and neutral lines). The rating label, located next to the mains inlet, gives the fuse ratings your signal generator uses. The mains voltage determines the value of the fuses used in some signal generators. If your signal generator uses fuses whose value depends on the mains voltage, Spirent recommends you correctly set the mains voltage selector to indicate the value of the mains fuses fitted.

If you need to change mains supply voltage, refer to the rating label for the fuse types and ratings you must use. If you need to change the fuses, always fit the same type of fuse to both the phase and Neutral lines. The mains fuses are located immediately adjacent to the mains inlet in a slide-out module that can take either 20 mm x 5 mm or 1¼ x ¼ inch fuses.

5.2.2 Communication ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) HOST port is an IEEE-488 compatible port used to download information from the SimGEN controller or Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

GSS7790 (Variant B) signal generators include the following additional ports:

- a) The ETH0 ports are currently for Spirent use only.
- b) The ETH1 port is for firmware upgrades, see details in the firmware upgrade kit.
- c) The COM2 port is a debug monitor port, RS232 compatible, for Spirent use only.
- d) The USB port is currently for Spirent use only.

5.2.3 Auxiliary Signal ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Section 5.2.3.1 covers Variant A Auxiliary signal ports.

Section 5.2.3.2 covers Variant B Auxiliary signal ports.

5.2.3.1 Variant A

Notes:

- 1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-2.
- 2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 15f/16 2, 10.23 MHz OUT and 78.771 MHz OUT.
- 3) The top two rows of BNC connectors are for “multi-box” configurations see Figure 5-3. Do not use these connectors in single unit configurations.

The Variant A Auxiliary Signal ports comprise 19 BNC connectors and 26 SMA connectors.

Table 5-3 details the Variant A Auxiliary signal ports you can use in single unit configurations. Make connections according to the appropriate installation diagram see section 5.5. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Table 5-3 GSS7790 Variant A auxiliary signal ports

Port	Description
EXT REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
10.23MHz OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	External system synchronisation input. TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone GSS7790 Variant A signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1, default is 1PPS, Gated
TIMER OUTPUT 3	As Timer Output 1, default is 1PPS, Ungated
137F (x1)	LO feed for Upconverter
15v (x1)	Power for Upconverter
17F (x24)	Individual output IF signals

Port	Description
10.23 MHz REF OUT, 15f/16 1, FECL 1, IF MONITOR, IF AUX I/P, IF AUX O/P	BNC connectors for multi-box configurations Note: Do not remove the links between: 10.23 MHz REF OUT and 10.23 MHz REF IN, 15f/16 1 and 15f/16 IN, FECL 1 and FECL IN
10.23 MHz REF IN, 15f/16 IN, FECL IN, 15f/16 2, FECL 2, 78.771 MHz,	

5.2.3.2 Variant B

Notes:

- 1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-2
- 2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 10.23 MHz REF OUT.
- 3) Some of the BNC connectors in the top two rows are for “multi-box” configurations see Figure 5-4. Do not use these connectors in single unit configurations.

The Variant B Auxiliary Signal ports comprise 16 BNC connectors and 34 SMA connectors.

Table 5-4 details the Variant B Auxiliary signal ports you can use in single unit configurations. Make connections according to the appropriate installation diagram see section 5.5. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Table 5-4 GSS7790 Variant B auxiliary signal ports

Port	Description
EXT REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
10.23MHz OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone GSS7790 Variant B signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1
TIMER OUTPUT 3	As Timer Output 1
LO1 (x1)	LO feed for Upconverter
15v (x1)	Power for Upconverter
17F (x24)	Individual output IF signals
LO2, LO3,	Not in current use
10.23 MHZ REF OUT, FECL 1, 15f/16 1, IF MONITOR, IF AUX I/P, IF AUX O/P	BNC connectors for multi-box configurations Note: Do not remove the links between: 10.23 MHz REF OUT and 10.23 MHz REF IN FECL 1 and FECL IN
10.23 MHz REF IN, FECL IN, FECL 2	
Unlabelled connectors	Six SMA connectors not in current use

5.2.4 MON/CAL ports

Notes:

- 1) This port is DC isolated. However, Spirent recommends you insert a suitable dc block.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.

Use the MON/CAL OUT port to monitor the GPS signal at a level approximately 50 dB higher than the front panel connector, mainly for calibration purposes. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

5.2.5 Jammer port

Notes:

- 1) The port is not DC isolated. Applying DC at these ports can cause damage to the signal generator.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

5.2.6 Cooling fans



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

Two cooling fans blow air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

A thermal sensor will shut down the signal generator if its internal temperature exceeds a pre-determined value. If the signal generator unexpectedly shuts down, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

5.3 Calibration

Table 2-2 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

5.4 Connectivity and specifications

Spirent supplies the latest issue of the product datasheet see Table 2-2, on the SimGEN installation CD. Refer to it for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

5.4.1 Lifting the signal generator



CAUTION - HEAVY

The product datasheet, see Table 2-1 and Table 2-2 details the weight of each signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

5.5 Interconnection

GSS7790 Variant A and Variant B signal generators need an IEEE-488 cable connection from the HOST socket on the signal generator rear panel to the IEEE-488 card (identified as card #0) in the PC.

Note: This IEEE-488 card is card #1 if your signal generator has the IEEE remote control option.

These are the factory default settings. Reference c) describes changing the default settings.

This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Figure 5-5 to Figure 5-7; Table 5-5 details the interconnects for all GSS7790 Variants.

Correctly position and tighten all cables and terminations.

Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator
- c) Switch on the PC

Table 5-5 GSS7790 (Variant A and B) interconnections

Connection type	From	To
Both Variants	SimGEN controller or Host PC, IEEE-488 card	Signal generator, HOST connector
IEEE-488 cable assembly		

Connection type	From	To
Variant B only, High data-rate (250 Hz) option BNC cable assembly	Timer Card adaptor, INTERRUPT IN connector	Signal generator, TIMER OUTPUT 2

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GSS7790

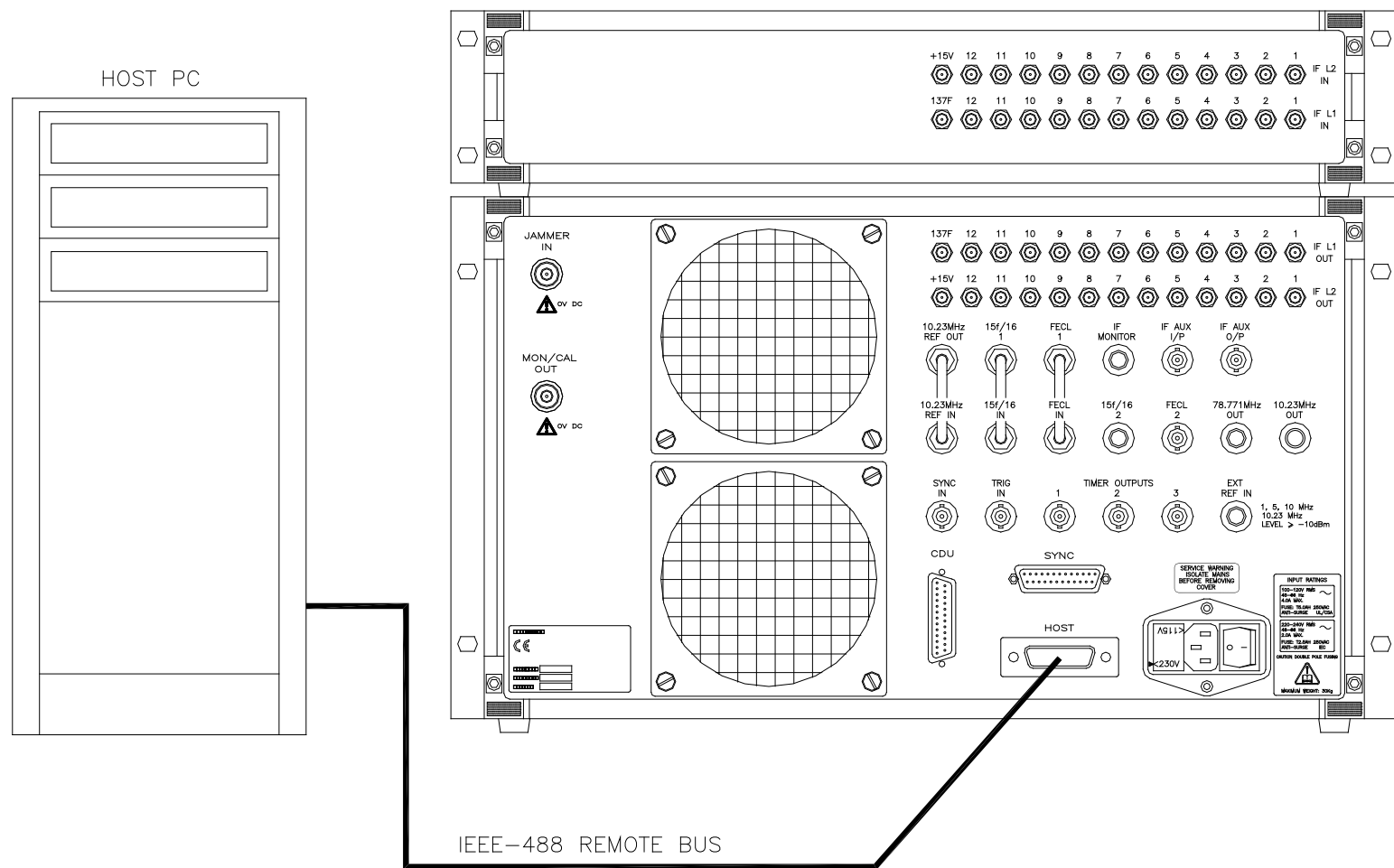


Figure 5-6 GSS7790 (Variant B) - interconnection drawing

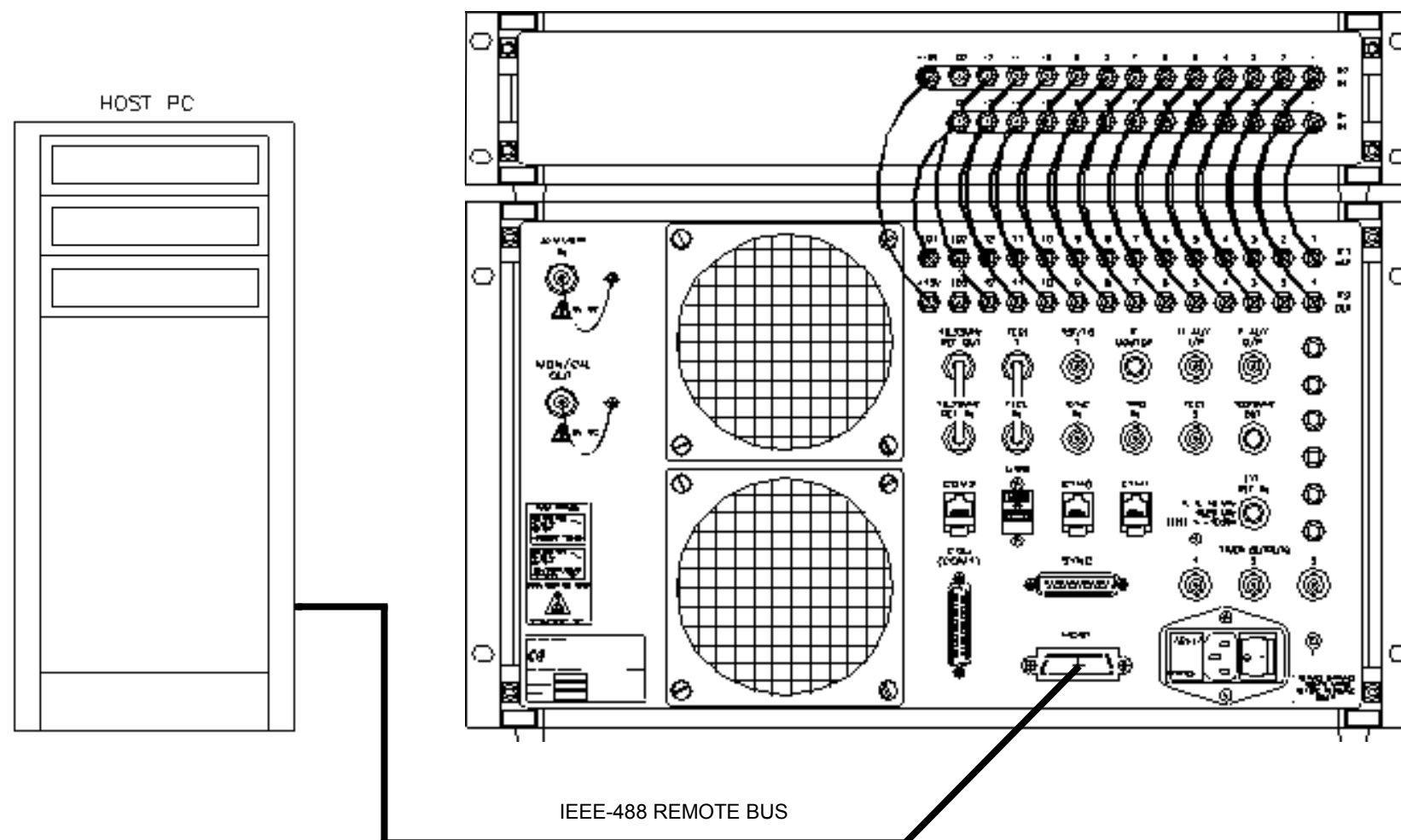
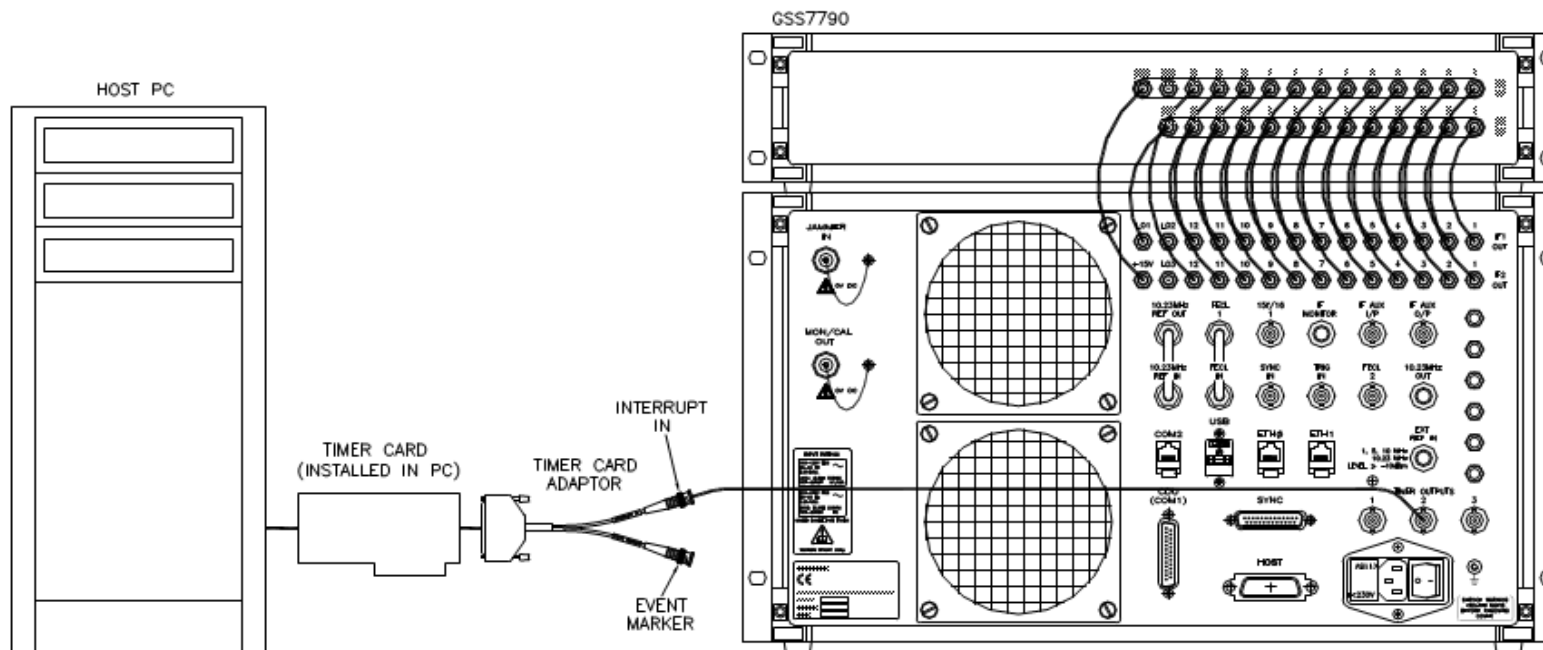


Figure 5-7 GSS7790 (Variant B) - interconnects for optional 250 Hz iteration rate

Note: All GSS7790 Variant B signal generators can support an iteration rate of 250 Hz (4 ms); however, signal generators shipped before January 2010 do not support this capability as standard. Contact Spirent for details on upgrading existing signal generators



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6 GSS8000-series

Notes: You must be an authorised user to use Galileo's Commercial, Safety of Life or Public Regulated Services. Users of SimGEN up to version 2.90 must use the dongle Spirent supplies. Users of SimGEN version 2.91 onwards must remove any Galileo dongle and, before using these Galileo services, install the licence file Spirent supplies onto their SimGEN Controller.

This chapter describes hardware features of the GSS8000-series signal generators. The GSS8000-series single-output signal generators can cover all Galileo, GLONASS and GPS carriers; while GSS8000-series dual-output signal generators cover GPS L1 and L2 only. With an appropriate licence, GSS8000-series signal generators support the Quasi-Zenith constellation.

Features of GSS8000-series signal generators:

- Up to 48 channels (3 banks of 16 channels for single output signal generators)
- Up to 48 channels in total (as 3 banks of 16 channels or 4 banks of 12 channels for dual output signal generators)
- Enhanced built-in test and monitoring
- Soft Master/Auxiliary switching ("multi-box" configurations)
- Soft configuration of timer outputs and external reference frequency

To use GPS L1C and GLONASS P-code, you may need to upgrade the FPGA release and/or firmware version of each signal generator card installed in your signal generator, see reference c). To use the Galileo Open Service, you may need to upgrade the FPGA release and/or firmware version of each signal generator card installed in your signal generator, see reference c).

References g) and l) are appendices to the SimGEN user manual describing the differences that apply when using GSS8000-series signal generators to simulate those Galileo carriers.

For reference, Table 6-1 compares Galileo, GLONASS, GPS and BeiDou frequencies.

Table 6-1 Galileo, GLONASS, GPS and BeiDou frequencies

Note: GLONASS uses an FDMA structure with channel numbers ranging from -7 to +6.

GLONASS L1 frequency = $1602 \pm (K \times 0.5625)$ MHz;

GLONASS L2 frequency = $1246 \pm (K \times 0.4375)$ MHz

Where: $K = (-7 \text{ to } +6)$

Frequency Bands	Centre Frequency, MHz
Galileo	
L1	1575.42
E5 (made up of E5a and E5b)	1191.795
E5a	1176.45
E5b	1207.14
E6	1278.75

Frequency Bands	Centre Frequency, MHz
GLONASS	
L1, Channel 0	1602.0
L2, Channel 0	1246.0
GPS	
L1	1575.42
L2	1227.6
L5	1176.45
BeiDou	
B1	1561.098
B2	1202.14

GSS7790 (Variant A and B), GSS8000-series and GSS7700 (Variant A and Variant B) signal generators limit the bandwidth of the GPS signal to 50 MHz (at -3 dB). In SimGEN, see reference c), the GPS constellation editor dialog **Signal Control-Signal Power** shows code offsets and power levels as powers of the equivalent, infinite bandwidth, signals; and shows the ratios of the in-band spectral densities. The SimGEN user manual details the decrease in total power of each signal component you will see as a result of limiting the GPS signal bandwidth to 50 MHz.

The GSS8000-series supports running L2 only.

6.1 Front panel

The main features on the front panel are the front panel display, the front panel door and the RF out port(s), see Figure 6-1.

Figure 6-1 GSS8000-series single output signal generator - Front Panel



6.1.1 Front panel display

The front panel display is a 50 x 80 character, backlit, colour LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

When you first switch on the signal generator the LCD shows self-test and Linux kernel loading information, before displaying information relating to the signal generator.

Figure 6-2 gives a typical GSS8000-series display showing GPS carriers.

Figure 6-2 Typical GSS8000 display showing GPS carriers

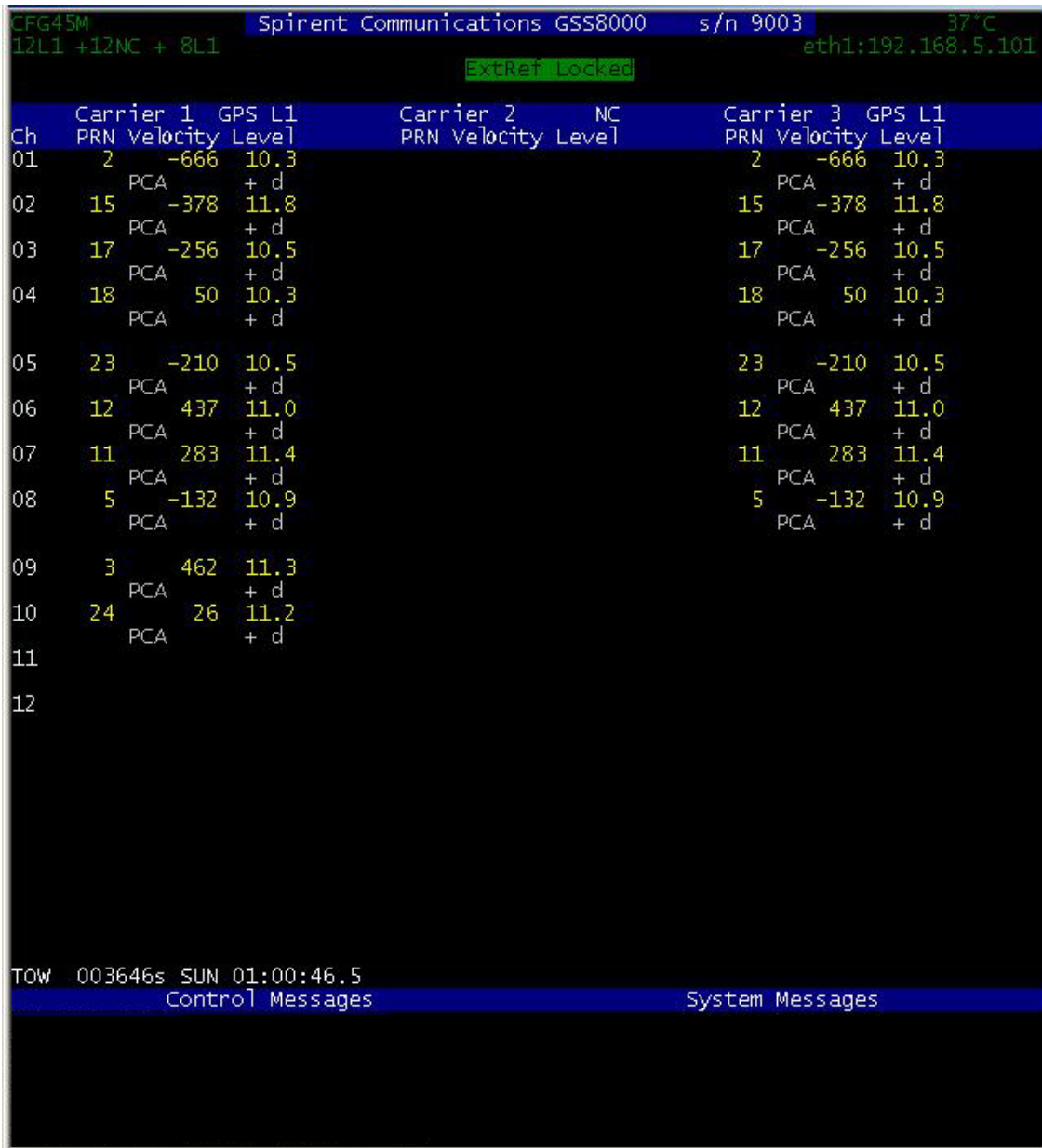


Table 6-2 describes the areas of the LCD display.

Table 6-2 GSS8000-series signal generator - LCD display areas

Display area	Description [details from Figure 6-2]
FIRST TWO LINES	
CFG_{na}	Signal generator configuration. <i>n</i> - configuration in use. <i>a</i> - M (Master) or A (Auxiliary) - for multi-box configurations only [CFG45M]
Spirent Communications GSS8000	Shows the type of signal generator [Spirent Communications GSS8000]
s/nxxxx	Signal generator serial number [s/n 9003]
t°C	The highest temperature of the signal generator FPGAs, degrees C. If the temperature exceeds 95°C, the background changes to red with flashing text. The text “°C Shutdown” displays underneath. The signal generator will automatically shutdown. Note: <i>Oven BITE messages replace t°C</i> [37°C]
nnWW + nnXX + nnYY + nnZZ	The number (nn) of signal generator channels available on each carrier (WW, XX, YY, ZZ). NC indicates channels are physically present but not available in the current configuration [12L1 + 12NC + 8L1]
eth1	The IP addresses of signal generator port ETH1 [eth1:192.168.5.101]
MAIN AREA	
Ch	Channel number [Carrier 1: Channel 1 to 12; Carrier 3: Channel 1 to 8]
PRN (yellow text)	Simulated PRN Blank if channel halted or channel not present. [2, 15, 17, 18, 23, 12, 11, 5, 3, 24 for Carrier 1]
Velocity (yellow text)	Simulated Velocity Blank if channel halted or channel not present While displaying Velocity, or blank BITE is OK BITE 01 PSU monitor alarm BITE 02 Clock monitor Alarm [-666, -381, -255, 49, -213, 438, 282, -132, 459, 24 for Carrier 1]

Display area	Description [details from Figure 6-2]
Level (yellow text)	RF power level (relative to nominal) Range: +20 dB, -40 dB Blank if channel halted or channel not present. [10.3, 11.8, 10.5, 10.3, 10.5, 11.0, 11.4, 10.9, 11.3, 11.2 for Carrier 1]
Code (grey text)	The code(s) simulated by the signal generator. Details shown in Table 6-3 to Table 6-8. [PCA - P code on C/A with legacy nav data for Carrier 1]
LOWER AREA	
TOW	Time of Week. In one-second epochs from start of constellation week, plus day of week and time of day. [TOW 003646s SUN 01:00:46.5]
Control Messages	Built In Test Equipment (BITE) messages relating to phase lock, power level, timing and status of various hardware modules in the signal generator. Note: Table 6-10 details BITE messages that may last longer than 60 seconds after switching on the signal generator. [No BITE messages shown]
System Messages	Shows system information messages [No System messages shown]
Debug	Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration. [No debug messages shown]

Table 6-3 to Table 6-9 detail the GSS8000-series symbols in the **Code** Display area (see Table) for each of the supported Galileo, GLONASS, GPS, Quasi-Zenith and BeiDou carriers. The text colour is grey.

In all cases:

OFF - Channel is OFF

CW - Modulation is OFF

Table 6-3 GSS8000-series signal generator - details of Galileo code**Note:** For Galileo L1, the order of codes B and C shows the CBOC status.

Galileo L1	Details	Galileo E5	Details	Galileo E6	Details
AnBC + gi	Possible codes and data (CBOC off)	aIQbIQ + fi	Possible codes and data	AneBeC + cg	Possible codes and data
AnCB + gi	Possible codes and data (CBOC on)				
CODES		CODES		CODES	
A	A component (PRS)	aIQ	E5a I/Q	A	A component (PRS)
An	A-Noise (PRS-Noise)	bIQ	E5b I/Q	An	A noise (PRS-Noise)
B	B component			B	B component
C	C component			eB	encrypted B
				C	C component
				eC	encrypted C
+	separator	+	separator	+	separator
DATA		DATA		DATA	
g	G/Nav	f	F/Nav	c	C/Nav
i	I/Nav	i	I/Nav	g	G/Nav

Table 6-4 GSS8000-series signal generator - details of GLONASS code

GLONASS L1	Details	GLONASS L2	Details
Fn-07 CA + c	Possible codes, data and frequency channel number	Fn-07 CA + c	Possible codes, data and frequency channel number
CODES		CODES	
CA	C/A code	CA	C/A code
P	P code	P	P code
+	separator	+	separator

GLONASS L1	Details	GLONASS L2	Details
DATA		DATA	
c	C/A Nav	c	C/A Nav
Fn	Frequency channel number	Fn	Frequency channel number

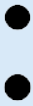
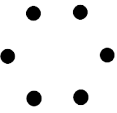
Table 6-5 GSS8000-series signal generator - details of GPS code

GPS L1	Details	GPS L2	Details	GPS L5	Details
CpdPCAM nFA# + cdm	Possible codes and data	CPMnFA# + cdm	Possible codes and data	I5Q5 + c	Possible codes and data
CODES		CODES		CODES	
Cp	L1C pilot	CP	L2C with P code	I5	
Cd	L1C data	Mn	M-Noise	Q5	
Cpd	L1C pilot + data	FA	See reference h)		
P	P-code	#	see Table 6-6		
Y	Y-code				
Z	Pseudo Y-code				
CA	C/A code				
Mn	M-Noise				
Mp	Pseudo M-code				
Ms	See reference i)				
FA	See reference h)				
#	see Table 6-6				
+	separator	+	separator	+	separator
DATA		DATA		DATA	
c	CNAV-2	c	L2 C/Nav	c	C/Nav

GPS L1	Details	GPS L2	Details	GPS L5	Details
d	Legacy nav data message on P and CA	d	Legacy nav data message on P and CA		
(DATA)		(DATA)			
m	M nav message	m	M nav message		
a	SBAS message	a	SBAS message		

Table 6-6 Schematic of GPS Mn or Mp code “dots”

Note: Regardless of your selection in **GPS signal sources file-Signal control-General**, *SimGEN* only uses Interplex if you enable all the relevant codes, for example using M code plus two legacy signals. With less than three codes present, the combining method reverts to Additive.

Dots	Description
	Code is modulated in the P code axis Modulation type is Interplex
	Code is modulated in the C/A code axis Modulation type is Interplex
	Code is modulated in the P code axis Modulation type is Additive
	Code is modulated in the C/A code axis Modulation type is Additive
	M code on C/A (or L2C) axis P code lags C/A (or L2C) Modulation type is Interplex
	M code on P axis P code lags C/A (or L2C) Modulation type is Interplex
	P code and L2C are on same axis Modulation type is Interplex

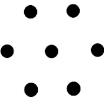
Dots	Description
	M code on P code axis P code lags C/A code Modulation type is Additive
	M code on C/A code axis P code lags C/A code Modulation type is Additive
	P code and L2C are in phase Modulation type is Additive

Table 6-7 Ground Transmitter codes

Note: You will only see Ground Transmitter (interference) codes if you use a scenario and signal generator that supports Ground Transmitters. See reference c).

Interference	Description
nnnk (grey text)	The frequency offset relative to L1 or L2, nnn kHz
CW / PSK (grey text)	Ground Transmitter is CW or PSK

Figure 6-3 shows a GSS8000 display running Quasi-Zenith and GPS constellations. Reference c) gives full details on using the Quasi-Zenith constellation. Quasi-Zenith satellites occupy the first eight channels, with GPS satellites occupying the remaining channels. Quasi-Zenith satellites use different PRNs from GPS satellites. The display headings refer to the GPS signals, with support for the associated Quasi-Zenith signal.

Table 6-8 shows the Quasi-Zenith codes, which are similar to the GPS codes.

Figure 6-3 GSS8000 display showing typical Quasi-Zenith and GPS constellations

Note: This Figure shows only odd channels for Channels 1 to 8 to show clearly the Quasi-Zenith codes. Channels 9 onward are for GPS satellites.

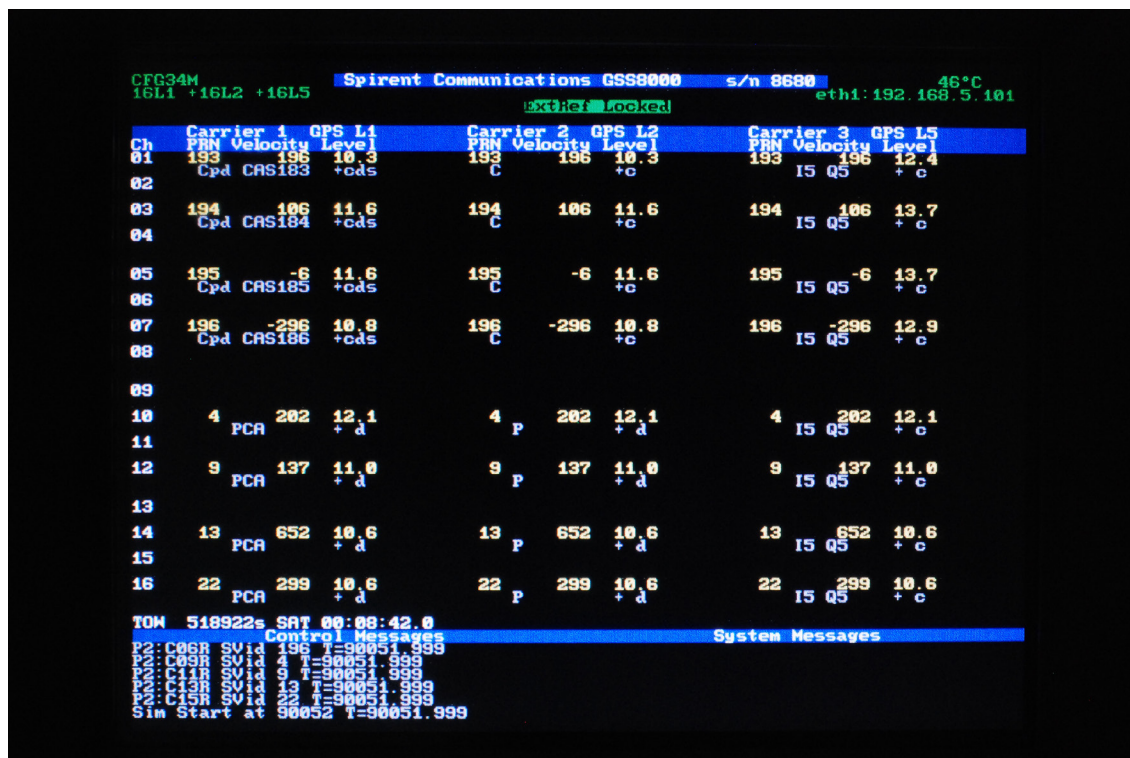


Table 6-8 GSS8000-series signal generator - details of first eight channels for Quasi-Zenith constellation

Notes:

1) Table 6-2 details PRN (for both L1C and L1C/A), Velocity and Level (yellow text). This table details only Quasi-Zenith codes (grey text).

2) L1-SAIF uses a different PRN to L1C and L1C/A

Carrier 1	Details	Carrier 2	Details	Carrier 3	Details
CpdCAS(pr n)+cds	Possible codes and data	C + c	Possible codes and data	I5Q5 + c	Possible codes and data
CODES		CODES		CODES	
Cpd	L1C pilot + data	C	L2C	I5	
CA	C/A code			Q5	
S(prn)	L1-SAIF prn code				

Carrier 1	Details	Carrier 2	Details	Carrier 3	Details
+	separator	+	separator	+	separator
DATA		DATA		DATA	
c	L1C	c	L2 CNAV	c	L5 CNAV
d	L1C/A				
s	L1-SAIF				

Table 6-9 GSS8000-series signal generator - details of BeiDou code

Note: In this table (I) refers to the I channel

Carrier 1	Details	Carrier 2	Details
Carrier 1 CMP B1 I + d	Possible codes and data	Carrier 2 CMP B2 I + d	Possible codes and data
CODES		CODES	
I	B1(I) ranging code	I	B2(I) ranging code
+	separator	+	separator
DATA		DATA	
d	B1(I) nav data	d	B2 (I) nav data

Table 6-10 GSS8000-series signal generator - major system BITE message

Message	Description
No message	Hardware operating normally Modulator oven(s) are at operating temperature. External reference standard not connected.
Oven 1 / Oven 2 / Oven 3 / Oven 4	Modulator ovens are not at operating temperature. Do not perform phase calibration. If this message persists, maintenance support is required to remedy the fault. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications. Note: <i>It is normal for this message to persist for up to 10 minutes after switching on the signal generator, depending on ambient temperature.</i>
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
137F unlocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
2nd LO UnLocked	Fault in the 2nd local oscillator circuit. Maintenance support will be required to remedy this fault. Under this fault condition, you cannot use the signal generator..
3rd LO UnLocked	Fault in the 3rd local oscillator circuit. Maintenance support will be required to remedy this fault. Under this fault condition, you cannot use the signal generator.
17F UnLocked	Fault in the IF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F ALC	Fault in the circuit maintaining the level of the IF local oscillator. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F LEVEL	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F REF	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

Message	Description
1s TICK	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

6.1.2 Front panel door

The front panel door is to the right of the front panel display and carries the Spirent logo. The front panel door covers a calibration adjustment port and the serial number label.

The front panel door hinges at the top. Use the recess behind the lower left-hand edge of the door to open the door. Friction hinges let you raise the door to any convenient height.

6.1.3 RF out ports

Note: Front panel RF ports are DC isolated to 50 V.

GSS8000-series signal generators have one or two RF Out ports that are type 'N' coaxial connectors. The RF Out port is the normal connection point for the receiver under test. For details see the product datasheet in Table 2-2, Table 6-11 shows the reference power levels for GSS8000-series signal generators

Table 6-11 Reference levels for GSS8000-series signal generators

Carrier	Code	Reference level, dBm	Comment
Galileo L1	L1-A	-125.5	Single-output signal generators only
	L1-B and L1-C	-128.5	Single-output signal generators only
Galileo E5 (I and Q)	E5a and E5b	-128.5	Single-output signal generators only
Galileo E6	E6-A	-125.5	Single-output signal generators only
	E6-B and E6-C	-128.5	Single-output signal generators only
GLONASS L1	L1, C/A and P	-131	Single-output signal generators only
GLONASS L2	L2, C/A	-137	Single-output signal generators only
	P	-131	Single-output signal generators only
GPS L1	C/A	-130.0	Single- and dual-output signal generators
	C Pilot code	-128.25	Single- and dual-output signal generators
	C Data code	-133.0	Single- and dual-output signal generators
	P or Y	-133.0	Single- and dual-output signal generators

Carrier	Code	Reference level, dBm	Comment
GPS L2	L2C or C/A	-136.0	Single- and dual-output signal generators
	P or Y	-136.0	Single- and dual-output signal generators
GPS L5	L5-I and L5-Q	-127.9	Single-output signal generators only
BeiDou B1	B1(I) ranging code	-130	Single-output signal generators only
BeiDou B2	B2(I) ranging code	-130	Single-output signal generators only

The power range for all carriers shown in Table 6-1 is +20 dB, -40 dB from nominal, see the product datasheet in Table 2-2.

Each RF output port is internally DC isolated, see the product datasheet in Table 2-2. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

6.2 Rear panel

Table 6-12 describe the rear panel of GSS8000-series signal generators.

Table 6-12 Rear panel features of GSS8000-series signal generators

Port	Described in section
Mains power inlet	6.2.1
Communications ports	6.2.2
BNC ports	6.2.3
TNC ports	6.2.4
MON/CAL port	6.2.5
Aux RF In port	6.2.6
Cooling fan	6.2.7

Figure 6-4 shows the rear panel of the single-output signal generator. Dual-output signal generators have two sets of Mon/Cal and Aux RF In connectors (connectors on left-hand side of Figure 6-4), one for each front panel RF out port.

Figure 6-4 GSS8000-series single-output signal generator - Rear Panel

Depending on the configuration, Spirent may fit blanking plugs to ports labelled LO2 and LO3, instead of connectors.

6.2.1 Mains power inlet



Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

NOTICE

You can operate GSS8000-series signal generators at 100-120 V or 220-240 V AC 50-60 Hz

Note: The mains power input switches automatically between 100-120 V and 220-240 V operation. If the mains voltage selector on the mains inlet is incorrectly set, no damage will occur.

This signal generator uses dual-pole/Neutral fusing (a fuse of the same type and rating is fitted to both the phase and neutral lines). The rating label, located next to the mains inlet, gives the fuse ratings your signal generator uses. The mains voltage determines the value of the fuses used in some signal generators. If your signal generator uses fuses whose value depends on the mains voltage, Spirent recommends you correctly set the mains voltage selector to indicate the value of the mains fuses fitted.

If you need to change mains supply voltage, refer to the rating label for the fuse types and ratings you must use. If you need to change the fuses, always fit the same type of fuse to both the phase and Neutral lines. The mains fuses are located immediately adjacent to the mains inlet in a slide-out module that can take either 20 mm x 5 mm or 1¼ x ¼ inch fuses.

6.2.2 Communications ports

**SAFETY WARNING**

Ensure connections to these ports are within the SELV limits of EN60950

Table 6-13 details each communication port.

Table 6-13 GSS8000-series signal generator - Communications ports

Port	Description
DATA	Not currently used
COM 1	Not currently used
USB	Not currently used
ETH0	Not currently used
ETH1	Local I/P connection to SimGEN controller or Host PC
HOST	Not currently used

6.2.3 BNC ports

**SAFETY WARNING**

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

- 1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-2.
- 2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR and INT REF OUT.
- 3) Do not remove the coaxial link cables from REF OUT to REF IN and FECL 1 to FECL IN.
- 4) Rear panel BNC connectors are NOT DC isolated.

Table 6-14 details the connectors. The top two rows of the BNC connectors are specific to single and “multi-box” configurations and should remain unused. Make connections according to the appropriate installation diagram see section 6.6. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Table 6-14 GSS8000-series signal generator - BNC input and output ports

Port	Description
------	-------------

Port	Description
REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
REF OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 1, 2, or 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone GSS8000-series signal generator are: Timer1: 1PPS Timer 2: Gated update, see Note 2) Timer 3: 1PPS Notes: 1) You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs. 2) GSS8000-series signal generators use Timer 2 and a Timer card in the SimGEN controller or Host PC to support high data rates. Timer 2 in GSS8000-series signal generators uses a factory default setting that is different to 7xxx and 4xxx signal generators. 3) If you use Immediate mode, and stop the scenario, and your simulator does not provide an input to the signal generator TRIG IN port, you must restart your signal generator before you can restart the scenario. 4) If you use Delayed mode and stop the scenario, stop the scenario, Spirent recommends you restart your signal generator by using one of the TIMER output ports in 1PPS mode connected to the TRIG IN port. Alternatively if an external trigger is unavailable, Spirent recommends using one of the TIMER output ports in 1PPS mode connected to the TRIG IN port.
TIMER OUTPUT 2	As Timer Output 1
TIMER OUTPUT 3	As Timer Output 1

6.2.4 TNC ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

- 1) Rear panel TNC connectors are DC isolated to 50 V.
- 2) Do not remove TNC link cables or TNC terminations on GSS8000-series signal generators.

The rear panel TNC connectors are for use in “multi-box” configurations. See the appropriate installation diagram in section 6.6.

6.2.5 MON/CAL port

Notes:

- 1) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Rear panel N type connector ports are DC isolated to 50 V.

Use the MON/CAL OUT port(s) to monitor the signal at a level approximately 50 dB higher than the front panel connector, mainly for calibration purposes. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

6.2.6 Aux RF In port

Notes:

- 1) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 2) Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the AUX RF IN port.
- 3) Rear panel N type connector ports are DC isolated to 50 V.

The AUX RF IN ports allow you to combine an external interfering signal with the signal present at the RF Out connector. The loss between the AUX RF IN port and the RF Out connector is approximately 15 dB.

6.2.7 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

The cooling fan blows air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in

which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

The signal generator will automatically shut down if its internal temperature exceeds a pre-determined value. If this happens, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

6.3 Remove and replace cards

SAFETY WARNINGS



Only suitably trained personnel should remove and replace cards.
Do not operate the signal generator with the top cover removed.
There are no user serviceable parts in this signal generator.



Use anti-static handling precautions when you remove and replace cards

Note: The connectors on the backplane, signal generator card and removable hard disk card are rated to 300 mating cycles. To avoid possible data loss or corruption, do not exceed 300 mating cycles.

You may need to remove and replace the hard disk card or a signal generator card. These cards are fitted to a card frame located in the signal generator. Section 6.3.1 details removing the top cover to access the cardframe. Sections 6.3.2 and 6.3.3 detail removing and replacing the hard disk card and signal generator card.

Table 6-15 and Figure 6-5 details the cards fitted in the card frame.

Table 6-15 GSS8000-series signal generator - Labelling for card frame and cards

Card frame label (left to right when viewing card frame)	Card label
LCD (blue background)	LCD (blue background)
CPU (red background)	CPU (red background)
HDD (green background)	HDD (green background)
SG 0 to SG 11 (silver background)	SG (silver background)
Timer (yellow background)	Timer (yellow background)

Figure 6-5 Schematic of signal generator cards in cardframe

		Cardframe slot number															
FRONT Panel (LCD)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	LCD	CPU	HDD		SG0	SG1	SG2	SG3	SG4	SG5	SG6	SG7	SG8	SG9	SG10	SG11	Timer
	LCD controller card	Processor card	Hard disk drive card	(spare)	Signal generator card 0	Signal generator card 1	Signal generator card 2	Signal generator card 3	Signal generator card 4	Signal generator card 5	Signal generator card 6	Signal generator card 7	Signal generator card 8	Signal generator card 9	Signal generator card 10	Signal generator card 11	Timer card

6.3.1 Top cover

To remove the top cover:

- Turn off the signal generator.
- Isolate the signal generator from the ac mains supply by removing the plug from the wall outlet.
- Wait thirty seconds before proceeding to remove the top cover.
- Working at the rear of the signal generator, use a suitable tool to remove the two top cover retainers.
- Carefully remove the top cover. Do not strain the earth (ground) bond connection to the top cover.
- Remove the earth (ground) bond connection from the terminal on the top cover.
- Store the top cover in a safe place.
- Reverse this procedure to replace the top cover.
- Ensure you replace the earth (ground) bond lead to the terminal fitted to the top cover before you refit the top cover.

6.3.2 Hard disk card



NOTICE

Handle the hard disk card carefully

If you damage the hard disk card, the signal generator may not operate correctly

The hard disk card is installed in the card frame located in the signal generator, see Figure 6-5. You can easily identify the hard disk card - it has a green label with the text HDD.

See section 6.3.1 and remove the top cover to get access to the card frame.

To remove the hard disk card:

- Use a suitable tool to undo the retaining screws at the left- and right-hand side of the card.

- b) Use the card ejectors to remove the card from the backplane connector.
- c) Withdraw the hard disk card from the card frame.
- d) Carefully place the hard disk card on a suitable anti-static surface.

Reverse this procedure to replace the hard disk card. Observe the correct orientation of the HDD card before inserting it in the card frame. Ensure you fully insert the hard disk card into the card frame and close the card ejectors before tightening the retaining screws.

Replace the hard disk card in the card frame slot identified with the HDD label defined in Figure 6-5.

You must re-fit the top cover before switching on the signal generator.

6.3.3 Signal generator card

Up to twelve signal generator cards may be installed in the card frame located in the signal generator, see Table 6-15 and Figure 6-5. You can easily identify the signal generator cards - they have a silver label with the text *SGn*, where *n* is a number from 0 to 11.

See section 6.3.1 and remove the top cover to get access to the card frame.

To remove a signal generator card:

- a) Remove the Compact Flash card from the signal generator card.
- b) Remove the AOC module, if fitted, from the signal generator card.
- c) Use a suitable tool to undo the retaining screws at the left- and right-hand side of the card.
- d) Use the card ejectors to remove the card from the backplane connector.
- e) Withdraw the signal generator card from the card frame.
- f) Carefully place the signal generator card on a suitable anti-static surface.

Reverse this procedure to replace the signal generator card. Observe the correct orientation of the signal generator card before inserting it in the card frame. Ensure you fully insert the signal generator card into the card frame and close the card ejectors before tightening the retaining screws.

Replace signal generator cards only in the card frame slots identified with the SG label defined in Table 6-15.

Before replacing the top cover, ensure you:

- a) Replace the AOC module (if fitted) in each replaced signal generator card.
- b) Replace the Compact flash card in each replaced signal generator card.

You must re-fit the top cover before switching on the signal generator.

6.4 Calibration

Table 2-2 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

6.5 Connectivity and specifications

Spirent supplies the latest issue of the product datasheet see Table 2-2, on the SimGEN installation CD. Refer to it for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

6.5.1 Lifting the signal generator



CAUTION - HEAVY

The product datasheet, see Table 2-1 and Table 2-2 details the weight of each signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

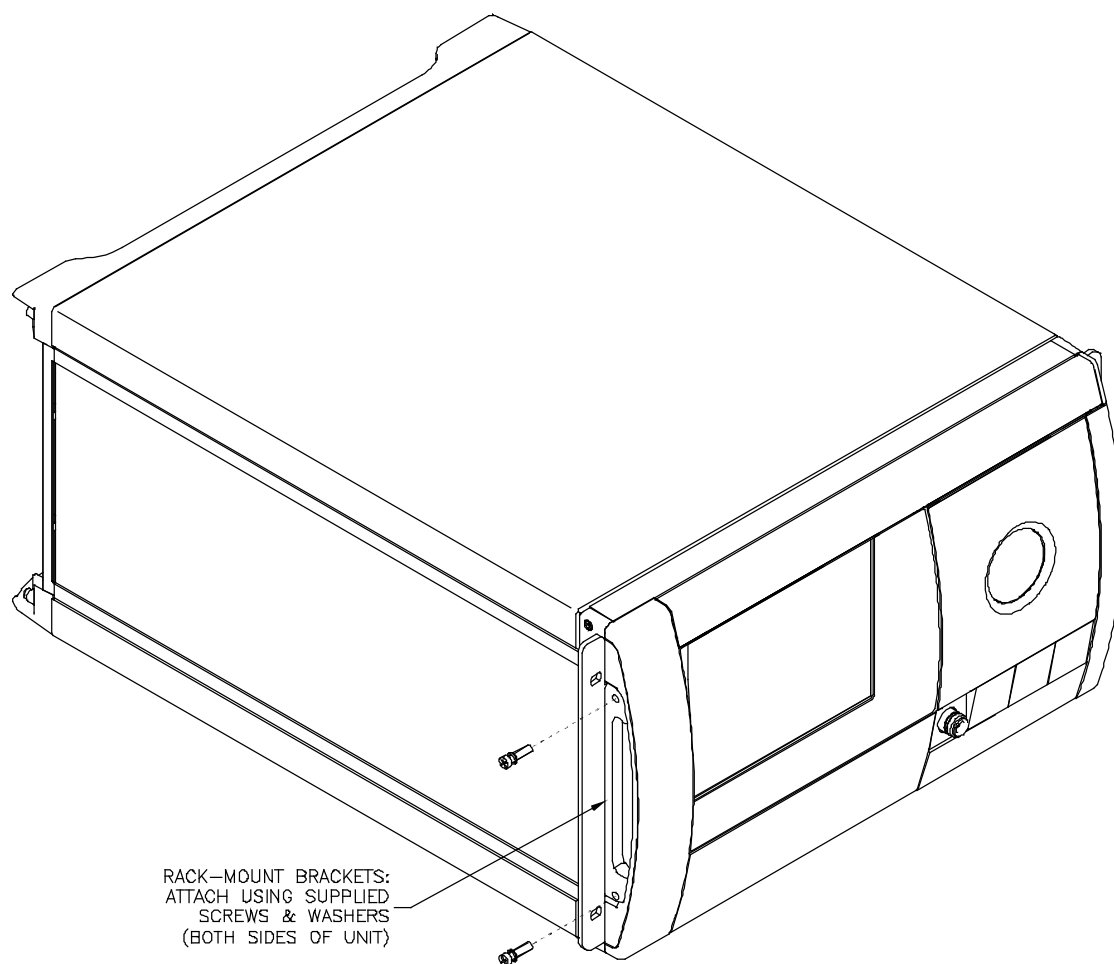
Spirent supply side grips only for aiding installation of the signal generator to and from a rack.

Do not use the side grips to move or carry the signal generator.

Figure 6-6 shows how to fit the rack-mount brackets to the signal generator (Spirent supplies a copy of this assembly drawing with each set of rack-mount brackets).

If you rack-mount a GSS8000-series signal generator, ensure you support the signal generator along its entire length(front-to-back), and on either side. Spirent recommends you contact the supplier of your rack to determine the correct supports you will need for the signal generator weight. The product datasheet, see Table 2-2, gives the weight of the signal generator.

Similar recommendations apply if you rack mount the SimGEN controller. Spirent provides the manufacturers installation instructions with each SimGEN controller.

Figure 6-6 Fitting rack-mount brackets to GSS8000 series signal generators

6.6 Interconnection

This document provides drawings for basic interconnections. For correct operation of your one or two signal generator system, see the interconnection drawings in Figure 6-7 to Figure 6-10. Table 6-16 details the interconnections for one GSS8000-series signal generator to the SimGEN controller or Host PC. Table 6-17 details the interconnections for two GSS8000-series signal generators to the SimGEN controller or Host PC.

Reference j) gives examples of interconnections for simulators using multiple GSS8000-series signal generators.

Correctly position and tighten all cables and terminations.

Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator (s)
- c) Switch on the SimGEN controller or Host PC

Table 6-16 GSS8000-series interconnections - single signal generator

Connection type	From	To
-----------------	------	----

Connection type	From	To
Ethernet Cat 5 cable assembly	SimGEN controller or Host PC, ETH 1 port	Signal generator, ETH 1 port
BNC cable assembly	Timer Card adaptor, INTERRUPT IN connector	Signal generator, TIMER OUTPUT 2

Table 6-17 GSS8000-series interconnections - all two signal generators

Connection type	From	To
Ethernet Cat 5 cable assembly (not shown in Figure 6-9)	SimGEN controller or Host PC, ETH 1 port	Ethernet switch, Port 1
Ethernet Cat 5 cable assembly	Ethernet switch, Port 2	GSS8000-series Master, ETH 1 port
Ethernet Cat 5 cable assembly	Ethernet switch, Port 3	GSS8000-series Auxiliary, ETH 1 port
BNC cable assembly	GSS8000-series Master, IF AUX I/P port	GSS8000-series Auxiliary, IF AUX O/P port
BNC cable assembly	GSS8000-series Master, FECL 2 port	GSS8000-series Auxiliary, FECL IN port
BNC cable assembly	GSS8000-series Master, INT REF OUT port	GSS8000-series Auxiliary, REF IN port
BNC cable assembly	GSS8000-series Master, TIMER OUTPUT 2	Timer Card adaptor, INTERRUPT IN connector
BNC cable assembly	GSS8000-series Master, TIMER OUPUT 3 port	GSS8000-series Auxiliary, SYNC IN port

Systems without an MCU (see Figure 6-9) also use:

BNC cable assembly	GSS8000-series Master, LO1 2 port	GSS8000-series Auxiliary, LO1 IN port
--------------------	--------------------------------------	--

Figure 6-7 GSS8000-series single-output signal generator interconnect

Note: For standalone operation, fit the loopback cable between the ports '1' and 'IN' and fit the termination to port '2' of all 'LO1' to 'LO3' ports with connectors. See the Auxiliary signal generator in Figure 6-10.

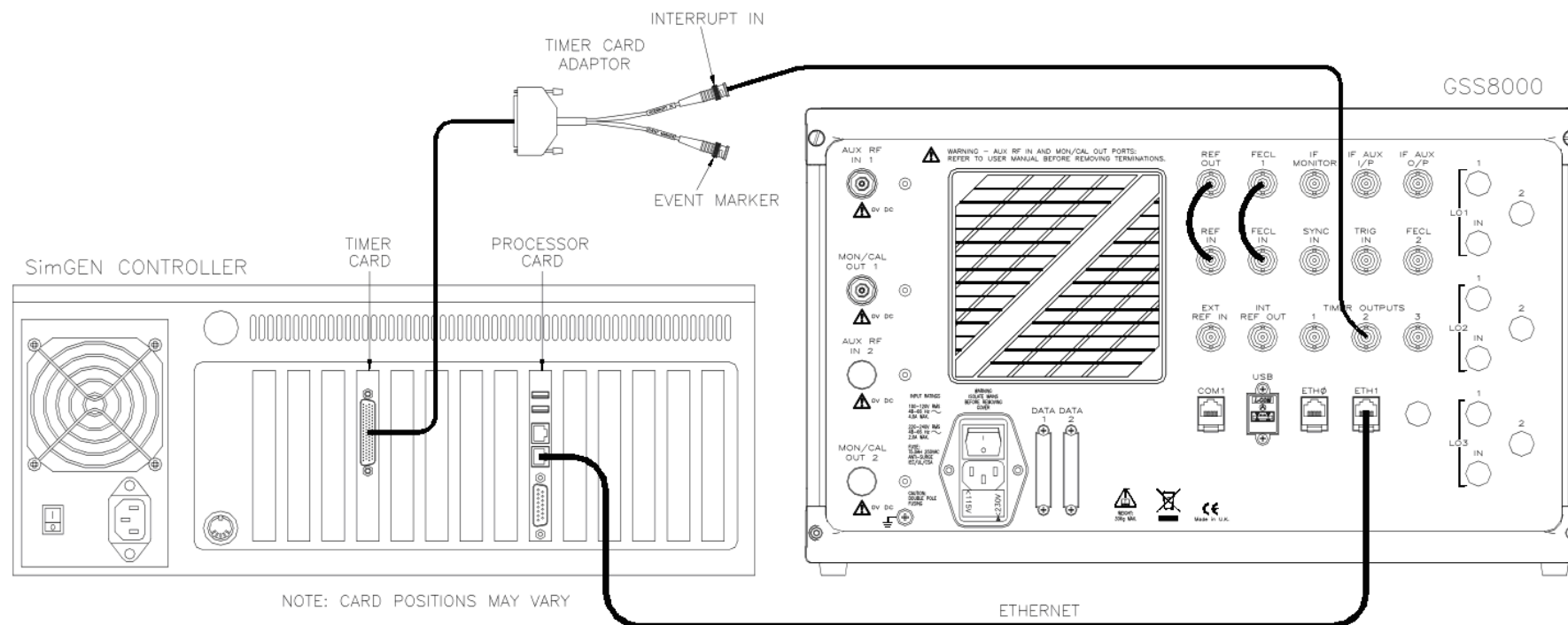


Figure 6-8 GSS8000-series dual-output signal generator interconnect

Note: For standalone operation, fit the loopback cable between the ports '1' and 'IN' and fit the termination to port '2' of all 'LO1' to 'LO3' ports with connectors. See the Auxiliary signal generator in Figure 6-10.

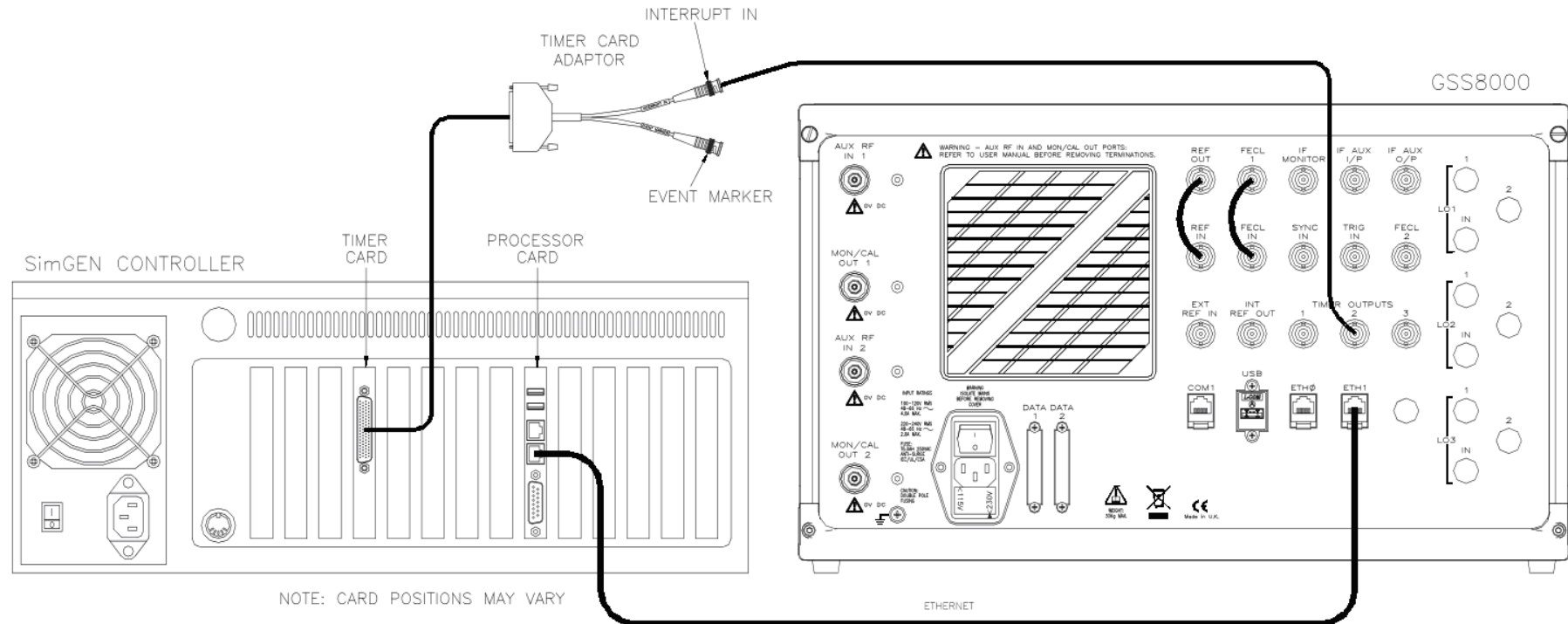


Figure 6-9 GSS8000-series interconnects for two signal generators

Note: Currently Spirent supplies an external Ethernet switch

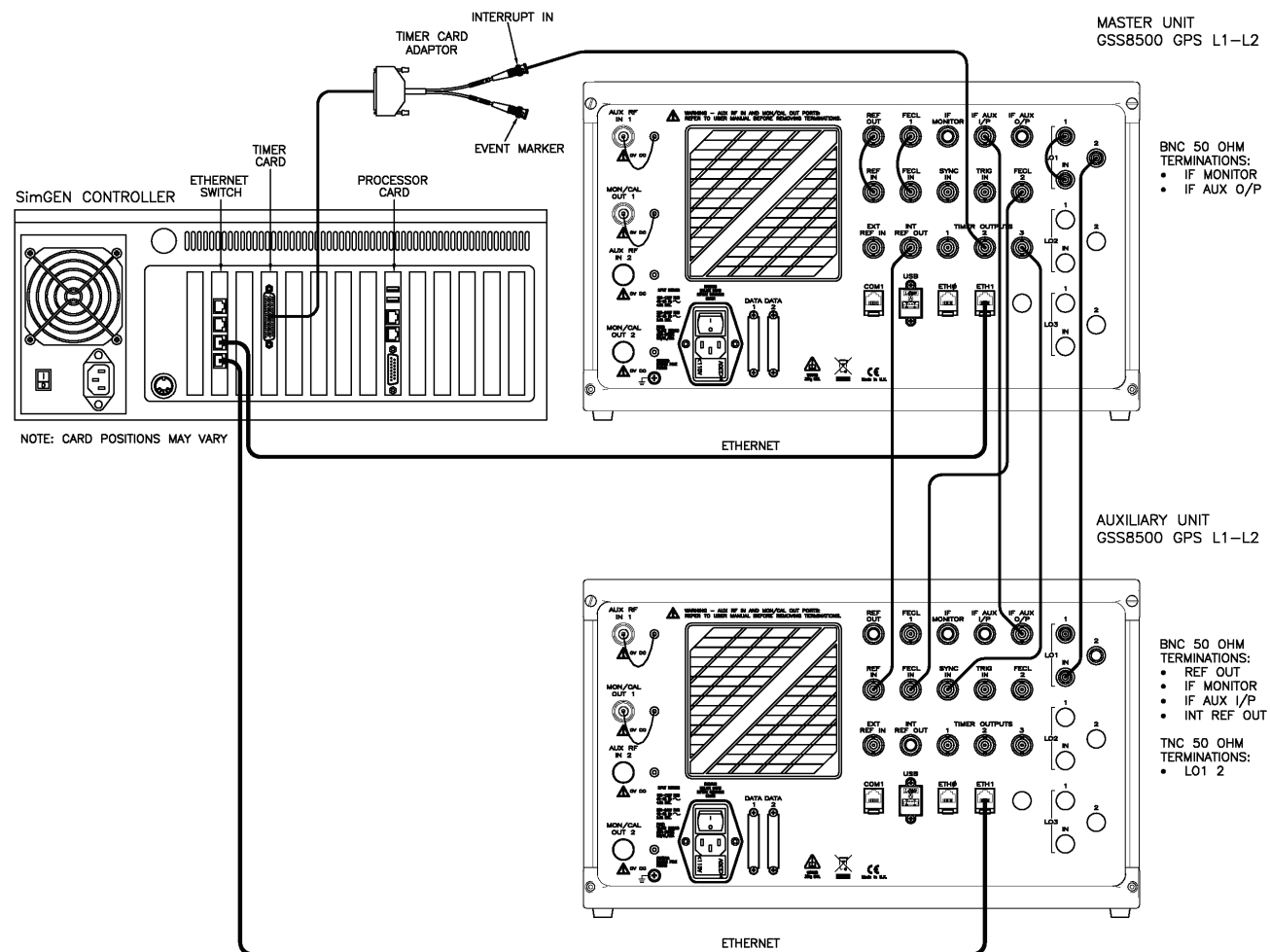
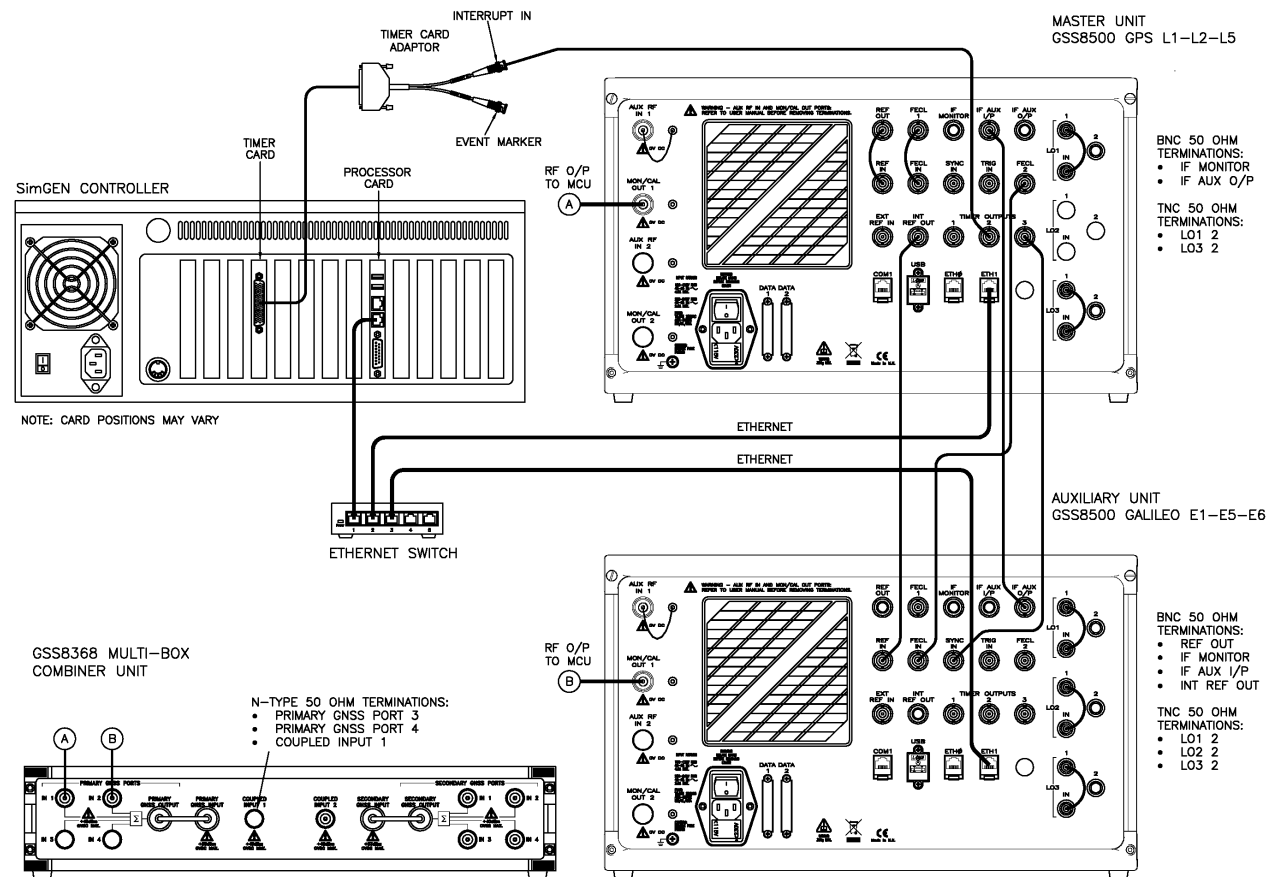


Figure 6-10 GSS8000-series interconnects for two signal generators with an MCU



Appendices

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A Abbreviations and acronyms

Appendix Table A-1 shows standard GPS and related abbreviations and acronyms this manual may use.

Appendix Table A-1 Abbreviations and acronyms

Abbreviation / acronym	Description
1 PPS	1 Pulse Per Second
A/J	Anti-jamming
AOC	Auxiliary Output Chip
ASCII	American Standard Code for Information Interchange
BITE	Built in Test Equipment
bps	Bits per second
BPSK	Bi-Phase Shift Keying
C/A code	Coarse/acquisition code
C/No	Carrier to Noise Ratio
CDMA	Code Division Multiplex Access
CDU	Control Display Unit
CRPA	Controlled Reception Pattern Antenna
CW	Continuous Wave
DAC	Digital to Analogue Converter
DGPS	Differential GPS
dRMS	Distance Root Mean Square
ECM	Electronic Counter Measures
EGNOS	European Geo-stationary Navigation Overlay System
GPS	Global Positioning System
GUI	Graphical User Interface
ICD	Interface Control Document
IF	Intermediate Frequency
J/S	Jamming to Signal Ratio

Abbreviation / acronym	Description
L1	GPS carrier frequency, 1575.42 MHz
L2	GPS carrier frequency, 1227.6 MHz
L5	GPS carrier frequency, 1176.45 MHz
LAAS	Local Area Augmentation System
LO	Local Oscillator
LSB	Least Significant Bit
MHz	Megahertz (10^6 Hz)
MSAS	MTSAT Satellite Augmentation System
MSB	Most Significant Bit
Nav Data	Navigation data message
ns	Nanosecond (10 ⁻⁹ second)
P code	Precise Code
PC	Personal Computer
PLTS	Position Location Test System
PPS	Precise Positioning Service
PPSSM	PPS Security Module
PRN	Pseudo Random Noise
RCVR	Receiver
S/A	Selective Availability
SAAS	Selective Availability and Anti-Spoofing
SBAS	Satellite Based Augmentation System (for example: WAAS, EGNOS, and MSAS)
Simulator	A configured arrangement of signal generators, computer controllers and ancillary items
Spirent	Spirent Communications Plc
SPS	Standard Positioning Service
SSS	Satellite Signal Source

Abbreviation / acronym	Description
TDOP	Time Dilution of Precision
UE	User Equipment
VDOP	Vertical Dilution of Precision
VHF	Very High Frequency
WAAS	Wide Area Augmentation System
Y code	Precise Code, A-S mode

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B Superseded signal generators

Appendix Table B-1 details superseded signal generators.

Appendix Table B-1 Superseded signal generators

Signal generator	See	Replaced by
GSS5060	C	GSS6700, see Chapter 3
GSS6560	D	GSS6700, see Chapter 3
GSS4750	E	Initially 7700, now GSS8000-series, see Chapter 6
STR4760	F	Initially 7700,now GSS8000-series, see Chapter 6
STR4780	G	Initially 7700, now GSS8000-series, see Chapter 6
STR4790	H	GSS8000-series, see Chapter 6
GSS7700	I	The GSS8000-series, see Chapter 6, supersedes both Variant A and Variant B
GSS7800	J	GSS8000-series, see Chapter 6
GSS7900	K	GSS8000-series, see Chapter 6

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C GSS5060

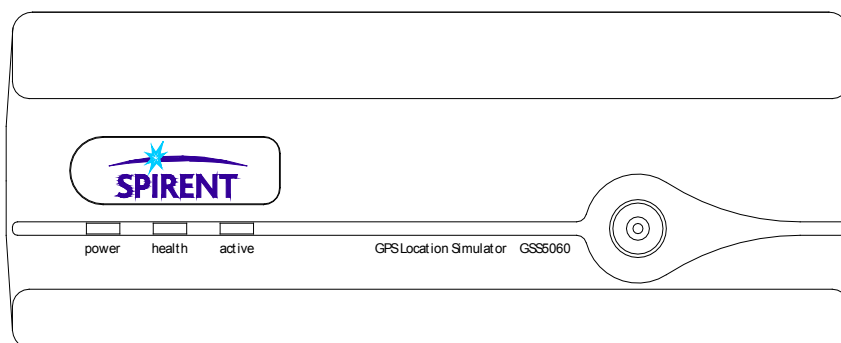
The GSS5060 signal generator supports up to twelve, L1, C/A code SV channels. It is capable of generating both GPS and SBAS signals. SimGEN controls the GSS5060 using the USB interface.

Normally, this signal generator is used in the Spirent PLTS system. The PLTS System Reference Manual covers external frequency and synchronisation.

C.1 Front panel

Appendix Figure C-1 and Appendix Table C-1 describe the front panel of the GSS5060.

Appendix Figure C-1 GSS5060 front panel



Appendix Table C-1 GSS5060 front panel features

Indicator	Type	Description
POWER	LED	ON when connected to ac power and the internal power supply is operating
HEALTH	LED	ON - operating normally Flashing - highlights is an error, as follows: 1 Hz flashing: BITE error 4 Hz flashing: FATAL error 3 flash repeating sequence at 4 Hz (3 flashes and one "no flash" every second): Ext Ref phase lock acquisition period
ACTIVE	LED	ON - simulation in progress Flashing - waiting for an external trigger at TRIG IN connector on rear panel

Connector	Type	Description
Primary RF Output	Co-axial type N	Simulated GNSS output

C.2 Rear panel

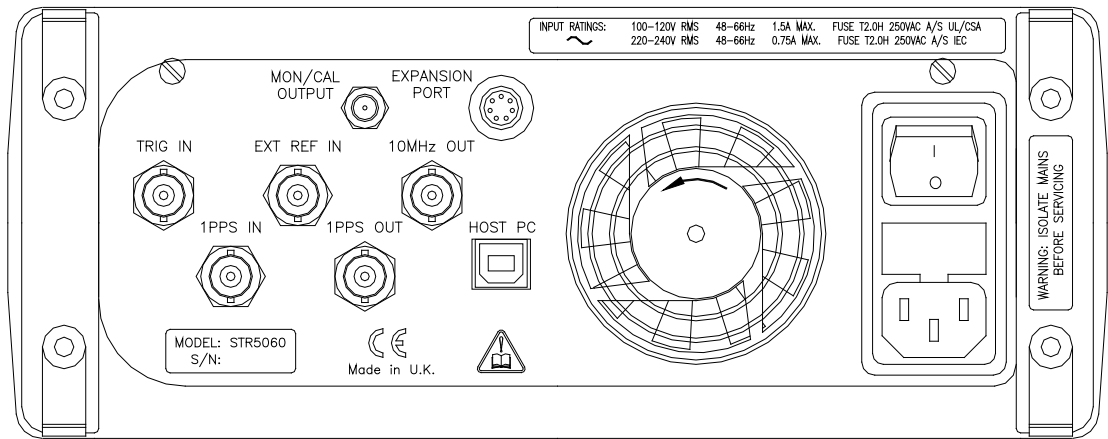


SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Appendix Figure C-2 and Appendix Table C-2 detail the rear panel of the GSS5060.

Appendix Figure C-2 GSS5060 rear panel



Appendix Table C-2 GSS5060 rear panel features

Connector	Type	Description
MON/CAL PORT	N Type female connector	High-level RF output port Used for level calibration
EXPANSION PORT	7-way Fischer type 103	Not Used
TRIG IN	BNC	Start a simulation using the rising edge of an external trigger signal. TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ω input impedance Section 3.6 shows timing details
10 MHz OUT	BNC	Internal reference output
EXT REF IN	BNC	Note: For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-1.

Connector	Type	Description
1PPS IN	BNC	External system synchronisation input. TTL level compatible: $-0.5\text{ V} < \text{Low} < +0.8\text{ V}$ $+2.0\text{ V} < \text{High} < +5.5\text{ V}$ 50 Ω input impedance Section 3.6 shows timing details
1PPS OUT	BNC	External system synchronisation output TTL output level: $-0.5\text{ V} < \text{Low} < +0.4\text{ V}$ $+2.4\text{ V} < \text{High} < +5.5\text{ V}$ into 50 Ω load Rising edge synchronised with 1 s epoch in GPS time
HOST PC	USB downstream connector	Control and data connection to the SimGEN controller or Host PC
Power in/switch/fuse	IEC	Mains supply ac power in

C.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS5060 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate

C.2.2 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

A cooling fan sucks air from inlet holes at the front edge of the base of the signal generator through the signal generator to the exhaust grille on the rear panel. Do not cover or restrict the inlet holes or exhaust grille; severe internal damage could result due to overheating. Periodically inspect the fan blades through the exhaust grille and remove excess dust using a vacuum cleaner.

The inspection interval will depend upon the environment in which the signal generator is situated; Spirent recommends you examine the fan at monthly intervals to determine a normal inspection interval.

A thermal sensor will shut down the signal generator if its internal temperature exceeds a pre-determined value. If the signal generator unexpectedly shuts down, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

C.3 Calibration

SAFETY WARNING



Calibration of the signal generator involves operating it with the casing removed and mains power applied.

You must be suitably trained and skilled to calibrate the signal generator.



Use anti-static handling precautions when you remove and replace the case.

The GSS5060 employs digital architecture and benefits from minimal calibration.

Two user adjustments are required: Frequency and Power. Both require simple potentiometer adjustments. Test equipment requirements are a suitable frequency counter with a stable reference and an RF power meter.

Spirent recommends you perform these calibrations yearly.

Remove the case and then perform the frequency and power level calibrations.

You must replace the chassis in the outer case after calibration.

Section C.3.1 details Removing the case.

Section C.3.2 details Frequency calibration.

Section C.3.3 details Power level calibration.

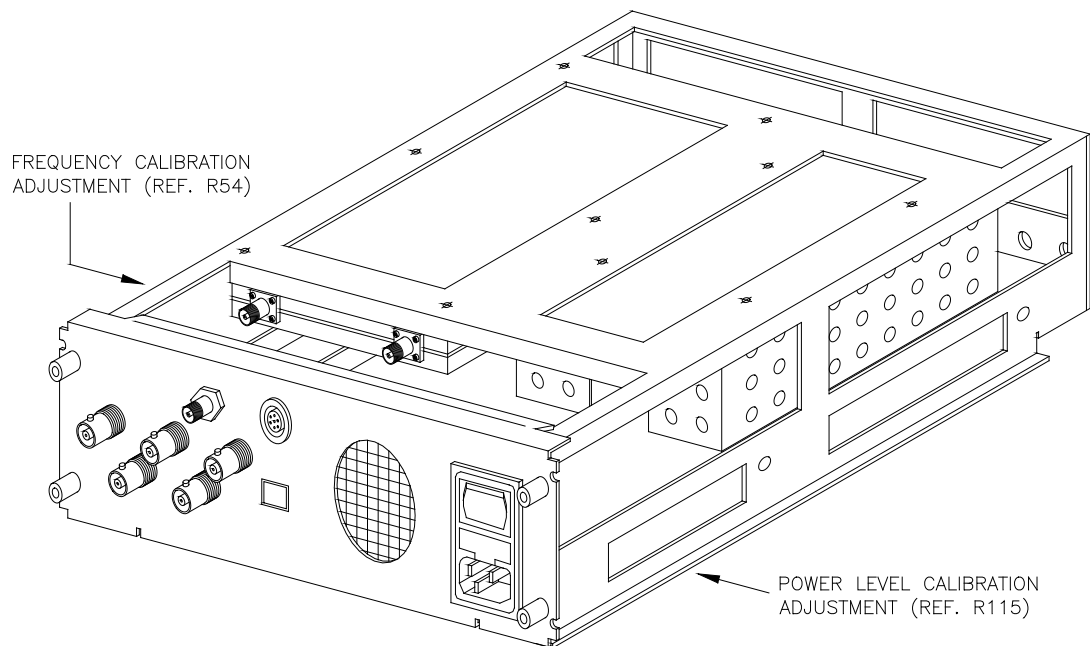
C.3.1 Removing the case

To remove the GSS5060 chassis from its outer case follow these steps:

- a) Remove all connectors from the front panel RF OUT connector.
- b) On the rear panel, turn off the power switch and remove the power cord.
- c) Remove USB cable and any other connections.
- d) Undo the four screws securing the rear panel bezel. These are located near the rubber feet. Remove the bezel.
- e) Undo the four screws securing the GSS5060 chassis into the case. These are located at the four corners of the rear panel.
- f) Undo the two screws on the underside of the GSS5060 case, which secure the chassis. Place signal generator correct way up on bench.
- g) Remove the chassis horizontally from the rear of the case, avoiding any upward force.

The frequency and power adjustment potentiometers are located as shown in Appendix Figure C-3

Appendix Figure C-3 GSS5060 chassis



C.3.2 Frequency calibration

This requires a frequency counter capable of measuring 10.00 MHz with at least 10 digits of accuracy, for example an HP53131A. The frequency counter should be locked to a frequency standard accurate to $< \pm 1 \times 10^{-9}$, for example an HP5065A Rubidium standard. You can use a less accurate standard if you are prepared to accept lower frequency accuracy for your signal generator.

- a) Attach the frequency counter to the 10MHz OUT BNC connector on the rear panel.
- b) Reconnect the power cord and turn on the GSS5060.
- c) Allow 30 minutes for the internal oscillator to stabilise.
- d) Locate the frequency adjustment potentiometer see Appendix Figure C-3.
- e) Adjust the potentiometer to achieve a frequency reading of 10 MHz $\pm$ 0.02 Hz.
- f) Continue with Power level calibration section C.3.3.

C.3.3 Power level calibration

This requires an RF power meter capable of measuring a frequency of 1.57542 GHz and power levels between –50 dBm and –60 dBm, for example an HP E4418B. You must use a power meter with current calibration to the manufacturer's instructions, including any adjustments for sensor calibration factor and frequency.

- a) Attach the RF power meter to the 'N type' MON/CAL Output connector on the rear panel of the signal generator.
- b) In SimGEN, select Tools-GSS6560/5060/4150 Utilities-Annual Calibration... and follow the on-screen instructions.
- c) Use the level adjustment potentiometer to set the level reading displayed within the Annual Calibration utility window, to within 0.05 dB.
- d) Replace GSS5060 chassis into outer casing, using reversal of the process described in section C.3.1.
- e) This concludes the Calibration procedure.

You must replace the chassis in the outer case before using the signal generator.

C.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product datasheet see Table 2-1. Refer to it for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

The SimGEN installation CD contains the latest issue of the Spirent product datasheet see Table 2-1. Refer to it for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

C.5 EMC and Safety Compliance

For the signal generator

The product complies with the Low Voltage Directive 73/23/EEC by application of the harmonised standard EN60950.

The signal generator complies with the EEC EMC Directive 89/336/EEC by application of the following harmonised standard:

EN61326-1 Electrical Equipment for Measurement, Control and Laboratory USE – EMC Requirements.

In particular, with regard to Radiated Emissions; the signal generator meets the requirements of

EN61326; 1997 +A1, 1998 (Table 3 [class A])

For the computer system

The computer system shall comply with appropriate equivalent EMC and Safety standards.

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D GSS6560

The GSS6560 signal generator supports up to twelve L1, C/A code channels. It is capable of generating both GPS and SBAS signals using SimGEN and is controlled using a USB link from the SimGEN controller.

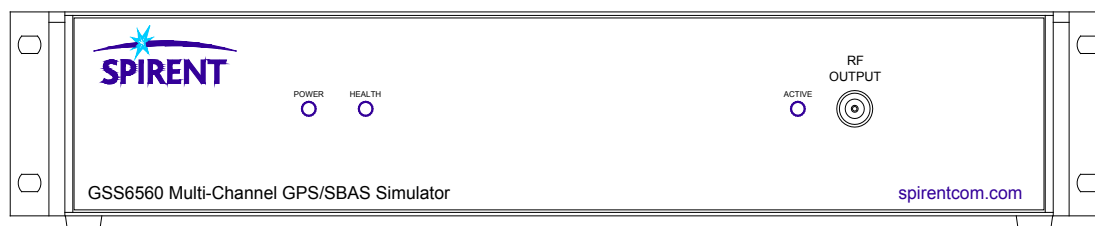
The signal generator has the capability to be phase-locked to an externally applied reference signal, triggered from an externally applied start pulse and synchronised to external equipment through its 1PPS input port. The internal 10 MHz reference OCXO, together with an output 1PPS synchronisation signal is available from rear panel of the signal generator.

This chapter covers the “multi-box” capability of the GSS6560.

D.1 Front panel

Appendix Figure D-1 and Appendix Table D-1 describe the front panel of the GSS6560.

Appendix Figure D-1 GSS6560 front panel



Appendix Table D-1 GSS6560 front panel features

Name	Type	Description
POWER	LED	ON when connected to ac power and the internal power supply is operating
HEALTH	LED	ON unless the internal monitoring detects an error, then: 1 Hz Flashing: BITE error. 4 Hz Flashing: FATAL error. 3 Flash repeating sequence at 4 Hz (3 flashes and one “no flash” every second): Ext Ref phase lock acquisition period
ACTIVE	LED	ON when a simulation is in progress. Flashes when waiting for an external trigger signal on rear panel TRIG IN
RF Output	‘N’ Type connector	Provides a composite GPS/SBAS signal

D.2 Rear panel

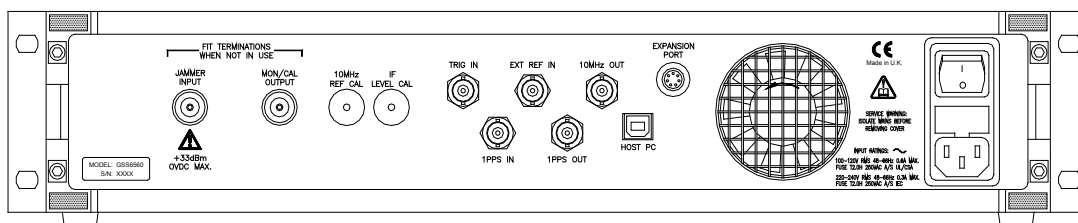


SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Appendix Figure D-2 and Appendix Table D-2 describe the rear panel of the GSS6560.

Appendix Figure D-2 GSS6560 rear panel



Appendix Table D-2 GSS6560 rear panel features

Connector	Type	Description
JAMMER PORT	N Type female connector	Input port for externally supplied interference signals
MON/CAL PORT	N Type female connector	High-level RF output port Used for level calibration, see section D.3.2
10MHz REF CAL	N/A	Calibration of internal 10MHz Reference, see section D.3.1
IF LEVEL CAL	N/A	Calibration of power level, see section D.3.2
EXPANSION PORT	7-way Fischer type 103	Used for Multi-box interconnection, see section D.5
TRIG IN	BNC	Start a simulation using the rising edge of an external trigger signal. TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ω input impedance Section D.6 shows timing details
10 MHz OUT	BNC	Internal reference output
EXT REF IN	BNC	Use to lock the signal generator to an external frequency reference. Note: For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product datasheet for your signal generator, see Table 2-3.

Connector	Type	Description
1PPS IN	BNC	External system synchronisation input. TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ω input impedance Section D.6 shows timing details
1PPS OUT	BNC	External system synchronisation output TTL output level: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V into 50 Ω load Rising edge synchronised with 1 s epoch in GPS time
HOST PC	USB downstream connector	Control and data connection to the SimGEN controller
Power in switch and fuse	IEC	Mains supply ac power in.

D.2.1 Mains power inlet



SAFETY WARNING

GSS6560 serial numbers 9355 onwards use IEC inlets with double-pole / Neutral fusing.



SAFETY WARNING

You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS6560 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate.

D.2.2 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator.

Periodically wash the fabric dust filter (if fitted) in clean water.

A cooling fan sucks air from inlet holes at the front edge of the base of the signal generator through the signal generator to the exhaust grille on the rear panel. Do not cover or restrict the inlet holes or exhaust grille; severe internal damage could result due to overheating. Periodically inspect the fan blades through the exhaust grille and remove excess dust using a vacuum cleaner.

The inspection interval will depend upon the environment in which the signal generator is situated; Spirent recommends you examine the fan at monthly intervals to determine a normal inspection interval.

A thermal sensor will shut down the signal generator if its internal temperature exceeds a pre-determined value. If the signal generator unexpectedly shuts down, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

D.3 Calibration

The GSS6560 employs digital architecture to produce accurate and stable signals and requires little calibration.

There are two user adjustments: Frequency and Power.

These are both simple potentiometer adjustments. Test equipment requirements are a suitable frequency counter with a stable reference and an RF power meter respectively.

Spirent recommends you perform these calibrations yearly.

- Section D.3.1 details Reference frequency calibration
- Section D.3.2 details Power level calibration

D.3.1 Reference frequency calibration

This requires a frequency counter capable of measuring 10.00 MHz with at least 10 digits of accuracy, for example an HP53131A. The frequency counter should be locked to a frequency standard accurate to $< \pm 1 \times 10^{-9}$, for example an HP5065A Rubidium standard. You can use a less accurate standard if you are prepared to accept lower frequency accuracy for your signal generator.

- a) Attach the frequency counter to the 10 MHz OUT BNC connector on the rear panel.
- b) Turn on the GSS6560 and allow 30 minutes for the internal oscillator to stabilise.
- c) Remove the 'Calibration Void if Broken' label covering the 10 MHz Ref Cal adjustment port (see Appendix Figure D-2).
- d) Use the frequency adjustment potentiometer to achieve a frequency reading of $10 \text{ MHz} \pm 0.02 \text{ Hz}$.
- e) Fit an appropriate calibration label over the 10 MHz Ref Cal adjustment port.
- f) This concludes the reference frequency calibration.

D.3.2 Power level calibration

This requires an RF power meter capable of measuring a frequency of 1.57542 GHz and power levels between -50 dBm and -60 dBm , for example an HP E4418B. You must use a power meter with current calibration to the manufacturer's instructions, including adjustments for sensor calibration factor and frequency.

- a) Turn on the GSS6560 and connect it to the SimGEN controller.

- b) Attach the RF power meter to the 'N type' MON/CAL Output connector on the rear panel of the signal generator
- c) Allow 30 minutes for the GSS6560 to stabilise.
- d) Remove the 'Calibration Void if Broken' label covering the IF Level Cal adjustment port (see Appendix Figure D-2).
- e) In SimGEN, select **Tools-GSS6560/5060/4150 Utilities-Annual Calibration...** and follow the on-screen instructions.
- f) Use the level adjustment potentiometer to achieve, within 0.05 dB, the level reading displayed in the SimGEN window.
- g) Fit an appropriate calibration label over the IF Level Cal adjustment port.
- h) This concludes the Power Level Calibration.

D.4 Connection to SimGEN controller

First:

- a) Turn on the SimGEN controller
- b) Wait for it to load Windows.

After Windows has started:

- a) Connect the SimGEN controller to your GSS6560 signal generator see Appendix Table D-3.
- b) Use the ac power cable to connect your GSS6560 to a suitable ac power outlet.
- c) Switch on your GSS6560.
- d) Start the Spirent software.

Appendix Table D-3 Single GSS6560 interconnection table

Connection type	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller, USB 1 port	GSS6560 Host PC USB port

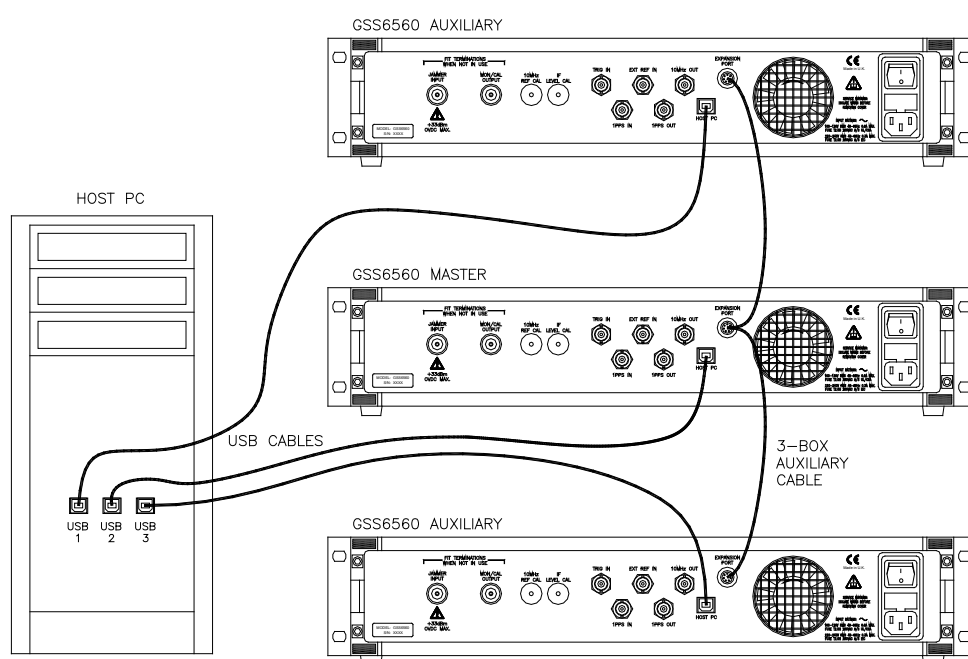
Section D.5 details using multiple GSS6560 signal generators, synchronising to other equipment and using the GSS6560 with an optional IEEE-488 interface.

D.5 Using multiple GSS6560 signal generators

Spirent can configure up to four GSS6560 signal generators to form a multiple output system. Such a system can simulate scenarios covering, for example, four independent vehicles each with a single antenna, or one vehicle with four independent antennas.

To configure two GSS6560 signal generators for "dual-box" operation, follow the set-up shown in Appendix Figure D-3 and Appendix Table D-4. Appendix Figure D-4 and Appendix Table D-5 detail three signal generators in a "three-box" system and Appendix Figure D-5 and Appendix Table D-6 detail four signal generators in a "four-box" system.

In all simulators using more than one signal generator you must designate one GSS6560 signal generator as the 'Master' and designate each of the remaining GSS6560 signal generators as 'Auxiliary'. The Master signal generator supplies each Auxiliary with an internal 10 MHz reference and a 1PPS synchronisation pulse, ensuring all signal generators effectively act as one signal source.

Appendix Figure D-4 Three-box interconnection diagram**Appendix Table D-5 Three-box interconnection table**

Connection	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller, USB 1 port	GSS6560 Auxiliary 1, Host PC USB port
USB cable assembly (USB type A to USB type B)	SimGEN controller, USB 2 port	GSS6560 Master, Host PC USB port
USB cable assembly (USB type A to USB type B)	SimGEN controller, USB 3 port	GSS6560 Auxiliary 2, Host PC USB port
Auxiliary cable (Special to Spirent)	GSS6560 Master, Expansion port	GSS6560 Auxiliary 1, Expansion port; and GSS6560 Auxiliary 2, Expansion port

Connection	From	To
Auxiliary cable (Special to Spirent)	GSS6560 Master, Expansion port	GSS6560 Auxiliary 1, Expansion port; and GSS6560 Auxiliary 2, Expansion port; and GSS6560 Auxiliary 3, Expansion port

D.5.1 Operating points

The following list gives points to observe when using more than one signal generator in a “multi-box” configuration.

- To operate in “multi-box” mode you must select your hardware configuration in SimGEN using **Tools-Change Hardware Configuration**.
- Spirent creates your hardware configuration during factory installation. If your hardware configuration does not exist, contact Spirent Applications Support.
- In a configuration using multiple GSS6560 signal generators, if the second, third or fourth signal generator provides an Auxiliary output, those signal generator will possess an auxiliary hardware key. Signal generators with auxiliary hardware keys can only operate in “multi-box” mode and cannot operate as “standalone” signal generators.
- Only the Master supports EXT REF IN, 1PPS IN and TRIG IN.
- You can operate a “three-box” or “four-box” system as a “two-box” system without disconnecting the third or fourth signal generator.
- When you are configuring a “three-box” or “four-box” system, you can only designate one signal generator as the Master. The Master signal generator will have a sticker on its rear panel.
- When configuring a “three-box” or “four-box” system, you must connect the auxiliary cables as shown in Appendix Figure D-4 and Appendix Figure D-5.

D.6 Synchronising from external equipment

Note: Using TRIG IN (immediate mode) together with 1PPS IN is inappropriate, as both would be attempting to control the timer; however you can use TRIG IN (delayed mode) with 1PPS IN.

The GSS6560 signal generator incorporates a number of input and output signal ports that you can use to synchronise time between the signal generator and your system. This section describes how to use the 1PPS IN and/or TRIG IN inputs to achieve synchronisation.

The GSS6560 maintains time internally using a time counter clocked by an internal 10 MHz clock. Simulations always start on a one-second rollover of this timer. Before starting a simulation, you can synchronise the timer to an external system by applying a rising edge to the 1PPS IN rear panel input. You can now start simulations either by appropriate timing of the software run command (Trigger Mode: Disabled) or by selecting Delayed Trigger Mode and applying a rising edge to the TRIG IN input. Both cause the simulation to start on the next one-second rollover of the timer. Alternatively, selecting Immediate Trigger Mode forces the timer to a point just before the one-second rollover and freezes it until the TRIG IN input detects a rising edge. The simulation starts running after a short delay.

If coarse synchronisation to your system is sufficient, you can use these methods without any additional considerations. However, certain fixed delays and uncertainties, of the order of 100 ns, will exist.

For precise synchronisation, you must supply the signal generator with an external 10 MHz frequency reference and observe certain timing requirements between the 1PPS IN and/or TRIG IN signals and the EXT REF IN signal. Section D.6 details these requirements.

D.6.1 1PPS in

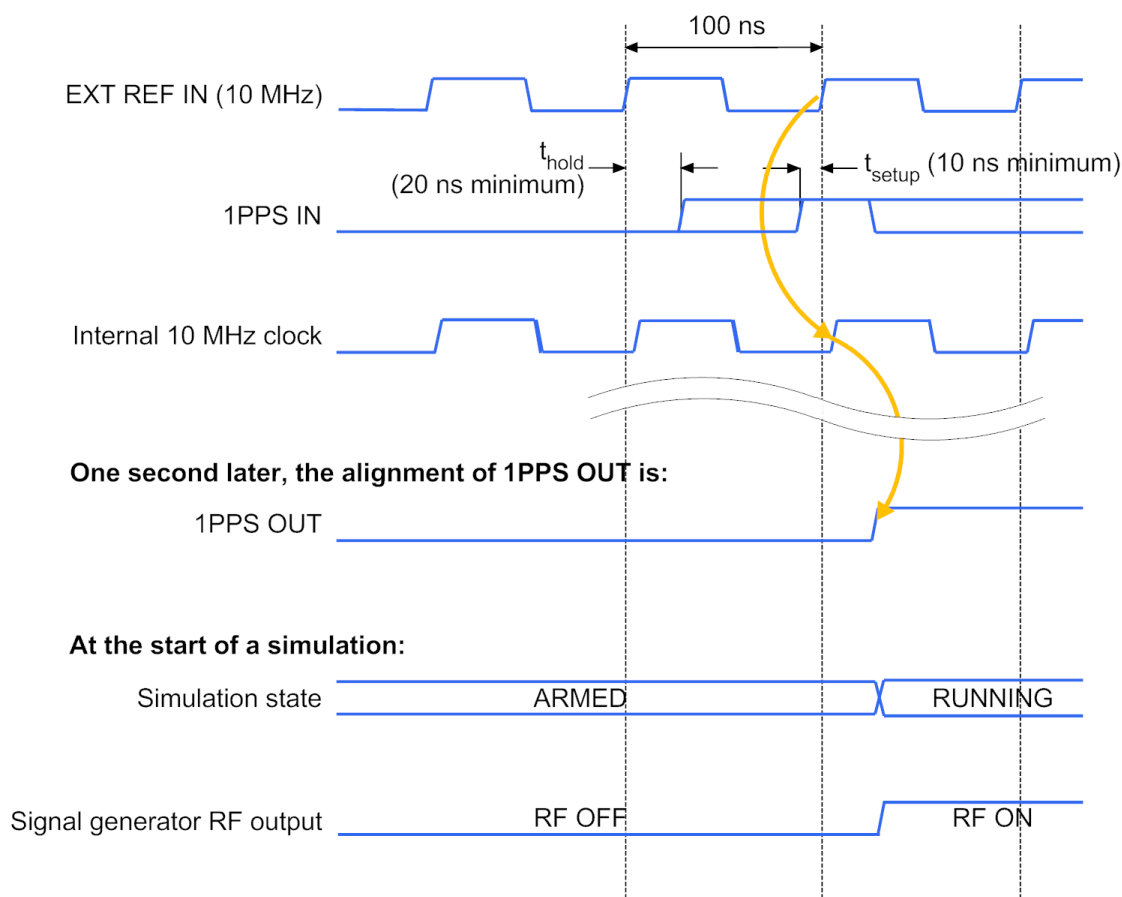
Notes:

- 1) Alignment of 1PPS OUT, as shown in Appendix Figure D-6 does not occur immediately, but one second after detecting 1PPS IN.
- 2) While a simulation is running, the 1PPS IN input is disabled.

Appendix Figure D-6 shows the required timing of the rising edge of 1PPS IN with respect to EXT REF IN, and the resulting timing of the start of simulation. Provided you keep to these timing requirements, the RF signal timing is fixed and repeatable with respect to REF IN every time you run a simulation.

The EXT REF IN signal may be a square wave as shown, (for example a TTL/CMOS signal) or a sinusoid. Whatever the REF IN input waveform, the timing reference point is the ac zero crossing of the signal.

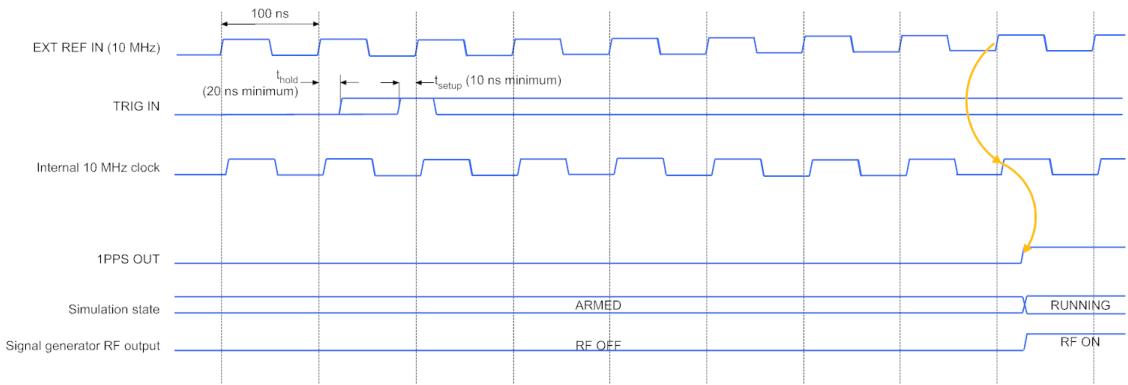
Appendix Figure D-6 Timing requirements for 1PPS IN and resulting start timing



D.6.2 TRIG In - immediate mode

When using the Immediate Trigger mode, the timing requirements for the rising edge of TRIG IN with respect to EXT REF IN are the same as for the 1PPS IN input (for example: 10 ns setup, 20 ns hold). However, there is a delay of six 10 MHz clock cycles after recognising the trigger before the simulation starts see Appendix Figure D-7.

Appendix Figure D-7 Timing requirements for TRIG IN (Immediate Mode) and resulting start timing



D.6.3 TRIG In - delayed mode

When you start on a defined 1PPS event, the rising edge of TRIG IN must be at least 1.1 milliseconds before the 1PPS.

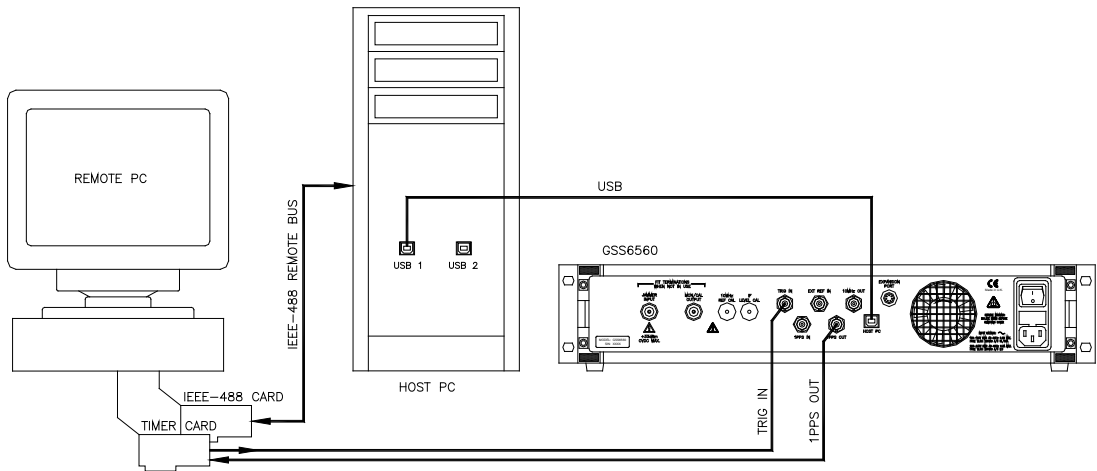
D.7 Configuring for remote control using IEEE-488

Appendix Figure D-8 and Appendix Table D-7 detail configuring the GSS6560 and the SimGEN controller to use a second PC for remote control operation over the IEEE-488 bus.

You can start the remote simulation by:

- ➔ Software Start - no external trigger required
- ➔ Immediate Start - after applied external trigger pulse.
- ➔ Delayed start - on next 1PPS after applied external trigger pulse

Appendix Figure D-8 GSS6560 remote control operation - interconnection diagram



Appendix Table D-7 GSS6560 remote control operation - interconnection table

Connection type	From	To
-----------------	------	----

Connection type	From	To
USB cable assembly (USB type A to USB type B)	SimGEN controller, USB 1 port	GSS6560, Host PC USB port
IEEE-488 cable assembly	SimGEN controller, IEEE-488 card	Remote PC, IEEE-488 card
BNC cable assembly	Remote PC, either: Timer card, TRIGGER OUT (new cable assembly); or Timer card, OUTPUT (old cable assembly)	GSS6560, TRIG IN connector
BNC cable assembly	Remote PC, either: Timer card, new adaptor, 1PPS IN; or Timer card, old adaptor, INPUT	GSS6560, 1PPS OUT connector

Select the mode you want to use with the remote command TR,n, see reference e), and apply the external trigger pulse (if required) at the TRIG IN port.

Section D.6 gives details on the constraints of trigger mode timing.

D.8 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product datasheet, see Table 2-3. Refer to it for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

D.9 EMC and Safety Compliance

For the signal generator

The product complies with the Low Voltage Directive 73/23/EEC by application of the harmonised standard EN60950.

The signal generator complies with the EEC EMC Directive 89/336/EEC by application of the following harmonised standard:

EN61326-1 Electrical Equipment for Measurement, Control and Laboratory USE – EMC Requirements.

In particular, with regard to Radiated Emissions; the signal generator meets the requirements of EN61326; 1997 +A1, 1998 (Table 3 [class A])

For the computer system

The computer system shall comply with appropriate equivalent EMC and Safety standards.

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E GSS4750

This chapter describes the hardware features of the GSS4750 GPS L5 signal generator.

The GSS4750 had two variants:

Single output L5 only.

Dual output L5 + L5.

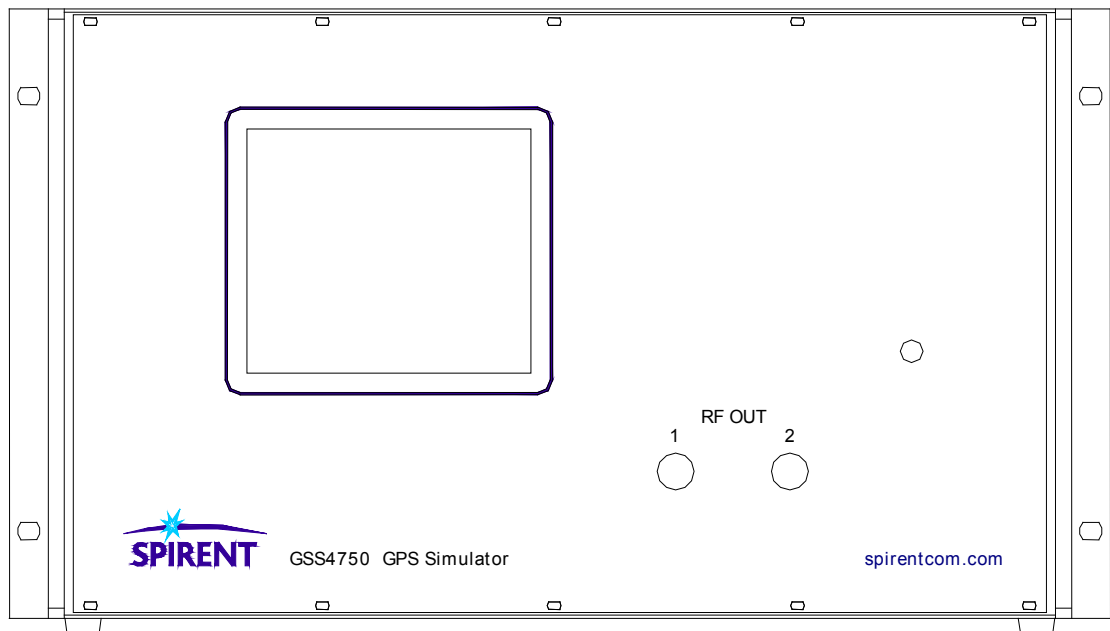
The variants provided:

- Up to 16 L5 channels on Output 1
- Up to 16 L5 channels on Output 2
- Enhanced built-in test and monitoring
- Soft Master/Auxiliary switching ("multi-box" configurations)
- Soft configuration of timer outputs and external reference frequency.

E.1 Front panel

Appendix Figure E-1 shows the front panel of the GSS4750 signal generator.

Appendix Figure E-1 GSS4750 front panel



E.1.1 Front panel display

The front panel display is a 25 x 54 character, backlit, monochrome LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

While running, the display backlight is permanently on. When the signal generator has been idle for a short time, the backlight will turn off to preserve backlight life. You can manually switch on the backlight using the command LCDP1, sent using the SimGEN IEEE String Send Utility, see reference c)

Appendix Figure E-2 shows a typical display for a twelve channel, single output unit.

Appendix Figure E-2 GSS4750 front panel display

```

12L5 + 0L5  44°C                                < SYSTEM BITE MESSAGES >
GPIB10  CFG01M  S/N 2000
CH PRN VELOCITY LEVEL CODE BITE PRN VELOCITY LEVEL CODE
 1   2      300  20.0 L5   .   .
 2   7      170  18.1 L5   .   .
 3   9      440  10.0 L5   .   .
 4  13      669   9.5 L5   .   .
 5  15     -170  10.3 L5   .   .
 6  18      230  10.3 L5   .   .
 7                                .   .
 8  23     -232  10.4 L5   .   .
 9  27      567  10.9 L5   .   .
10  29      998  10.7 L5   .   .
11  31     -786  10.6 L5   .   .
12  32     -501  10.5 L5   .   .
13                                .   .
14                                .   .
15                                .   .
16                                .   .
TOW   420 SUN 10:39:10.0  TOW   420 SUN 10:39:10.0
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

The following paragraphs describe the LCD fields:

nnL5 + mmL5

The number of signal generator channels available. **nnL5** corresponds to the channels fitted to RF output 1 and **mmL5** for RF output 2.

n°C

This field gives an indication, in degrees Celsius, of the internal temperature of the signal generator, in this example 44°C. If the temperature rises above 70°C, the signal generator will automatically shut down.

SYSTEM BITE MESSAGES**Notes**

1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Appendix Table E-1 details conditions that may persist for longer than 60 seconds.

2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

This field contains BITE (Built In Test Equipment) and status messages relating to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Appendix Table E-1 GSS4750 major system BITE messages

Message	Description
No message	Hardware operating normally Modulator oven(s) are at operating temperature. External reference standard not connected.

Message	Description
Oven 1/Oven 2	Modulator ovens are not at operating temperature. Do not perform phase calibration. If this message persists, maintenance support is required to remedy the fault. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications. Note: <i>It is normal for this message to persist for up to 10 minutes after switching on the signal generator, depending on ambient temperature.</i>
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
132F UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F UnLocked	Fault in the IF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F ALC Fail	Fault in the circuit maintaining the level of the IF local oscillator. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F Level Fail	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F Ref Unlocked	Note: <i>It is normal for this message to persist for up to 120 seconds after switching on the signal generator</i> Fault in the reference oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator..
1 PPS Fail	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

GPiB *n*

The GPiB (IEEE-488) address of the signal generator, defaulted to 10.

CFG*na*

n The configuration of the currently selected signal generator. Some of the currently defined configurations are:

- 1 L5+L5 (or L5 only), Master
- 3 L5+L5 (or L5 only) Auxiliary

a shows configuration as Master (M) or Auxiliary (A).

S/N_n

The signal generator serial number

CH

Channel number

PRN

PRN code being simulated. Blank for halted channel or channel not present.

VELOCITY

Velocity being simulated. Blank for halted channel or channel not present.

LEVEL

Power level being generated relative to nominal. Range ± 20 dB with respect to nominal levels. Blank for halted channel or channel not present.

CODE

Code being simulated for example L5. Blank for halted channel or channel not present.

Note: A '-' symbol next to the L5 text denotes CNAV is switched off.

BITE

Channel Built In Test Equipment indication number

Two digits, the first refers to the L5/antenna1 channel status, the second refers to the L5/antenna 2 status.

The available codes are:

- 0: OK
- 1: Code Clock Fail
- 2: Code Fail

TOW

Time of week in X1 epochs since start of GPS week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F/

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

E.1.2 Main RF output connector(s)

The main RF output connectors are type 'N' coaxial and are the normal connection point for the GPS receiver under test. For details, see the product specification in Table 2-3. Normally, these power levels are:

L5 Code0 dB level -127.9 dBm Range ± 20 dB

Each RF output port is internally DC isolated see the product specification in Table 2-3. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

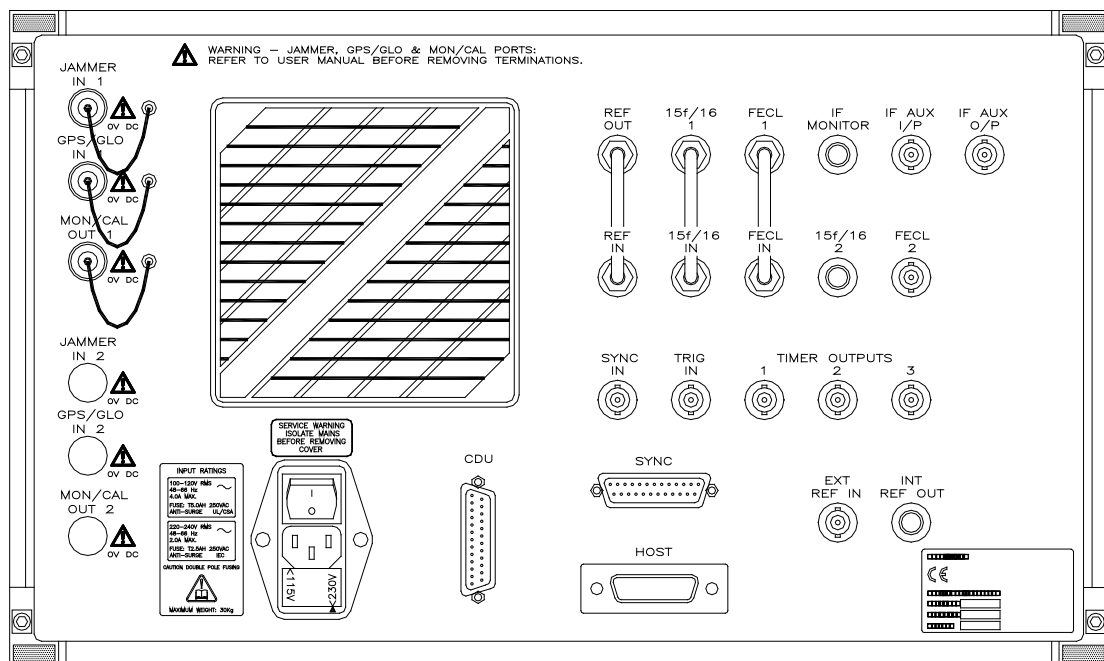
E.2 Rear panel

Appendix Table E-2 details the main rear panel features shown in Appendix Figure E-3.

Appendix Table E-2 Rear panel features of GSS4750 signal generators

Port	See section
Mains power inlet	E.2.1
Communication ports	0
Auxiliary signal ports	E.2.3
MON/CAL ports	E.2.4
Jammer port	E.2.5
GPS/GLO in port	E.2.6
Cooling fan	E.2.7

Appendix Figure E-3 GSS4750 rear panel



E.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS4750 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: *The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.*

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate

E.2.2 Communication ports

SAFETY WARNING



Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) HOST port is an IEEE-488 compatible port used to download information from the SimGEN controller or Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

E.2.3 Auxiliary signal ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product specification for your signal generator, see Table 2-3.

2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 15f/16 2 and INT REF OUT.

The Auxiliary Signal ports comprise 18, BNC connectors see Appendix Table E-3. The top two rows are specific to single and “multi-box” configurations of GSS4750 signal generators. Make connections according to the appropriate installation diagram see section E.4. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Appendix Table E-3 GSS4750 auxiliary signal ports

Port	Description
EXT REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
INT REF OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 1, 2, or 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone GSS4750 signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1, default is 1PPS, Gated
TIMER OUTPUT 3	As Timer Output 1, default is 1PPS, Ungated

E.2.4 MON/CAL ports

Notes:

- 1) The ports are DC isolated.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.

Use the MON/CAL OUT port to monitor the GPS signal at a level approximately 60 dB higher than the front panel connector, mainly for calibration purposes. Product codes NTNE10AA and NTNE10CA are fitted with two MON/CAL OUT ports, one for each front panel output. Product code NTNE10BA has only one. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

E.2.5 Jammer port

Notes:

- 1) The ports are DC isolated.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

E.2.6 GPS/GLO in port

The **GPS/GLO IN** port is used to combine a (MON/CAL) GPS or GPS/GLONASS signal with the GSS4750 GPS L5 Signal. Once combined the composite GPS L1/L2/L5 and GLONASS signal will be present at the front panel N type connector of the GSS4750 – see Appendix Figure E-4 to Appendix Figure E-7.

E.2.7 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

The cooling fan blows air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

The signal generator will automatically shut down if its internal temperature exceeds a pre-determined value. If this happens, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

E.3 Calibration

Table 2-3 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

E.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product specification see Table 2-3. Refer to the product specification for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

E.5 Lifting the signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

E.6 Interconnection

Systems using GSS8000-series signal generators need an IEEE-488 cable connection from the “Host” socket on the rear panel to the IEEE-488 card (identified as card #0) in the PC.

Notes:

- 1) This IEEE-488 card is card #1 if your signal generator has the IEEE remote control option.*
- 2) If you use SimGEN for VMS, the SYNC cable is not required as the IEEE interface provides synchronisation signals.*

These are the factory default settings. Reference c) describes changing the default settings.

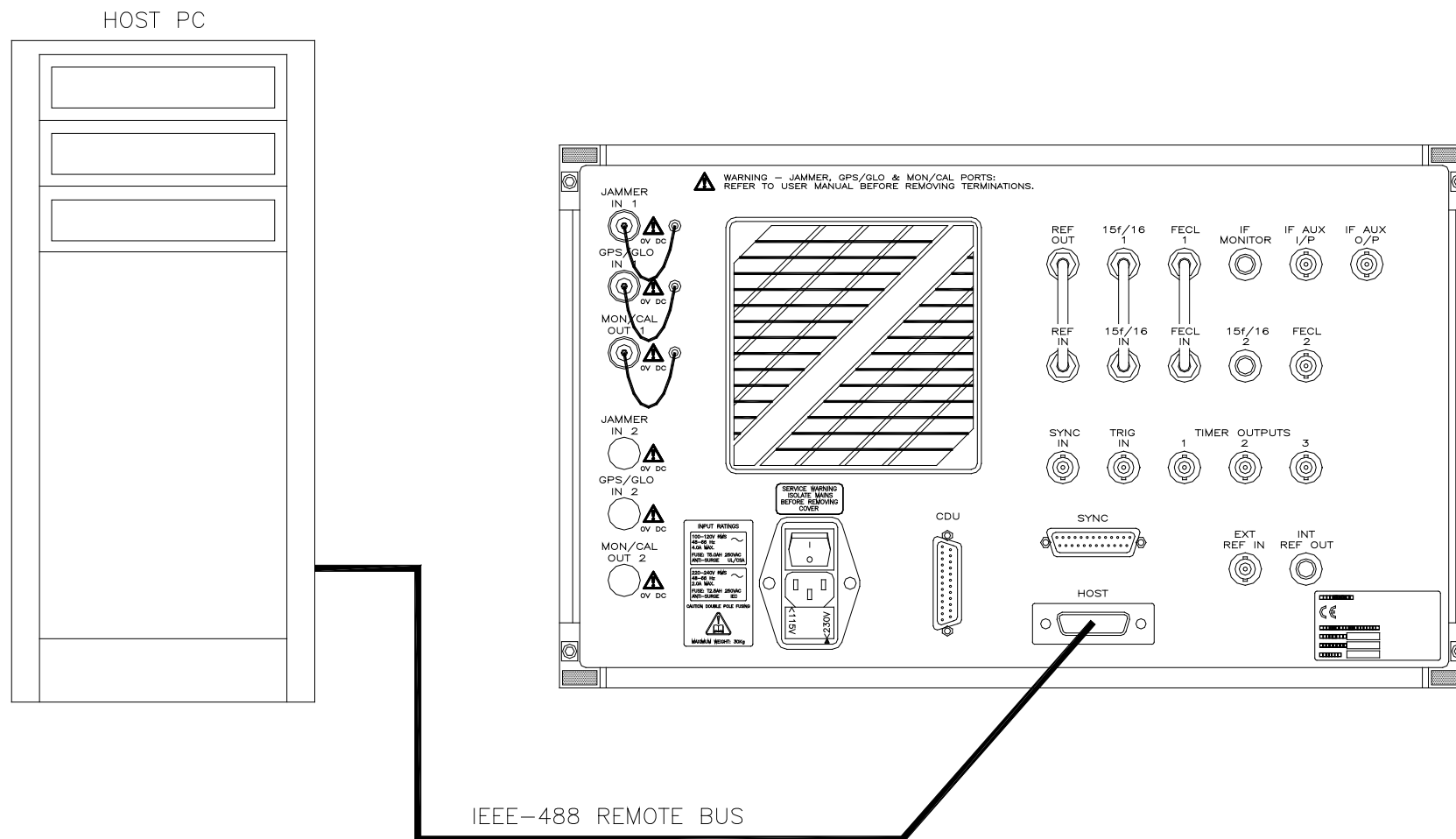
This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Appendix Figure E-4 to Appendix Figure E-7.

Correctly position and tighten all cables and terminations.

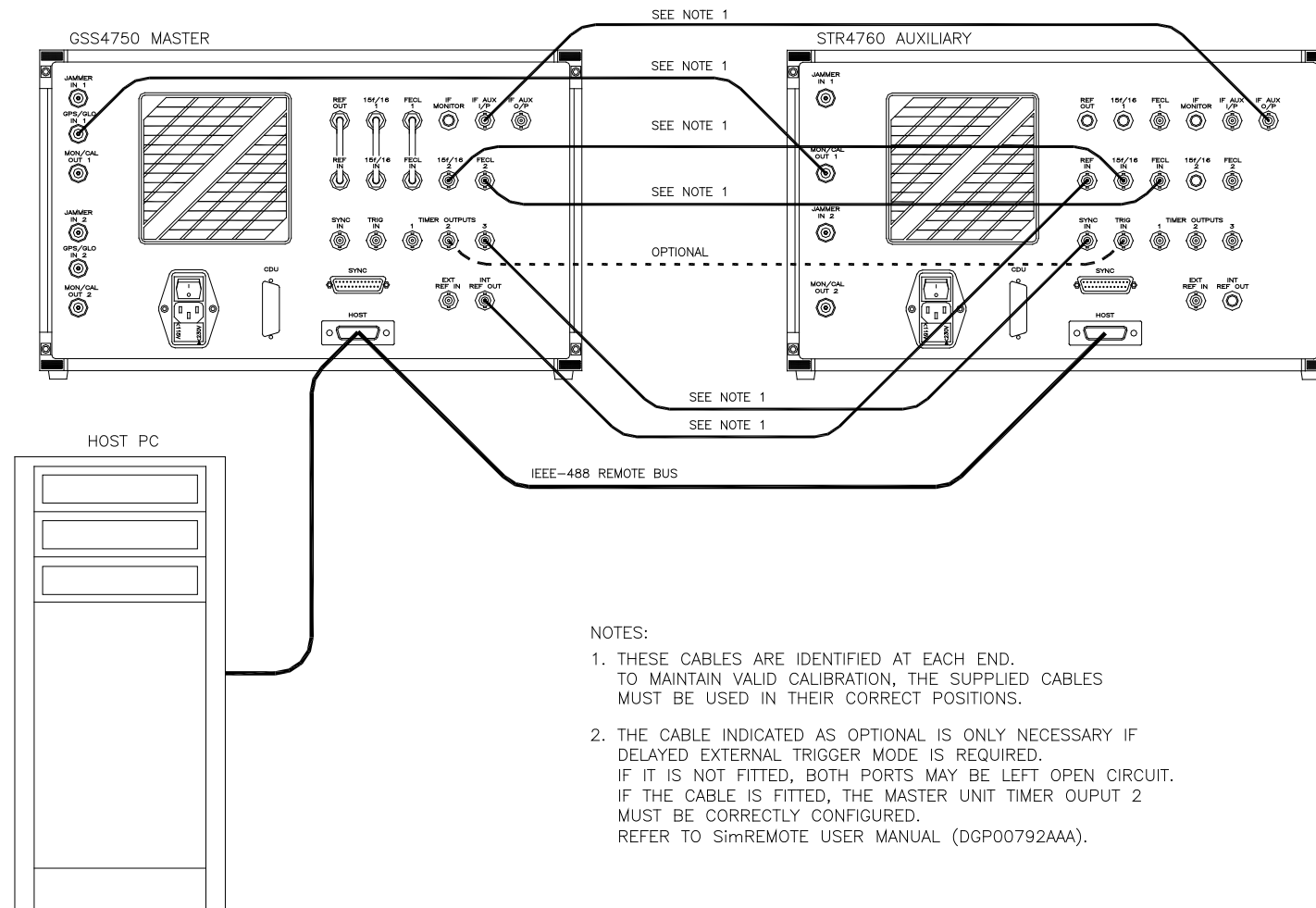
Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator
- c) Switch on the PC

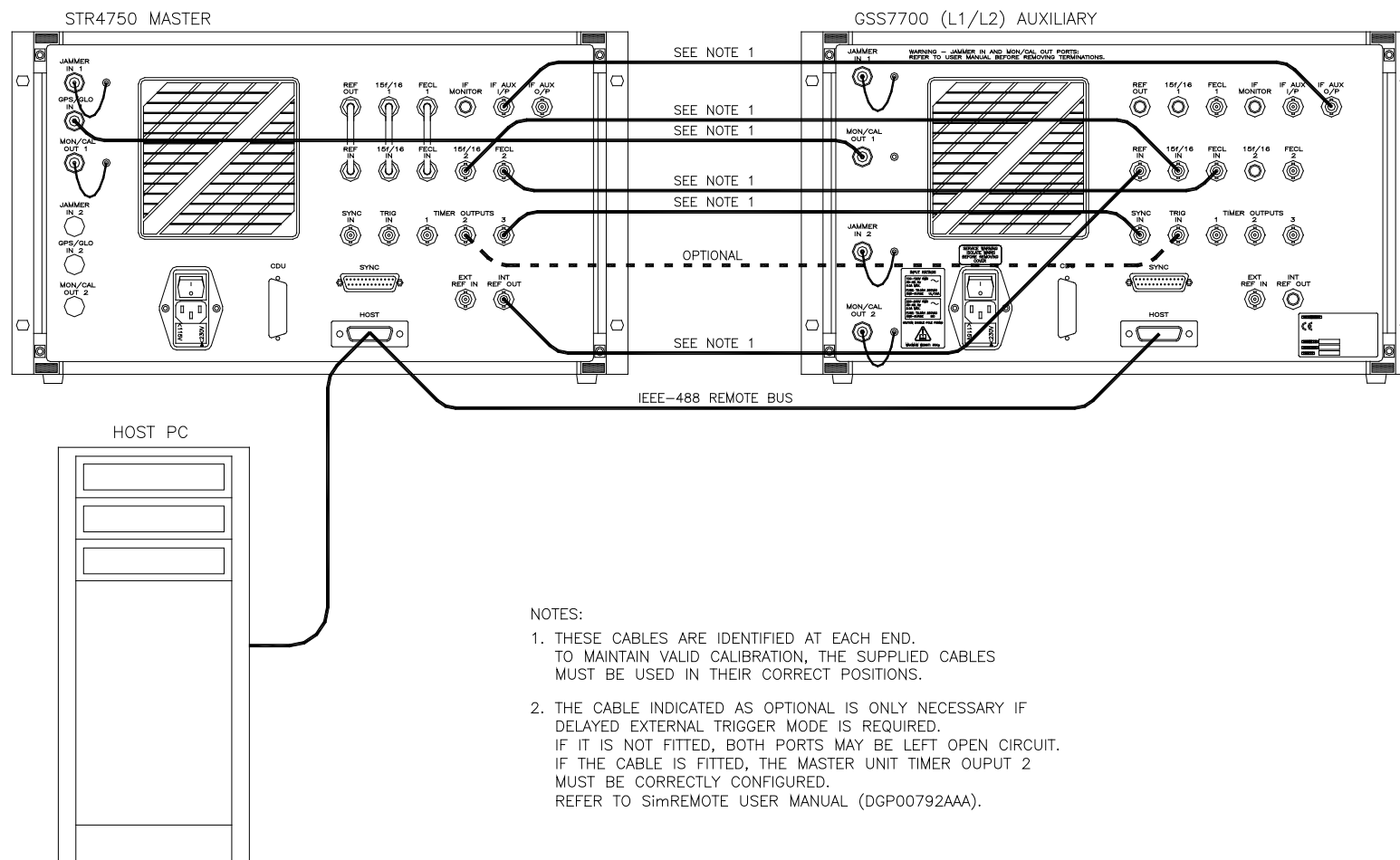
Appendix Figure E-4 GSS4750 single



Appendix Figure E-5 GSS4750 + STR4750 dual



Appendix Figure E-6 GSS4750 + GSS7700 dual (variant A)



F STR4760

Notes:

1) The STR4760 does not support independent channels running pseudo-Y code. If you set some STR 4760 channels running pseudo-Y code, the STR4760 will automatically run with ALL channels running pseudo-Y code and the System Messages window displays the warning “ALL channels set to pseudo-Y code, cannot be switched individually”.

2) STR4760 signal generators do not support running GPS L2 only; you must use L1 and L2.

This chapter describes the external hardware features of the STR4760 GPS signal generator.

Appendix Table F-1 shows the main variants of the STR4760.

Appendix Table F-1 STR4760 main variants

Product code	Frequency	Output
NTNE10AA	Switchable between:	
	Dual (L1 + L2)	Dual (L1 + L1)
NTNE10BA	Single (L1 only)	Single (L1) only
NTNE10CA	Single (L1 only)	Dual output (L1 + L1)

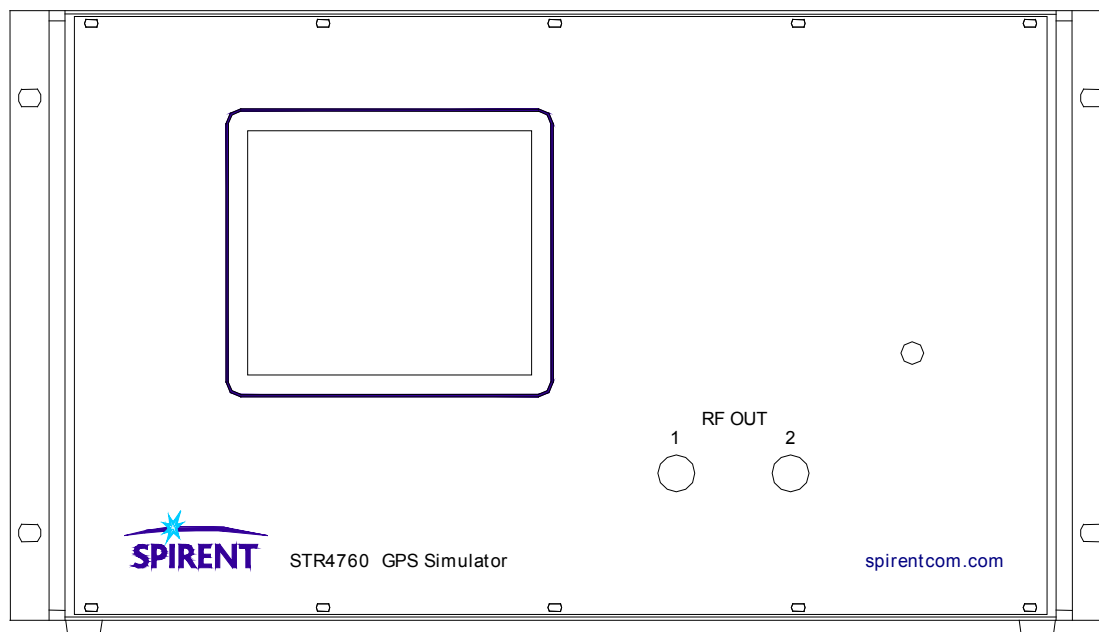
The STR4760 provided:

- Up to 16 L1 channels
- Up to 16 L2 or second L1 output channels (NTNE10AA/NTNE10CA)
- Soft switchable between L1/L2 and L1/L1 operation (NTNE10AA Only)
- SBAS capability standard
- Enhanced built-in test and monitoring
- Soft Master/Auxiliary switching (“multi-box” configurations)
- Soft configuration of timer outputs and external reference frequency.

F.1 Front panel

The front panel features are the front panel display and the main RF output connector(s), see Appendix Figure F-1.

Appendix Figure F-1 STR4760 front panel



F.1.1 Front panel display

The front panel display is a 25 x 54 character, backlit, monochrome LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

While running, the display backlight is permanently on. When the signal generator has been idle for a short time, the backlight will turn off to preserve backlight life. You can manually switch on the backlight using the command LCDP1, sent using the SimGEN IEEE String Send Utility, see reference c).

Appendix Figure F-2 shows a typical display for a twelve + twelve channel L1/L2 unit.

Appendix Figure F-2 STR4760 front panel display

```

12L1 + 12L2  44°C                                < SYSTEM BITE MESSAGES >
GPIB1    CFG02M  S/N 2000
CH PRN VELOCITY LEVEL CODE BITE PRN VELOCITY LEVEL CODE
 1  2      300  20.0 P+CA . .  2      300  20.0 P
 2  7      170  18.1 P+CA . .  7      170  18.1 P
 3  9      440  10.0 P+CA . .  9      440  10.0 P
 4 13      669   9.5 P+CA . . 13      669   9.5 P
 5 15     -170  10.3 P+CA . . 15     -170  10.3 P
 6 18      230  10.3 P+CA . . 18      230  10.3 P
 7                                     . .
 8 23     -232  10.4 P+CA . . 23     -232  10.4 P
 9 27      567  10.9 P+CA . . 27      567  10.4 P
10 29      998  10.7 P+CA . . 29      998  10.7 P
11 31     -786  10.6 P+CA . . 31     -786  10.6 P
12 32     -501  10.5 P+CA . . 32     -501  10.5 P
13                                     . .
14                                     . .
15                                     . .
16                                     . .
TOW    420 SUN 10:39:10.0  TOW    420 SUN 10:39:10.0
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

The following paragraphs describe the LCD fields:

nnL1 + nnL2

The number of signal generator channels available, in this case 24. When switched to dual frequency operation this field displays **nnL1** for the L1 channels, and **nnL2** for the L2 channels. When switched to dual antenna operation this field changes to **nnL1** for the Antenna 1 channels plus **nnL1** for the Antenna 2 channels.

n°C

This field gives an indication, in degrees Celsius, of the internal temperature of the signal generator, in this example 44°C. If the temperature rises above 70°C, the signal generator will automatically shut down.

SYSTEM BITE MESSAGES

BITE (Built In Test Equipment) and status messages relating to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Notes

- 1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Appendix Table F-2 details conditions that may persist for longer than 60 seconds.
- 2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

Appendix Table F-2 STR4760 major system BITE messages

Message	Message appears when
No message	Hardware operating normally Modulator oven(s) are at operating temperature. External reference standard not connected.
Oven 1/Oven 2	Modulator ovens are not at operating temperature. Do not perform phase calibration. If this message persists, maintenance support is required to remedy the fault. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications. Note: <i>It is normal for this message to persist for up to 10 minutes after switching on the signal generator, depending on ambient temperature</i>
ExtRef UnLocked	Internal reference PLL has not locked to the external frequency standard. Read the Note below. If the message persists check the reference standard frequency is ± 0.1 ppm and its power level is > -10 dBm. Note: <i>It is normal for this message to persist for up to 60 seconds after connecting an external reference source.</i>
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
137F UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F UnLocked	Fault in the IF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F ALC Fail	Fault in the circuit maintaining the level of the IF local oscillator. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F Level Fail	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F Ref Unlocked	Fault in the reference oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator. Note: <i>It is normal for this message to persist for up to 120 seconds after switching on the signal generator.</i>
1 PPS Fail	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

GPIB *n*

The GPIB (IEEE-488) address of the signal generator

CFG n a

n - configuration of the currently selected signal generator. Configurations include:

- | | |
|---|----------------------------|
| 1 | L1+L1 (or L1 only), Master |
| 2 | L1+L2 Master |
| 3 | L1+L1 Auxiliary |
| 4 | L1+L2 Auxiliary |

a - shows configuration as Master (M) or Auxiliary (A).

S/N n

The signal generator serial number

CH

Channel number

PRN

PRN code being simulated. Blank for halted channel or channel not present.

VELOCITY

Velocity being simulated. Blank for halted channel or channel not present.

LEVEL

Power level being generated relative to nominal. Range ± 20 dB with respect to nominal levels. Blank for halted channel or channel not present.

CODE

Code(s) being simulated, (P, CA, P+CA, Y, Y+CA, OFF, Z, or Z+CA). Blank for halted channel or channel not present.

Note: 'Z' represents pseudo-Y code.

BITE

Channel Built In Test Equipment indication number

Two digits, the first refers to the L1/antenna1 channel status, the second refers to the L2/antenna 2 status.

The available codes are:

- 0: OK
- 1: Code Clock Fail
- 2: Code Fail

TOW

Time of week in X1 epochs since start of GPS week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F/

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

F.1.2 Main RF output connector(s)

The main RF output connectors are type 'N' coaxial and are the normal connection point for the GPS receiver under test. Spirent specifies all power levels at this interface. For details, see the product specification in Table 2-3. Normally, these power levels are:

L1 C/A Code	0 dB level -130 dBm, range ± 20 dB
L1 P Code	0 dB level -133 dBm, range ± 20 dB
L2 P or C/A Code	0 dB level -136 dBm, range ± 20 dB

Product codes NTNE10AA and NTNE10CA are fitted with two RF outputs, RF OUT 1 being the combined L1/L2 output in dual frequency operation. Product code NTNE10BA is fitted with a single RF output. Each RF output port is internally DC isolated, see the product datasheet in Table 2-2. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

The L1 C/A code (STR4760) and L1/L2 P code (STR4760/02) models use one RF connector. Twin or Dual Antenna L1 only systems (STR4760/01) use two RF connectors, one for each antenna, labelled accordingly.

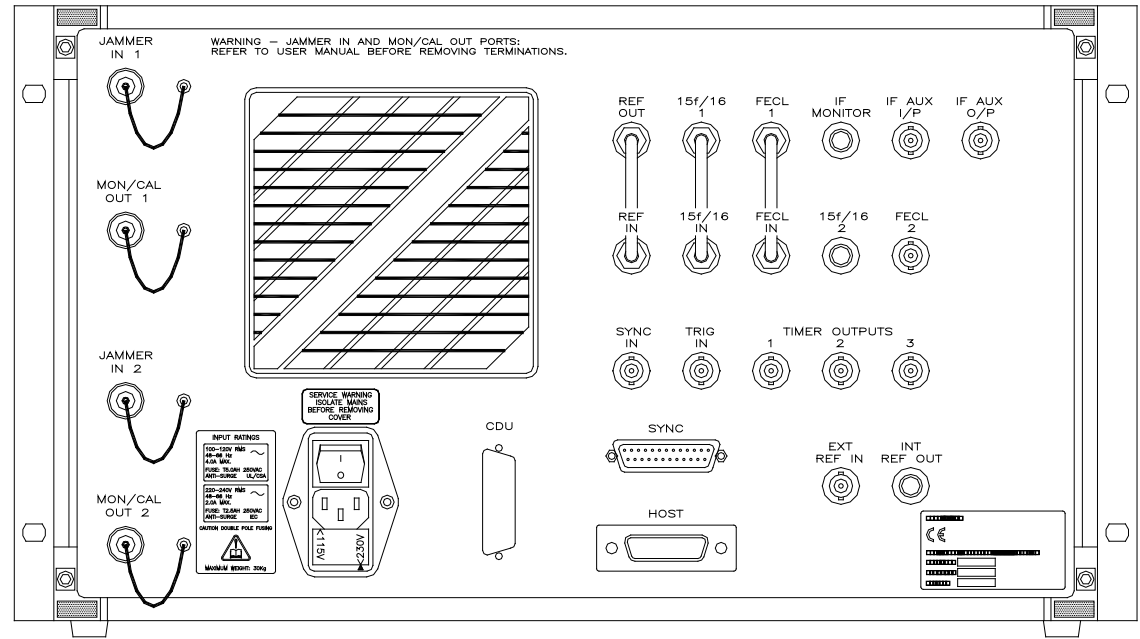
F.2 Rear panel

Appendix Table F-3 details the main rear panel features shown in Appendix Figure F-3.

Appendix Table F-3 Rear panel features of GSS8000-series signal generators

Port	Described in section
Mains power inlet	F.2.1
Communication ports	F.2.2
Auxiliary Signal ports	F.2.3
MON/CAL ports	F.2.4
Jammer ports	F.2.5
Cooling fan	F.2.6

Appendix Figure F-3 STR4760 rear panel



F.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the STR4760 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate

F.2.2 Communication ports

SAFETY WARNING



Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) The HOST port is an IEEE-488 compatible port used to download information from the Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

F.2.3 Auxiliary Signal ports

SAFETY WARNING



Ensure connections to these ports are within the SELV limits of EN60950

The Auxiliary Signal ports comprise eighteen, BNC connectors see Appendix Table F-4. The top two rows are specific to single and “multi-box” configurations of STR4760 signal generators. Make connections according to the appropriate installation diagram see section F.6.

You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Appendix Table F-4 STR4760 auxiliary signal ports

Port	Description
EXT REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
INT REF OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 1, 2, or 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone STR4760 signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1, default is 1PPS, Gated
TIMER OUTPUT 3	As Timer Output 1, default is 1PPS, Ungated

Notes:

- 1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product specification for your signal generator, see Table 2-3.
- 2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 15f/16 2 and INT REF OUT.

F.2.4 MON/CAL ports

Notes:

- 1) Depending on the product code, the ports may not be DC isolated. Applying DC at these ports may damage your signal generator. All STR4760 product codes at build standard Release 6 or higher (Release number indicated on rear panel label) have DC isolated MON/CAL OUT port(s). Contact Spirent Applications Support if you are in doubt.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output

3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.

Use the MON/CAL OUT port to monitor the GPS signal at a level approximately 60 dB higher than the front panel connector, mainly for calibration purposes. Product codes NTNE10AA and NTNE10CA are fitted with two MON/CAL OUT ports, one for each front panel output. Product code NTNE10BA has only one. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

F.2.5 Jammer ports

Notes:

1) Depending on the product code, the ports may not be DC isolated. Applying DC at these ports may damage your signal generator. All STR4760 product codes at build standard Release 6 or higher (Release number indicated on rear panel label) have DC isolated JAMMER IN port(s). Contact Spirent Applications Support if you remain in doubt.

2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output

3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. Product codes NTNE10AA and NTNE10CA are fitted with two JAMMER IN ports, one for each front panel output. Product code NTNE10BA has only one. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

F.2.6 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator.
Periodically wash the fabric dust filter (if fitted) in clean water.

The cooling fan blows air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

The signal generator will automatically shut down if its internal temperature exceeds 95°C. If this happens, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

F.3 Calibration

Table 2-3 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

F.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product specification see Table 2-3. Refer to the product specification for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

F.5 Lifting the signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

F.6 Interconnection

Systems using GSS8000-series signal generators need an IEEE-488 cable connection from the "Host" socket on the rear panel to the IEEE-488 card (identified as card #0) in the PC.

Notes:

- 1) *This IEEE-488 card is card #1 if your signal generator has the IEEE remote control option.*
- 2) *If you use SimGEN for VMS, the SYNC cable is not required as the IEEE interface provides synchronisation signals.*

These are the factory default settings. Reference c) describes changing the default settings.

This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Appendix Figure G-4 to Appendix Figure G-6.

Correctly position and tighten all cables and terminations.

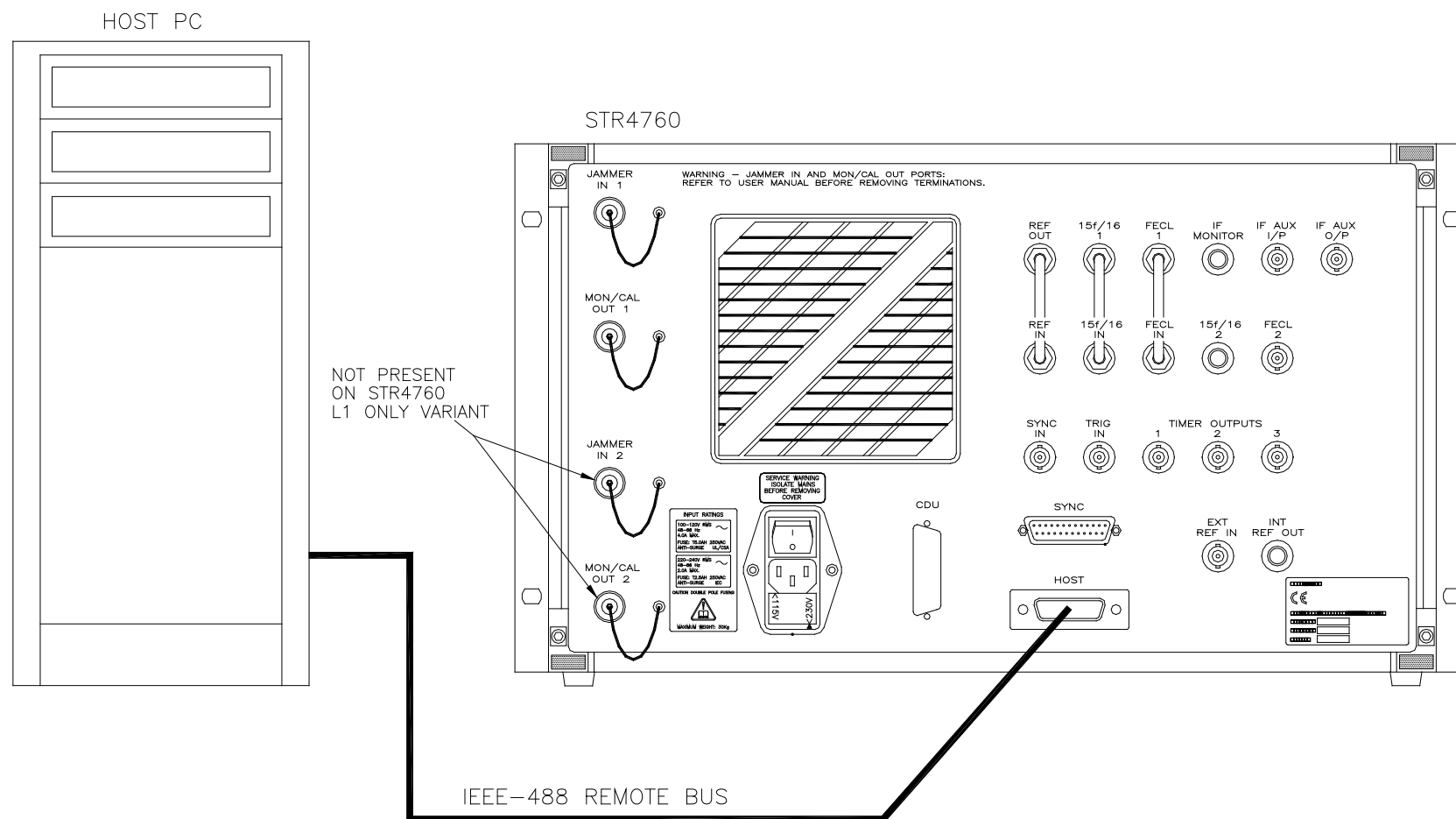
Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator
- c) Switch on the PC

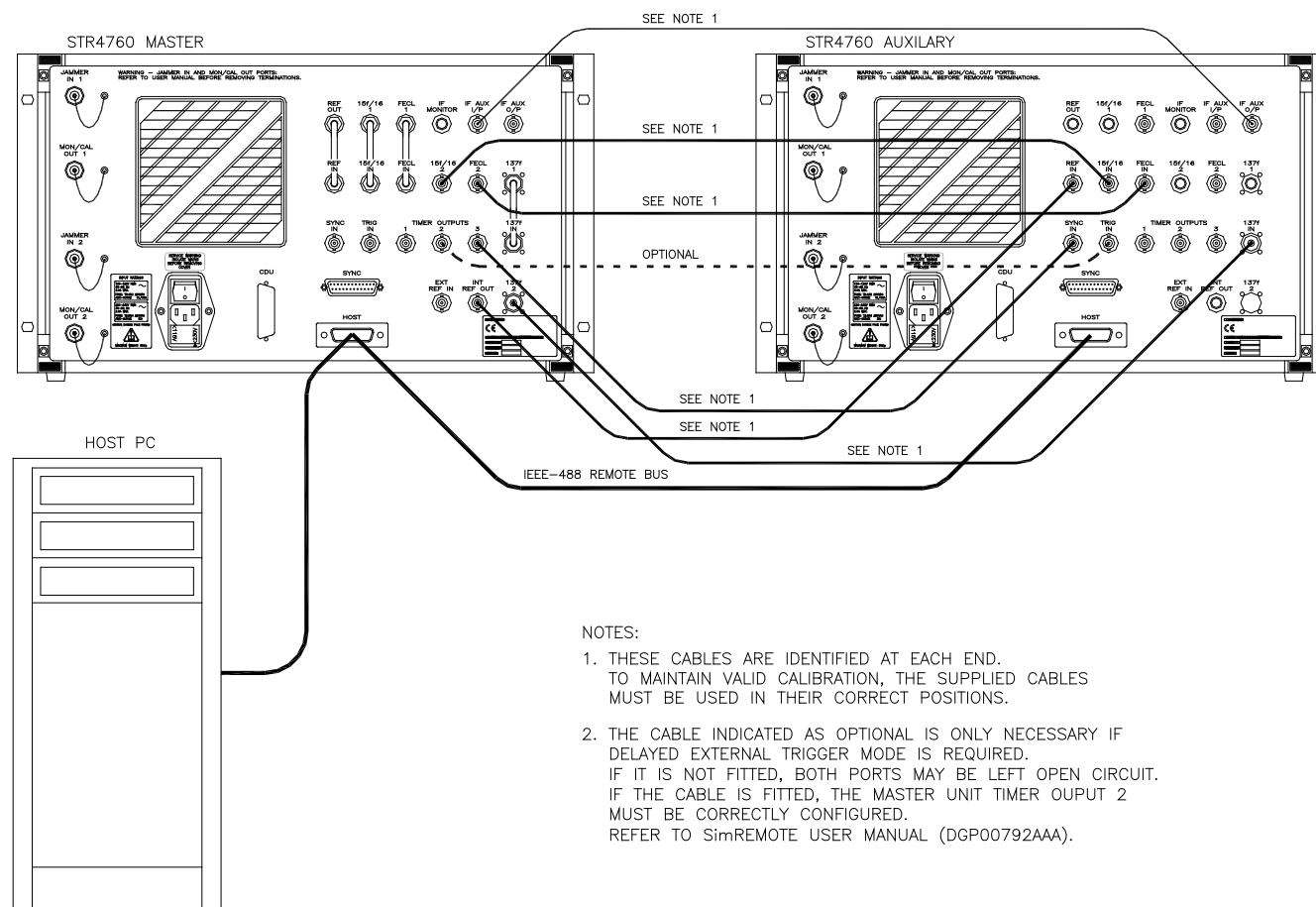
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Appendix Figure F-4 STR4760 single interconnection diagram

Note: For standalone operation of signal generators with rear panel 137F ports, fit the loopback cable between ports '137F 1' and '137F IN' and fit the termination to port '137F 2'. The Master signal generator in Appendix Figure F-5 shows the loopback cable.



Appendix Figure F-5 STR4760 dual interconnection diagram



G STR4780

This chapter describes the external hardware features of the STR4780 GLONASS signal generator.

The STR4780 had one variant, the NTNE30AA.

The main features of the signal generator are:

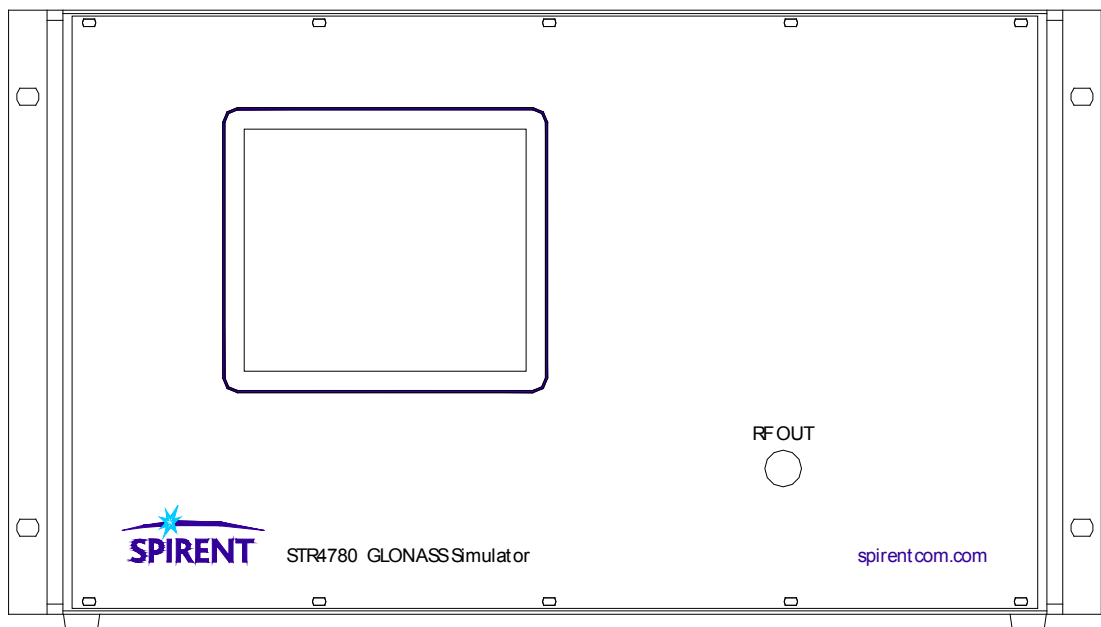
- Up to twelve GLONASS L1 channels
- Supports all current and planned L1 GLONASS channel frequencies
- Built in test and monitoring
- Large front-panel display

You can use the STR4780 with GSS7700 / STR4760 GPS/SBAS simulators to give mixed satellite navigation system capability.

G.1 Front panel

The front panel features the front panel display and the main RF output connector(s), see Appendix Figure G-1.

Appendix Figure G-1 STR4780 front panel



G.1.1 Front panel display

The front panel display is a 25 x 54 character, backlit, monochrome LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

While running, the display backlight is permanently on. When the signal generator has been idle for a short time, the backlight will turn off to preserve backlight life. You can manually switch on the backlight using the command LCDP1, sent using the SimGEN IEEE String Send Utility, see reference c)

Appendix Figure G-2 shows a typical display for a twelve channel L1 unit.

Appendix Figure G-2 STR4780 front panel display

```

12L1 + 0L2  44°C                                < SYSTEM BITE MESSAGES >
GPIB1  CFG01M  S/N 2000
CH FRQ VELOCITY LEVEL CODE BITE FRQ VELOCITY LEVEL CODE
1  2      300  20.0  CA  .  .
2  7      170  18.1  CA  .  .
3  9      440  10.0  CA  .  .
4  13     669  09.5  CA  .  .
5  15     -170  10.3  CA  .  .
6  18      230  10.3  CA  .  .
7                      .  .
8  23     -232  10.4  CA  .  .
9   -7      567  10.9  CA  .  .
10  0      998  10.7  CA  .  .
11 -4     -786  10.6  CA  .  .
12 -2     -501  10.5  CA  .  .
13                      .  .
14                      .  .
15                      .  .
16                      .  .
TOW  420 SUN 10:39:10.0  TOW
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

The following paragraphs describe the LCD fields:

nnL1 + 0L2

The number of signal generator channels available, in this case twelve L1.

n°C

This field gives an indication, in degrees Celsius, of the internal temperature of the signal generator, in this example 44°C. If the temperature rises above 70°C, the signal generator will automatically shut down.

SYSTEM BITE MESSAGES**Notes**

- 1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Appendix Table G-1 details conditions that may persist for longer than 60 seconds.
- 2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

This field contains BITE (Built In Test Equipment) and status messages relating to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Appendix Table G-1 STR4780 major system BITE messages

Message	Description
No message	Hardware operating normally External reference standard not connected.

Message	Description
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
90Fg UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
5Fg UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
F Level Fail	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F Ref Unlocked	Note: It is normal for this message to persist for up to 120 seconds after switching on the signal generator Fault in the reference oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator..
1 PPS Fail	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

GPiB *n*

The GPiB (IEEE-488) address of the signal generator

CFG*na*

n The current signal generator configuration.

a shows configuration as Master (M) or Auxiliary (A).

S/N*n*

The signal generator serial number

CH

Channel number

FRQ

GLONASS Frequency channel being simulated (-7 to 24). Blank for halted channel or channel not present.

VELOCITY

Velocity being simulated. Blank for halted channel or channel not present.

LEVEL

Power level being generated relative to nominal. Range ± 20 dB with respect to nominal levels. Blank for halted channel or channel not present.

CODE

Code being simulated. Blank for halted channel or channel not present.

BITE

Channel Built In Test Equipment indication number

Two digits, the first refers to the L1/antenna1 channel status, the second refers to the L2/antenna 2 status.

The available codes are:-

0: OK

1: Code Clock Fail

2: Code Fail

TOW

Time of week in seconds since start of GPS week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F/

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

G.1.2 Main RF output connector

The main RF output connector is a type 'N' coaxial and is the normal connection point for the GLONASS receiver under test. For details, see the product specification in Table 2-3. Normally, these power levels are:

L1 C/A Code 0 dB level -131 dBm Range ± 20 dB

Each RF output port is internally DC isolated see the product specification in Table 2-3. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

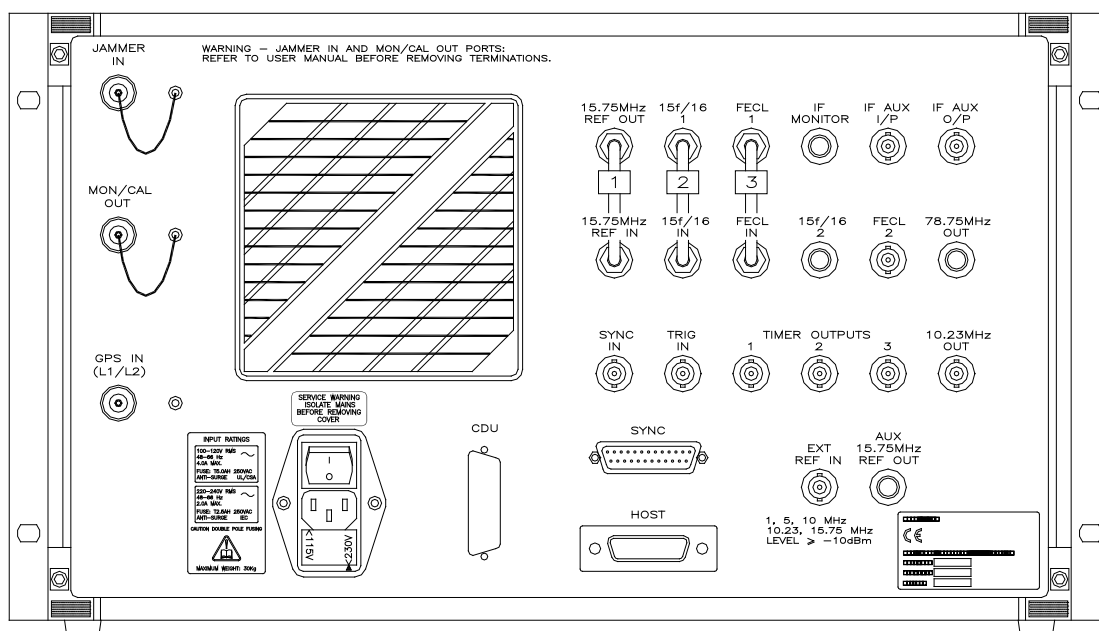
G.2 Rear panel

Appendix Table G-2 details the main rear panel features shown in Appendix Figure G-3.

Appendix Table G-2 Rear panel features of STR4780 signal generators

Port	Described in section
Mains power inlet	G.2.1
Communication ports	G.2.2
Auxiliary signal ports	0
MON/CAL ports	G.2.4
Jammer ports	G.2.5
GPS IN port	G.2.6
Cooling fan	G.2.7

Appendix Figure G-3 STR4780 rear panel



G.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the STR4780 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate

G.2.2 Communication ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) HOST port is an IEEE-488 compatible port used to download information from the SimGEN controller or Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

G.2.3 Auxiliary signal ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

- 1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product specification for your signal generator, see Table 2-3.
- 2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 15f/16 2, 10.23 MHz OUT, AUX 15.75 MHz OUT and 78.75 MHz OUT.

The Auxiliary Signal ports comprise 20, BNC connectors see Appendix Figure G-3. The top two rows are specific to single and “multi-box” configurations of GSS4750 signal generators. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Make connections according to the appropriate installation diagram see section G.6.

Appendix Table G-3 STR4780 auxiliary signal ports

Port	Description
EXT REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
10.23MHz OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.

Port	Description
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance
TIMER OUTPUT 1	This output can be programmed to provide any of the following: 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone STR4780 signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1, default is 1PPS, Gated
TIMER OUTPUT 3	As Timer Output 1, default is 1PPS, Ungated

G.2.4 MON/CAL ports

Notes:

- 1) The port is not DC isolated. Applying DC at this port can damage your signal generator.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.

Use the MON/CAL OUT port to monitor the GPS signal at a level approximately 50dB (60dB on early models) higher than the front panel connector, mainly for calibration purposes. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

G.2.5 Jammer ports

Notes:

- 1) *The port is not DC isolated. Applying DC at this port can damage your signal generator.*
- 2) *When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output*
- 3) *Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.*

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

G.2.6 GPS IN port

Use the GPS IN port to combine a (MON/CAL) GPS signal, from an STR4760 or GSS7700, with the GLONASS signal generated by the STR4780. Once combined, the composite GPS/GLONASS signal will be present on the front panel N type connector of the STR4780.

G.2.7 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

The cooling fan blows air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

The signal generator will automatically shut down if its internal temperature exceeds a pre-determined value. If this happens, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

G.3 Calibration

Table 2-3 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

G.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product specification see Table 2-3. Refer to the product specification for:

- a) Connectivity details

- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

G.5 Lifting the signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack

G.6 Interconnection

Systems using STR4780 signal generators need an IEEE-488 cable connection from the “Host” socket on the rear panel to the IEEE-488 card (identified as card #0) in the PC.

Notes:

- 1) *This IEEE-488 card is card #1 if your signal generator has the IEEE remote control option.*
- 2) *If you use SimGEN for VMS, the SYNC cable is not required as the IEEE interface provides synchronisation signals.*

These are the factory default settings. Reference c) describes changing the default settings.

This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Appendix Figure G-4 to Appendix Figure G-6.

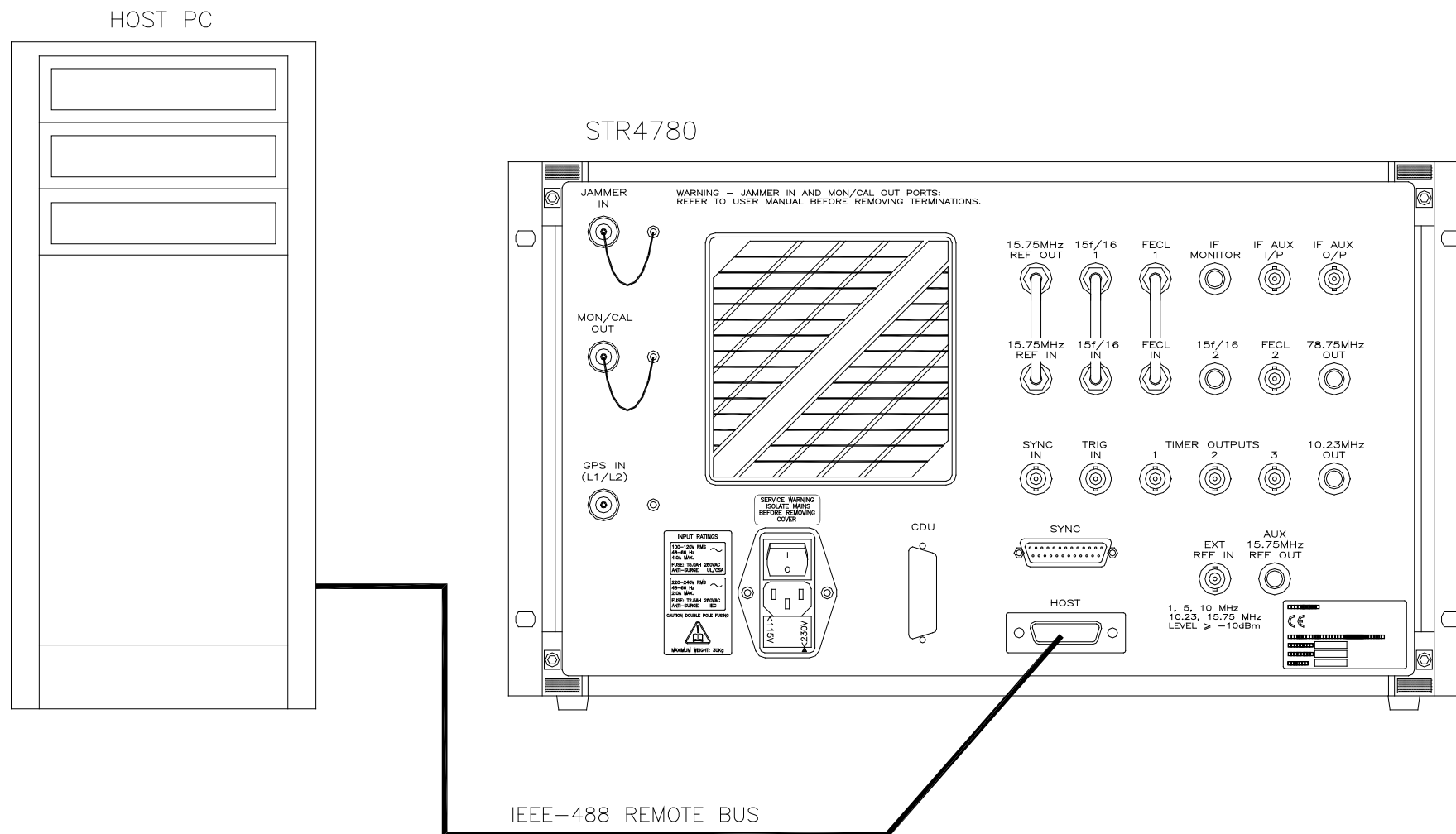
Correctly position and tighten all cables and terminations.

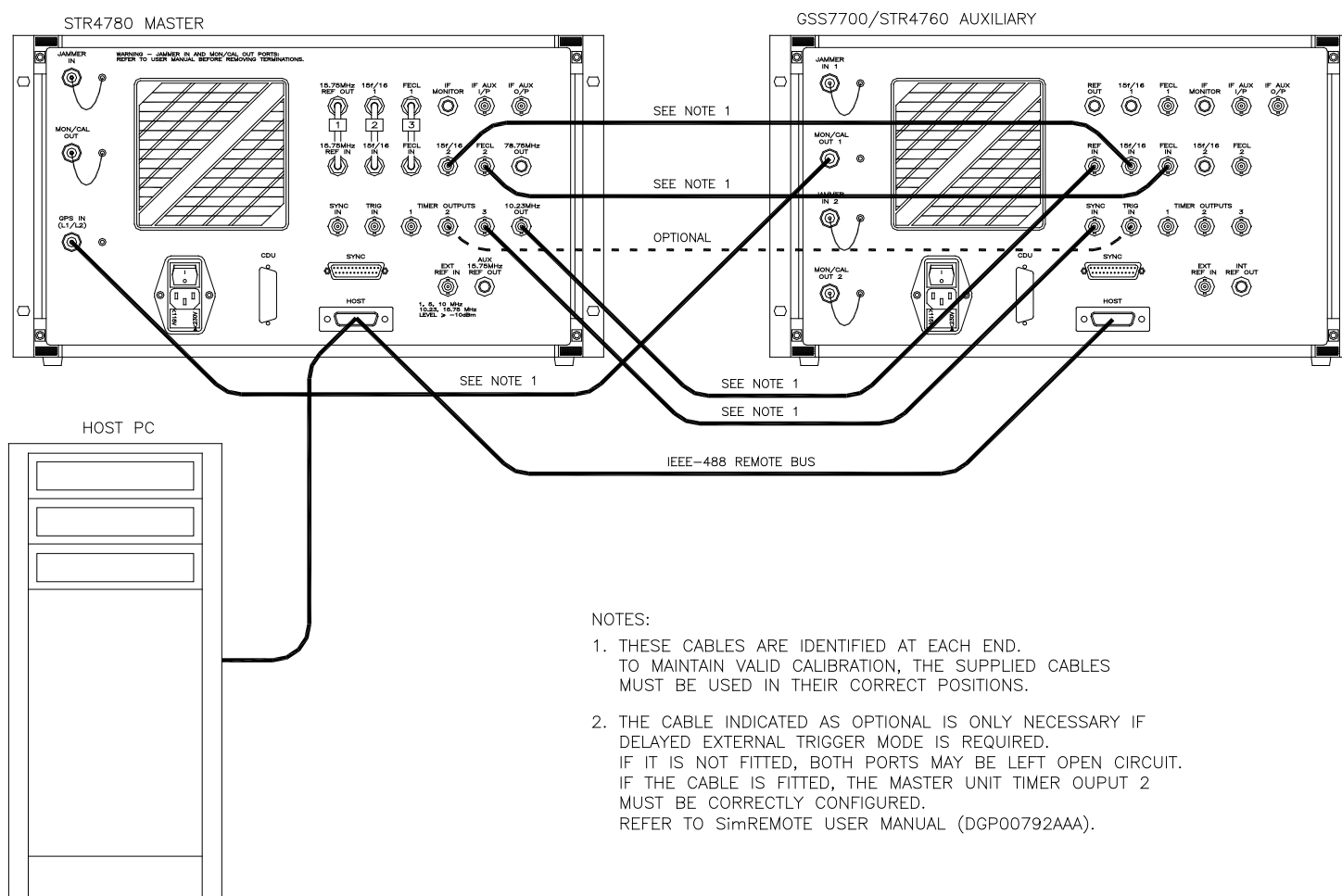
Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator
- c) Switch on the PC

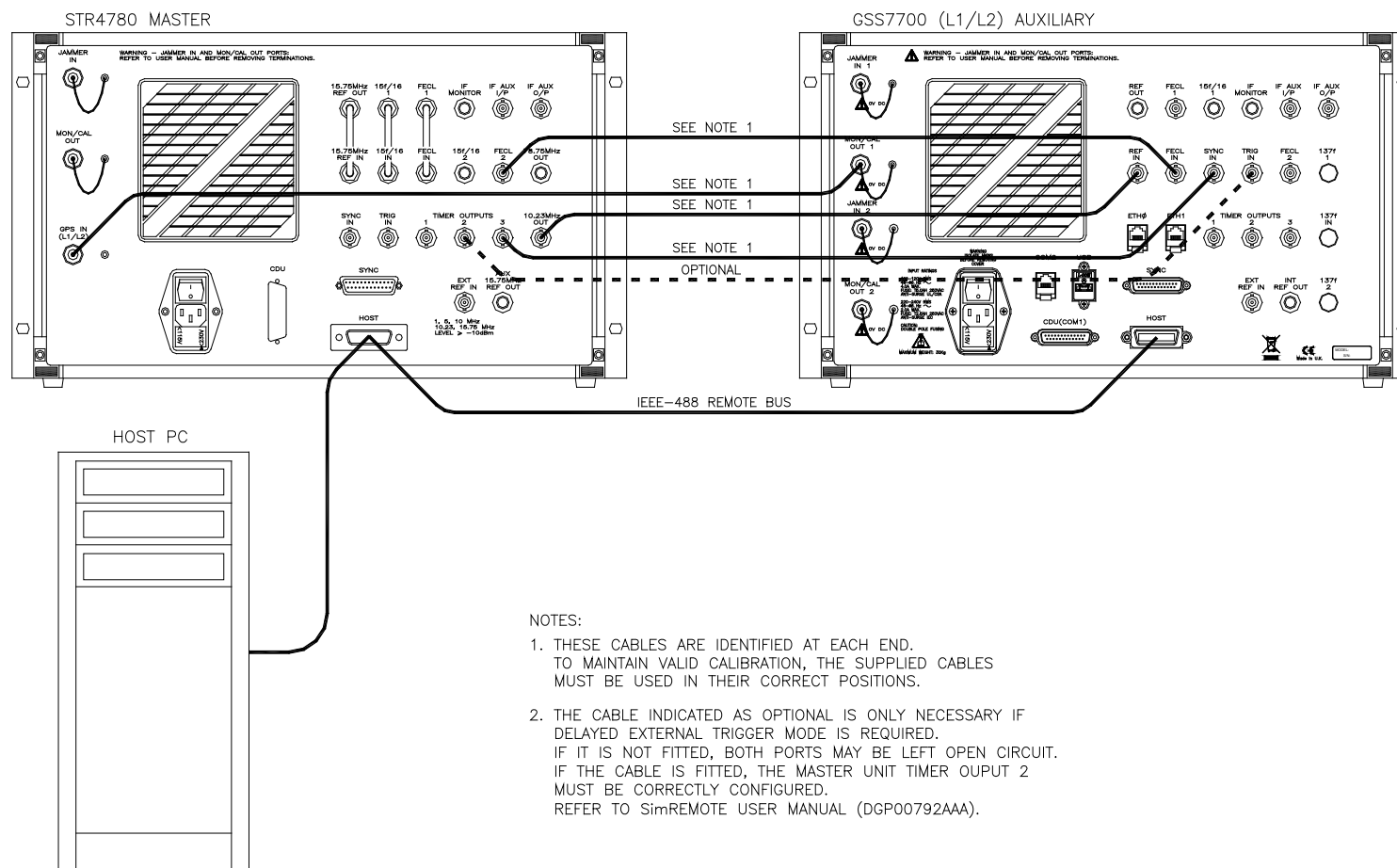
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Appendix Figure G-4 STR4780 single



Appendix Figure G-5 STR4780 + GSS7700 dual (variant A) / STR4760


Appendix Figure G-6 STR4780 + GSS7700 dual (variant B)



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H STR4790

This chapter describes the external hardware features of the STR4790 GPS Multi- Output signal generator.

The STR4790 was originally only available in a single variant with:

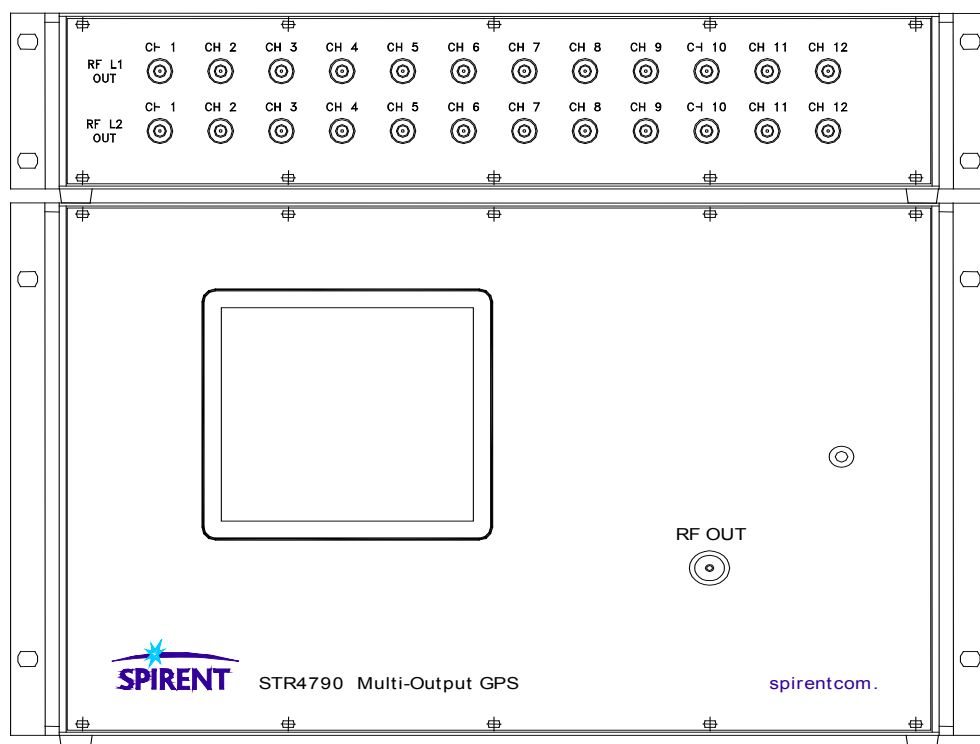
- Up to twelve L1 channels
- Up to twelve L2 channels
- SBAS capability standard
- Enhanced built-in test and monitoring
- Soft configuration of timer outputs and external reference frequency.

An upgrade to this gave the signal generator combined output capability. The following sections assume the STR4790 has been fitted with the combined output upgrade.

H.1 Front panel

The STR4790 is divided into the IF Generator (bottom box) and the RF Upconverter (top box) see Appendix Figure H-1. The main features are the front panel display and the combined RF output on the IF generator, and the twelve L1/twelve L2 RF Output Connectors on the RF Upconverter.

Appendix Figure H-1 STR4790 front panel



H.1.1 Front panel display

The front panel display is a 25 x 54 character, backlit, monochrome LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

While running, the display backlight is permanently on. When the signal generator has been idle for a short time, the backlight will turn off to preserve backlight life. You can manually switch on the backlight using the command LCDP1, sent using the SimGEN IEEE String Send Utility, see reference c)

Appendix Figure H-2 shows a typical display.

Appendix Figure H-2 STR4790 front panel display

```
12L1 + 12L2  44°C                                < SYSTEM BITE MESSAGES >
GPIB1  CFG02M  S/N 2000
CH PRN VELOCITY LEVEL CODE BITE PRN VELOCITY LEVEL CODE
1   2      300  20.0 P+CA .   .   2      300  20.0  P
2   7      170  18.1 P+CA .   .   7      170  18.1  P
3   9      440  10.0 P+CA .   .   9      440  10.0  P
4  13      669   9.5 P+CA .   .  13      669   9.5  P
5  15     -170  10.3 P+CA .   .  15     -170  10.3  P
6  18      230  10.3 P+CA .   .  18      230  10.3  P
7                                     .   .
8  23     -232  10.4 P+CA .   .  23     -232  10.4  P
9  27      567  10.9 P+CA .   .  27      567  10.4  P
10 29      998  10.7 P+CA .   .  29      998  10.7  P
11 31     -786  10.6 P+CA .   .  31     -786  10.6  P
12 32     -501  10.5 P+CA .   .  32     -501  10.5  P
13                                     .   .
14                                     .   .
15                                     .   .
16                                     .   .
TOW   420 SUN 10:39:10.0  TOW   420 SUN 10:39:10.0
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
```

The following paragraphs describe the LCD fields:

nnL1 + nnL2

The number of signal generator channels available, in this case 24. When switched to dual frequency operation this field displays **nnL1** for the L1 channels, and **nnL2** for the L2 channels. When switched to dual antenna operation this field changes to **nnL1** for the Antenna 1 channels plus **nnL1** for the Antenna 2 channels.

n°C

This field gives an indication, in degrees Celsius, of the internal temperature of the signal generator, in this example 44°C. If the temperature rises above 70°C, the signal generator will automatically shut down.

SYSTEM BITE MESSAGES

Notes

- 1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Appendix Table H-1 details conditions that may persist for longer than 60 seconds.
- 2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

BITE (Built In Test Equipment) and status messages relating to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Appendix Table H-1 STR4790 major system BITE messages

Message	Description
No message	Hardware operating normally External reference standard not connected.
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
137F UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
77Fj UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
F Level Fail	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F Ref Unlocked	Note: It is normal for this message to persist for up to 120 seconds after switching on the signal generator Fault in the reference oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator..
1 PPS Fail	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

GPiB *n*

The GPiB (IEEE-488) address of the signal generator

CFG_na

n The current signal generator configuration
a shows configuration as Master (M) or Auxiliary (A).

S/N_n

The signal generator serial number

CH

Channel number

VELOCITY

Velocity being simulated. Blank for halted channel or channel not present.

LEVEL

Power level being generated relative to nominal. Range ± 20 dB with respect to nominal levels. Blank for halted channel or channel not present.

CODE

Code(s) being simulated, (P, CA, P+CA, Y, Y+CA, OFF, Z, or Z+CA). Blank for halted channel or channel not present.

Note: 'Z' represents pseudo-Y code.

BITE

Channel Built In Test Equipment indication number

Two digits, the first refers to the L1/antenna1 channel status, the second refers to the L2/antenna 2 status.

The available codes are:

0: OK

1: Code Clock Fail

2: Code Fail

TOW

Time of week in seconds since start of GPS week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

H.1.2 RF combined output connector

This provides a combined L1/L2 signal source. For details, see the product specification in Table 2-3. Normally, these power levels are:

L1 nominal signal level 0 dB level: -130 dBm C/A, -133 dBm P, Range: ± 20 dB

L2 nominal signal level 0 dB level: -136 dBm P, Range ± 20 dB

Each RF output port is internally DC isolated see the product specification in Table 2-3. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

H.1.3 Main individual RF output connectors

The main RF output connectors are type 'SMA' coaxial. Spirent specifies all power levels at this interface. For details, see the product specification in Table 2-3. Normally, these power levels are:

L1 nominal signal level 0 dB level: -81.76 dBm C/A, -84.76 dBm P, Range ± 20 dB

L2 nominal signal level 0 dB level: -83 dBm P, Range ± 20 dB

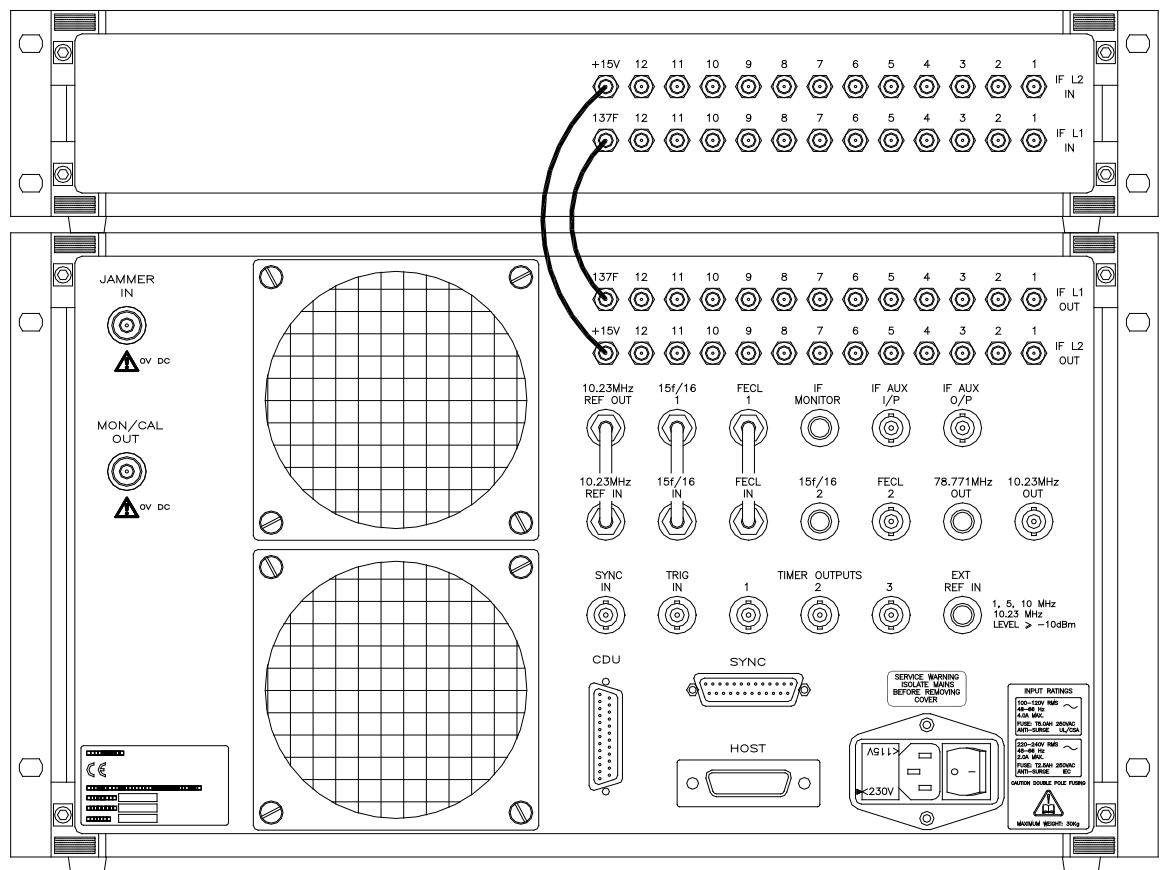
Each RF output port is internally DC isolated, see the product datasheet in Table 2-2. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

H.2 Rear panel

Appendix Table H-2 details the main rear panel features shown in Appendix Figure H-3.

Appendix Table H-2 Rear panel features of GSS8000-series signal generators

Port	Described in section
Mains power inlet	H.2.1
Communication ports	H.2.2
Auxiliary Signal ports	H.2.3
MON/CAL ports	H.2.4
Jammer ports	H.2.5
Cooling fans	H.2.6

Appendix Figure H-3 STR4790 rear panel**H.2.1 Mains power inlet****SAFETY WARNING**

You must connect this signal generator to mains earth (ground)
Completely isolate mains power by removing the plug from the mains socket,

which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the STR4790 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: *The mains fuse may blow if you do not fit the correctly rated mains fuse. See the signal generator rating plate for fuse details.*

Depending on the mains voltage, the mains input automatically switches to 100-120 V or 220-240 V. No damage will occur if the mains voltage selector on the mains inlet is incorrectly set. However, Spirent recommends you always set the selector to the mains voltage at your location, especially if you have changed the mains fuses from those originally supplied with the signal generator.

You may need to fit different mains fuses depending on the mains voltage at your location. The fuses are located immediately adjacent to the mains inlet in a slide-out module. If you change mains voltage, you must change both fuses in the module. Refer to the rear panel of the signal generator for fuse types and ratings. When you replace a fuse, always use the type specified on the rear panel rating plate

H.2.2 Communication ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) HOST port is an IEEE-488 compatible port used to download information from the SimGEN controller or Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

H.2.3 Auxiliary Signal ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

- 1) *For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product specification for your signal generator, see Table 2-3.*
- 2) *When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 15f/16 2, 10.23 MHz and 78.771 MHz.*

The Auxiliary Signal ports comprise:

Twenty BNC type connectors

Twenty-six SMA type connectors

Appendix Table H-3 details these connectors.

The top two rows are specific to single and “multi-box” configurations and should remain unused. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Appendix Table H-3 STR4790 auxiliary signal ports

Port	Description
EXT REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
10.23MHz OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz..
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 1, 2, or 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone STR4790 signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1, default is 1PPS, Gated
TIMER OUTPUT 3	As Timer Output 1, default is 1PPS, Ungated
137F (x1)	LO feed for Upconverter
15v (x1)	Power for Upconverter
17F (x24)	Individual output IF signals

H.2.4 MON/CAL ports

Notes:

1) Depending on the product code, the ports may not be DC isolated. Applying DC at these ports may damage your signal generator. All STR4790 product codes at build standard Release 6 or higher (Release number indicated on rear

panel label) have DC isolated MON/CAL OUT port(s) and JAMMER IN port(s). Contact Spirent Applications Support if you remain in doubt.

- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.

Use the MON/CAL OUT port to monitor the GPS signal at a level approximately 60 dB higher than the front panel connector, mainly for calibration purposes. Product codes NTNE10AA and NTNE10CA are fitted with two MON/CAL OUT ports, one for each front panel output. Product code NTNE10BA has only one. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

H.2.5 Jammer ports

Notes:

- 1) Depending on the product code, the ports may not be DC isolated. Applying DC at these ports may damage your signal generator. All STR4790 product codes at build standard Release 6 or higher (Release number indicated on rear panel label) have DC isolated MON/CAL OUT port(s) and JAMMER IN port(s). Contact Spirent Applications Support if you are in doubt.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. Product codes NTNE10AA and NTNE10CA are fitted with two JAMMER IN ports, one for each front panel output. Product code NTNE10BA has only one. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

H.2.6 Cooling fans



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

Two cooling fans blow air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

A thermal sensor will shut down the signal generator if its internal temperature exceeds 100°C. If the signal generator unexpectedly shuts down, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed

H.3 Calibration

Table 2-2 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

H.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product specification see Table 2-3. Refer to the product specification for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

H.5 Lifting the signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

H.6 Interconnection

Systems using GSS8000-series signal generators need an IEEE-488 cable connection from the “Host” socket on the rear panel to the IEEE-488 card (identified as card #0) in the PC.

Notes:

- 1) *This IEEE-488 card is card #1 if your signal generator has the IEEE remote control option.*
- 2) *If you use SimGEN for VMS, the SYNC cable is not required as the IEEE interface provides synchronisation signals.*

These are the factory default settings. Reference c) describes changing the default settings.

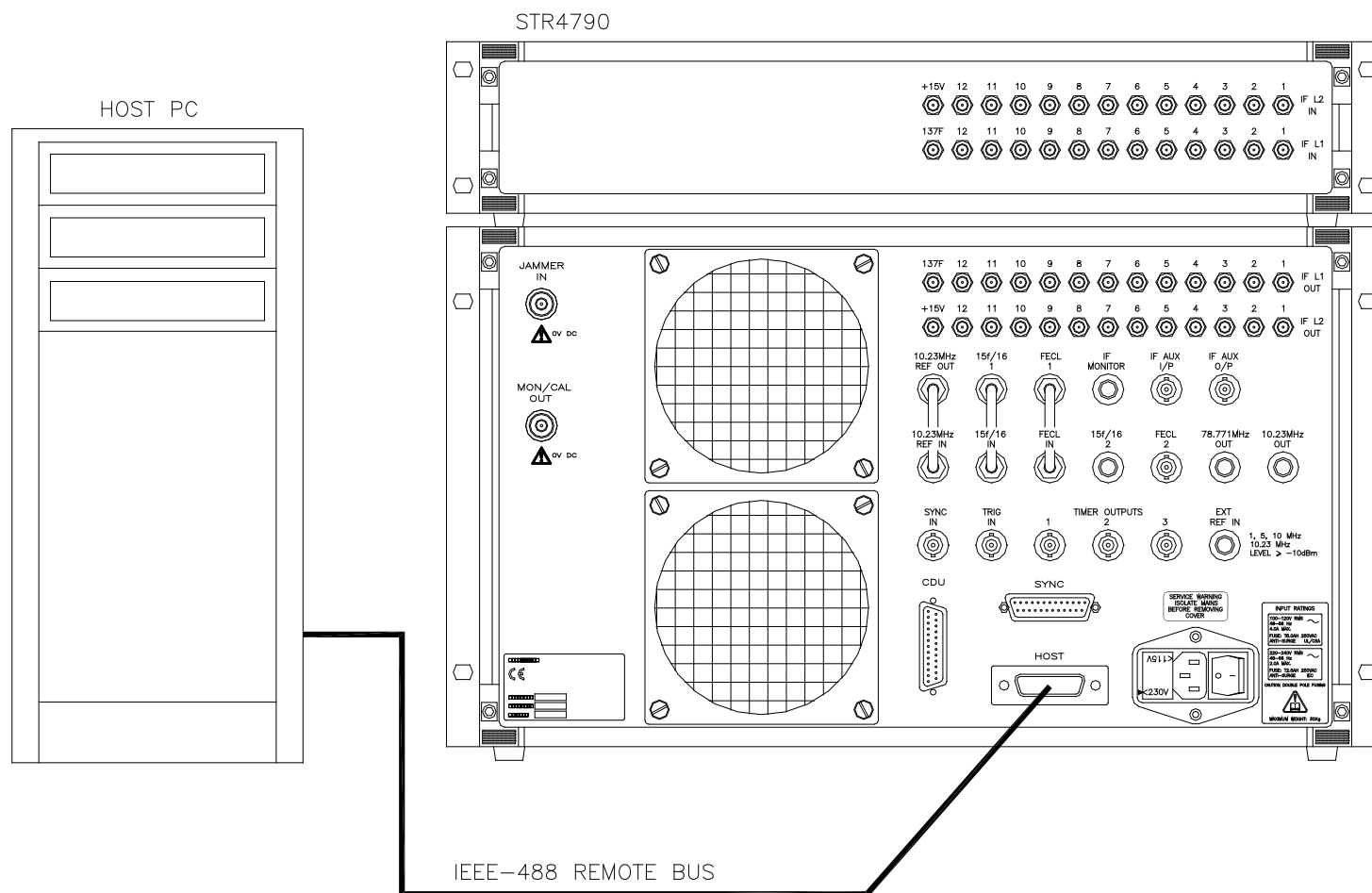
This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Appendix Figure H-4.

Correctly position and tighten all cables and terminations.

Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator
- c) Switch on the PC

Appendix Figure H-4 STR4790 interconnection drawing



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I GSS7700

Note: From SimGEN v2.70, Spirent supplied the SimGEN PC for the GSS7700 (Variant B only) fitted with a timer card to provide a hardware pulse used for the 250 Hz (4 ms) iteration rate. Contact Spirent for details on upgrading existing simulators.

This chapter describes the external hardware features of the GSS7700 GPS signal generator.

The GSS7700 was available in four types:

- Switchable between (L1 + L2) operation and dual output (L1 + L1) operation.
- L1 Single frequency, single output.
- Dual output (L5 + L5) operation.
- L5 Single frequency, single output.

GSS7700 features:

- Up to 16 channels (L1 or L2 or L5)
- Soft switchable between L1/L2 and L1/L1 operation (variant 1 only).
- SBAS capability on L1 standard.
- M Noise capability on L1 and L2 as standard.
- Enhanced built-in test and monitoring.
- Soft Master/Auxiliary switching ("multi-box" configurations).
- Soft configuration of timer outputs and external reference frequency.
- Embedded interferer capability (when used with L1 / L2 capable signal generators and SimGEN v2.60 and higher).

IMPORTANT:

From December 2005, the GSS7700 used a replacement micro-processor platform to host the system's embedded firmware. The following nomenclature denotes the two GSS7700 variants:

Variant A: Original (before December 2005) micro-processor platform.

Variant B: Replacement (after December 2005) micro-processor platform.

Both variants support basic GPS features. Some features in SimGEN v2.70 on, such as 250 Hz iteration rate, are only supported by Variant B micro-processor platforms. Contact Spirent Applications Support if you want to use a Variant A micro-processor platform with features introduced after SimGEN v2.70.

GSS7790 (Variant A and B), GSS8000-series and GSS7700 (Variant A and Variant B) signal generators limit the bandwidth of the GPS signal to 50 MHz (at -3 dB). In SimGEN, see reference c), the GPS constellation editor dialog **Signal Control-Signal Power** shows code offsets and power levels as powers of the equivalent, infinite bandwidth, signals; and shows the ratios of the in-band spectral densities. The SimGEN user manual details the decrease in total power of each signal component you will see as a result of limiting the GPS signal bandwidth to 50 MHz.

Notes:

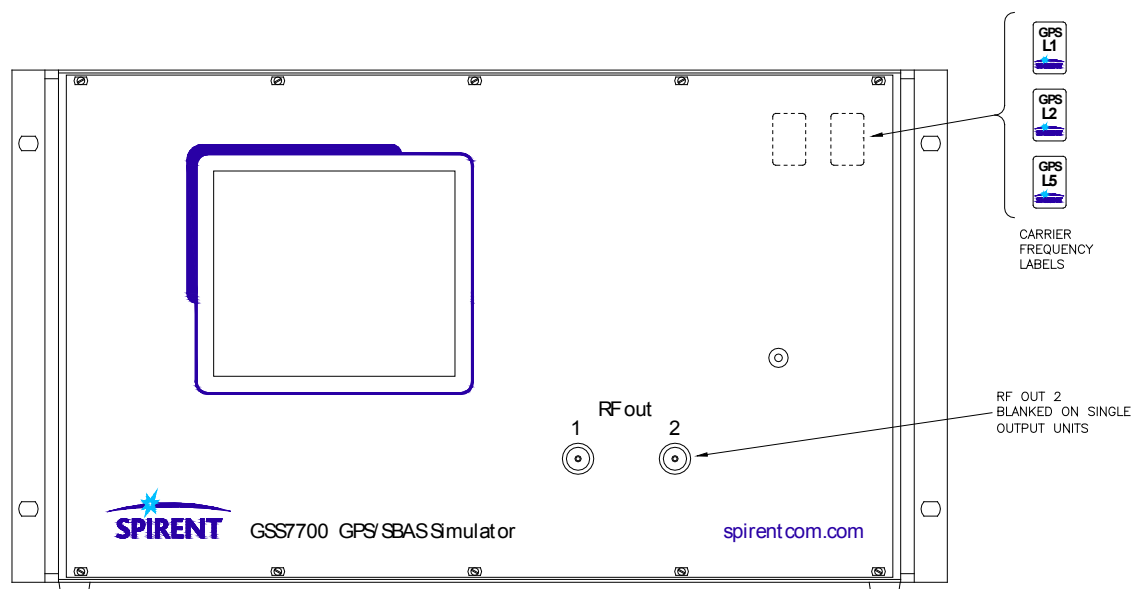
1) When using the embedded interferer, you must connect the co-axial link (supplied with the generator) from the Jammer In 1 port (the top port on the left-hand side of the rear panel) to the Mon/Cal Out 2 port (the bottom port on the left-hand side of the rear panel).

- 2) GSS7700 Variant A signal generators declared as GSS7700 do not allow L2 only; you must use L1 and L2.
- 3) GSS7700 Variant B signal generators declared as GSS???? support L2 only.

I.1 Front panel

The front panel features are the front panel display, and the main RF output connector(s) see Appendix Figure I-1.

Appendix Figure I-1 GSS7700 front panel



I.1.1 Front panel display

The front panel display is a 25 x 54 character, backlit, monochrome LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

While running, the display backlight is permanently on. When the signal generator has been idle for a short time, the backlight will turn off to preserve backlight life. You can manually switch on the backlight using the command LCDP1, sent using the SimGEN IEEE String Send Utility, see reference c)

Appendix Figure I-2 shows a typical display for a twelve + twelve channel L1/L2 unit.

Appendix Figure I-2 GSS7700 front panel display

```

12L1 + 12L2  44°C                                < SYSTEM BITE MESSAGES >
GPIB1  CFG02M  S/N 2000                          < SYSTEM INFO MESSAGES >
CH PRN VELOCITY LEVEL CODE  PRN VELOCITY LEVEL CODE
1   2      300  20.0 P+CA .  2      300  20.0 P
2   7      170  18.1 P+CA .  7      170  18.1 P
3   9      440  10.0 P+CA .  9      440  10.0 P
4  13      669  09.5 P+CA . 13      669  09.5 P
5  15     -170  10.3 P+CA . 15     -170  10.3 P
6  18      230  10.3 P+CA . 18      230  10.3 P
7                                     .
8  23     -232  10.4 P+CA . 23     -232  10.4 P
9  27      567  10.9 P+CA . 27      567  10.4 P
10 29      998  10.7 P+CA . 29      998  10.7 P
11 31     -786  10.6 P+CA . 31     -786  10.6 P
12 32     -501  10.5 P+CA . 32     -501  10.5 P
13                                     .
14                                     .
15                                     .
16                                     .
TOW  420 SUN 10:39:10.0  TOW  420 SUN 10:39:10.0
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

Note: There are LCD differences between Variant A and Variant B signal generators.

When the signal generator is first switched on, the LCD on GSS7700 (variant B) signal generators can remain blank for up to two minutes (normally less than one minute). The LCD in GSS7700 (variant A) signal generators will remain blank, after switch on, for less than ten seconds.

The following paragraphs describe the LCD fields:

nnL1 + nnL2

The number of signal generator channels available, in this case 24. When switched to dual frequency operation this field displays **nnL1** for the L1 channels, and **nnL2** for the L2 channels. When switched to dual antenna operation this field changes to **nnL1** for the Antenna 1 channels plus **nnL1** for the Antenna 2 channels.

n°C

This field gives an indication, in degrees Celsius, of the internal temperature of the signal generator, in this example 44°C. If the temperature rises above 100°C, the signal generator will automatically shut down.

SYSTEM BITE MESSAGES**Notes**

1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Appendix Table I-1 details conditions that may persist for longer than 60 seconds.

2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

This field contains BITE (Built In Test Equipment) and status messages relating to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Appendix Table I-1 GSS7700 major system BITE messages

Message	Description
No message	Hardware operating normally Modulator oven(s) are at operating temperature. External reference standard not connected.
Oven 1/Oven 2	Modulator ovens are not at operating temperature. Do not perform phase calibration. If this message persists, maintenance support is required to remedy the fault. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications. Note: <i>It is normal for this message to persist for up to 10 minutes after switching on the signal generator, depending on ambient temperature.</i>
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
137F UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator. Note: <i>GPS L1/L2 capable signal generators only.</i>
132F UnLocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator. Note: <i>GPS L5 capable signal generators only.</i>
17F UnLocked	Fault in the IF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F ALC	Fault in the circuit maintaining the level of the IF local oscillator. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F LEVEL	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

Message	Description
F REF	Note: It is normal for this message to persist for up to 120 seconds after switching on the signal generator Fault in the reference oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator..
1s TICK	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

GPiB *n*

The GPiB (IEEE-488) address of the signal generator

CFG*na*

n The configuration of the currently selected signal generator. Some of the currently defined configurations are:

- 1 L1+L1 (or L1 only), Master
- 2 L1+L2 Master
- 3 L1+L1 Auxiliary
- 4 L1+L2 Auxiliary
- 5 L5 Master

a shows configuration as Master (M) or Auxiliary (A).

S/N*n*

The signal generator serial number

CH

Channel number

PRN

PRN code being simulated. Blank for halted channel or channel not present.

VELOCITY

Velocity being simulated. Blank for halted channel or channel not present.

Note: From Processor Firmware Issue 1-03 onwards, channel BITE is also displayed in the 'VELOCITY' field.

Whilst simulated velocity is displayed, or the field is blank, BITE is OK

BITE 01 PSU monitor alarm

BITE 02 Clock monitor Alarm

LEVEL

Power level being generated relative to nominal. Range ± 20 dB with respect to nominal levels. Blank for halted channel or channel not present.

CODE

This field displays the currently simulated code(s).

The following code / code combinations can be displayed:

P, CA, P CA, Y, Y CA, OFF, Z, Z CA, Mn, Mp. Blank for halted channel or channel not present.

In the display

'Z' represents pseudo-Y code, 'Mn' represents M Noise and 'Mp' represents Pseudo-M code.

'+' sign shows Nav Data is being broadcast.

Two horizontal dots '..' next to either Mn or Mp show the code is modulated in the P code axis and the modulation type is Interplex.

Two vertical dots '⋮' next to either Mn or Mp show the code is modulated in the C/A code axis and the modulation type is Interplex.

Three horizontal dots next to either Mn or Mp show the code is modulated in the P code axis and the modulation type is Additive.

Three vertical dots next to either Mn or Mp show the code is modulated in the C/A code axis and the modulation type is Additive.

Regardless of the selection made on the SimGEN menus, the two dots indicating Interplex combining are only displayed if Interplex is in use, for example if M code plus two legacy signals are present. With less than three codes present, the combining method reverts to Additive.

TOW

Time of week in X1 epochs since start of GPS week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F/

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

I.1.2 Main RF output connector(s)

The main RF output connectors are type 'N' coaxial and are the normal connection point for the GPS receiver under test. For details, see the product specification in Table 2-3. Normally, these power levels are:

L1 C/A Code	0 dB level -130 dBm,	Range ± 20 dB
L1 P Code	0 dB level -133 dBm,	Range ± 20 dB
L2 P or C/A Code	0 dB level -136 dBm,	Range ± 20 dB
L5 Code	0 dB level -127.9 dBm,	Range ± 20 dB

Each RF output port is internally DC isolated see the product specification in Table 2-3. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

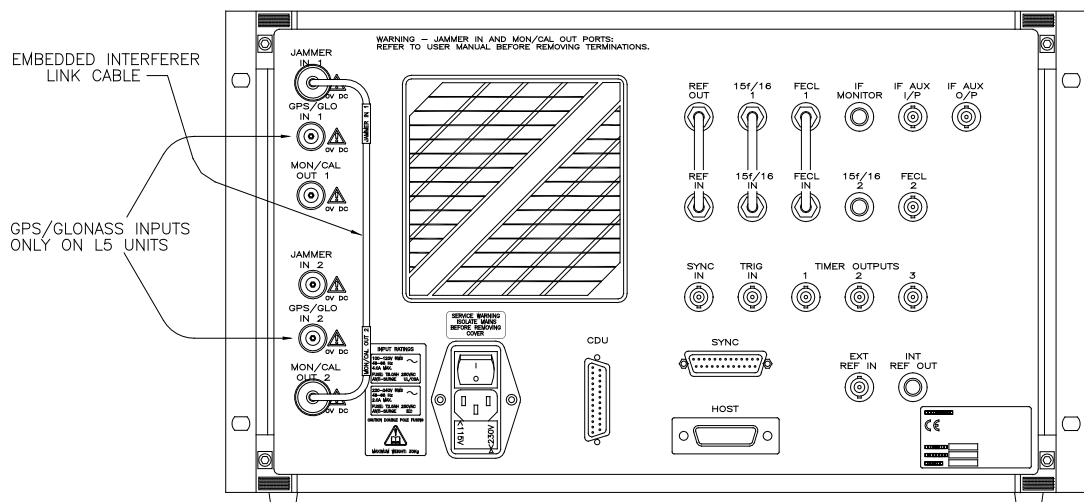
I.2 Rear panel

Appendix Table I-2 details the main rear panel features shown in Appendix Figure I-3 (Variant A) and Appendix Figure I-4 (Variant B).

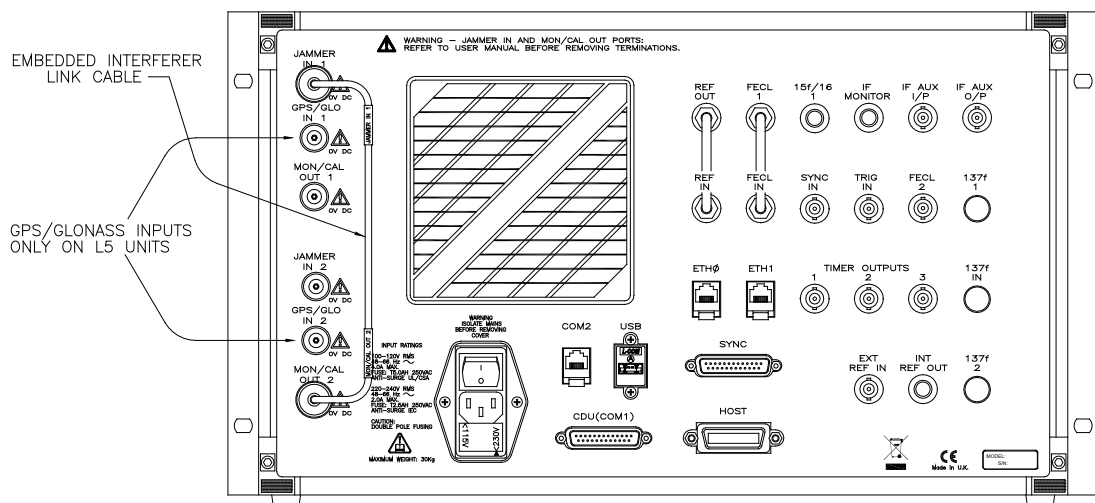
Appendix Table I-2 Rear panel features of GSS8000-series signal generators

Port	Described in section
Mains power inlet	I.2.1
Communication ports	I.2.2
Auxiliary signal ports	I.2.3
MON/CAL ports	I.2.4
Jammer ports	I.2.5
GPS/GLO IN port	I.2.6
Cooling fan	I.2.7

Appendix Figure I-3 GSS7700 (variant A) rear panel



Appendix Figure I-4 GSS7700 (variant B) rear panel



I.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

NOTICE

You can operate the GSS7700 at 100-120 V or 220-240 V AC 50-60 Hz.

Note: The mains power input switches automatically between 100-120 V and 220-240 V operation. If the mains voltage selector on the mains inlet is incorrectly set, no damage will occur.

This signal generator uses dual-pole/Neutral fusing (a fuse of the same type and rating is fitted to both the phase and neutral lines). The rating label, located next to the mains inlet, gives the fuse ratings your signal generator uses. The mains voltage determines the value of the fuses used in some signal generators. If your signal generator uses fuses whose value depends on the mains voltage, Spirent recommends you correctly set the mains voltage selector to indicate the value of the mains fuses fitted.

If you need to change mains supply voltage, refer to the rating label for the fuse types and ratings you must use. If you need to change the fuses, always fit the same type of fuse to both the phase and Neutral lines. The mains fuses are located immediately adjacent to the mains inlet in a slide-out module that can take either 20 mm x 5 mm or 1¼ x ¼ inch fuses.

I.2.2 Communication ports**SAFETY WARNING**

Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) HOST port is an IEEE-488 compatible port used to download information from the SimGEN controller or Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

GSS8000-series (Variant B) signal generators include the following additional ports:

- a) The ETH0 ports are currently for Spirent use only.
- b) The ETH1 port is for firmware upgrades, see details in the firmware upgrade kit.
- c) The COM2 port is a debug monitor port, RS232 compatible, for Spirent use only.
- d) The USB port is currently for Spirent use only.

I.2.3 Auxiliary signal ports**SAFETY WARNING**

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product specification for your signal generator, see Table 2-3.

2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 15f/16 2 (only present on Variant A) and INT REF OUT.

The Auxiliary Signal ports comprise:

Eighteen BNC connectors for Variant A

Sixteen BNC connectors for Variant B

Appendix Table I-3 details the connectors. Some of these connectors are specific to single and “multi-box” configurations the signal generator and some are user inputs and outputs. Depending on the specific configuration, some user inputs/outputs may not be accessible.

Make connections according to the appropriate installation diagram see section I.6. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Appendix Table I-3 GSS7700 auxiliary signal ports

Port	Description
EXT REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
INT REF OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 1, 2 or 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone GSS7700 signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1
TIMER OUTPUT 3	As Timer Output 1

1.2.4 MON/CAL ports

Notes:

1) The ports are DC isolated. However, if you have upgraded an STR4760 to a GSS7700, it is possible these ports are not DC isolated. You can check by measuring the dc resistance of the port, from the centre conductor to the outer. If you remain in doubt about the dc isolation, Spirent recommends you insert a suitable dc block.

2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output

3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.

Use the MON/CAL OUT port to monitor the GPS signal at a level approximately 50 dB higher than the front panel connector, mainly for calibration purposes.

Dual output systems are fitted with two MON/CAL OUT ports one for each front panel output, the single output variant has one MON/CAL port. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

1.2.5 Jammer ports

Notes:

- 1) The port is not DC isolated. Applying DC at this port can damage your signal generator.
- 2) When ports are not in use, fit the supplied terminations to maintain power level accuracy at the front panel output
- 3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. Dual output systems are fitted with two JAMMER IN ports, one for each front panel output. Single output systems have only one. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

1.2.6 GPS/GLO IN port

The GPS/GLO IN (L5 only signal generators) port is used to combine a (MON/CAL) GPS signal or GPS/GLONASS with the L5 Signal. Once combined the composite GPS L1/L2/L5 and GLONASS signal will be present at the front panel N-type connector of the GSS7700.

1.2.7 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator.
Periodically wash the fabric dust filter (if fitted) in clean water.

The cooling fan blows air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

The signal generator will automatically shut down if its internal temperature exceeds a pre-determined value. If this happens, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

1.3 Calibration

Table 2-2 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

1.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product specification see Table 2-3. Refer to the product specification for:

- a) Connectivity details

- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

This specification covers variants A and B.

I.5 Lifting the signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

I.6 Interconnection drawings

Systems using GSS8000-series signal generators need an IEEE-488 cable connection from the “Host” socket on the rear panel to the IEEE-488 card (identified as card #0) in the PC.

Notes:

- 1) *This IEEE-488 card is card #1 if your signal generator has the IEEE remote control option.*
- 2) *The interconnection drawings do not show the embedded interferer link cable.*

The IEEE -488 card settings in this document are the factory default settings. Reference c) describes changing the default settings.

This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Appendix Figure I-5 to Appendix Figure I-19.

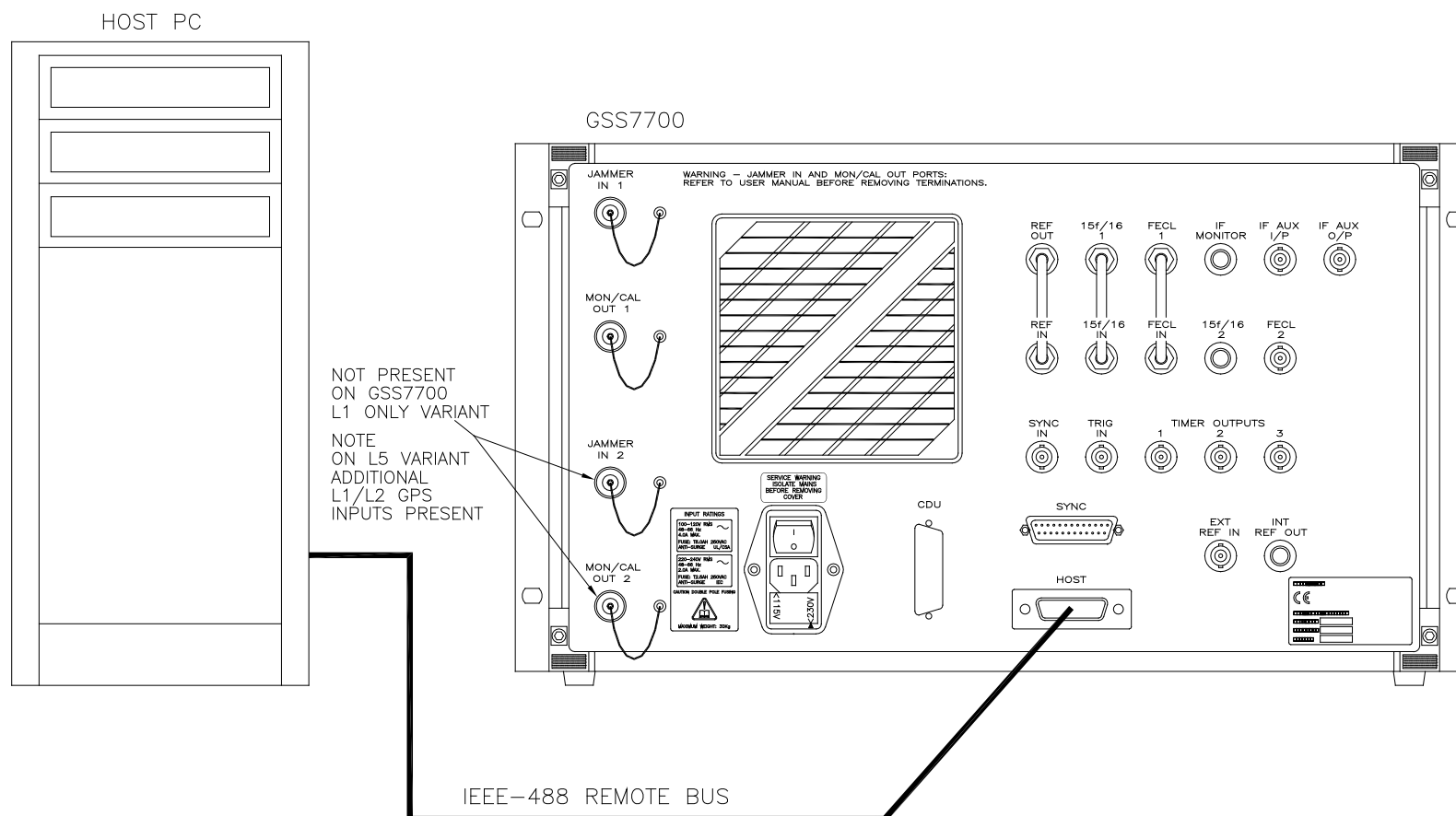
Correctly position and tighten all cables and terminations.

Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator
- c) Switch on the PC

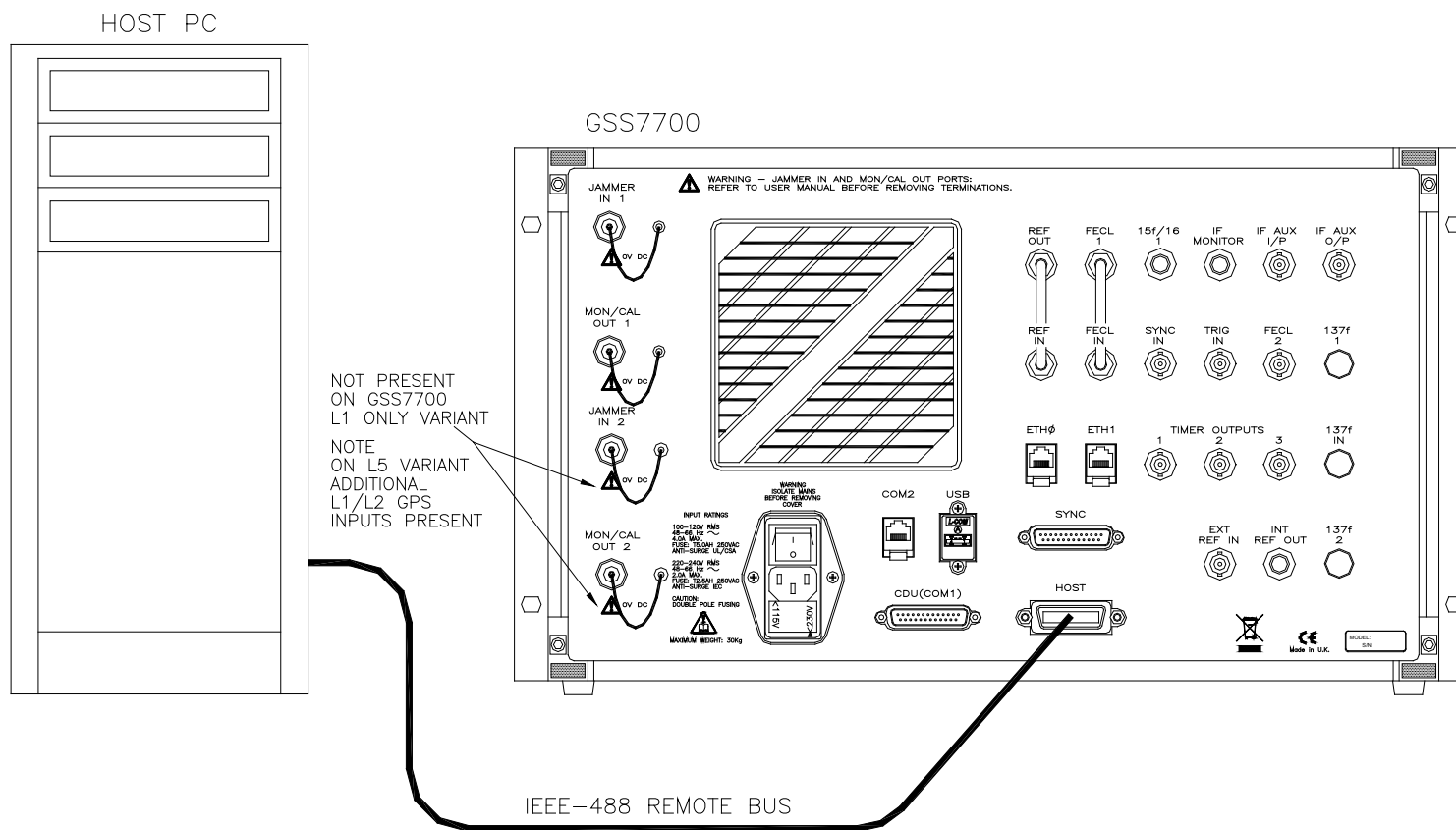
Appendix Figure I-5 GSS7700 single (variant A)

Note: For standalone operation of signal generators with rear panel 137F ports, fit the loopback cable between ports '137F 1' and '137F IN' and fit the termination to port '137F 2'. The Master signal generator in Appendix Figure I-7 shows the loopback cable.

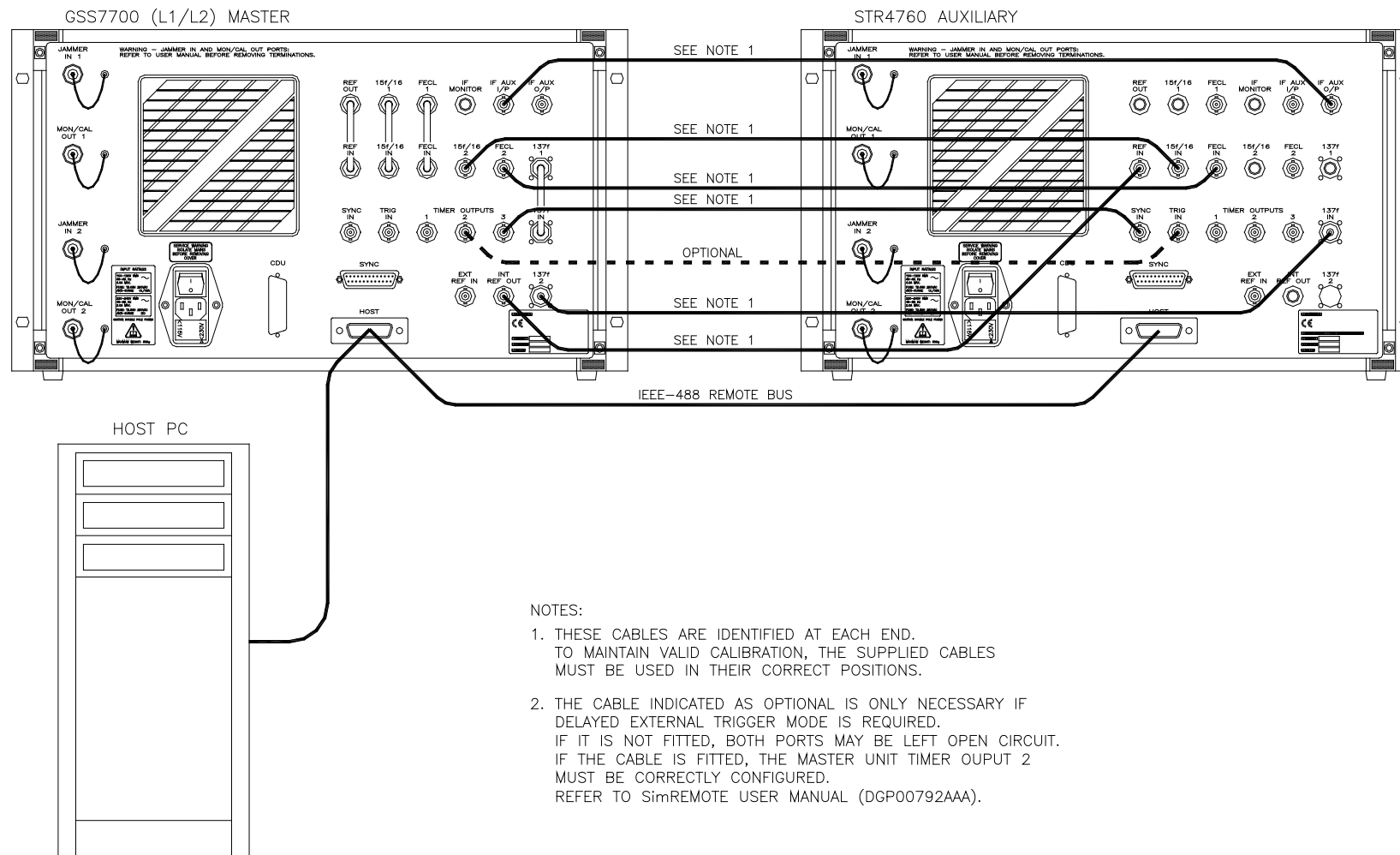


Appendix Figure I-6 GSS7700 single (variant B)

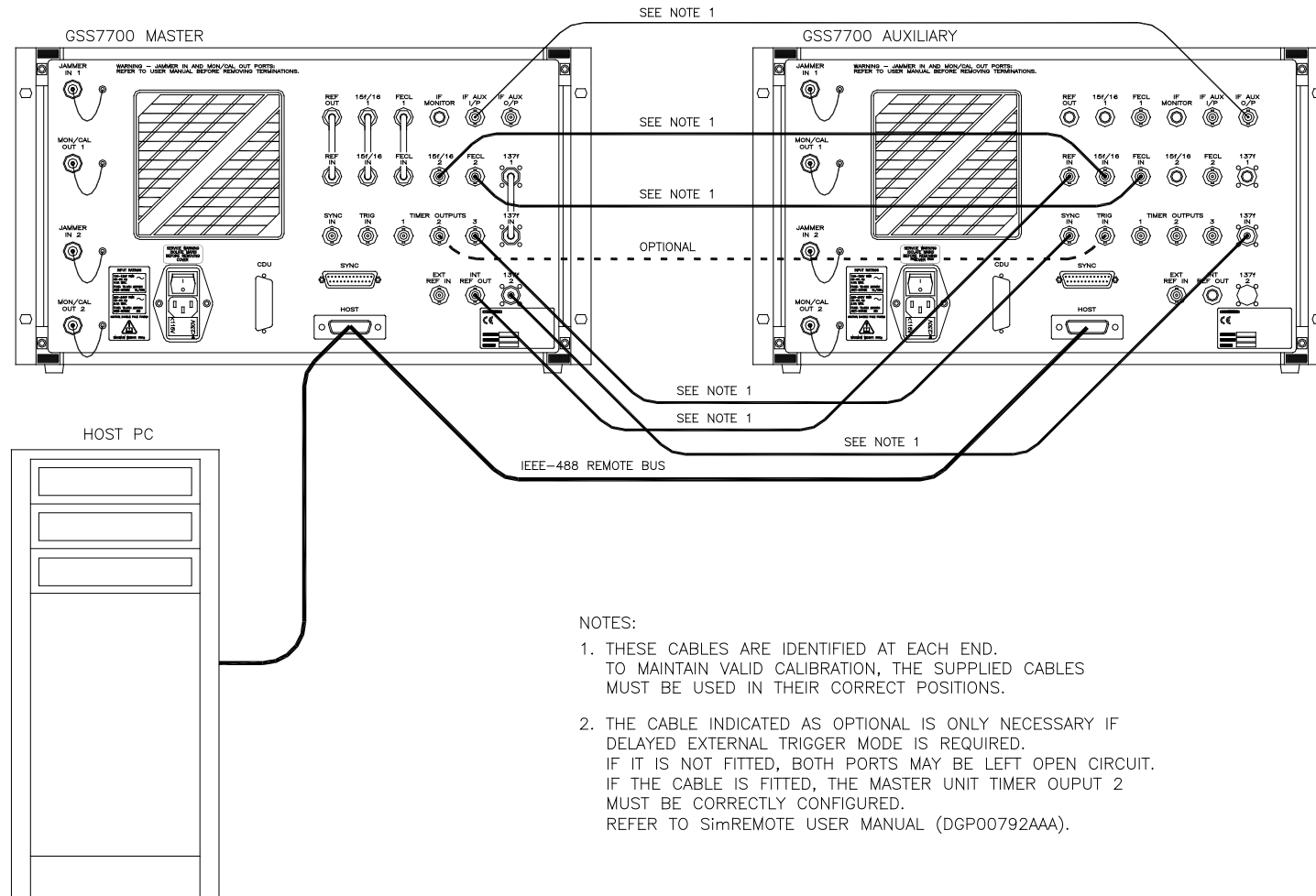
Note: For standalone operation of signal generators with rear panel 137F ports, fit the loopback cable between ports '137F 1' and '137F IN' and fit the termination to port '137F 2'. The Master signal generator in Appendix Figure I-7 shows the loopback cable.



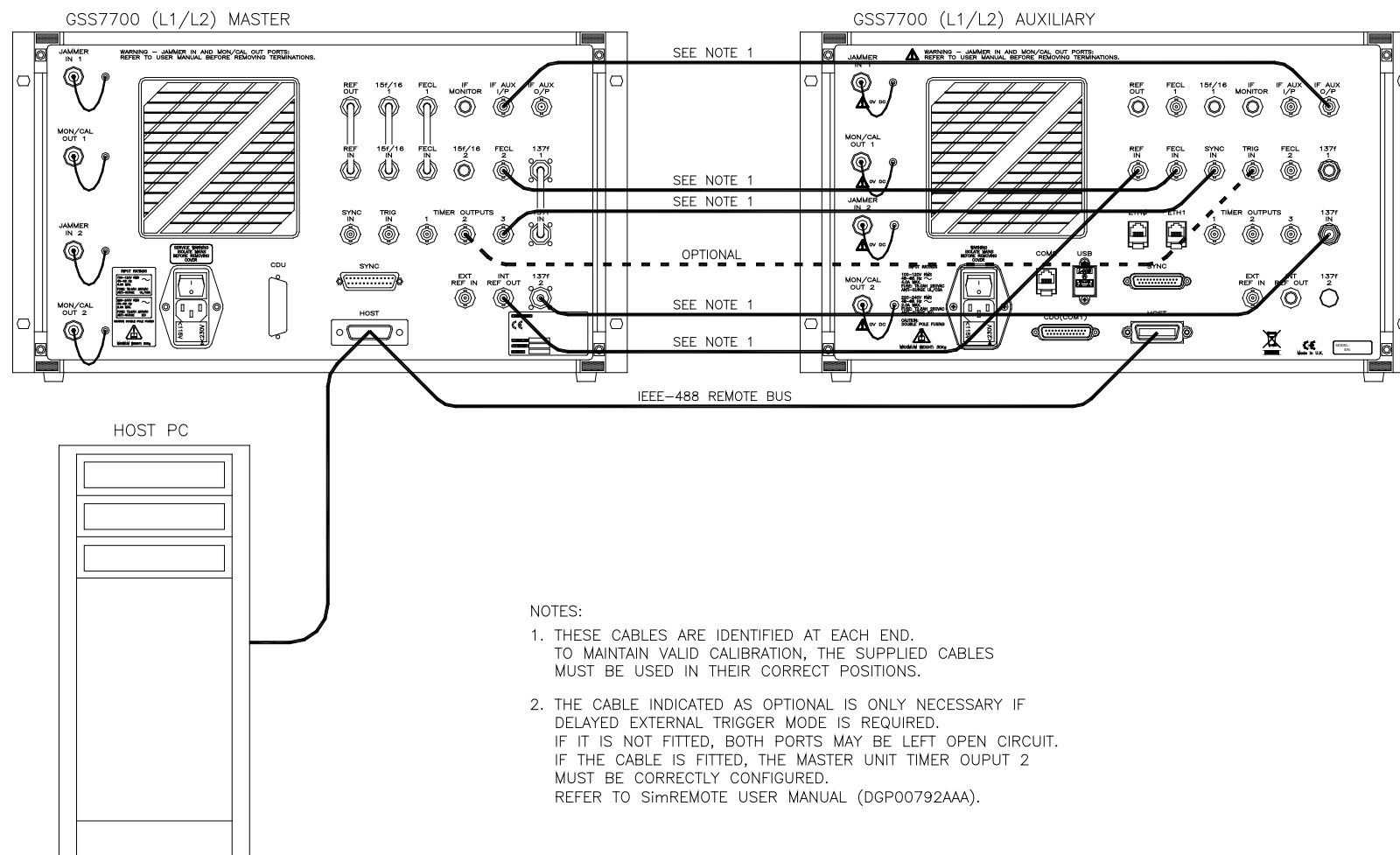
Appendix Figure I-7 GSS7700 L1/L2 dual (variant A) + STR4760



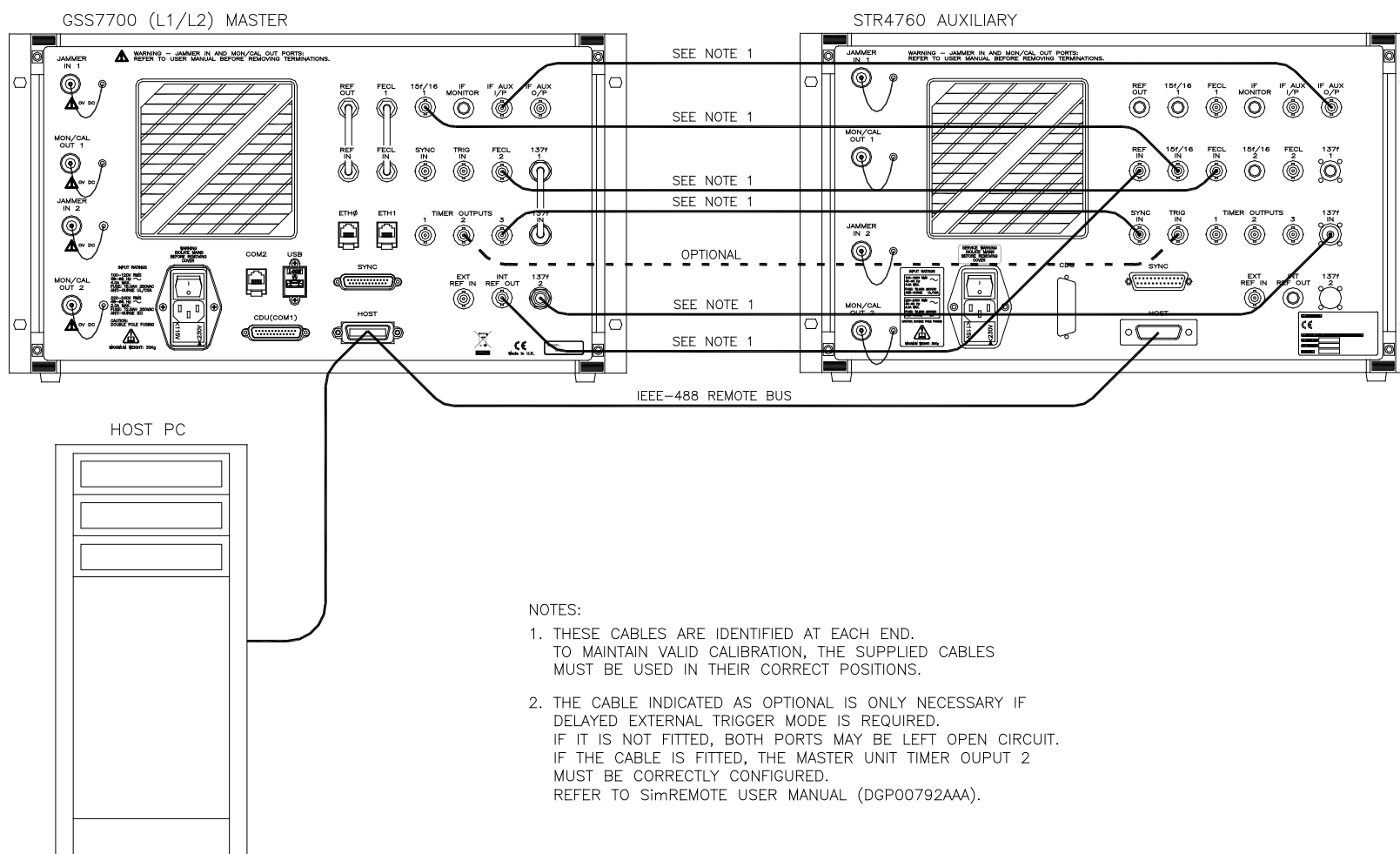
Appendix Figure I-8 GSS7700 L1/L2 dual (variant A) + GSS7700 L1/L2 (variant A)



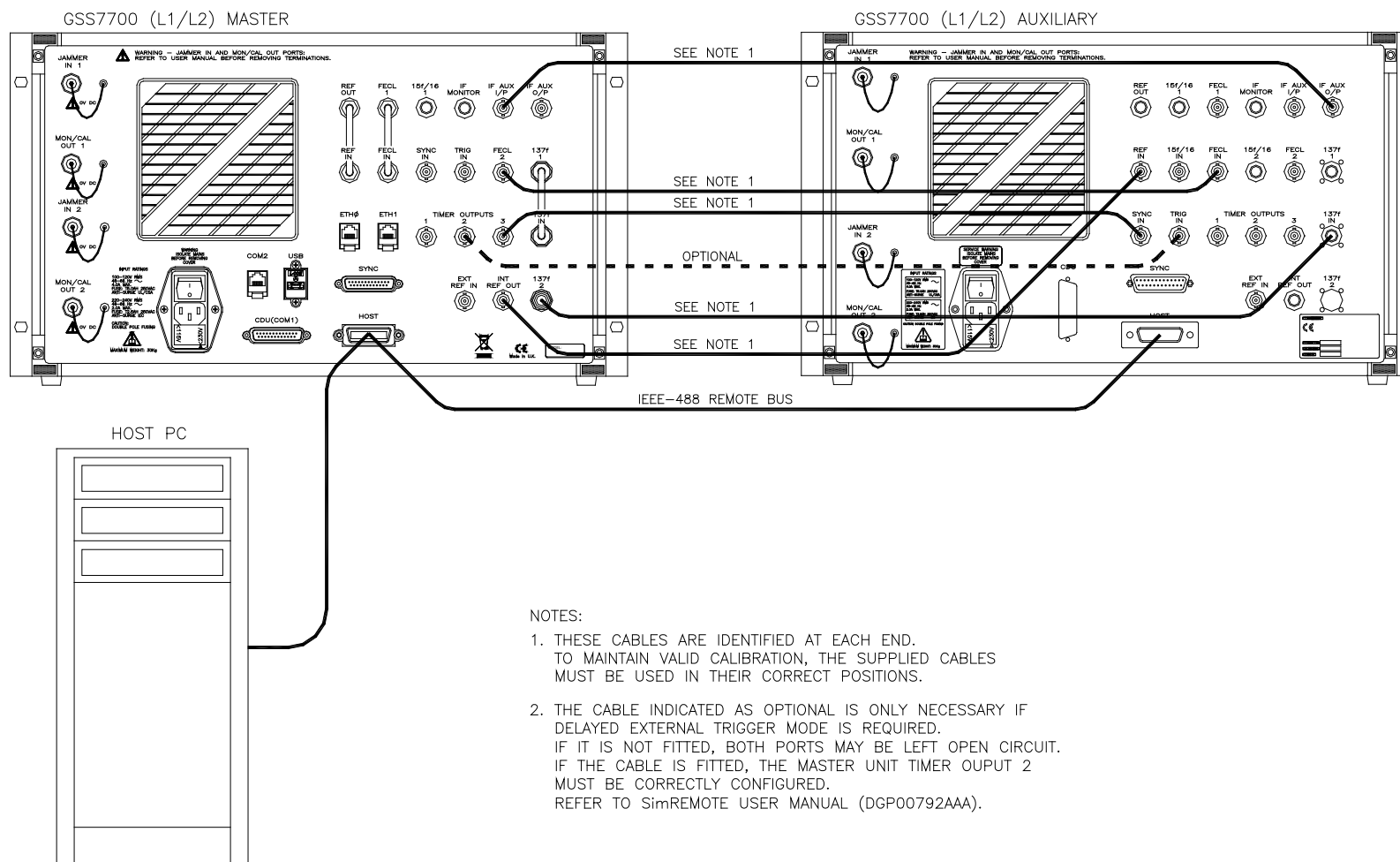
Appendix Figure I-9 GSS7700 L1/L2 dual (variant A) + GSS7700 L1/L2 (variant B)



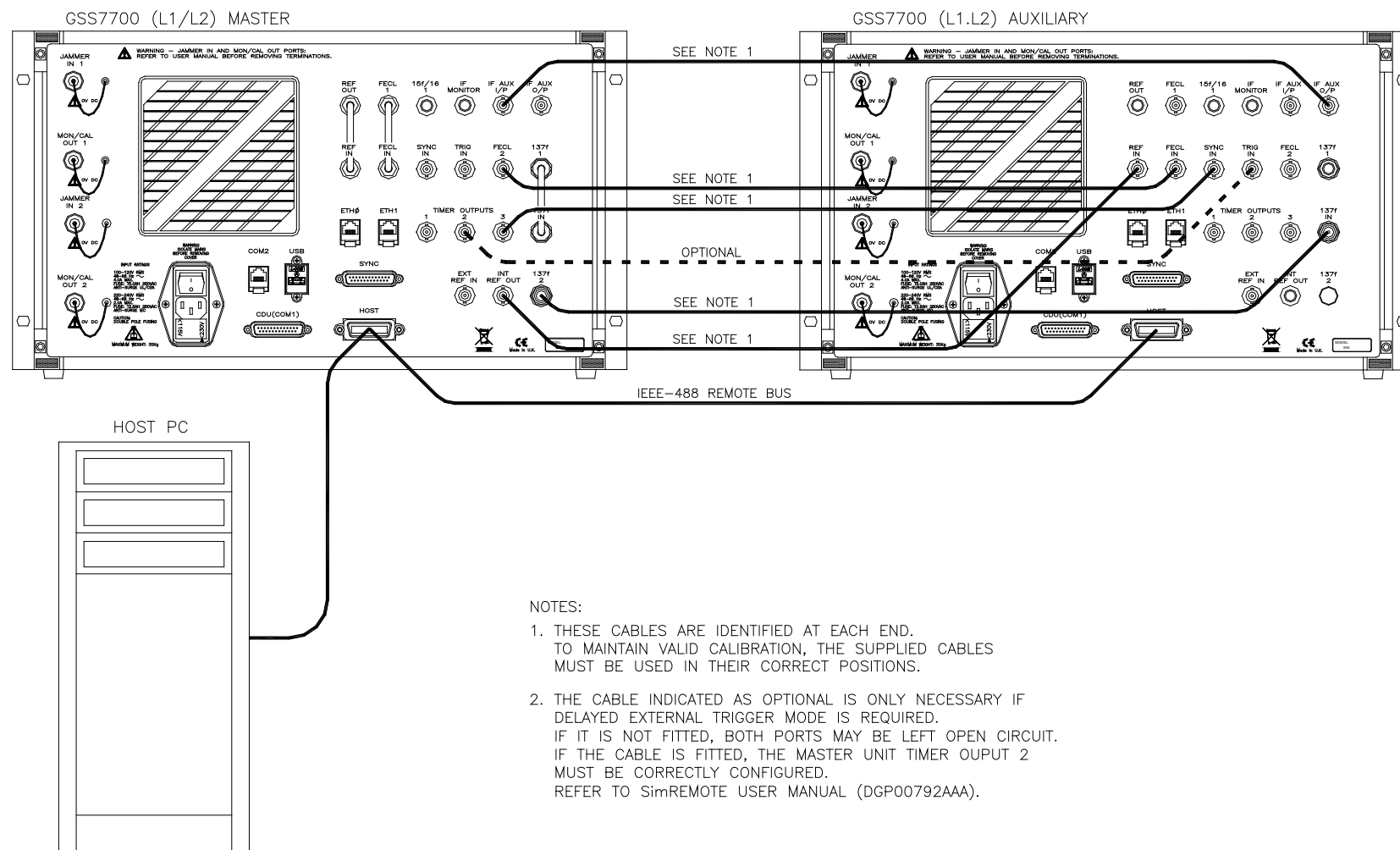
Appendix Figure I-10 GSS7700 L1/L2 dual (variant B) + STR4760



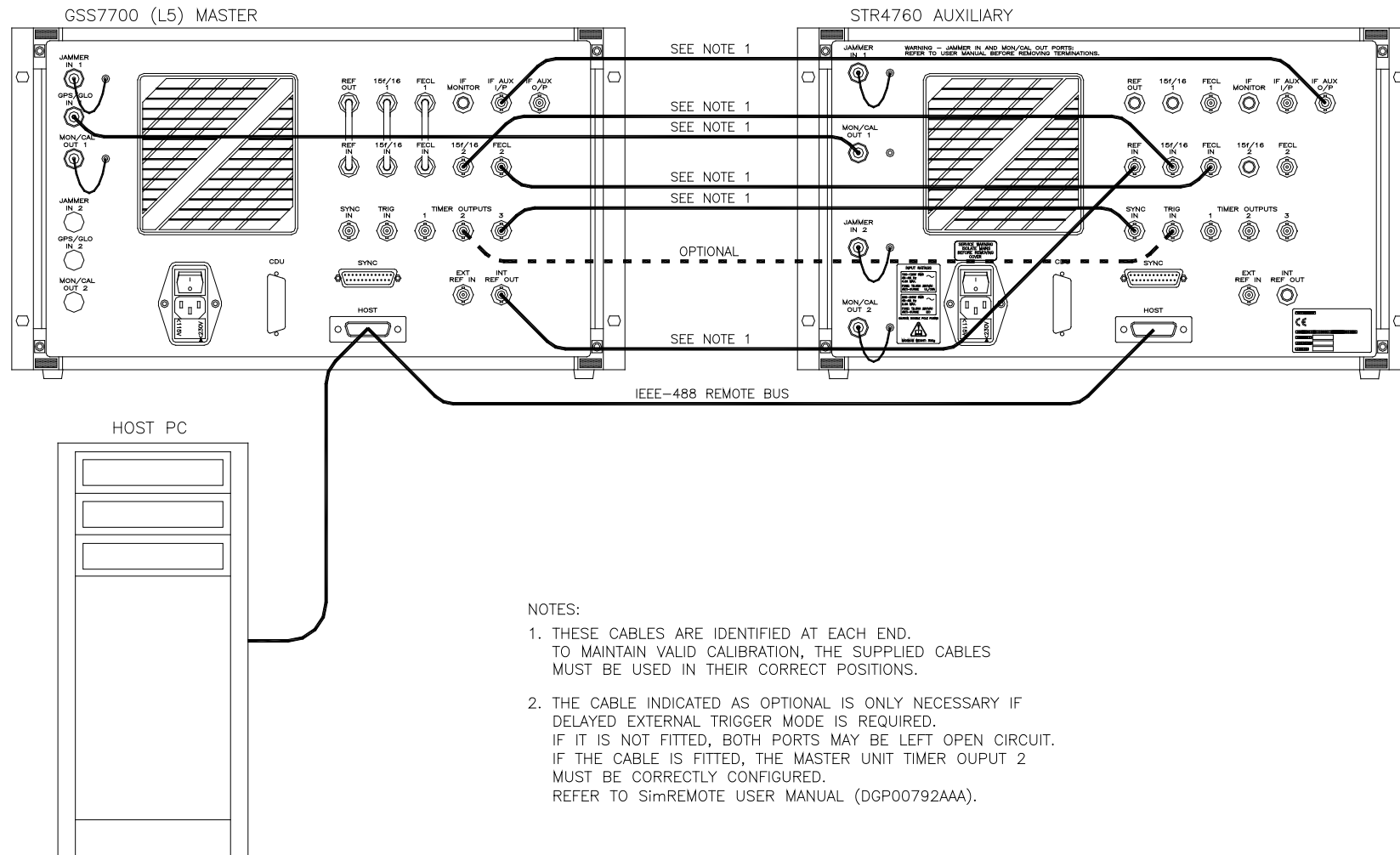
Appendix Figure I-11 GSS7700 L1/L2 dual (variant B) + GSS7700 L1/L2 (variant A)



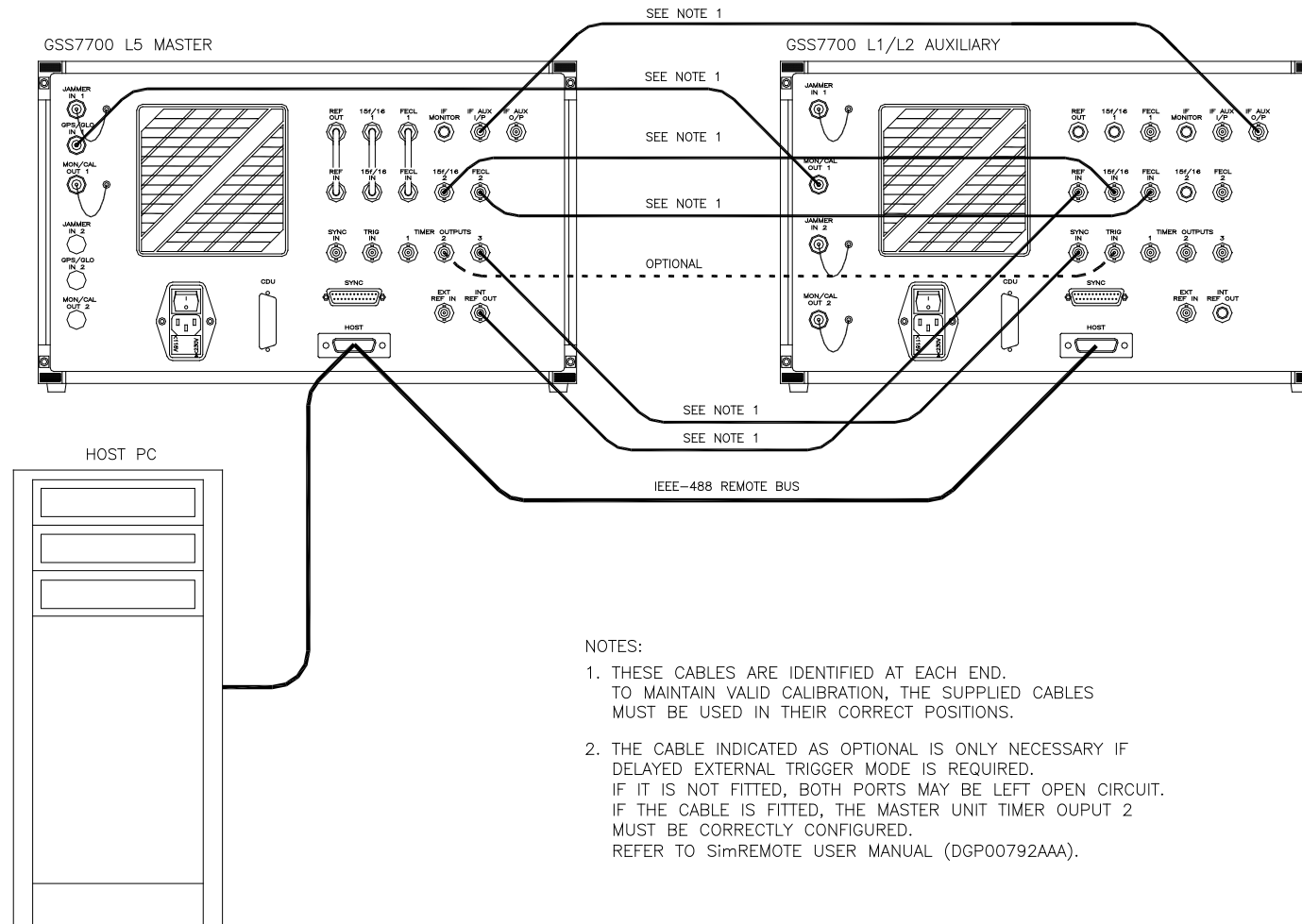
Appendix Figure I-12 GSS7700 dual L1/L2 (variant B) + GSS7700 L1/L2 (variant B)

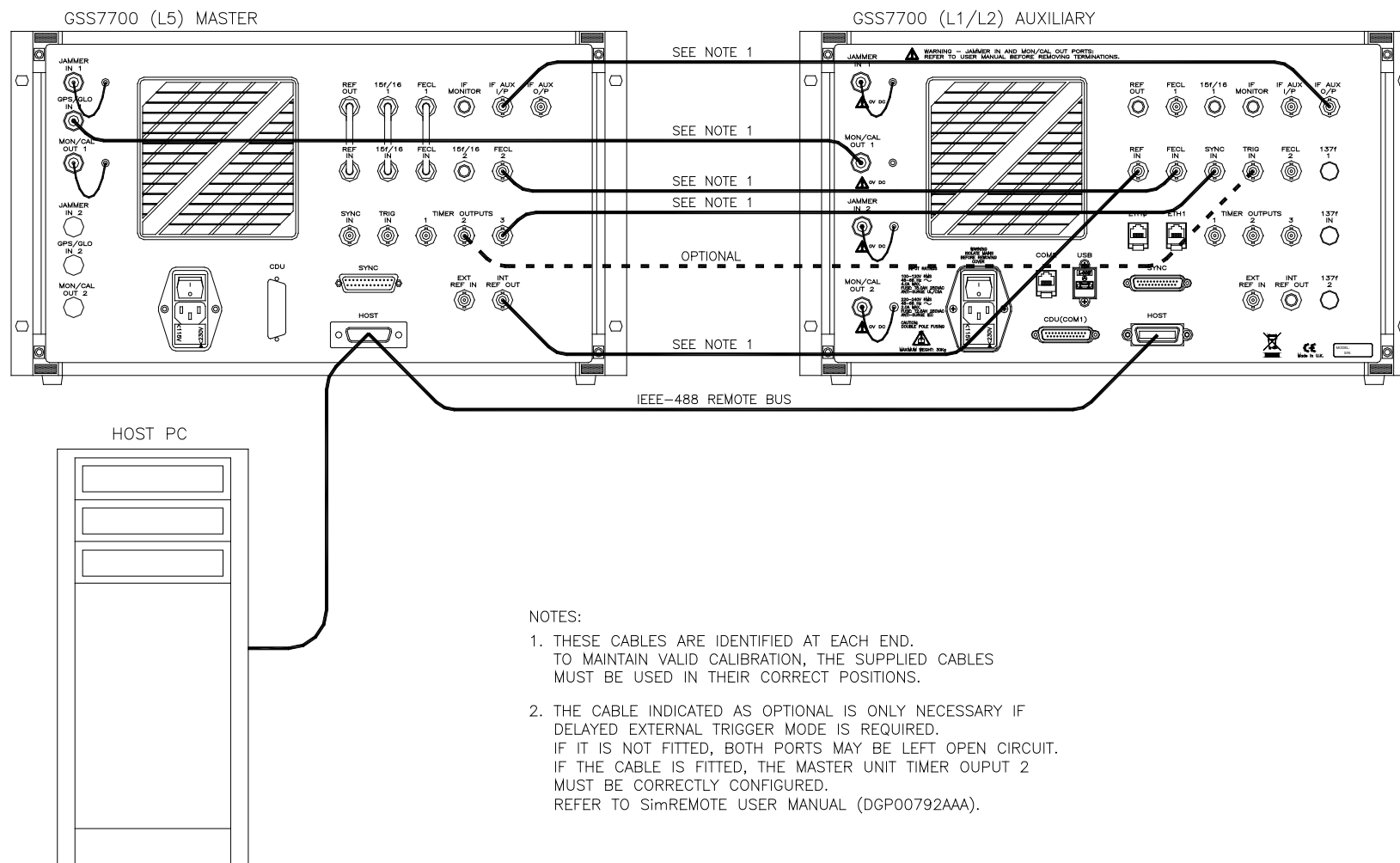


Appendix Figure I-13 GSS7700 L5 dual (variant A) + STR4760

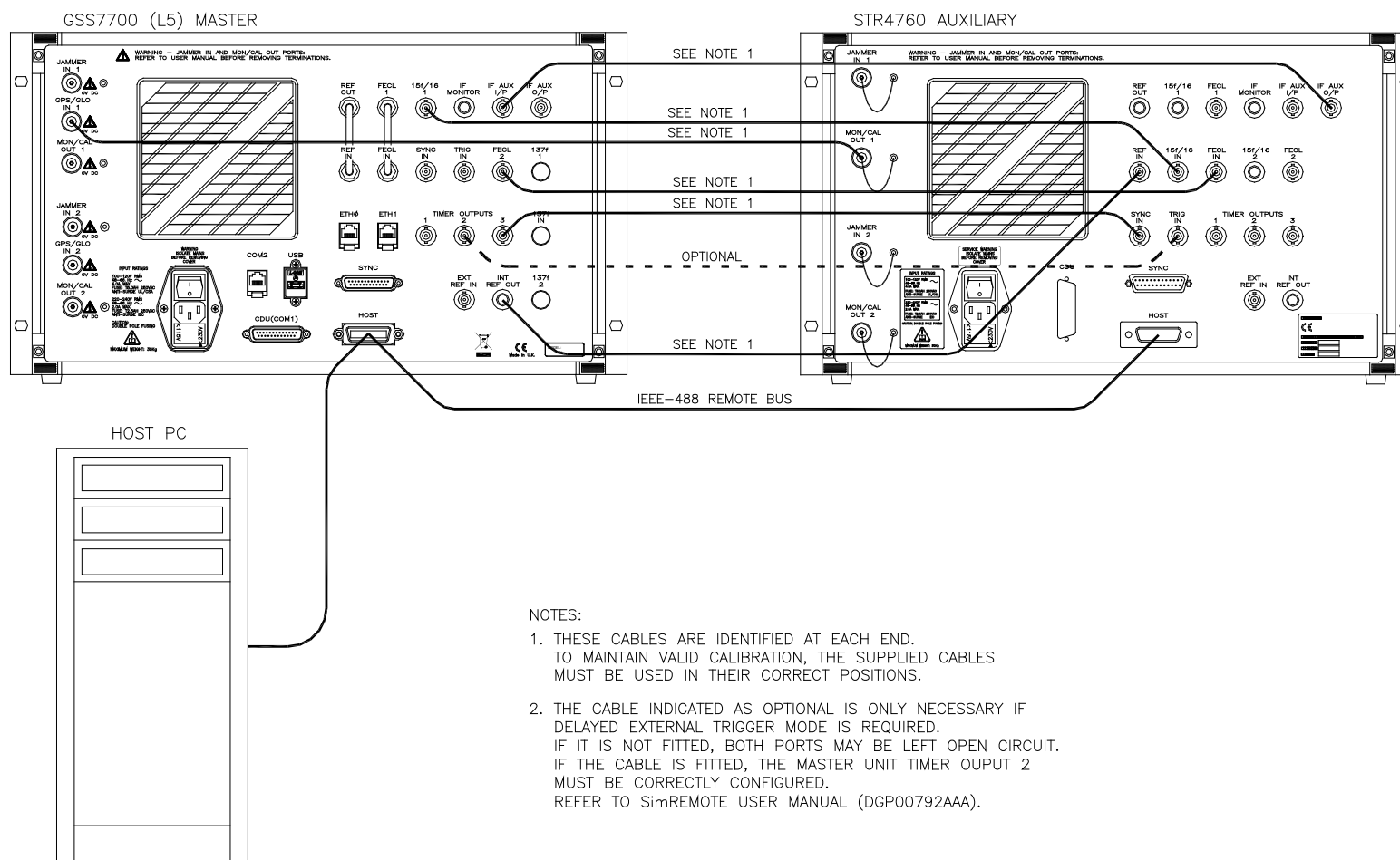


Appendix Figure I-14 GSS7700 L5 dual (variant A) + GSS7700 L1/L2 (variant A)

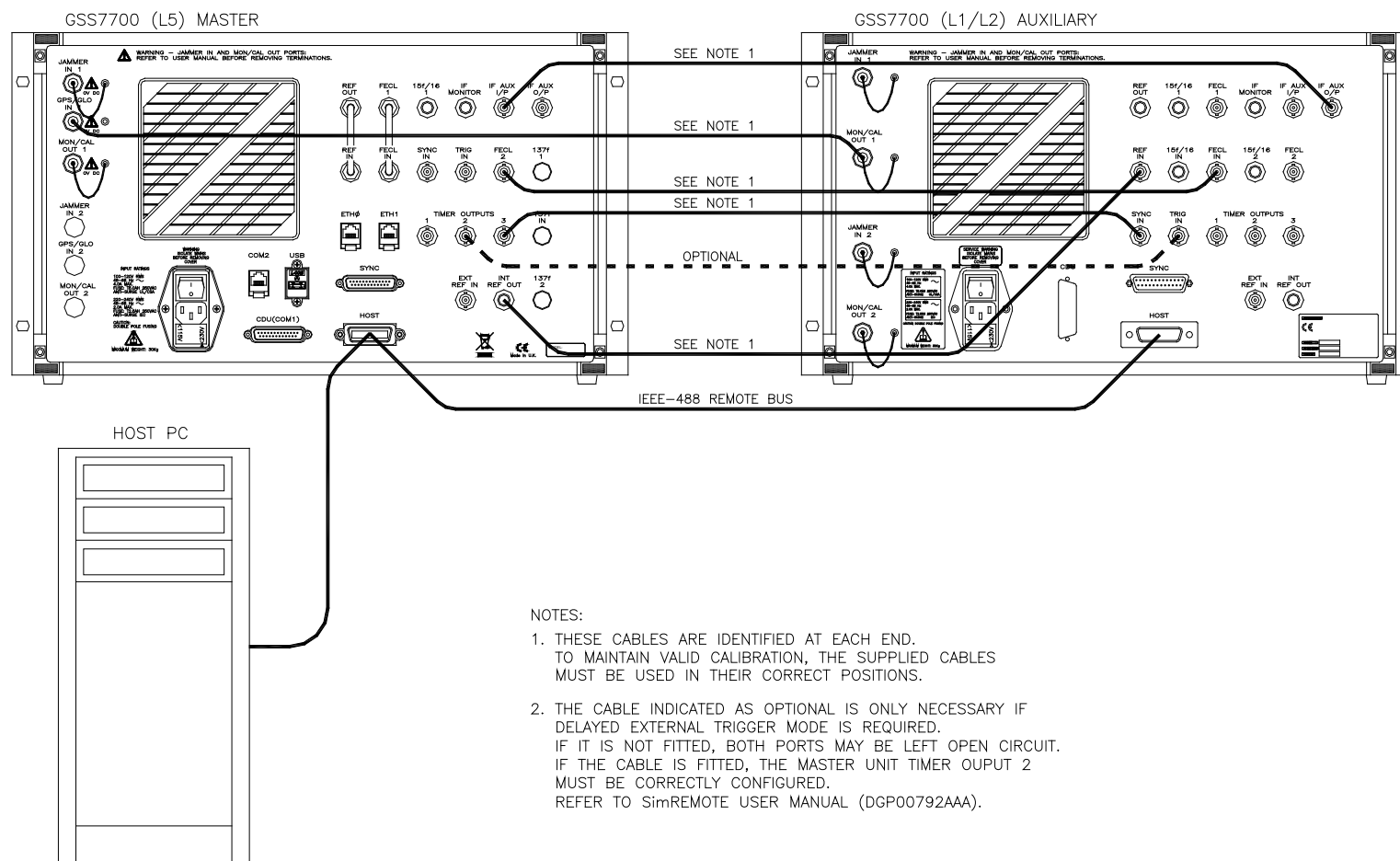


Appendix Figure I-15 GSS7700 L5 dual (variant A) + GSS7700 L1/L2 (variant B)


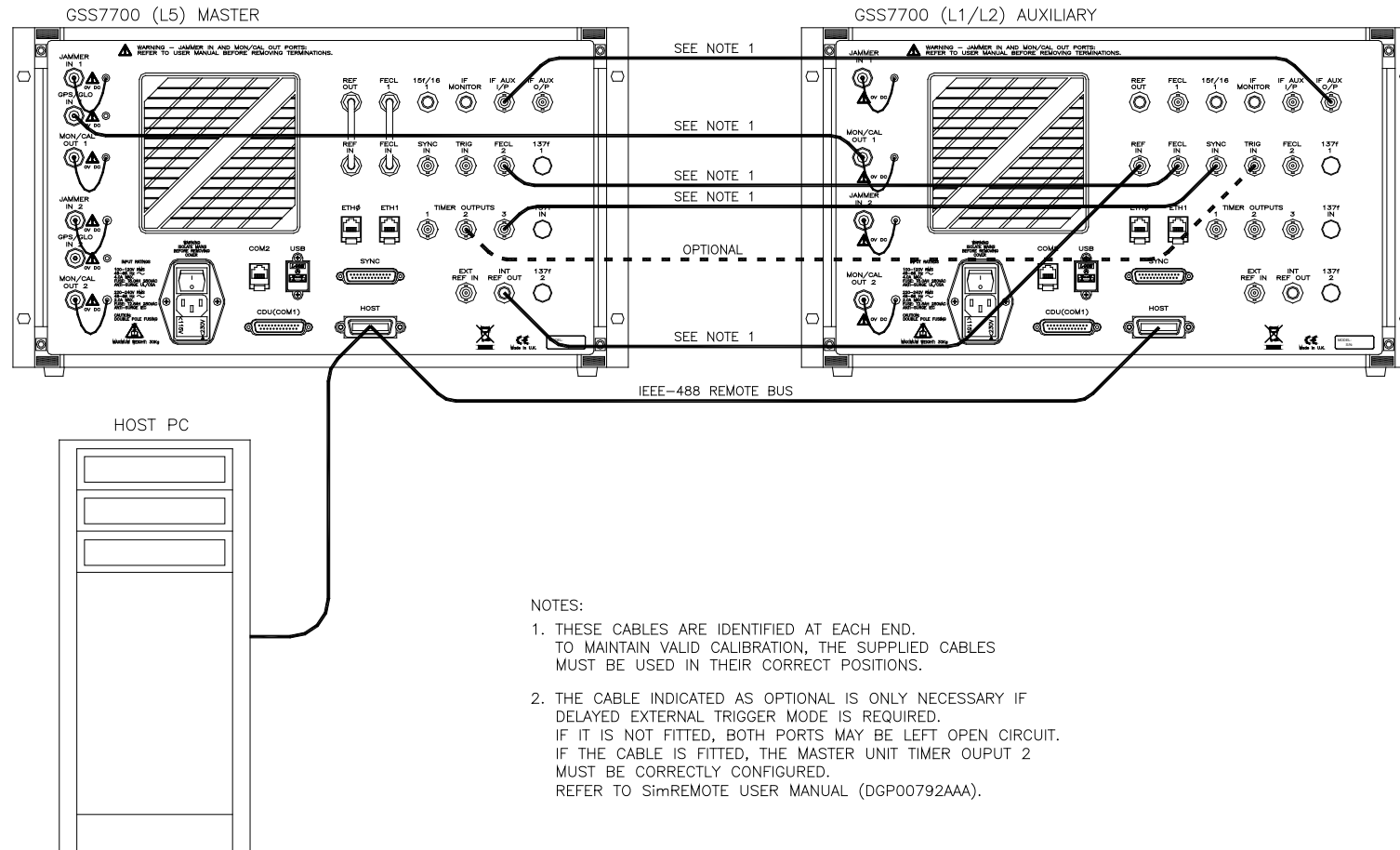
Appendix Figure I-16 GSS7700 L5 dual (variant B) + STR4760



Appendix Figure I-17 GSS7700 L5 dual (variant B) + GSS7700 L1/L2 (variant A)

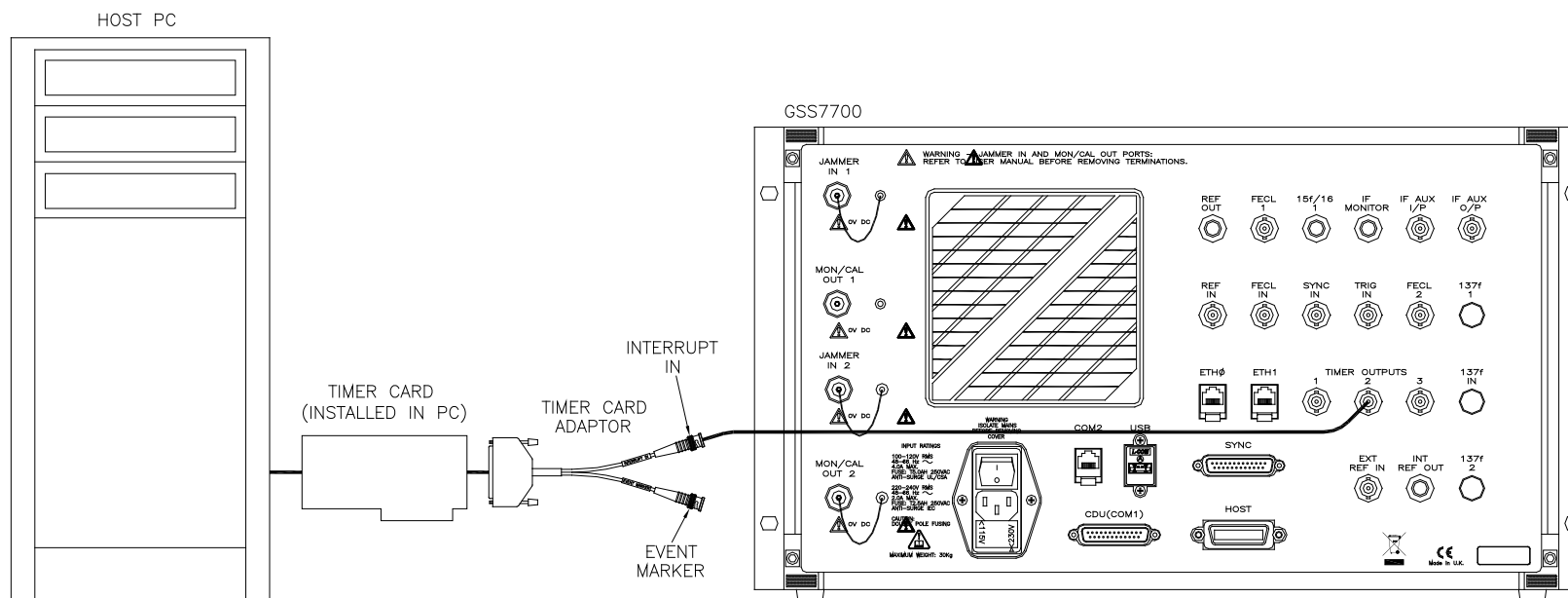


Appendix Figure I-18 GSS7700 L5 dual (variant B) + GSS7700 L1/L2 (variant B)



Appendix Figure I-19 GSS7700 (Variant B) - interconnects for optional 250 Hz iteration rate

Note: Contact Spirent about the possibility of operating your GSS7700 (Variant B) at an iteration rate of 250 Hz (4 ms).



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J GSS7800

Notes:

- 1) From SimGEN v2.70, Spirent supplied the SimGEN PC for the GSS7800 fitted with a timer card to provide a hardware pulse used for the 250 Hz (4 ms) iteration rate. Contact Spirent for details on upgrading existing simulators.
- 2) The GSS7800 Galileo signal generator supports Galileo's Open Service. To use the Galileo Open Service, you may need to upgrade the FPGA release and/or firmware version of each signal generator card installed in your signal generator, see reference c).
- 3) You must be an authorised user to use Galileo's Commercial, Safety of Life or Public Regulated Services. Users of SimGEN up to version 2.90 must use the dongle Spirent supplies. Users of SimGEN version 2.91 onwards must remove any Galileo dongle and, before using these Galileo services, install the licence file Spirent supplies onto their SimGEN Controller.

This chapter describes hardware features of the GSS7800 Galileo signal generator.

References g) and l) are appendices to the SimGEN user manual that describe using SimGEN with those Galileo carriers.

The GSS7800 covers the Galileo L1/E1/E5 carriers. For reference, Appendix Table J-1 compares GPS and Galileo frequencies.

Features of the GSS7800:

- Up to 16 channels (L1/E1/E5, depending on installed options)
- Enhanced built-in test and monitoring
- Soft Master/Auxiliary switching ("multi-box" configurations)
- Soft configuration of timer outputs and external reference frequency

Appendix Table J-1 GPS and Galileo frequencies

Parameter	Description
GPS	
f	10.23 MHz
154f	L1
120f	L2
115f	L5
Galileo	
f	10.23 MHz
154f	L1
116.5f	E1
125f	E5

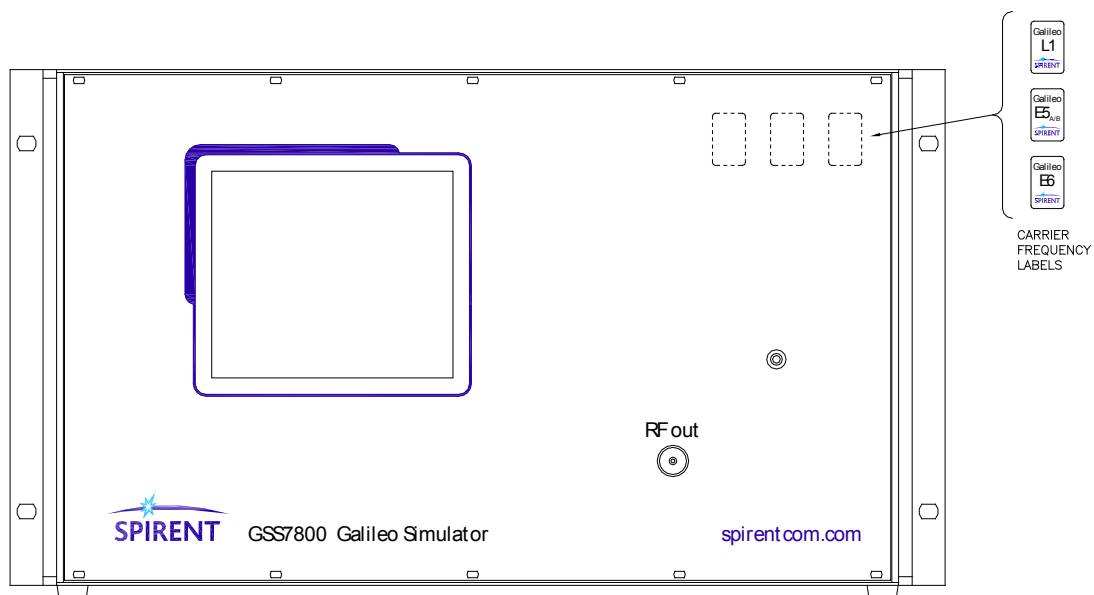
Parameter	Description
Both	
LO	137f
IF	17f

J.1 Front panel

Note: Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

The Front Panel features are the front panel display, and the RF out connector, see Appendix Figure J-1

Appendix Figure J-1 GSS7800 front panel



J.1.1 Front panel display

The front panel display is a 25 x 54 character, backlit, monochrome LCD that displays information about the hardware configuration.

When the signal generator is running, the display shows some parameters relating to signal dynamics for each signal generation channel.

While running, the display backlight is permanently on. When the signal generator has been idle for a short time, the backlight will turn off to preserve backlight life. You can manually switch on the backlight using the command LCDP1, sent using the SimGEN IEEE String Send Utility, see reference c)

Appendix Figure J-2 shows a typical front panel display.

Note: The right-hand side of the display alternately shows data for E5 and E6 every 6 seconds.

Appendix Figure J-2 GSS7800 front panel display

```

12L1 +12E1 +12E5          < SYSTEM BITE MESSAGES >44°C
GPIB1  CFG02M  S/N 2000    < SYSTEM INFO MESSAGES >
CH PRN VELOCITY LEVEL CODE  PRN VELOCITY LEVEL CODE
 1  2      300  20.0      .  2      300  20.0  E1+
 2  7      170  18.1 L1+ .  7      170  18.1  E1+
 3  9      440  10.0 L1+ .  9      440  10.0  E1+
 4 13      669  09.5 L1+ . 13      669  09.5  E1+
 5 15     -170  10.3 L1+ . 15     -170  10.3  E1+
 6 18      230  10.3 L1+ . 18      230  10.3  E1+
 7
 8 23     -232  10.4 L1+ . 23     -232  10.4  E1+
 9 27      567  10.9 L1+ . 27      567  10.4  E1+
10 29      998  10.7 L1+ . 29      998  10.7  E1+
11 31     -786  10.6 L1+ . 31     -786  10.6  E1+
12 32     -501  10.5 L1+ . 32     -501  10.5  E1+
13
14
15
16
TOW 403199 SUN 10:39:10.0      Bank 2 12E1
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

After 6 seconds, the right-hand side of the display shows E6 data:

```

12L1 +12E1 +12E5          < SYSTEM BITE MESSAGES >44°C
GPIB1  CFG02M  S/N 2000    < SYSTEM INFO MESSAGES >
CH PRN VELOCITY LEVEL CODE  PRN VELOCITY LEVEL CODE
 1  2      300  20.0      .  2      300  20.0  E5+
 2  7      170  18.1 L1+ .  7      170  18.1  E5+
 3  9      440  10.0 L1+ .  9      440  10.0  E5+
 4 13      669  09.5 L1+ . 13      669  09.5  E5+
 5 15     -170  10.3 L1+ . 15     -170  10.3  E5+
 6 18      230  10.3 L1+ . 18      230  10.3  E5+
 7
 8 23     -232  10.4 L1+ . 23     -232  10.4  E5+
 9 27      567  10.9 L1+ . 27      567  10.4  E5+
10 29      998  10.7 L1+ . 29      998  10.7  E5+
11 31     -786  10.6 L1+ . 31     -786  10.6  E5+
12 32     -501  10.5 L1+ . 32     -501  10.5  E5+
13
14
15
16
TOW 403199 SUN 10:39:10.0      Bank 2 12E5
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

After a further 6 seconds the right-hand side reverts to E5 data.

Note: These images may not reflect the images you see on a GSS7800 LCD

When you first switch on the signal generator, the LCD can remain blank for up to four minutes (typically less than two minutes).

The paragraphs below describe the fields you can see in Appendix Figure J-2.

nnL1 + nnE5 + nnE6

The number of signal generator channels available. Appendix Figure J-2 shows 36 channels.

Note: The LCD shows Galileo frequency L1 as E1.

In tri-frequency operation, this field displays **nnL1** for the L1 channels, and **nnE5** for the E5 channels and **nnE6** for the E6 channels.

SYSTEM BITE MESSAGES

Notes

1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Appendix Table J-2 details conditions that may persist for longer than 60 seconds.

2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

These messages relate to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Appendix Table J-2 GSS7800 major system BITE messages

Message	Description
No message	Hardware operating normally Modulator oven(s) are at operating temperature. External reference standard not connected.
Oven 1 / Oven 2 / Oven 3	Modulator ovens are not at operating temperature. Do not perform phase calibration. If this message persists, maintenance support is required to remedy the fault. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications. Note: It is normal for this message to persist for up to 10 minutes after switching on the signal generator, depending on ambient temperature.
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
137F unlocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator. Note: Galileo L1 capable signal generators only.
2nd LO UnLocked	Fault in the 2nd local oscillator circuit. Maintenance support will be required to remedy this fault. Under this fault condition, you cannot use the signal generator. Note: Galileo E5 capable signal generators only.

Message	Description
3rd LO UnLocked	Fault in the 3rd local oscillator circuit. Maintenance support will be required to remedy this fault. Under this fault condition, you cannot use the signal generator.
17F UnLocked	Fault in the IF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F ALC	Fault in the circuit maintaining the level of the IF local oscillator. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F LEVEL	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F REF	Fault in the 10.23 MHz clock oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator
1s TICK	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

n°C

The internal temperature of the signal generator, in degrees C.

Appendix Figure J-2 shows the internal temperature as 44°C.

The generator will automatically shut down if the temperature rises above 100°C.

Note: *Oven BITE messages replace n °C*

GPIB n

The GPIB (IEEE-488) address of the signal generator

CFGna

n The current signal generator configuration. Some currently defined configurations are:

- 1 L1+L1+L1 Master
- 2 L1+E1+E5 Master
- 3 L1+E5 Auxiliary
- 4 L1+E1 Auxiliary

a shows configuration as Master (M) or Auxiliary (A).

Note: *Currently only Master operation is supported.*

S/Nn

The signal generator serial number

SYSTEM INFO MESSAGE**CH**

Channel number

PRN

PRN code being simulated.

Blank for halted channel or channel not present.

VELOCITY

Velocity being simulated.

Blank for halted channel or channel not present.

Note: Under a fault condition channel BITE is displayed in the 'VELOCITY' field.

While displaying simulated velocity, or the field is blank, BITE is OK

BITE 01 PSU monitor alarm

BITE 02 Clock monitor Alarm

LEVEL

Power level being generated relative to nominal.

Range ± 20 dB with respect to nominal levels.

Blank for halted channel or channel not present.

CODE

Appendix Table J-3 shows all codes the LCD can display.

Appendix Table J-3 GSS7800 signal generator - code details

Note: For Galileo E1, the order of codes B and C shows the CBOC status.

Galileo E1	Details	Galileo E5	Details	Galileo E6	Details
E1+	An+B+C+i or else any combination of:	E5+	E5a+E5b+f+i or else any combination of:	E6+	An+B+C+c or else any combination of:
AnBC + gi	Possible codes and data (CBOC off)	E5aIQbI Q + fi	Possible codes and data	AnbBcC + cg	Possible codes and data
AnCB + gi	Possible codes and data (CBOC on)				
CODES		CODES		CODES	
A	A component (PRS)	E5aIQ	E5a	A	A component (PRS)
An	A-Noise (PRS-Noise)	E5bIQ	E5b	An	A noise (PRS-Noise)
B	B component			B	B component
C	C component			b	encrypted B
				C	C component
				c	encrypted C
+	separator	+	separator	+	separator

Galileo E1	Details	Galileo E5	Details	Galileo E6	Details
DATA		DATA		DATA	
g	G/Nav	f	F/Nav	c	C/Nav
i	I/Nav	i	I/Nav	g	G/Nav

TOW

Time of week in one second epochs since start of Galileo week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F/

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

J.1.2 RF out connector

Note: Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

The RF Out connector is a type 'N' coaxial connector. It is the normal connection point for the Galileo receiver under test. For details, see the product specification in Table 2-3. Normally, these power levels are:

L1 carrier	0 dB level -132 dBm, range ± 20 dB
E5 carrier	0 dB level -132 dBm, range ± 20 dB
E5ab carrier	0 dB level -132 dBm, range ± 20 dB

Each RF output port is internally DC isolated see the product specification in Table 2-3. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

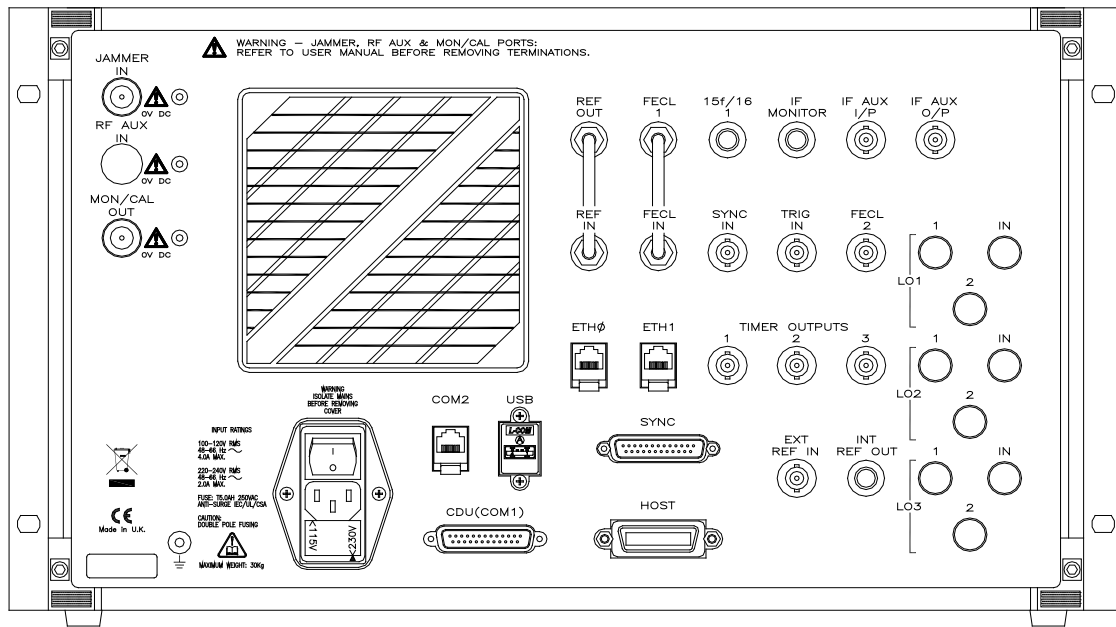
J.2 Rear panel

Appendix Table J-4 details the main rear panel features shown in Appendix Table J-4

Appendix Table J-4 Rear panel features of GSS8000-series signal generators

Port	Described in section
Mains power inlet	J.2.1
Communication ports	J.2.2
Auxiliary signal ports	0
MON/CAL port	J.2.4
Jammer Port	J.2.5
Cooling fan	J.2.6

Appendix Figure J-3 GSS7800 Rear Panel



Depending on the configuration, Spirent may fit blanking plugs to ports labelled LO2 and LO3, instead of connectors.

J.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS7800 at 100-120 V or 220-240 V AC 50-60 Hz

Note: The mains power input switches automatically between 100-120 V and 220-240 V operation. If the mains voltage selector on the mains inlet is incorrectly set, no damage will occur.

This signal generator uses dual-pole/Neutral fusing (a fuse of the same type and rating is fitted to both the phase and neutral lines). The rating label, located next to the mains inlet, gives the fuse ratings your signal generator uses. The mains voltage determines the value of the fuses used in some signal generators. If your signal generator uses fuses whose value depends on the mains voltage, Spirent recommends you correctly set the mains voltage selector to indicate the value of the mains fuses fitted.

If you need to change mains supply voltage, refer to the rating label for the fuse types and ratings you must use. If you need to change the fuses, always fit the same type of fuse to both the phase and Neutral lines. The mains fuses are

located immediately adjacent to the mains inlet in a slide-out module that can take either 20 mm x 5 mm or 1¼ x ¼ inch fuses.

J.2.2 Communication ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) HOST port is an IEEE-488 compatible port used to download information from the SimGEN controller or Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

J.2.3 Auxiliary signal ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

- 1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product specification for your signal generator, see Table 2-3.
- 2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR, 15f/16 1 and INT REF OUT.
- 3) Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

The Auxiliary Signal ports comprise 16 BNC connectors. Make connections according to the appropriate installation diagram see section J.6. You can also use these ports for calibration, maintenance and diagnostic purposes, when instructed by Spirent engineers.

Appendix Table J-5 details the rear panel input and output ports.

Appendix Table J-5 GSS7800 rear panel input and output ports

Port	Description
REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
REF OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.

Port	Description
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 1, 2 or 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone GSS7800 signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1
TIMER OUTPUT 3	As Timer Output 1

J.2.4 MON/CAL port

Notes:

1) The MON/CAL OUT and RF Out connectors are DC isolated; , however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

2) To maintain power level accuracy at the RF Out port when the MON/CAL OUT port is not in use, fit the terminations supplied with the signal generator to the MON/CAL OUT port.

3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a load with a VSWR higher than 1.2. This is only an issue if both front panel and MON/CAL OUT ports are in use simultaneously.

Use the MON/CAL OUT port to monitor the Galileo signal at a level approximately 45 dB higher than the front panel, mainly for calibration purposes. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

You can access the Galileo signal at this port.

J.2.5 Jammer Port

Note:

1) The port is not DC isolated. Applying DC to this port can damage your signal generator. Spirent recommends you use a suitable DC block.

2) To maintain power level accuracy at the RF Out port when the JAMMER IN port is not in use, fit the terminations supplied with the signal generator to the JAMMER IN port.

3) Spirent do not guarantee the power level at the front panel to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

J.2.6 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

The cooling fan blows air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

The signal generator will automatically shut down if its internal temperature exceeds a pre-determined value. If this happens, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

J.3 Calibration

Table 2-3 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

J.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product specification see Table 2-3. Refer to the product specification for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

J.5 Lifting the signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

J.6 Interconnection

Notes:

- 1) *The IEEE-488 card in the PC is card #1 if your signal generator has the IEEE remote control option.*
- 2) *The Ethernet cable shown in Appendix Figure J-4 is for firmware upgrades. Refer to the information Spirent send with the firmware upgrade kit.*
- 3) *Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.*

Systems using GSS8000-series signal generators need an IEEE-488 cable connection from the “Host” socket on the rear panel to the IEEE-488 card (identified as card #0) in the PC.

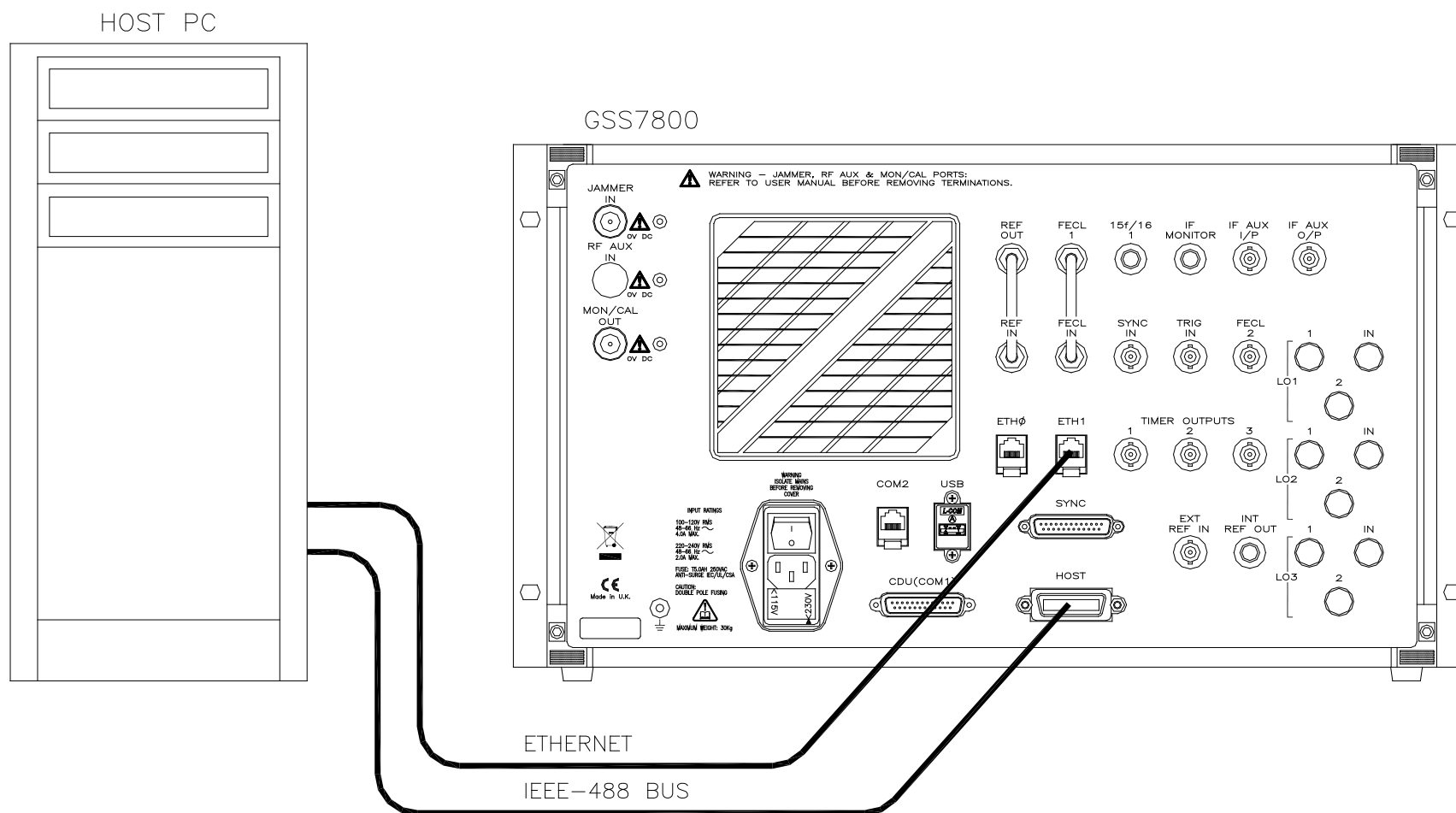
This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Appendix Figure J-4 to Appendix Figure J-7.

Correctly position and tighten all cables and terminations.

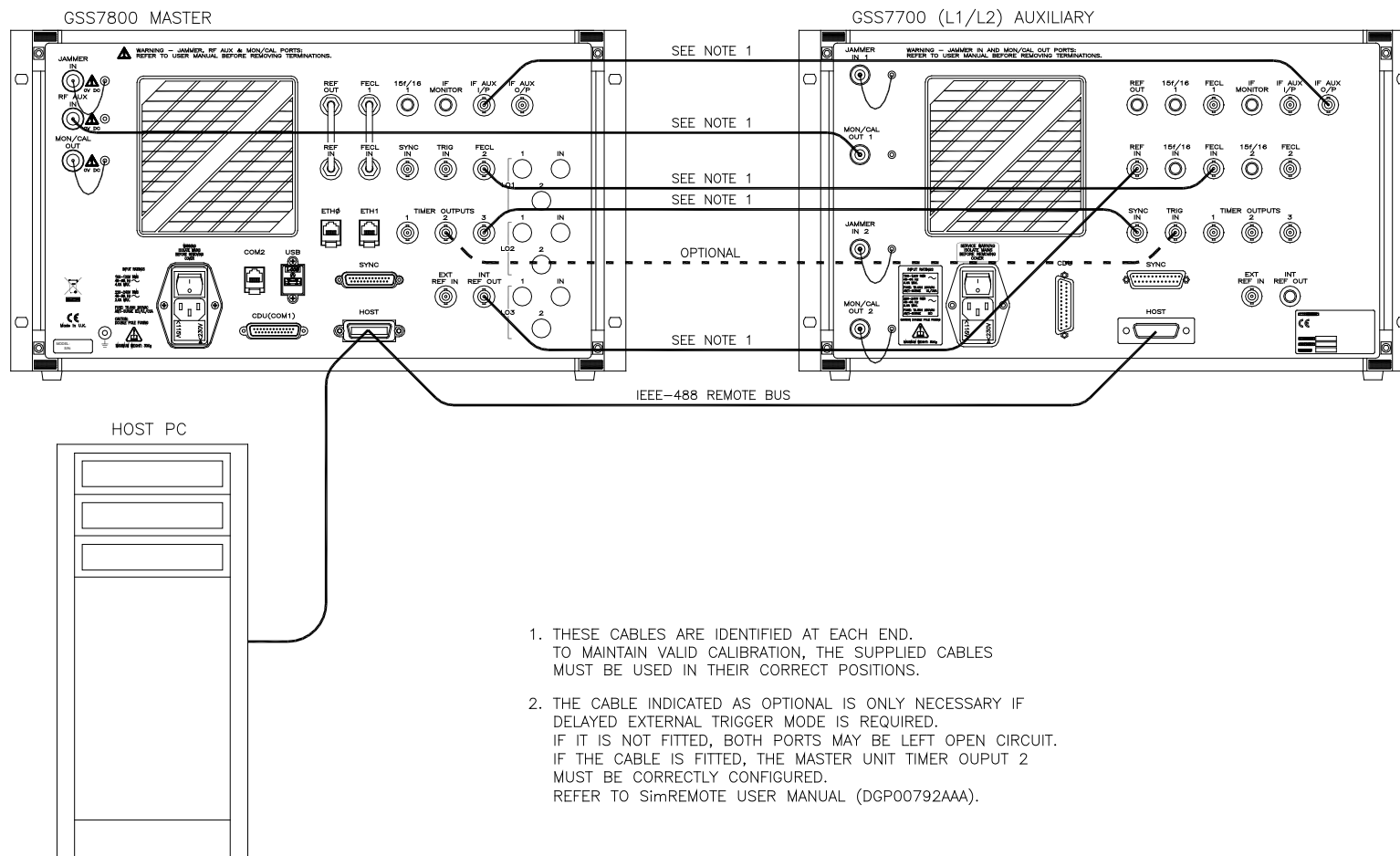
Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.
- b) Switch on the signal generator
- c) Switch on the PC

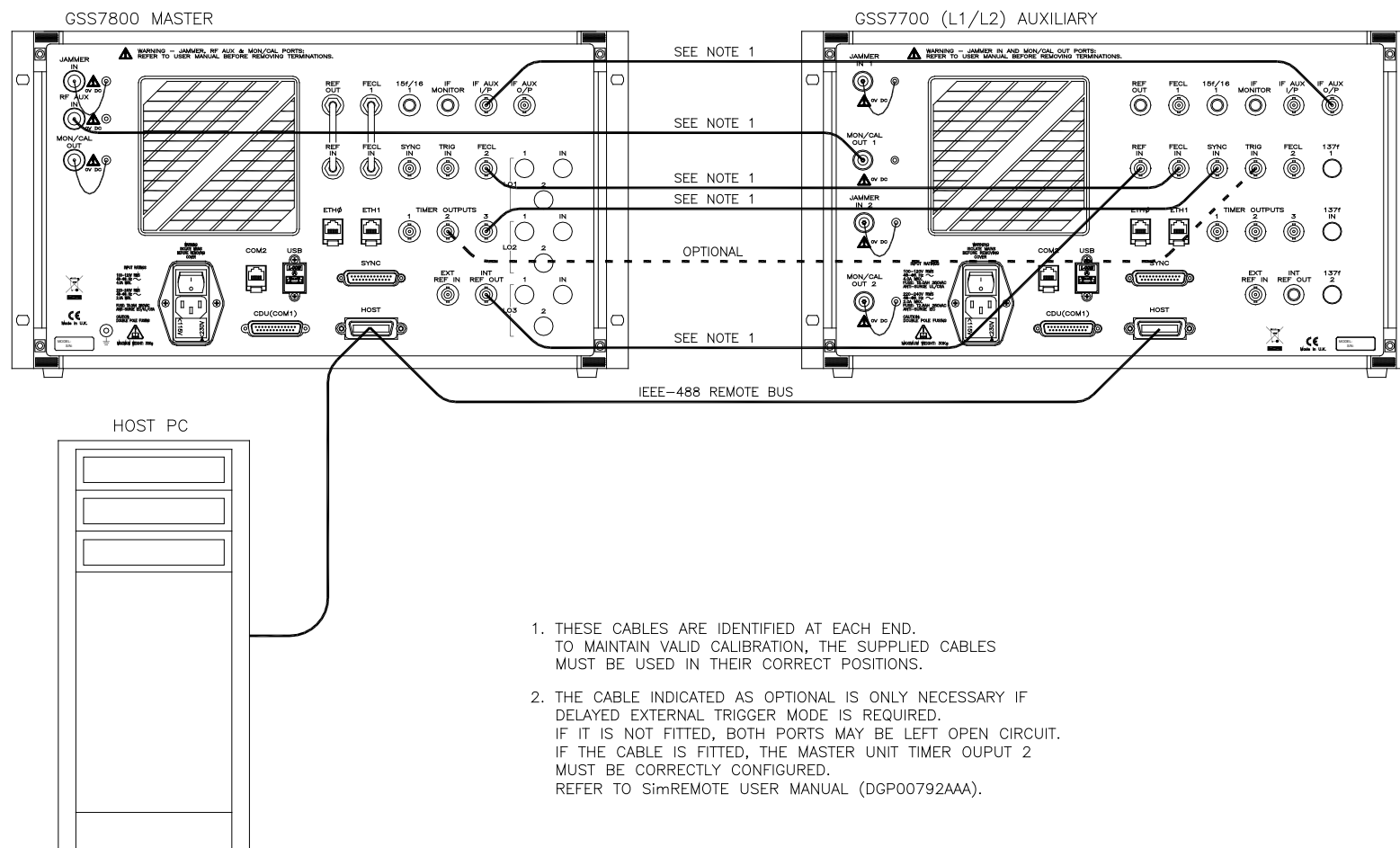
Appendix Figure J-4 GSS7800 interconnect



Appendix Figure J-5 GSS7800 + GSS7700 (Variant A)



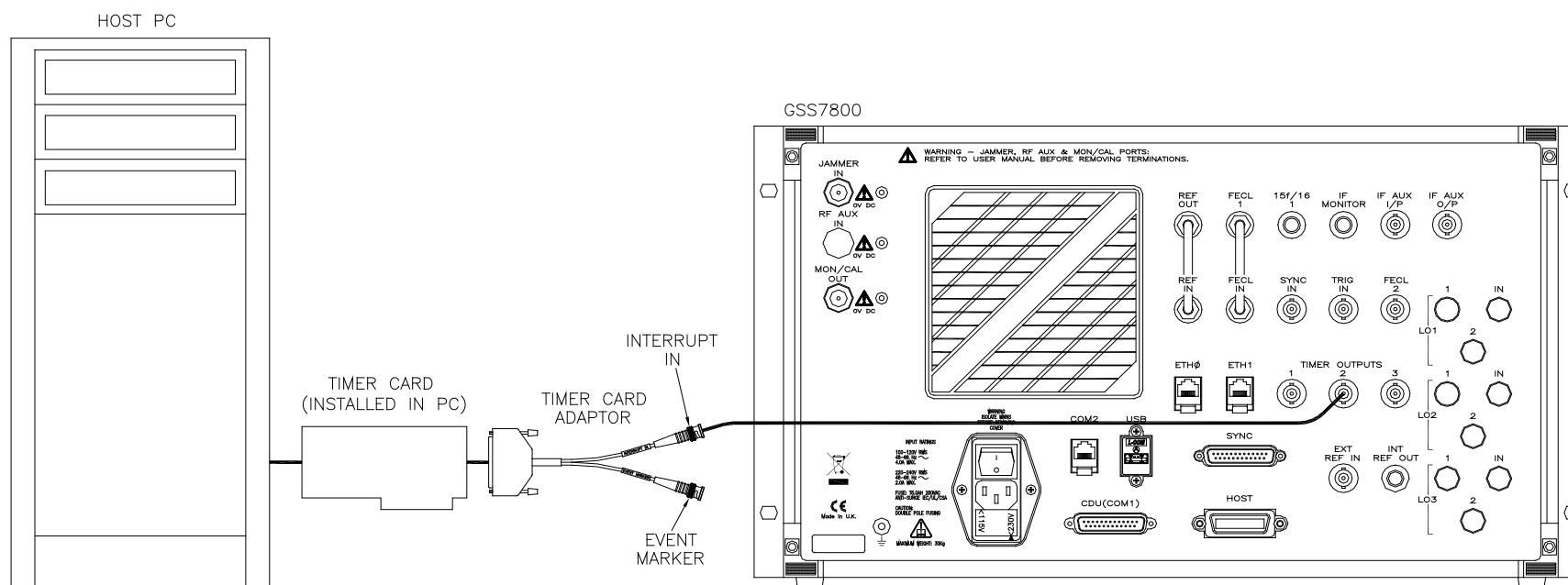
Appendix Figure J-6 GSS7800 + GSS7700 (Variant B)



Appendix Figure J-7 GSS7800 - interconnects for 250 Hz iteration rate

Notes:

- 1) Contact Spirent about the possibility of operating your GSS7800 at an iteration rate of 250 Hz (4 ms).
- 2) See reference e) for details on:
 - a) Using the **Interrupt In** connector
 - b) Setting the Timer output when you use **Interrupt In**
 - c) Using the **Event Marker** connector
 - d) Two-box operation, which can use a Timer output from the Auxiliary signal generator



K GSS7900

Notes:

1) From SimGEN v2.70, Spirent supplied the SimGEN PC for the GSS7900 fitted with a timer card. This card provided a hardware pulse used for the 250 Hz (4 ms) iteration rate. Contact Spirent for details on upgrading existing systems.

2) You must be an authorised user to use Galileo's Commercial, Safety of Life or Public Regulated Services. Users of SimGEN up to version 2.90 must use the dongle Spirent supplies. Users of SimGEN version 2.91 onwards must remove any Galileo dongle and, before using these Galileo services, install the licence file Spirent supplies onto their SimGEN Controller.

This chapter describes hardware features of the GSS7900 GPS and Galileo signal generator.

An appendix to the SimGEN user manual describes the differences that apply when using GSS7900 to simulate Galileo carriers.

References g) and l) are appendices to the SimGEN user manual that describe using SimGEN with those Galileo carriers.

The GSS7900 covers the L1 / E1 (GPS / Galileo) and the L1/E1/E5 (GPS / Galileo / Galileo) carriers. For reference, Appendix Table K-1 compares GPS and Galileo frequencies.

Features:

- Up to 16 channels (L1/E1/E5, depending on installed options)
- Enhanced built-in test and monitoring.
- Soft configuration of timer outputs and external reference frequency.

Appendix Table K-1 GPS and Galileo frequencies

Parameter	Description
GPS	
f	10.23 MHz
154f	L1
120f	L2
115f	L5
Galileo	
f	10.23 MHz
154f	L1
116.5f	E1
125f	E5
Both	
LO	137f

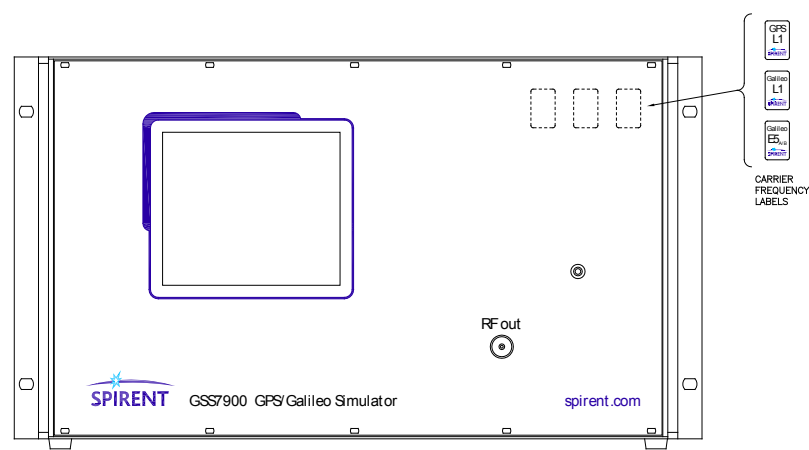
Parameter	Description
IF	17f

K.1 Front panel

Note: Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

The main front panel features are the front panel display, and the RF Out connector, see Appendix Figure K-1.

Appendix Figure K-1 GSS7900 front panel



K.1.1 Front panel display

Note: The right-hand side of the display alternately shows data for E1 and E5 every 6 seconds.

The front panel display is a 25 x 54 character, backlit LCD. It displays information about the hardware configuration.

When the signal generator is running, the LCD displays parameters relating to signal dynamics for each signal generation channel.

The LCD backlight remains on while the signal generator is running. When the signal generator has been idle for around 5 minutes, the backlight will turn off. You can turn on the backlight by sending the command LCDP1 using the IEEE String Send Utility, see reference c).

Appendix Figure K-2 shows a typical front panel display.

Appendix Figure K-2 GSS7900 front panel display

```

12L1 +12E1 +12E5          < SYSTEM BITE MESSAGES >44°C
GPIB1  CFG02M  S/N 2000    < SYSTEM INFO MESSAGES >
CH PRN VELOCITY LEVEL CODE  PRN VELOCITY LEVEL CODE
 1  2      300  20.0      .  2      300  20.0  E1+
 2  7      170  18.1 L1+ .  7      170  18.1  E1+
 3  9      440  10.0 L1+ .  9      440  10.0  E1+
 4 13      669  09.5 L1+ . 13      669  09.5  E1+
 5 15     -170  10.3 L1+ . 15     -170  10.3  E1+
 6 18      230  10.3 L1+ . 18      230  10.3  E1+
 7
 8 23     -232  10.4 L1+ . 23     -232  10.4  E1+
 9 27      567  10.9 L1+ . 27      567  10.4  E1+
10 29      998  10.7 L1+ . 29      998  10.7  E1+
11 31     -786  10.6 L1+ . 31     -786  10.6  E1+
12 32     -501  10.5 L1+ . 32     -501  10.5  E1+
13
14
15
16
TOW 403199 SUN 10:39:10.0      Bank 2 12E1
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

After 6 seconds, the right-hand side of the display shows E5 data (if fitted):

```

12L1 +12E1 +12E5          < SYSTEM BITE MESSAGES >44°C
GPIB1  CFG02M  S/N 2000    < SYSTEM INFO MESSAGES >
CH PRN VELOCITY LEVEL CODE  PRN VELOCITY LEVEL CODE
 1  2      300  20.0      .  2      300  20.0  E5+
 2  7      170  18.1 L1+ .  7      170  18.1  E5+
 3  9      440  10.0 L1+ .  9      440  10.0  E5+
 4 13      669  09.5 L1+ . 13      669  09.5  E5+
 5 15     -170  10.3 L1+ . 15     -170  10.3  E5+
 6 18      230  10.3 L1+ . 18      230  10.3  E5+
 7
 8 23     -232  10.4 L1+ . 23     -232  10.4  E5+
 9 27      567  10.9 L1+ . 27      567  10.4  E5+
10 29      998  10.7 L1+ . 29      998  10.7  E5+
11 31     -786  10.6 L1+ . 31     -786  10.6  E5+
12 32     -501  10.5 L1+ . 32     -501  10.5  E5+
13
14
15
16
TOW 403199 SUN 10:39:10.0      Bank 2 12E5
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>
<<DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F>>

```

After a further 6 seconds, the right-hand side reverts to E1 data.

Note: These images may not reflect the images you see on a GSS7900 LCD

When you first switch on the signal generator the LCD can remain blank for up to four minutes (typically less than two minutes).

The paragraphs below describe the fields you can see in Appendix Figure K-2.

nnL1 + nnE1 + nnE5

The number of signal generator channels available. Appendix Figure K-2 shows 36 channels.

Note: The LCD shows Galileo frequency L1 as E1.

In tri-frequency operation, this field displays **nnL1** for the L1 channels, and **nnE1** for the E1 channels and **nnE5** for the E5 channels.

SYSTEM BITE MESSAGES

Notes

1) Some BITE conditions may persist up to 60 seconds after switching on the signal generator. Appendix Table K-2 details conditions that may persist for longer than 60 seconds.

2) The LCD shows BITE messages in sequence when more than one BITE condition is active.

These messages relate to phase lock, power level, timing, and status of various hardware modules within the signal generator.

Appendix Table K-2 GSS7900 major system BITE messages

Message	Description
No message	Hardware operating normally Modulator oven(s) are at operating temperature. External reference standard not connected.
Oven 1 / Oven 2 / Oven 3	Modulator ovens are not at operating temperature. Do not perform phase calibration. If this message persists, maintenance support is required to remedy the fault. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications. Note: It is normal for this message to persist for up to 10 minutes after switching on the signal generator, depending on ambient temperature.
ExtRef UnLocked	Two possible reasons: 1) The signal generator internal oscillator has drifted from 10.23 MHz. Measure oscillator frequency at the rear panel connector 10.23 MHz OUT. If necessary, follow appropriate calibration procedure. 2) Internal reference PLL has not locked to the external frequency standard. If the message persists for longer than 60 seconds after connecting the external reference source, check the reference frequency is ± 0.1 ppm and its power level is > -10 dBm.
ExtRef Locked	The internal reference PLL is locked to the external reference standard.
137F unlocked	Fault in the RF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator. Note: GPS / Galileo L1 capable signal generators only.
3rd LO UnLocked	Fault in the 3rd local oscillator circuit. Maintenance support will be required to remedy this fault. Under this fault condition, you cannot use the signal generator. Note: GPS L1 / Galileo E1 / E5 capable signal generators only.

Message	Description
17F UnLocked	Fault in the IF local oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
15F16 UnLocked	Fault in the 15/16f oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator.
17F ALC	Fault in the circuit maintaining the level of the IF local oscillator. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F LEVEL	Fault in the reference oscillator circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications
F REF	Fault in the 10.23 MHz clock oscillator circuit. Maintenance support is required. Under this fault condition, you cannot use the signal generator
1s TICK	Fault in the timing circuit. Maintenance support is required. Although you may be able to use the signal generator, Spirent does not guarantee operation within published specifications

n°C

The internal temperature of the signal generator, in degrees C.

Appendix Figure K-2 shows the internal temperature as 44°C.

The generator will automatically shut down if the temperature rises above 100°C.

Note: *Oven BITE messages replace n °C*

GPIB n

The GPIB (IEEE-488) address of the signal generator

CFGna

n The current signal generator configuration Some currently defined configurations are:

- 1 L1 + E1 Master
- 2 L1 + E1 + E5 Master

a shows configuration as Master (M) or Auxiliary (A).

Note: *Currently only Master operation is supported.*

S/Nn

The signal generator serial number

<SYSTEM INFO MESSAGE>**CH**

Channel number

PRN

PRN code being simulated.

Blank for halted channel or channel not present.

VELOCITY

Velocity being simulated.

Blank for halted channel or channel not present.

Note: Under a fault condition channel BITE is displayed in the 'VELOCITY' field.

While displaying simulated velocity, or the field is blank, BITE is OK

BITE 01 PSU monitor alarm

BITE 02 Clock monitor Alarm

LEVEL

Power level being generated relative to nominal.

Range ± 20 dB with respect to nominal levels.

Blank for halted channel or channel not present.

CODE

The currently simulated code(s).

Combinations of L1, E1 and E5 can be displayed.

The '+' sign shows Nav Data is being broadcast.

TOW

Time of week in one second epochs since start of GPS week, plus day of week and time of day.

DEBUG AREA ECHOING MESSAGES RECEIVED OVER HOST I/F

Use for debug and diagnostics. Viewing this area gives an indication of activity during long operations, such as Phase Calibration.

K.1.2 RF out connector

Note: Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

The RF Out connector is a type 'N' coaxial connector. It is the normal connection point for the receiver under test. For details, see the product specification in Table 2-3. Normally, these power levels are:

GPS power levels specified at the RF Out connector:

L1 carrier	0 dB level	-130 dBm	Range ± 20 dB
------------	------------	----------	-------------------

Galileo power levels specified at the RF Out connector:

L1 carrier	0 dB level	-132 dBm	Range ± 20 dB
E5 carrier	0 dB level	-132 dBm	Range ± 20 dB

Each RF output port is internally DC isolated see the product specification in Table 2-3. You can directly connect receivers with DC present on their RF inputs without damaging the signal generator.

K.2 Rear panel

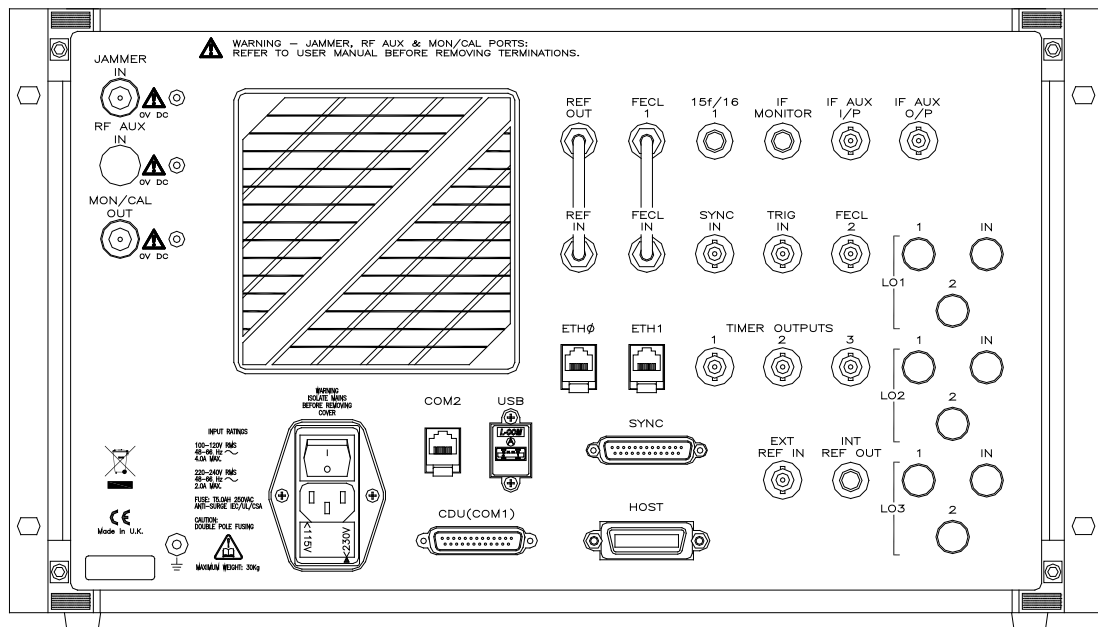
Appendix Figure K-3 and Appendix Table K-3 describe the rear panel of the GSS7900GSS8000-series.

Appendix Table K-3 Rear panel features of GSS8000-series signal generators

Port	Described in section
Mains power inlet	0
Communication ports	K.2.2
Auxiliary signal ports	0

Port	Described in section
MON/CAL port	K.2.4
Jammer Port	K.2.5
Cooling fan	K.2.6

Appendix Figure K-3 GSS7900 Rear Panel



Depending on the configuration, Spirent may fit blanking plugs to ports labelled LO2 and LO3, instead of connectors.

K.2.1 Mains power inlet

SAFETY WARNING



You must connect this signal generator to mains earth (ground)

Completely isolate mains power by removing the plug from the mains socket, which should be close to the signal generator and readily accessible

Do not operate this signal generator with any panel removed



NOTICE

Wait 10 seconds before re-applying mains power to avoid blowing the mains fuses

You can operate the GSS7900 at 100-120 V or 220-240 V AC 50-60 Hz

Note: The mains power input switches automatically between 100-120 V and 220-240 V operation. If the mains voltage selector on the mains inlet is incorrectly set, no damage will occur.

This signal generator uses dual-pole/Neutral fusing (a fuse of the same type and rating is fitted to both the phase and neutral lines). The rating label, located next to the mains inlet, gives the fuse ratings your signal generator uses. The mains voltage determines the value of the fuses used in some signal generators. If your signal generator uses fuses whose value depends on the mains voltage, Spirent recommends you correctly set the mains voltage selector to indicate the value of the mains fuses fitted.

If you need to change mains supply voltage, refer to the rating label for the fuse types and ratings you must use. If you need to change the fuses, always fit the same type of fuse to both the phase and Neutral lines. The mains fuses are located immediately adjacent to the mains inlet in a slide-out module that can take either 20 mm x 5 mm or 1¼ x ¼ inch fuses.

K.2.2 Communication ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

The Communication Ports take the form of these multi-way connectors:

- a) HOST port is an IEEE-488 compatible port used to download information from the SimGEN controller or Host PC.
- b) The SYNC port is not used
- c) The CDU port is a debug monitor port, RS232 compatible, for use by Spirent service engineers.

K.2.3 Auxiliary signal ports



SAFETY WARNING

Ensure connections to these ports are within the SELV limits of EN60950

Notes:

- 1) For successful lock, the frequency of the signal you apply to EXT REF IN must be as shown in the product specification for your signal generator, see Table 2-3.
- 2) When not in use, fit 50 Ohm terminations to the ports IF MONITOR and INT REF OUT.
- 3) Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

The Auxiliary Signal ports comprise 16 BNC connectors, used as input or output ports. These ports may also be used for calibration, maintenance and diagnostic purposes, as instructed by Spirent.

Connect your system according to the appropriate installation diagram in section K.5. Depending on the specific configuration, some of the connectors may not be used. Appendix Table K-4 details the rear panel input and output ports.

Appendix Table K-4 GSS7900 rear panel input and output ports

Port	Description
REF IN	A 50 Ohm input port for an external frequency standard. The input frequency is soft configurable for 1 MHz, 1.023 MHz, 5 MHz, 10 MHz, 10.23 MHz, or 15.75 MHz. The factory default is 10 MHz; contact Spirent for details on reconfiguring. Input level -10 to +10 dBm, Frequency tolerance ± 0.1 ppm.
REF OUT	A 50 Ohm output port for the internal frequency reference oscillator. The nominal output level is +10 dBm. Nominal frequency is 10.23 MHz ± 0.1 Hz.
SYNC IN	Use to synchronise to external systems.
TRIGGER IN	Trigger a simulation from the rising edge of an external trigger signal. Input is TTL level compatible: -0.5 V < Low < +0.8 V +2.0 V < High < +5.5 V 50 Ohm impedance

Port	Description
TIMER OUTPUT 1	TTL level output capable of driving 50 Ω. Signal levels are: -0.5 V < Low < +0.4 V +2.4 V < High < +5.5 V This output can be programmed to provide any of the following: 100PPS Sync: High time 1 ms, period 10 ms. Rising edge occurs 98 ns after the 10 ms epoch in GPS time. 10PPS Sync: High time 1 ms, period 100 ms. Rising edge occurs 98 ns after the 100 ms epoch in GPS time. 1PPS Sync: High time 100 ms, period 1 s. Rising edge synchronised with 1 s epochs in GPS time. Update: High time 195.5 ns (2 p-chips), Period: 1, 2 or 4 ms. All velocity changes occur at the mid-point of the pulse. In addition, any of the above can be set to: Ungated: continuously running; or Gated: only present while a scenario is running. As shipped, the default timer settings for a stand-alone GSS7900 signal generator are: Timer1: 1PPS Timer 2: Gated 1PPS Timer 3: 1PPS Note: You can change Timer outputs using SimGEN. However, certain hardware configurations (mainly multi-box configurations) may become invalid. If you are in doubt, contact Spirent before changing Timer outputs.
TIMER OUTPUT 2	As Timer Output 1
TIMER OUTPUT 3	As Timer Output 1

K.2.4 MON/CAL port

Note:

- 1) The MON/CAL OUT port is DC isolated.
- 2) To maintain power level accuracy at the RF Out port when the MON/CAL OUT port is not in use, fit the terminations supplied with the signal generator to the MON/CAL OUT port.
- 3) When you use the RF Out connector and the MON/CAL OUT port simultaneously, the power level at the RF Out connector is not guaranteed to be within specification if you connect a load with a VSWR higher than 1.2 to the RF Out connector.

Use the MON/CAL OUT port to monitor the GPS/Galileo signal at a level approximately 45 dB higher than the front panel connector, mainly for calibration purposes. Spirent calibrates the exact difference in level between the MON/CAL OUT port and the RF Out connector for each signal generator. This data is available on request.

K.2.5 Jammer Port

Note:

- 1) *The port is not DC isolated. Applying DC to this port can damage your signal generator. Spirent recommends you use a suitable DC block.*
- 2) *The power level at the RF out connector is not guaranteed to be within specification if you connect a source with a VSWR higher than 1.2 to the JAMMER IN port.*

Use the JAMMER IN port to combine an external interfering signal with the signal present at the front panel. The power loss between the JAMMER IN port and the corresponding front panel port is approximately 15 dB.

K.2.6 Cooling fan



NOTICE

Failure to keep the filters clean can result in permanent damage to the signal generator. Periodically wash the fabric dust filter (if fitted) in clean water.

The cooling fan blows air into the signal generator, which vents through one side panel. Do not cover or restrict the inlet or outlets – overheating may result in severe and permanent damage. A removable dust filter is fitted to the inlet. Periodically remove the filter and wash it in clean water. The inspection interval will depend upon the environment in which the signal generator is situated. Spirent recommends carrying out monthly examinations to determine a suitable interval.

The signal generator will automatically shut down if its internal temperature exceeds a pre-determined value. If this happens, verify the fan filter is clean and the cooling air inlet and outlets are clean and unobstructed.

K.3 Calibration

Table 2-3 details the Customer Calibration specification, which includes calibration of:

- a) Reference Clock Frequency
- b) Carrier Breakthrough
- c) I/Q Balance
- d) RF Level Control

K.4 Connectivity and specifications

The SimGEN installation CD contains the latest issue of the Spirent product specification see Table 2-3. Refer to the product specification for:

- a) Connectivity details
- b) Performance specification
- c) Accuracy specification
- d) Environmental specification

Lifting the signal generator



CAUTION - HEAVY

The product datasheet, see Table 2-1 and Table 2-2 details the weight of each signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

K.4.1 Lifting the signal generator



CAUTION - HEAVY

The product datasheet, see Table 2-1 and Table 2-2 details the weight of each signal generator

Refer to local and national manual handling legislation before lifting the signal generator. A two-man lift may be required.

When installing or removing the signal generator use the rack extraction grips as aids. Do not use the rack extraction grips to hold or carry the signal generator.

Always support the signal generator from underneath when installing or removing it from a rack.

K.5 Interconnection

Notes:

1) The Ethernet cable shown in Appendix Figure K-4 is for firmware upgrades. Refer to the information Spirent send with the firmware upgrade kit.

2) Some RF ports are DC isolated, however Spirent recommends you ensure that all RF connections to the signal generator are DC isolated using suitable DC blocks.

Systems using GSS8000-series signal generators need an IEEE-488 cable connection from the “Host” socket on the rear panel to the IEEE-488 card (identified as card #0) in the PC.

Note: This IEEE-488 card is card #1 if your signal generator has the IEEE remote control option.

These are the factory default settings. Reference c) describes changing the default settings.

This document provides drawings for basic interconnections of your signal generator to the SimGEN controller or Host PC. For correct operation of your system, see the interconnection drawing Spirent supplies with your simulator and Appendix Figure K-4 to Appendix Figure K-5.

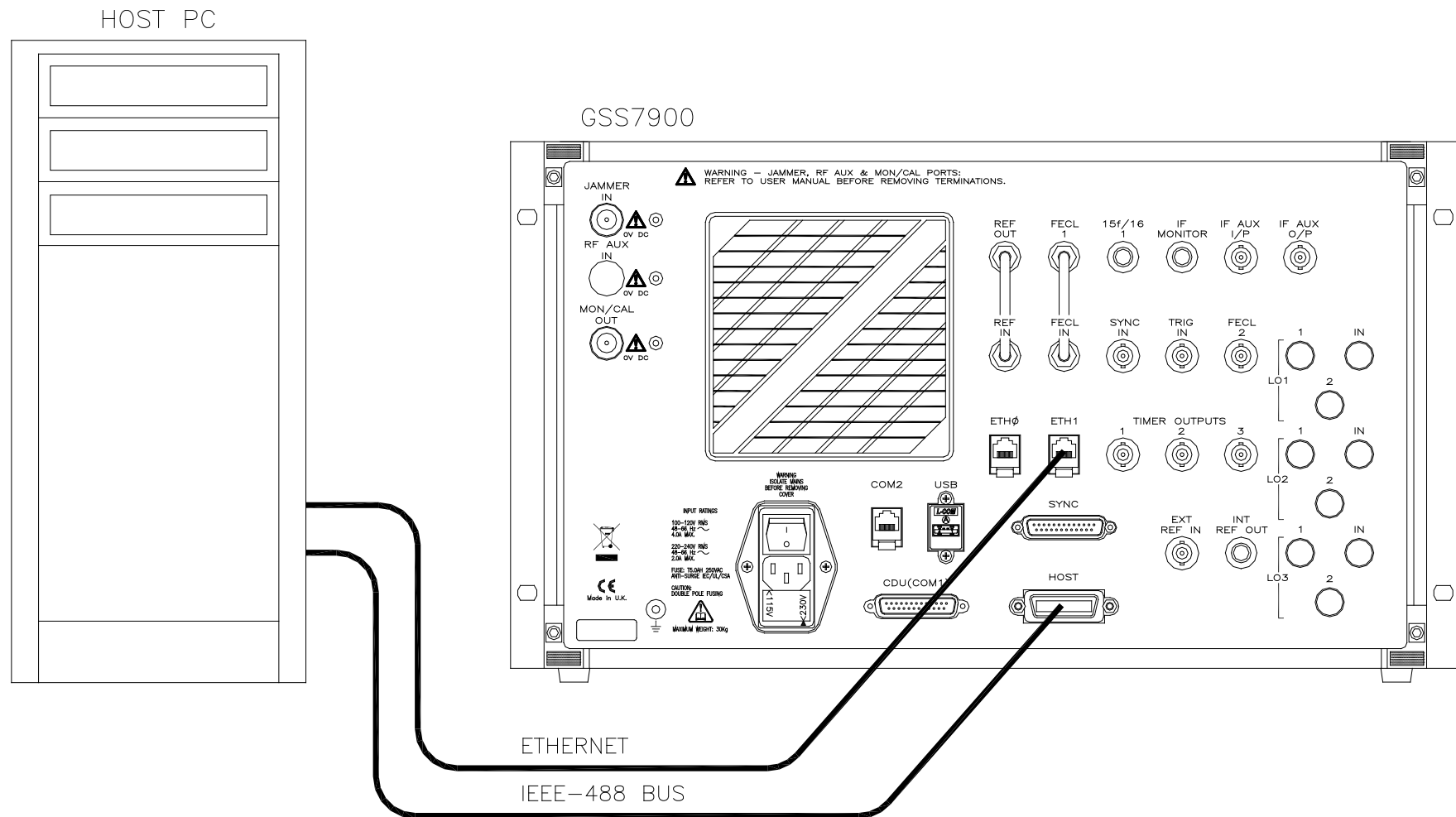
Correctly position and tighten all cables and terminations.

Then:

- a) Use the ac power cable to connect your signal generator to a suitable ac power outlet.

- b) Switch on the signal generator
- c) Switch on the PC

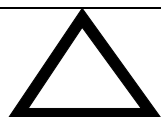
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Appendix Figure K-4 GSS7900 interconnect

L Product safety information sheets

These sections contain the Product Safety Information Sheets for all signal generators in this user manual.

L.1 GSS6560 (superseded)



PRODUCT TITLE : GPS/SBAS SIMULATOR
 PRODUCT CODE : GSS6560
 DATA SHEET No : N/A

PRODUCT SAFETY INFORMATION SHEET

This safety Information Sheet should be read in conjunction with the Product Data Sheet (where applicable).

Failure to observe the ratings and the information on this sheet may result in a safety hazard.

This PSIS applies to the signal generator unit of the simulator only. For information on the computer workstation see safety section of the manufacturer's handbook.

(b) Secondary

Under overload conditions the external finishing paint will burn. Excessive overload/heating of materials will cause emission of toxic gases.

1.MATERIAL CONTENT

This unit contains Printed Circuit Board semi-conductor assemblies. Materials contained within the unit include PTFE, ABS and epoxy/glass laminate.

5.HANDLING

The unit is sensibly robust but dropping or excessive vibration may lead to immediate damage or later component failure with consequent damage. The portable unit weighs 5kg (approx). The unit is supplied in an approved design package to minimise damage in transit.

2.PHYSICAL FORM

The equipment is housed in a vented aluminium enclosure.

Enclosure dimensions are 449mm x 386mm x 89mm Total weight of the Simulator Unit is 5kg (approx).

6.STORAGE

Care should be observed when storing to ensure units cannot be subjected to environmental conditions in excess of those given in the relevant data. Units should not be stored in conditions exceeding the temperature range of -20°C to +60°C.

3.INTRINSIC PROPERTIES

(a) Non-operating

Safe, when isolated from primary power source.

7.DISPOSAL

Disposal of the unit should be in accordance with the toxic waste disposal procedure, current at the time of disposal. Units must not be incinerated due to the presence of PTFE which would emit toxic fumes.

(b) Operating

Removing fixed panels during operation presents an electric shock hazard. Fixed panels may only be removed by suitably qualified personnel. High voltage hazard warning labels are affixed to the outside of the Unit.

8.UNSAFE USE

Electric shock hazard is present if panels are removed during operation. Fire hazard could occur during overload conditions. Replacement fuses should be of the correct rating and type to minimise overload conditions. Toxic fume hazard possible if unit is overheated from internal or external source. Mechanical hazard can occur if the unit is mishandled or incorrectly secured. Under damage conditions do not use.

WARNING: This equipment must be earthed.

4.FIRE CHARACTERISTICS

Primary

Overload conditions could present a fire hazard. The limiting oxygen index value of the glass/epoxy laminate is 25-32. Protection circuits incorporated minimise the overload and/or component failure hazards. The case is vented to minimise heat and gas concentration.

L.2 GSS4150



PRODUCT TITLE : LAAS Signal Generator
 PRODUCT CODE : GSS4150
 DATA SHEET No : N/A

PRODUCT SAFETY INFORMATION SHEET

This safety Information Sheet should be read in conjunction with the Product Data Sheet (where applicable).

Failure to observe the ratings and the information on this sheet may result in a safety hazard.

This PSIS applies to the signal generator unit of the simulator only. For information on the computer workstation see safety section of the manufacturer's handbook.

1.MATERIAL CONTENT

This unit contains Printed Circuit Board semi-conductor assemblies. Materials contained within the unit include PTFE, ABS and epoxy/glass laminate.

2.PHYSICAL FORM

The equipment is housed in a vented aluminium enclosure.

Enclosure dimensions are 449mm x 386mm x 89mm Total weight of the Simulator Unit is 5kg (approx).

3.INTRINSIC PROPERTIES

(a) Non-operating

Safe, when isolated from primary power source.

(b) Operating

Removing fixed panels during operation presents an electric shock hazard. Fixed panels may only be removed by suitably qualified personnel. High voltage hazard warning labels are affixed to the outside of the Unit.

WARNING: This equipment must be earthed.

4.FIRE CHARACTERISTICS

Primary

Overload conditions could present a fire hazard. The limiting oxygen index value of the glass/epoxy laminate is 25-32. Protection circuits incorporated minimise the overload and/or component failure hazards. The case is vented to minimise heat and gas concentration.

(b) Secondary

Under overload conditions the external finishing paint will burn. Excessive overload/heating of materials will cause emission of toxic gases.

5.HANDLING

The unit is sensibly robust but dropping or excessive vibration may lead to immediate damage or later component failure with consequent damage. The portable unit weighs 5kg (approx). The unit is supplied in an approved design package to minimise damage in transit.

6.STORAGE

Care should be observed when storing to ensure units cannot be subjected to environmental conditions in excess of those given in the relevant data. Units should not be stored in conditions exceeding the temperature range of -20°C to +60°C.

7.DISPOSAL

Disposal of the unit should be accordance with the toxic waste disposal procedure, current at the time of disposal. Units must not be incinerated due to the presence of PTFE which would emit toxic fumes.

8.UNSAFE USE

Electric shock hazard is present if panels are removed during operation. Fire hazard could occur during overload conditions. Replacement fuses should be of the correct rating and type to minimise overload conditions. Toxic fume hazard possible if unit is overheated from internal or external source. Mechanical hazard can occur if the unit is mishandled or incorrectly secured. Under damage conditions do not use.

L.3 All other STR/GSS series signal generators



PRODUCT TITLE : MULTI-CHANNEL SIMULATOR
PRODUCT CODE : STR/GSS Series
DATA SHEET No : N/A

PRODUCT SAFETY INFORMATION SHEET

This safety Information Sheet should be read in conjunction with the Product Data Sheet (where applicable).

Failure to observe the ratings and the information on this sheet may result in a safety hazard.

This PSIS applies to the signal generator unit of the simulator only. For information on the computer workstation see safety section of the manufacturer's handbook.

1.MATERIAL CONTENT

This unit contains Printed Circuit Board semi-conductor assemblies. The semi-conductors may utilise Beryllium Oxide.

Materials contained within the unit include PTFE, Nylon 11, PVC and epoxy/glass laminate.

2.PHYSICAL FORM

The equipment is housed in a vented aluminium and steel enclosure.

Enclosure dimensions are 270mm(h) x 540mm(d) x 450mm(w) (approx).
Total weight of the Simulator Unit is 28kg (approx).

3.INTRINSIC PROPERTIES

(a) Non-operating

Safe, when isolated from primary power source.

(b) Operating

Removing fixed panels during operation presents an electric shock hazard. Fixed panels may only be removed by suitably qualified personnel. High voltage hazard warning labels are affixed to the outside of the Unit. The +5V power rail within the unit constitutes an energy hazard (>240VA).

WARNING: This equipment must be earthed.

4.FIRE CHARACTERISTICS

Primary

Overload conditions could present a fire hazard.
The limiting oxygen index value of the glass/epoxy laminate is 25-32.
Protection circuits incorporated minimise the overload and/or component failure hazards.
The case is vented to minimise heat and gas concentration.

(b) Secondary

Under overload conditions the external finishing paint will burn.
Excessive overload/heating of materials will cause emission of toxic gases.

5.HANDLING

The unit is sensibly robust but dropping or excessive vibration may lead to immediate damage or later component failure with consequent damage.

The portable unit weighs 28kg (approx).

Handles on the unit are not for transportation.

The front and rear handles aid removal of the unit from rack assemblies and give panel protection.

Units mounted into a 19 inch rack shall have secure fixings.

The unit is supplied in an approved design package to minimise damage in transit.

6.STORAGE

Care should be observed when storing to ensure units cannot be subjected to environmental conditions in excess of those given in the relevant data.

Units should not be stored in conditions exceeding the temperature range of -20°C to +60°C.

7.DISPOSAL

Disposal of the unit should be in accordance with the toxic waste disposal procedure, current at the time of disposal.

Units must not be incinerated due to the presence of Beryllium Oxide and PTFE which would emit toxic fumes.

The unit contains Lithium cells. Dispose of used batteries in accordance with the manufacturer's instructions.

8.UNSAFE USE

Electric shock hazard is present if panels are removed during operation. Fire hazard could occur during overload conditions. Replacement fuses should be of the correct rating and type to minimise overload conditions.

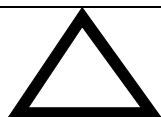
Toxic fume hazard possible if unit is overheated from internal or external source.

Mechanical hazard can occur if the unit is mishandled or incorrectly secured.

Under damage conditions do not use.

The unit contains Lithium cells which are toxic if damaged and exposed. Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer.

L.4 GSS5060 (superseded)



PRODUCT TITLE : GPS LOCATION SIMULATOR
 PRODUCT CODE : GSS5060
 DATA SHEET No : N/A

PRODUCT SAFETY INFORMATION SHEET

This safety Information Sheet should be read in conjunction with the Product Data Sheet (where applicable).

Failure to observe the ratings and the information on this sheet may result in a safety hazard.

This PSIS applies to the signal generator unit of the simulator only. For information on the computer workstation see safety section of the manufacturer's handbook.

1.MATERIAL CONTENT

This unit contains Printed Circuit Board semi-conductor assemblies. Materials contained within the unit include PTFE, ABS and epoxy/glass laminate.

2.PHYSICAL FORM

The equipment is housed in a vented aluminium enclosure.

Enclosure dimensions are 99mm(h) x 345mm(d) x 254mm(w) (approx). Total weight of the Simulator Unit is 5kg (approx).

3.INTRINSIC PROPERTIES

(a) Non-operating

Safe, when isolated from primary power source.

(b) Operating

Removing fixed panels during operation presents an electric shock hazard. Fixed panels may only be removed by suitably qualified personnel. High voltage hazard warning labels are affixed to the outside of the Unit.

WARNING: This equipment must be earthed.

4.FIRE CHARACTERISTICS

Primary

Overload conditions could present a fire hazard. The limiting oxygen index value of the glass/epoxy laminate is 25-32. Protection circuits incorporated minimise the overload and/or component failure hazards. The case is vented to minimise heat and gas concentration.

(b) Secondary

Under overload conditions the external finishing paint will burn. Excessive overload/heating of materials will cause emission of toxic gases.

5.HANDLING

The unit is sensibly robust but dropping or excessive vibration may lead to immediate damage or later component failure with consequent damage. The portable unit weighs 5kg (approx). The unit is supplied in an approved design package to minimise damage in transit.

6.STORAGE

Care should be observed when storing to ensure units cannot be subjected to environmental conditions in excess of those given in the relevant data. Units should not be stored in conditions exceeding the temperature range of -20°C to +60°C.

7.DISPOSAL

Disposal of the unit should be in accordance with the toxic waste disposal procedure, current at the time of disposal. Units must not be incinerated due to the presence of PTFE which would emit toxic fumes.

8.UNSAFE USE

Electric shock hazard is present if panels are removed during operation. Fire hazard could occur during overload conditions. Replacement fuses should be of the correct rating and type to minimise overload conditions. Toxic fume hazard possible if unit is overheated from internal or external source. Mechanical hazard can occur if the unit is mishandled or incorrectly secured. Under damage conditions do not use.

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M Contacting Spirent Global Services

During normal office hours, you can contact Spirent Global Services in the United Kingdom, Asia Pacific and the USA by e-mail, fax or telephone. The Global contact details are on the next page.

Spirent Global can provide general information on any aspect of Spirent simulator hardware or software; or they can answer specific questions. Spirent Global is available to all customers under Warranty or with a maintenance agreement. Please note that Spirent Global is available to customers without a maintenance agreement, but Spirent is not obliged to provide solutions to any customer without a maintenance agreement.

Spirent Global aims to respond (or, where necessary, initiate a System Report) to any query within one working day (local and national holidays permitting).

Spirent requests you tell them when your simulator behaves in an unexpected, unusual or unacceptable way; including suspected faults or errors in the hardware, software or documentation.

Spirent's fault reporting system will ensure Global can quickly return your simulator to normal working operation. After contacting Spirent Global to report a fault, Global staff will create a System Report (SR) and copy you with the SR reference number. Spirent Global request you use the SR reference number in all correspondence relating to that incident. All responses from Spirent in relation to your incident will contain the SR reference number.

When you first contact Spirent Applications Support to report a fault, please provide the following information:

- ✓ Your name
- ✓ Your e-mail address
- ✓ Your telephone or fax number
- ✓ The types and version numbers of your Spirent software
- ✓ The serial number of your signal generator (located on rear panel)
- ✓ A comprehensive description of the incident

Where appropriate, provide:

- ✓ A copy of the [executable filename]_message_log.txt file
- ✓ Copies of your scenario files, including all shared files.
- ✓ Provide a separate list, as a plain text (*.txt) file, of all files you send Spirent.
- ✓ Details of the repeatability of the incident
- ✓ Details of changes to your system, including any new software added and all upgrades (including Windows, new hardware, new drivers, Spirent software and so on)

This will enable a swift response and improve the service to you.

Spirent Global contact details:

In the US, Government/Contractors and Universities

Spirent Federal Systems, Inc.

1402 W. State Road,
Pleasant Grove
Utah
84062
USA

Tel: +1 801 785 1448
Fax: +1 801 785 1294
E-mail: help@spirentfederal.com

In the US Commercial, and rest of Americas

Spirent Communications Inc

541 Industrial Way West
Eatontown, NJ 07724
USA

Tel: 1.800.SPIRENT
Fax: +1 732 544-8347
E-mail: support@spirent.com

Asia Pacific (All Positioning Customers)

Spirent Communications,

Shining Tower, No. 35, Xueyuan Road,
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Beijing 100083,
China

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Tel (Toll free mainland China): 4008109529
Tel (Outside mainland China): +86 4008109529
Fax: +86 1082330022
E-mail: help_asia@spirent.com

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Paignton,
Devon
TQ4 7QR
United Kingdom

Contact Applications Support:
Tel: + 44 1803 546333
Fax: + 44 1803 546302
E-mail: help@spirent.com

Go to <http://support.spirent.com> for access to Spirent's Global , FAQ and document databases.

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Signal Generator Hardware User Manual

Hardware Platforms for the Spirent range of Navigation Simulator Products

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