NSG 9000

Universal EdgeQAM

HW and Installation User's Guide

VERSION 1.5 & UP

NSG 9000

Rev C

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Conventions

NOTE: The Note symbol calls your attention to additional information that you will benefit from heeding. It may be used to call attention to an especially important piece of information you need, or it may provide additional information that applies in only some carefully delineated circumstances.

TIP: The Tip symbol calls your attention to parenthetical information that is not necessary for performing a given procedure, but which, if followed, might make the procedure or its subsequent steps easier, smoother, or more efficient.

In addition to these symbols, this manual uses the following text conventions:

- `Data Entry`: indicates text you enter at the keyboard.
- User Interface: indicates a button to click, a menu item to select, or a key or key sequence to press.
- `Screen Output:` shows console output or other text that is displayed to you on a computer screen.
- **Bold**: indicates the definition of a new term.
- *Italics*: used for emphasis, cross-references, and © 2009 Harmonic Inc.hyperlinked cross-references in online documents.

Complimentary Documentation

Document	Explanation
NSG 9000 Software Guide	Describes the main features, configuration and alarms of the NSG 9000 application.
bNSG 9000 Firmware Guide	Describes the main features, initial configuration and alarms of the bNSG 9000 application.

Revision History

Table 0-1: Revision History

Revision	Date	Description	By
A	May 2009	Creating document	Tova
B	October 2009	Corrections to table 1-1	Tova
C	November 2009	Correction to table 1-12	Tova

Table of Contents

Maintenance

Chapter 1
Main Features and Specifications

1.1 Introduction

This platform may operate as NSG 9000, a powerful Network Services Gateway™ or as bNSG 9000, an augmented Broadcasting Network Gateway™.

NOTE: NSG 9000 comes with either an AC power supply or –48 VDC power supply. All types of the NSG 9000 platform are intended to be installed in restricted access locations.

1.2 Main Features

The following table describes the main features of the NSG 9000 platform:

Table 1-1: Main Specifications

Component	Feature	Description
Chassis	Chassis	2-RU, mounts in Electronic Industries Association (EIA) standard rack
Chassis	Hot-swappable Front Panel	The front panel module includes four cooling fans, LCD display panel and a keypad, and indication LEDs. The module may be removed for maintenance purposes while the system is operational.
Chassis	Indication LEDs	2 power, alarm and 9 output status LEDs.
Processing module	6 x GbE input ports (3 active & 3 backup)	■ Provides three independent ports receiving simultaneously different feeds ■ Only three ports are simultaneously active, see, "GbE Input Ports" on page 15. ■ Input rate of up to 1000 Mbps per port
Processing module	1 x ASI monitoring port	ASI monitoring port can be configured to output the same data as a selected QAM-RF output TS. The ASI Port can be configured to monitor any output TS.
Processing module	Back panel LEDs	Activity and alarm LED pair for each GbE port (12 LEDs in all).
Processing module	10Base-T/ 100Base-T Ethernet ports	Two independent Ethernet ports, typically used for management (ETH1) and scrambling (ETH2).
Processing module	2xDTI ports (optional)	Two DTI ports, typically used for M-CMTS applications.

Table 1-1: Main Specifications

Component	Feature	Description
QAM-RF module	Hot-swappable	Up to 9 QAM-RF modules may be mounted in the chassis. Modules may be added or removed while the system is operational.
QAM-RF modules	Up to nine QAM-RF modules, with 2x QAM-RF ports per module. Overall, the system includes up to 18 QAM-RF ports, capable of carrying up to 72 QAM-RF channels	Each port carries up to four QAM channels combined and upconverted. For further information, refer to page 18. ■ QAM Mode: ❑ ITU-T J.83 Annex-A (DVB): 8 MHz ❑ ITU-T J.83 Annex-B: 6 MHz ❑ ITU-T J.83 Annex-C (Japan): 6 MHz ■ QAM Constellations: ❑ ITU-T J.83 Annex-A:16, 32, 64, 128, 256 ❑ ITU-T J.83 Annex-B: 64, 256 ❑ ITU-T J.83 Annex-C:16, 32, 64, 128, 256 For further QAM-RF specifications, see product specification sheet.
QAM-RF module	Maximum output bit rate	■ ITU-T J.83 Annex-A ❑ Up to 3xQAM channels per physical port (Triple QAM) ❑ Up to 6xQAM channels per module ❑ Max output bitrate per QAM channel - 51.287 Mbps ■ ITU-T J.83 Annex-B: ❑ Up to 4xQAM channels per physical port (Quad QAM) ❑ Up to 8xQAM channels per module ❑ Max output bitrate per QAM channel - 38.811 Mbps ■ ITU-T J.83 Annex-C: ❑ Up to 4xQAM channels per physical port (Quad QAM) ❑ Up to 8xQAM channels per module ❑ Max output bitrate per QAM channel - 39.171 Mbps
Power Supply	AC/DC Power Supply Options	Two distinct types of Power Supply are available: AC (input voltage range 85 - 264 VAC) DC (input voltage range 36 - 72 VDC)
Power Supply	Hot Swappable redundant power supply	Two independent Power Supply units may be mounted in the chassis. The units can be removed or inserted while the system is operational.
Power Supply	Current and load sharing	When operating with two Power Supplies, load is shared and balanced between the two modules.

1.3 NSG 9000 Physical and Power Specifications

1.3.1 Physical Dimensions

Table 1-2: Physical Dimensions

Dimension	Inches	mm
Height	3.47	88.1
Width	19.00	482.6
Total Length (front to back)	22.88	581.2
Depth (From rack mount fixture to back of device)	21.78	553.4

1.3.2 NSG 9000 Weight

Table 1-3: NSG 9000 Weight

Configuration	Weight (lb.)	Weight (kg)
Chassis	33.97	15.44
Power Supply (AC/DC)	3.95	1.80
QAM-RF blade	2.29	1.04
Full platform (chassis + 2xPS + 9xQRF)	62.48	28.4
Full platform, single PS (chassis + 1xPS + 9xQRF)	58.53	26.6

1.3.3 Power Consumption

NOTE: The values in the following table refer to a fully populated unit.

Table 1-4: Power Consumption

Input Voltage	Max Power consumption (Watts)	Max Steady State Current (Amp)	In Rush Current Draw (Amp)
110V AC	490	4.5	16.7
220V AC	480	2.2	33.5
48V DC	450	9.4	20

NOTE: The power consumption of a single QAM-RF module is 36W.

1.3.4 Environmental Specifications

The following table lists the environmental specifications for the NSG 9000 (NSG-9K-CS-01):

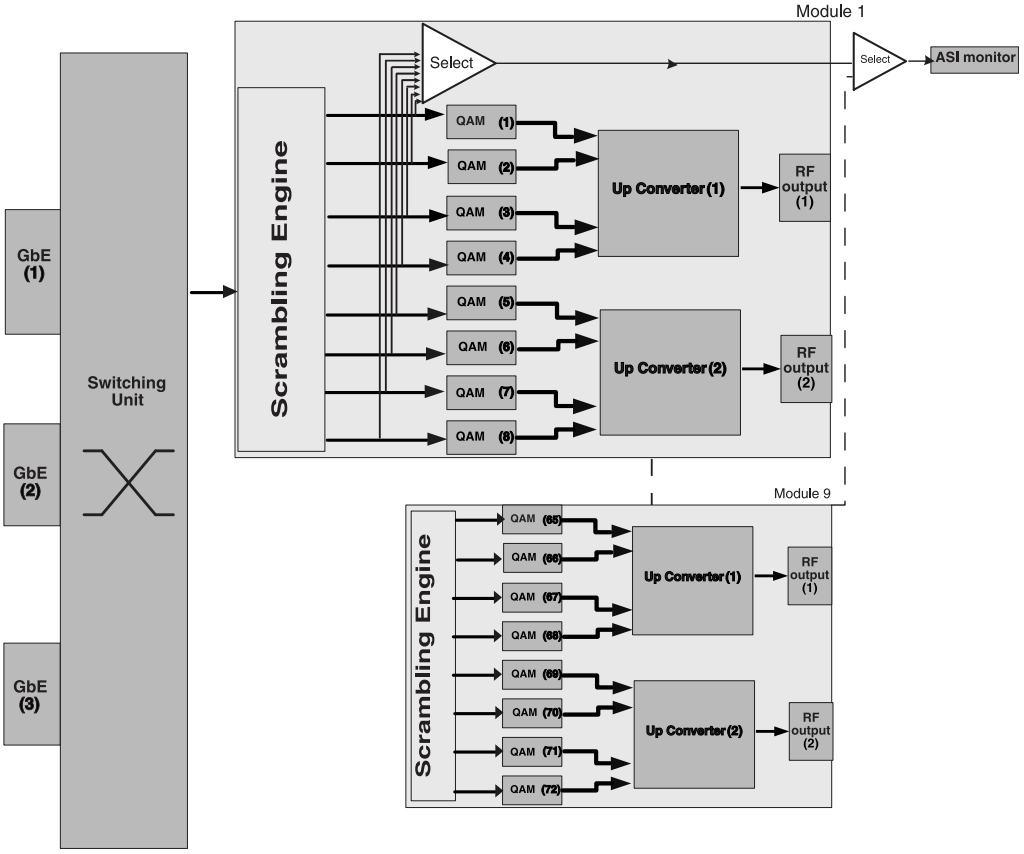
Table 1-5: Environmental Specifications

Parameter	Description
Operating temperature	0 to 50 °C (32 to 122 °F)
Storage temperature	−20 to 80 °C (−4 to 176 °F)
Relative humidity	Maximum 95% non-condensing
Ventilation	If units are installed in a closed rack, the rack must be ventilated to ensure proper cooling of the units. Ventilation rate must be: At least 1.0 cubic meter per minute (35 cubic feet per minute) per NSG 9000 unit. Ventilation rate must be at least 2.2 M^3/min (78 CFM) per NSG 9000 unit. This is the air flow through the unit while fans operate at full speed.

1.4 Stream Processing Overview

The NSG 9000 accepts a GbE input, and outputs MPEG data over QAM-RF signal. The following diagram shows the flow of data through the GbE channel.

NOTE: The diagram shows the flow of data via a single Quadruple QAM-RF module. NSG 9000 may include up to 9 Quadruple QAM modules.

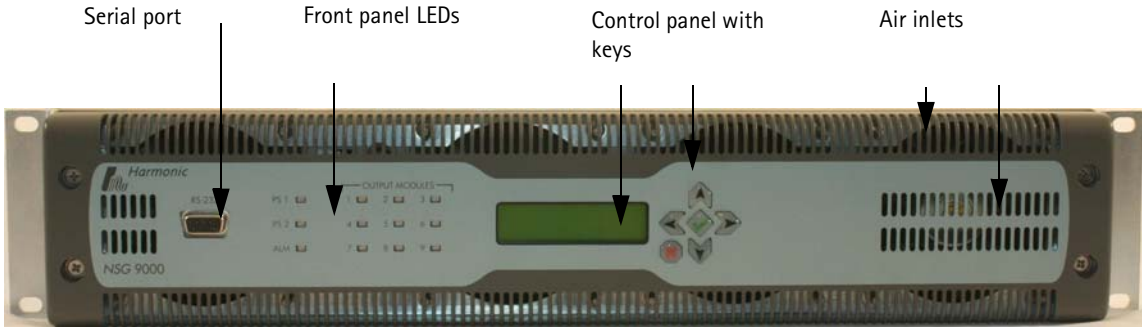


1.5 NSG 9000 Front Panel

The front panel of the NSG 9000 platform contains the following:

- Front bezel
- RS-232 connector
- LEDs
- Control panel
- Four cooling fans

The following figure illustrates the front panel of the NSG 9000 platform:



1.5.1 Front Bezel

The NSG 9000 platform has a detachable front bezel that snaps on top of the control panel. The air inlets located on the bezel provide air flow. See also, "Air Inlets" on page 12.

1.5.2 EIA-232 Serial Port

The EIA-232 serial port may be used to configure the Ethernet port IP addresses. You can use the serial port for monitoring and manual maintenance operations. The EIA-232 serial port has a female DB-9 D-typ connector.

1.5.3 Front Panel LEDs

The front panel of the NSG 9000 platform includes the following LEDs:

- Output Modules LEDs - nine LEDs for monitoring the status of the modules.
- Operation Status LEDs - include two Power supply LEDs and an Alarm LED. The Operation Status LEDs enable to monitor the status of the NSG 9000 power and of the unit's operation. The LEDs function the same in both standalone and NMX control modes. The following table describes the front panel LEDs, from left to right and from top down.

Table 1-6: Frot Panel LEDs

LED	Color	Description
Power PS1 and PS2	Green/Red	ON (Green) - Power supply unit is working properly. ON (Red) - Power supply unit is faulty. OFF - Power supply unit is not mounted in the slot.
Alarm	Red/Orange	ON (Red) - Indicates an alarm has been activated in the device. Refer to NSG 9000 Software User's Guide for further details. OFF - Indicates no alarm activated.
Module 1 - 9	Green/Red/Orange	ON (Green) - A module is mounted and it is working properly. ON (Red) - A module is mounted and is faulty. OFF - No module is mounted.

1.5.4 Control Panel

The control panel consists of an LCD display area and a keypad. The control panel enables preliminary configuration and basic monitoring of the device. It is usually used for standalone devices. For further information, see *NSG 9000 Software User's Guide* or *bNSG 9000 Firmware User's Guide*.

1.5.5 Air Inlets

Air inlets are located along the lower, upper right and middle of the front panel. The air inlets are designed to provide maximum air flow. The air flow is critical for maintaining the proper temperature range. Fans in the front unit draw air in through the front inlets.

CAUTION: Do not obstruct the airflow when mounting the device on the rack. Severe equipment damage can result when the device cannot properly exhaust the airflow.

1.5.6 Cooling Fans

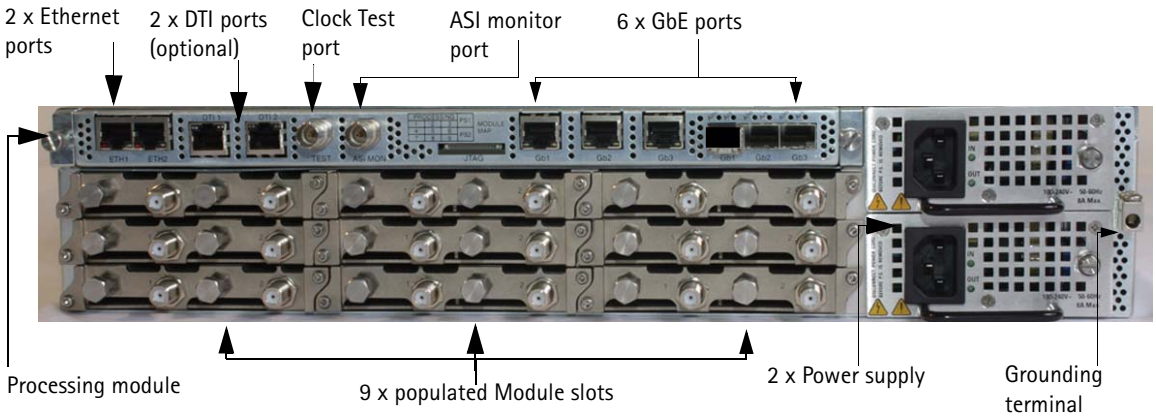
The NSG 9000 platform uses four fans to control the temperature during operation. The fans located in the front of the device, use air from the front and exhaust it to the rear of the device. Each fan has a speed control and the CPU manages their speed to increase Mean time Between Failures and to lower the noise level.

All four fans are mounted on the back side of the front panel to allow a quick and easy hot swap in case of a fan failure. For further information, refer to "Cooling Fans Unit" on page 45.

1.6 Back Panel

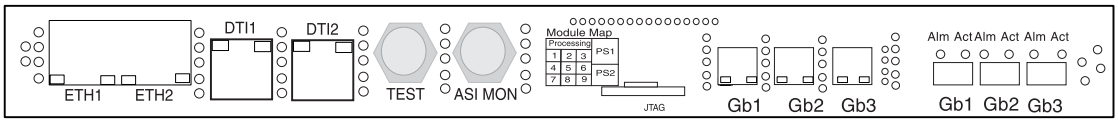
This section describes the back panel of the NSG 9000 platform. The back panel of the NSG 9000 platform includes the following:

- Processing module
- 9 x Module Slots
- 2 x Power supply
- Grounding terminal



1.6.1 Processing Module

The Processing module is the main module of the NSG 9000 platform. It includes the communication interfaces of the unit and the GbE interfaces. The Processing module manages, configures and monitors the device and its modules. It is a swappable module that is easily mounted from the rear side of the platform. The Central Processing module includes the following components:



- Ethernet ports
- 2 x DTI ports for M-CMTS application (optional)
- 1 x Clock Test port for future use only
- ASI Monitor port
- Module map
- JTAG - for servicing the device
- 6 x GbE port

NOTE: In case of processing module malfunction, replace the module as instructed in "Inserting the Modules" on page 23 and send the faulty module to Harmonic.

1.6.1.1 Ethernet Ports

Ethernet ports - allow connection to separate networks. The Ethernet ports are labeled ETH1 and ETH2. ETH1 is a management port and ETH2 is for future use. Both ports are 10/100 Base-T ports. For cabling instructions, see "Cabling the Ethernet Ports" on page 28.

1.6.1.2 DTI Ports

The DTI ports, labeled DTI1 and DTI2, are optional and are operating once a DTI card is installed. The latter is installed when the NSG 9000 device is operating in an M-CMTS application. You may purchase a device with the DTI card installed or install it by yourself. For installation and cabling instructions, see "Installing a DTI Card (Optional)" on page 32. The following table lists the DTI ports specifications:

Table 1-7: DTI Ports Specifications

Parameter	Specification
Input signal	Complies with DOCSIS 3.0 DTI

1.6.1.3 ASI Monitoring Port

The NSG 9000 platform may duplicate one of the output transport streams to the ASI output port designed for monitoring purposes. Use this port to connect to devices that accept ASI input such as an MPEG analyzer. For cabling instructions, see "Cabling the ASI Monitoring Port" on page 28.

1.6.1.4 Module Map

The Module Map is a graphic view of the back panel of the device for ease of use.

1.6.1.5 GbE Input Ports

The NSG 9000 platform includes six GbE ports labeled GbE 1- 3 and GbE 1 - 3. Three ports support Small Form Factor Pluggable (SFP) transreceivers for either fiber or copper cables and the other three support copper cables for 1000 Base-T cables only.

Any combination of active ports is supported except for the following:
Copper #1 & SFP #1
Copper #2 & SFP #2
Copper #3 & SFP #3

The following table lists the GbE port specification:

Table 1-8: GbE Port Specifications

Parameter	Specification
Connector	Three receptacles for SFP connectors RJ-45 connector
Maximum input bitrate	n Line rate up to 1000 Mbps n Processing up to
Maintenance	Swappable

The NSG 9000 back panel features two LEDs for each GbE port. The following table describes the LEDs:

Table 1-9: LEDs of GbE Ports

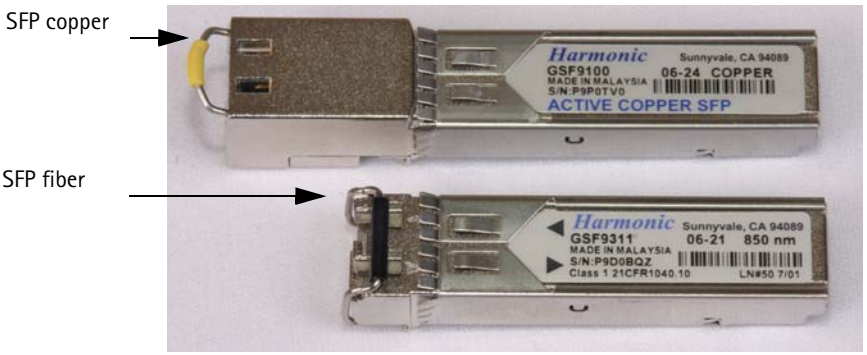
LED	Color	Description
Activity	Green Blinking green	■ Illuminates when a live fiber is connected and a network link is detected. ■ Blinking when real traffic flows through the link.
Error	Yellow	■ Illuminates when an alarm is issued ■ Off when port is inactive or no alarm has been issued.

1.6.1.6 SFP Module

The SFP (Small Form Factor Pluggable) module converts optical data into electrical data and vice versa. The SFP modules allow the NSG to receive input signals over a variety of physical interfaces:

- Single-mode optical interface (1000 Base-LX)
- Multi-mode optical interface (1000 Base-SX)
- Copper interface (1000 Base-T)

The following figure illustrates an SFP module:



Warning: Class I laser product. (IEC/EN 60825-1; 21CFR SubChapter J (1040.10 and 1040.11)

You can use either of the following types of SFP depending on the cable/fiber type you are using.

Harmonic sells SFP modules that have been thoroughly qualified to operate with the NSG 9000 device. These SFPs are made by Finisar, and may be purchased either directly from Harmonic, or from other sources.

Table 1-10 on page 15 lists the Harmonic part numbers for the qualified SFP modules, as well as the matching Finisar part numbers for the same modules. Use these part numbers for ordering your SFP modules.

NOTE: To be eligible for support by Harmonic, use qualified SFPs only.

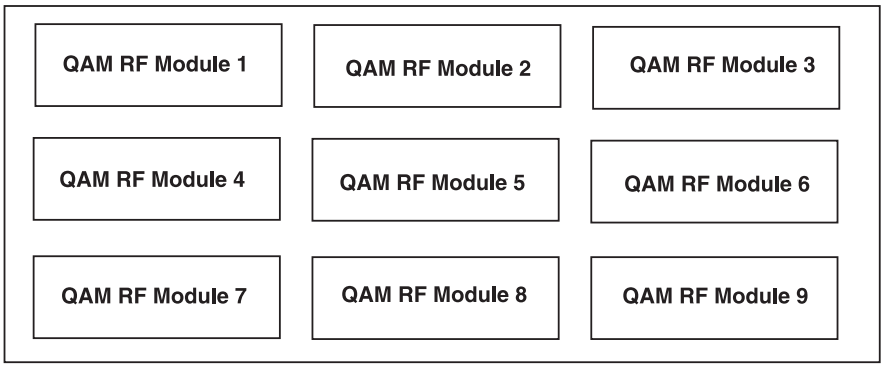
Table 1-10: SFP Modules

Harmonic Part Num.	Fiber/Cable Type	Connector Type	Wave Length	Max. Cable/ Fiber Length	Qualified Finisar SFP Model Part Num.
GSF9311-02	Multimode fiber	2 x LC	850 nm	550m	FTLF8519P2BNL
GSF9322-02	Singlemode fiber	2 x LC	1310 nm	10 km	FTLF1319P1BTL
GSF9132-02	Singlemode fiber	2 x LC	1550 nm	70 km	FTLF1621P2BCL
GSF9100-02	Shielded and grounded CAT-6 or CAT-7	1 x RJ-45	N/A	100m	FCLF-8521-3

An optical SFP has two LC sockets, Receive(Rx) and Transmit(Tx). Use Multimode or Singlemode fiber optics to connect your Gigabit Ethernet switch to the Rx socket. If bi-directional topology is used, connect the Tx socket back to the switch.

1.6.2 Module Slots

The back panel of the NSG 9000 platform includes nine module slots labeled Module 1 to nine. Each one of the slots accommodates a single QAM-RF module. The following figure illustrates the arrangement of the slots at the back panel of the device:



1.6.2.1 QAM-RF Modules

Each QAM-RF module performs QAM modulation and up conversion of the QAM signal. Each QAM-RF module includes two QAM-RF ports labeled 1 and 2. Each port may output up to four channels as your license permits. For further details refer to the *NSG 9000 Online Help* or to the *NSG 9000 SW User's Guide* and for bNSG to *NMX Online Help*.

The following table provides the RF port specifications:

Table 1-11: RF Port Specifications

Parameter	Description
Connector	Male F connector
Cable	RG-6 only
Output center frequency	ANNEX A 54 - 866MHz ANNEX B 53 - 867MHz

NOTE: For detailed specifications, see NSG 9000 data sheet.

Each module may be configured offline and when mounted into the slot, the system identifies the inserted module. The modules are hot swappable and are mounted and plugged from the rear side of the device.

For information on how to connect the ports, see"Cabling the QAM-RF Ports" on page 28.

1.6.3 Power Supply

The NSG 9000 device is furnished with two hot swappable redundant AC or DC power supply units. Each power supply unit easily accommodates the power consumption of a fully populated device. When both power supply units are plugged in and connected to the mains, the power supply units operate in current sharing mode. For power consumption specifications, see "Power Consumption" on page 7.

1.6.3.1 AC Power Supply

The following table lists the power supply specifications:

Parameter	Specification
Physical Dimensions	40mmH x 90mmW x 440mmD
Input voltage	85-264 VAC
Line frequency	47–63 Hz
Typical power consumption	See "Power Consumption" on page 7.

Each power supply unit features two LEDs. The following table describes the LEDs:

LED	Color	Description
In Ok	Green	Illuminates when mains input voltage is present.
Out Ok	Green	Illuminates when output voltage is greater than 80% of the nominal output rate.

For instructions to connect the AC power supply, see "Connecting Power" on page 29.

1.6.3.2 –48 VDC Power Supply

The -48 VDC power supply unit is supplied with the required 3-pin male connector. See "Wiring the –48 VDC Power Supply" on page 63 for instructions to connect the power supply.

The NSG 9000's electrical rating for the -48VDC type is as follows:

Parameter	Specification
Physical Dimensions	40mmH x 90mmW x 440mmD
Input voltage	36 - 72VDC
Maximum Operating Current	16A
Typical power consumption	See "Power Consumption" on page 7.

Each power supply unit features two LEDs. For detailed description, see "AC Power Supply" on page 19.

NOTE: Consideration should be given to the connection of the equipment to the supply circuit and the effect that overloading of circuits might have on overcurrent protection and supply wiring. Appropriate consideration of equipment nameplate ratings should be used when addressing this concern.

1.6.4 What's Next...

The next step is to unpack and cable the NSG 9000 platform, as described in the following chapter.

Chapter 2
Installation

This chapter instructs you on how to install the NSG 9000 device. For best results, perform the required actions according to following order:

2.1 Unpacking the NSG 9000 Platform

The NSG 9000 platform comes in a specially designed shipping container that ensures its safety during shipping and handling. To avoid damaging the NSG 9000 platform, unpack it carefully. The container includes the following:

- Chassis - front panel is attached but no modules are mounted
- Processing module - the module is static sensitive. Unpack, following the ESD guidelines on page 29.

The QAM-RF modules and power supply units are shipped separately.

2.2 Installing the NSG 9000 Platform

NOTE: The NSG 9000 platforms are used in restricted access locations.

NOTE: To prevent body injury when mounting or servicing this platform in a rack, you must take special precautions to ensure that the system remains stable. Read the following guidelines to assure your safety.

2.2.1 Rack Specifications

Install the 2-RU chassis in the following rack:

- a standard EIA 19-inch computer rack with at least 30" (76cm) depth.
- To allow free air flow, the rack must be completely open at its front side.
- The rack should be mounted with side walls and a back door.
- The back door should have ventilation slots at its bottom part.
- The top of the rack should be closed and mounted with cooling fan(s). For fan requirements, see following section.

2.2.2 Rack Ventilation

- Each NSG 9000 unit requires ventilation of at least 2.2 M^3\min (78 CFM). Calculate the total required M^3\min or CFM accordingly. In case devices of another type are mounted on the rack, consider their cooling requirements as well.
  For example, the combined air flow of fans mounted at the top of a rack mounted with ten NSG 9000 devices is at least 22.7 M^3/min (780 CFM).

2.2.3 Rack Positioning and Device Mounting

2.2.3.1 Rack positioning

- From front - leave clearance of at least 25″(63cm) from the front to any neighboring cabinet/wall.
- From back - leave clearance of at least 20″(51cm) from the back to any neighboring cabinet/wall.

2.2.3.2 Device Mounting

The following table lists the guidelines and specifications for mounting the NSG 9000 devices on a rack:

NOTE: Do not obstruct the airflow of the platform. Severe equipment damage can result when the device cannot properly exhaust the airflow.

Parameter	Description
Occupied Space	2 rack unit
Mounting Order	Partially filled rack - load rack from the bottom to the top with the heaviest component at the bottom of the rack.
Max Number	According to allowed floor load. See, "Rack Weight" on page 26. Spacing between units (1RU or more) is recommended for ease of cabling. Block the spaces between units as explained in this table in "Open space".
Mounting Method	Mount each device on supporting rails provided by Harmonic in a separate kit (P/N RM-4-30). Install the rack-mounting rails before mounting the device on the rack.
Open space	To prevent hot air circulation: n All open spaces below and above the devices should be closed with a blank panel.
Cabling	Route all cables at the back panel along the sides of the rack to allow pulling out the power supply unit and QAM-RF modules.

2.2.4 Rack Weight

1. Check the allowed floor load of the facility.
2. Calculate the total weight and load according to the following parameters:

Item	Value (US)	Value (metric)
Single fully loaded NSG 9000 unit	58.53 lbs	26.6 Kg
Footprint of a typical 23"x30" rack	4.8 sqr. Ft	0.446 m^2

3. Limit the number of NSG 9000 devices on a rack according to the allowed floor load. Take into account also additional equipment to be mounted on the rack.

2.2.5 Power Source and Wiring Specifications

2.2.5.1 Redundant power supply

When installing NSG 9000 devices with a redundant power supply, both power supply units should be fed by different power sources:

- Dual AC supplies - use two different phases of the AC power plant.
- Dual DC supplies - use two distinct DC sources (A line and B line). It is highly recommended to maintain regularity, and connect all top power supply units to the A line and all bottom power supply units to the B line.
- One AC and one DC - no additional measures are needed in order to ensure adequate protection against power outage.

2.2.5.2 Overcurrent protection

NOTE: Overcurrent protection devices must meet applicable national and local electrical safety codes and be approved for the intended application.

To ensure adequate over-current protection, mount power feed lines with circuit breakers (CB) of the appropriate rating. Power feed to the NSG9000 should be segmented as specified below:

	Inrush Current	Steady State Current	Number of Units per CB
110VAC	16.7Amp	4.6Amp	15A CB - 1 unit 20A CB - 2 units
220VAC	33.5Amp	2.3Amp	15A CB - 1 unit 20A CB - 2 units
48VDC	20Amp	10.1Amp	N/A

When using DC power supply, over-current protection should be provided by a fuse panel, with a separate fuse for each individual NSG9000 unit. The power supply of the NSG includes an integrated fast-acting 20Amp fuse, which protects the NSG from damage in case of internal power supply problem. The external fuse is meant primarily for protecting the DC power source from damage in such a situation.

Two optional fuse types are recommended for the external fuse panel:

- 15 Amp GMT, 60 VDC / 125 VAC rating, Fast-acting
- 15 Amp, 250 VAC rating, Slow-blow.

For additional details on AC/DC power source requirements, see "Wiring the –48 VDC Power Supply" on page 51.

2.2.5.3 Ground

- Every rack must be properly earthed, connected to the ground bus of the plant.
- Each NSG9000 device in the rack must also be connected to the main Earth line of the rack, using a 14 AWG copper wire. See "Grounding the Mounted Devices" on page 42.

2.2.6 Facility Cooling Requirements

Each fully-loaded NSG 9000 device generates heat of 510 Watts (in case of AC power supply). This translates into 1,734 BTU/hour.

Considering 15% general leakage of a typical air conditioning system and 25% latent heat, the required cooling capacity of the facility's air conditioning system is:

- Per a single NSG 9000 unit - 2,490 BTU/hour
- Per a rack of ten NSG 9000 units - 24,925 BTU/hour

NOTE: It is assumed that the head-end air conditioning system is designed to circulate the air in a manner that ensures the same ambient temperature for all the NSG 9000 devices in a rack.

Ambient temperature for a continuously operating device should be 25c°. NSG 9000 can continuously operate in ambient temperature of up to 50c°. However, continuous operation in a high ambient temperature shortens the device lifetime.

2.2.7 Required Tools for Installation

- Four screws to secure the unit to the rack
- A screwdriver for fastening the screws
- Supporting rails provided by Harmonic in a separate kit (P/N RM-4-30).

⇨ To install the NSG 9000 platform in a rack:

NOTE: It is recommended to install the NSG 9000 platform before mounting any cards or modules.

1. Install the rack-mounting rails before mounting the device on the rack.
2. Place the 2-RU chassis on the rack and slide it along the supporting rails.
3. Push the device back until the rack-mount holes in the front of the device line up with the rack posts.
4. Insert four screws through the mount holes in the front of the device to go through the corresponding holes on the rack posts.
5. Tighten the screws with a screwdriver.

2.3 Inserting the Modules

The NSG 9000 platform is shipped without any modules inserted. Prior to inserting the Processing module or QAM-RF modules, read the following guidelines for handling the modules.

Warning: Electrostatic Discharge (ESD) may damage the platform components. Take precautions to eliminate ESD from your body and clothes before handling the platform or module by using a wrist band and a rubber mat and read the following section.

To prevent damage caused by ESD, it is recommended to follow these instructions:

- When unpacking a module, keep it in the anti-static wrapping until you are ready to instal it in the device. Unwrap the module only at an ESD workstation or when grounded.
- If for any reason you cannot insert the module, lay it in an anti-static container or packaging.
- Handle the module only at ESD workstation and use anti-static rubber mat and wrist bands.

- Handle the module with care. Do not touch components and contacts on the board and hold board by its edges.

2.3.1 Tools for Mounting/Replacing a Module

Mounting the Processing module and the QAM-RF modules requires various tools and equipment. The following table lists the required action, tools and equipment:

Action	Tool
Removing Fillers	Socket head Screwdriver 3/32" x 4"
Fastening QAM-RF module	3/32" Allen wrench (provided with the chassis) P/N 019-0003-001 3/32" screwdriver bit (provided with the chassis) P/N 019-0004-001
Fastening Processing module	Slotted screwdrivers 5/16" x 4"
Handling Processing and QAM-RF modules	ESD-preventing wrist band and a rubber mat

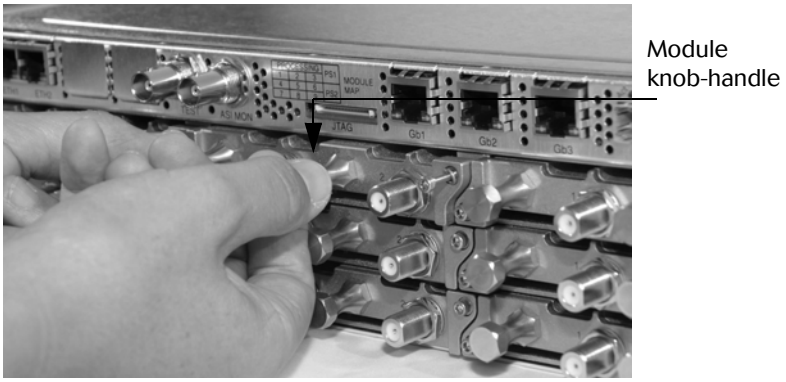
⇨ To insert/replace a module:

1. When inserting - Unscrew the screws that attach the filler to the chassis and move to step 4.

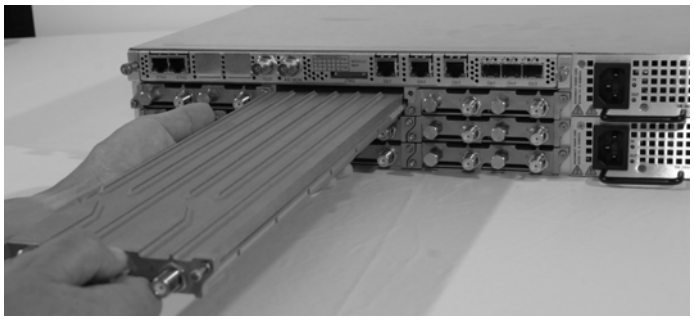
   When replacing a QAM-RF module - Unscrew the screws that attach the module to the chassis.

   When replacing the Processing module - Unscrew the screws that attach the module to the chassis in a synchronized manner.

2. When replacing - Hold the module by its knob-holders and pull it out of the slot.



3. Hold the module by its edges and lay it in an anti-static container or packaging.



4. While following the ESD guidelines mentioned above, unpack the module.
5. While holding the module by its edges, insert it into the slot. Make sure that the sides of the module slide into the guides of the slot.
6. Push the module until its edge-connector mates securely with the connector in the slot.
7. Fasten the screws of the module to secure the module to the chassis.
8. Using the Web client, or management system, assign the module.

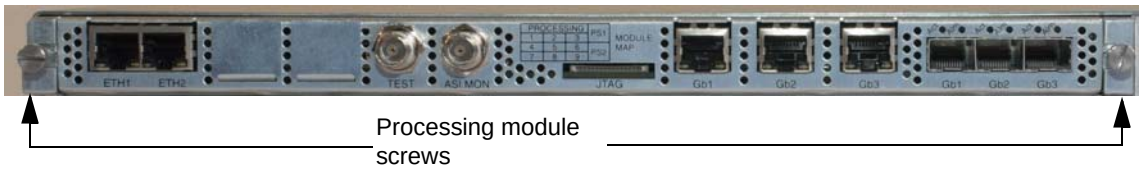
NOTE: To ensure proper cooling of the device, install a filler panel in any unoccupied slot. This applies equally to QAM-RF module slots and to Power Supply slots.

2.3.2 Installing a DTI Card (Optional)

NSG 9000 also operates in M-CMTS applications. To enable this mode of operation, install a DTI card in the NSG 9000 device as explained below, unless you ordered a device with the DTI card installed.

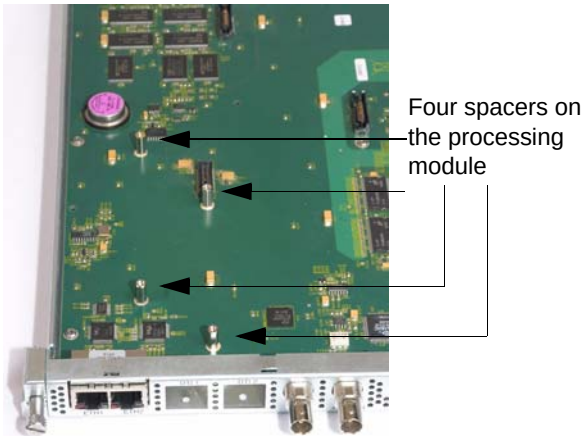
NOTE: During this procedure, follow the ESD guidelines as explained in "Inserting the Modules" on page 29.

1. Power off the device.
2. Unscrew both screws of the processing module. Unscrew them together or make sure to work in a synchronized manner when unscrewing the screws.

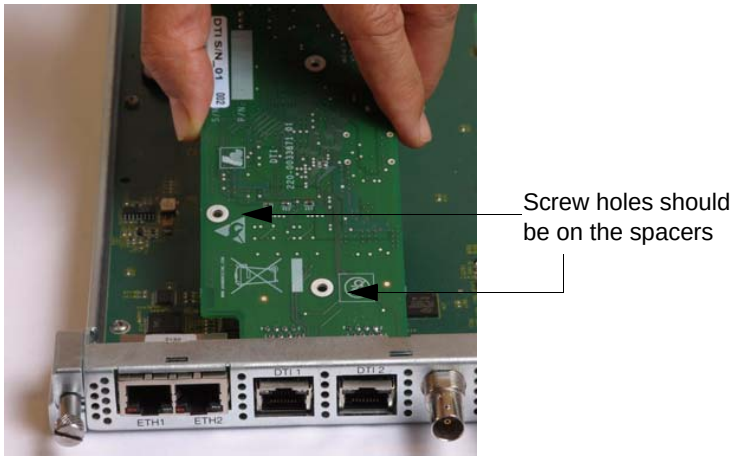


3. Pull out the processing module and handle it according to the ESD guidelines. See, "Inserting the Modules" on page 29.
4. Place the processing module on its side and unscrew the fillers of the DTI connectors. See following picture:

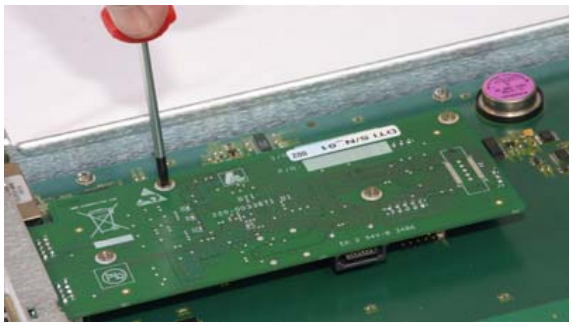
5. On the Processing module locate four spacers.



6. Hold the DTI card by its edges, raise its back up while pushing the DTI receptacles into the DTI connectors of the processing module.



7. Verify that the screw holes on the DTI card are on the spacers.
8. Insert screws and fasten them to secure the DTI card to the processing module.



9. Mount the processing module into its slot and fasten the processing module screws.

For DTI cabling instructions, see

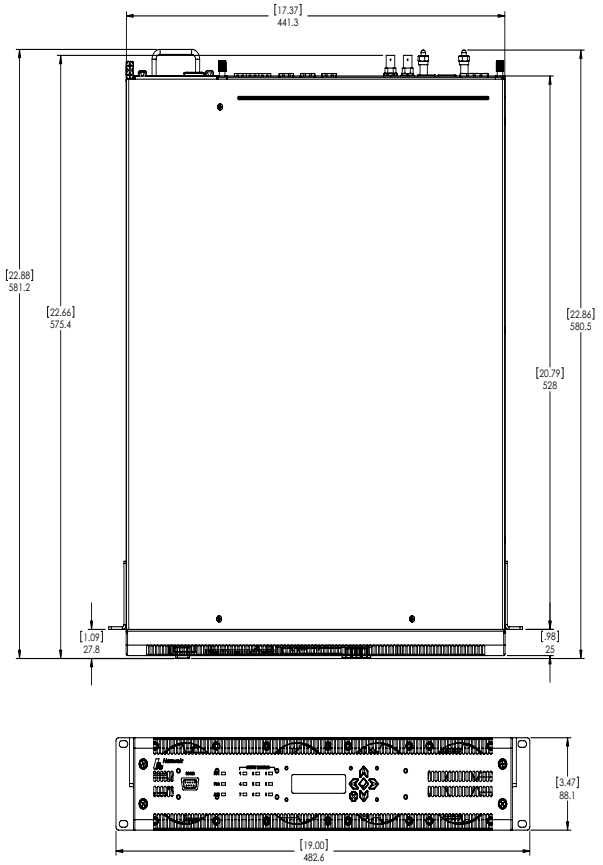
Chapter 3
Cabling

The Cabling chapter guides you on how to connect the GbE, QAM-RF and Ethernet ports. Connecting cables to the NSG 9000 platform is straightforward. The NSG 9000 ports are clearly marked on the NSG 9000 back panel. See "Back Panel" on page 12 for placement.

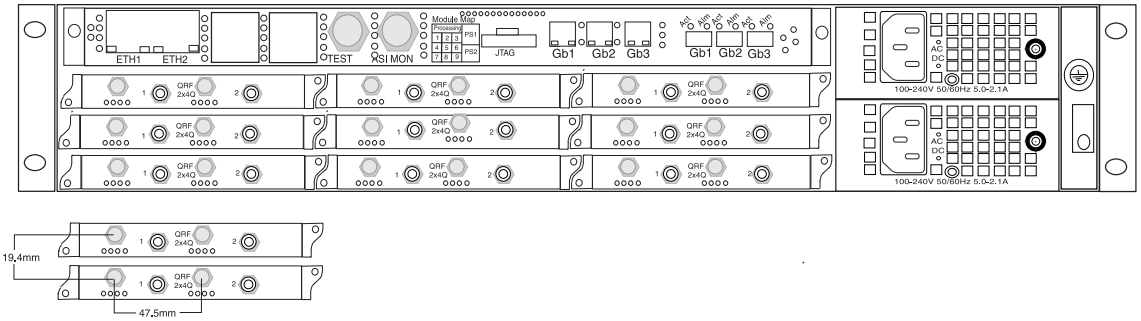
The Cabling chapter also includes device dimensions to allow better planning of the rack cabling scheme:

3.1 Device Dimensions

Dimensions are provided in Inches and millimeters as follows:
[inch]
mm



3.1.1 Back Panel Measurements



3.2 Cabling the GbE Ports

To connect the GbE port to the GbE switch, use either of the following:

- Multimode or single-mode optic fiber with an LC connector. The LC connector plugs into an SFP receptacle and accommodates two fibers, one for transmission and the other for reception.
- Shielded and grounded CAT-6 or CAT-7 cable with an RJ-45 connector. The RJ-45 connector plugs into a copper SFP receptacle or a built-in RJ-45 connector.

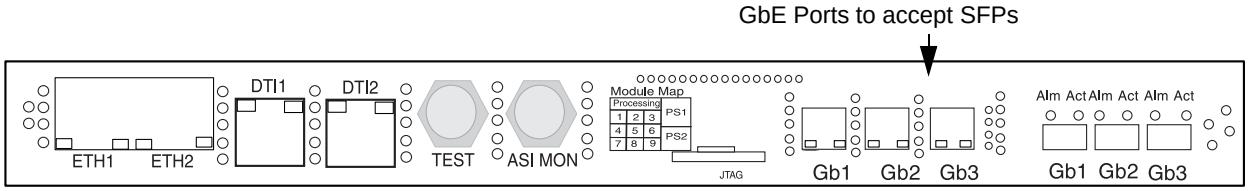
The GbE ports are either fiber/copper or copper only ports. The following configuration of GbE ports is not supported:

GbE 1 fiber/copper and GbE1 copper,
GbE 2 fiber/copper and GbE 2 copper
GbE 3 fiber/copper and GbE 3 copper

NOTE: GbE port redundancy is not supported in this version

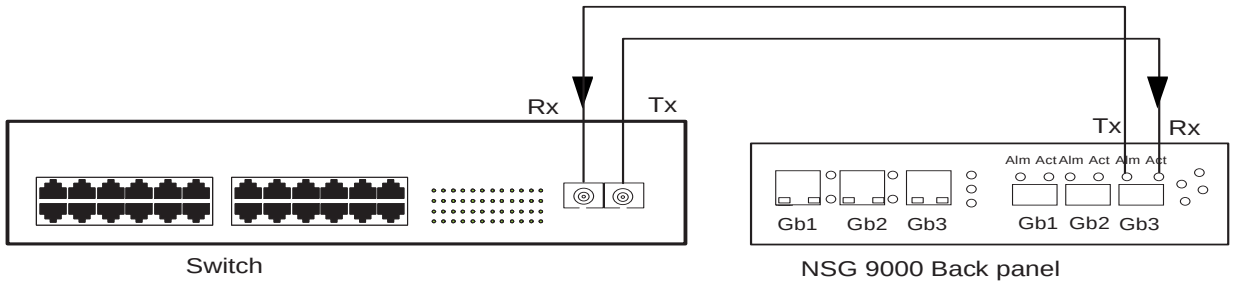
To cable the GbE ports

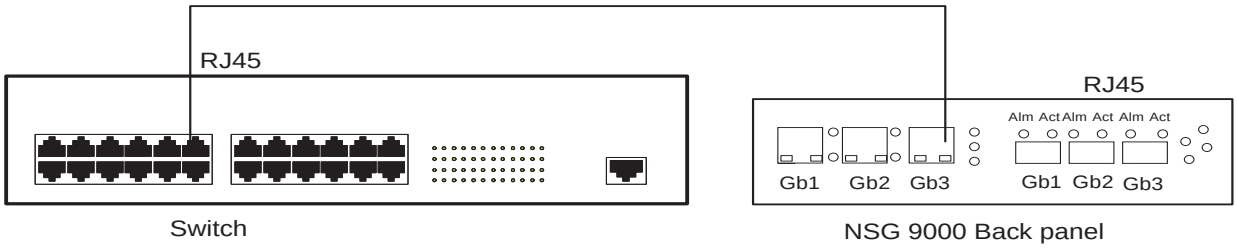
1. Insert the SFP modules into the required ports at the back of the NSG 9000.



2. Insert the LC/RJ-45 plugs into the SFP module or built-in RJ-45 cage.
3. Connect the NSG 9000 to a switch or other NSG 9000 as appropriate for your network configuration.

   The following figures show a basic connection between an NSG 9000 and a switch. The first figure refers to a connection with optic fibers and the second with copper cables:





3.2.1 Mirroring a GbE Input Port

The NSG 9000 unit may duplicate the incoming content of any GbE input port to any GbE port that is defined as a mirroring port. See, NSG 9000 Software User's Guide.

Once a port is defined as a mirroring port, connect it to devices that accept GbE input.

⇨ To connect a mirroring port

1. Insert the SFP modules into the required receptacles at the back of the NSG 9000.
2. Insert the LC/RJ-45 plugs into the SFP module or RJ-45 cage.
3. Connect the NSG 9000 to any device with GbE interface with an RJ-5 connector such as an IP analyzer.

3.3 Connecting the QAM-RF Output Cables

The NSG 9000 device accommodates up to nine modules with two QAM-RF ports for each module. The ports are labeled RF 1and 2 and implement the dual upconverter technology. Each port delivers up to four RF channels.

When cabling the QAM-RF ports, use RG-6 coaxial cables equipped with F-type connectors only. Using cables other than RG-6 coaxial cables, may adversely affect the QAM-RF performance.

⇨ To connect the RF Cables:

- Use RG-6 coaxial cables equipped with F-type connectors to connect the outgoing ports to your output equipment according to your network schema.

3.4 Connecting the ASI Monitoring Port Cables

The ASI output port for the NSG 9000 provides a method to monitor the device's output data.

⇨ To connect the ASI output cable:

- Connect the ASI cable with a BNC connector from the ASI output port on the NSG 9000 back panel to a device such as an MPEG analyzer.

3.5 Connecting the Ethernet Cables

The Ethernet ports, labeled ETH1 and ETH2, provide access to two independent networks. The required cables are shielded and grounded CAT-5E cables with RJ-45 connectors.

⇨ To connect the Ethernet cables:

- Connect an Ethernet cable with RJ-45 connectors from the ETH1 port on the NSG 9000 to your management network hub or switch.

3.6 Cabling the DTI Card

Cabling the DTI card is straightforward. See "Back Panel" on page 12 for placement.

For connecting the DTI ports to the DTI server, use the following cables:

- Shielded and grounded CAT-5E or CAT 6 cables with RJ-45 connectors.

⇨ To connect the DTI cables:

- Connect one side of the DTI cable to a DTI port on the NSG 9000 back panel and the other side of the DTI cable to the DTI server.

3.7 Connecting Power

The NSG 9000 comes with either an AC power supply or a –48 VDC power supply. Follow the instructions appropriate to your power supply.

NOTE: Reliable earthing of rack-mounted equipment should be maintained. Particular attention should be given to supply connections other than direct connections to the branch circuit.

3.7.1 Grounding the Mounted Devices

Each device should be grounded using the ground terminal on the back panel of the device. For grounding a device use a non terminated 14 AWG copper wire.

⇨ To ground each mounted device:

1. Connect one edge of the grounding wire to the Rack grounding terminal.
2. Connect the other edge of the grounding wire to the device grounding terminal by inserting the wire into the grounding terminal and fastening the screws of the grounding terminal.

3.7.2 Connecting the AC Power Cable

If your NSG 9000 has the AC power line cord, connect the power cord to the power plug on the NSG 9000 back panel, and connect the power cord to the power outlet.

The power supply automatically senses the input voltage.

3.7.3 Connecting the –48 VDC Power Supply

If your NSG 9000 has the optional –48 VDC power supply, see Appendix B, "Wiring the –48 VDC Power Supply," for instructions to wire the power supply.

When you connect the NSG 9000 to the power supply, the boot up procedure starts. During boot up the following messages appear in the control panel display:

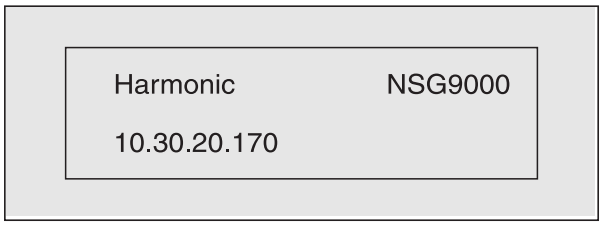
Power up - indicates the beginning of the procedure.

Booting... - indicates the booting stage.

Loading... - indicates that the unit loads the application.

Once boot up is complete the Power Up screen appears in the control panel display and you may start configuring the device. The Power Up screen shows the company's name, type of current application (NSG 9000 or bNSG 9000 and a default IP address

.



NOTE: The above Power Up screen is of NSG 9000 narrowcast firmware. For bNSG 9000 broadcast firmware, the title is "Harmonic bNSG9K".

CAUTION: Once you power up the device, the QAM-RF ports should always be connected as explained in "Connecting the QAM-RF Output Cables" on page 40 or else terminated.

NOTE: The unit may have more than one power supply cord. To protect against electric shock, disconnect all power supply cords before servicing.

3.8 Establishing Ethernet Connection

Because the NSG 9000 is configured and controlled by a remote management system, you must set the IP addresses of the Ethernet ports located on the back panel of the NSG 9000. For further information, see for NSG 9000, NSG 9000 Software User's Guide and for bNSG, bNSG 9000 User's Guide.

NOTE: The NSG 9000/bNSG 9000 requires a user name and password to log in to all management interfaces, including the serial communications console, web client and FTP. Both user name and password are *configure*.

3.8.1 What's Next...

The next step is to set preliminary configuration to the NSG 9000/bNSG 9000, as described in the *NSG 9000 Software User's Guide* and in the *bNSG 9000 Firmware User's Guide*, respectively.

Chapter 4
Maintenance

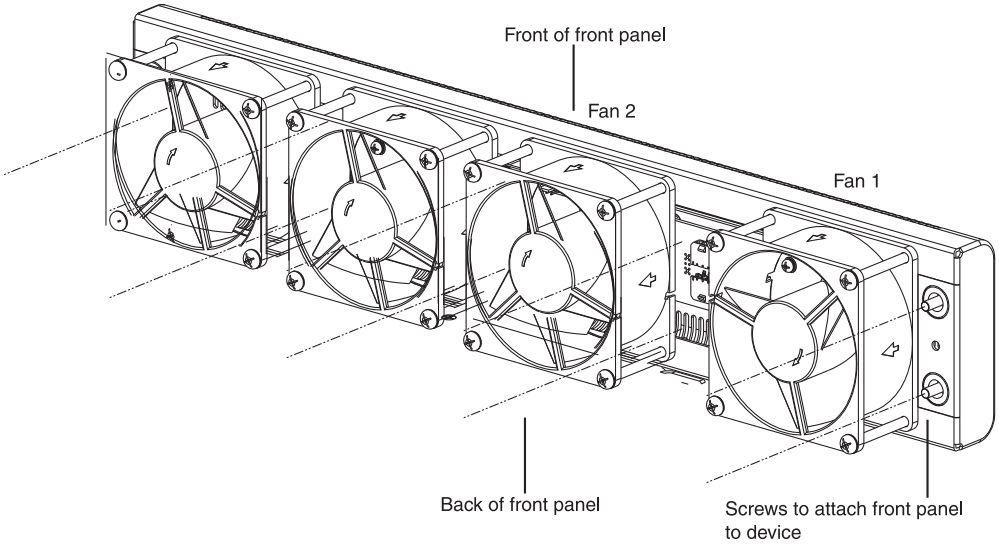
This chapter contains service information that explains how to replace the following components of the platform:

- Cooling fans unit
- power supply

NOTE: To prevent body injury when servicing this unit in a rack, you must take special precautions to ensure that the system remains stable.

4.1 Cooling Fans Unit

The NSG 9000 uses four fans to control the temperature of the platform during operation. All four fans are mounted on the back side of the front panel to allow a quick and easy hot swap in case of a fan failure.



NOTE: A failure of a single fan, requires the replacement of the front panel of the platform.

4.1.1 Removing and Replacing the Cooling Fans Unit

The design of the device allows a quick hot swap of the fans. Removing and replacing the fans does not affect the device operation and should last not more than two minutes. If it exceeds two minutes, the device may be damaged.

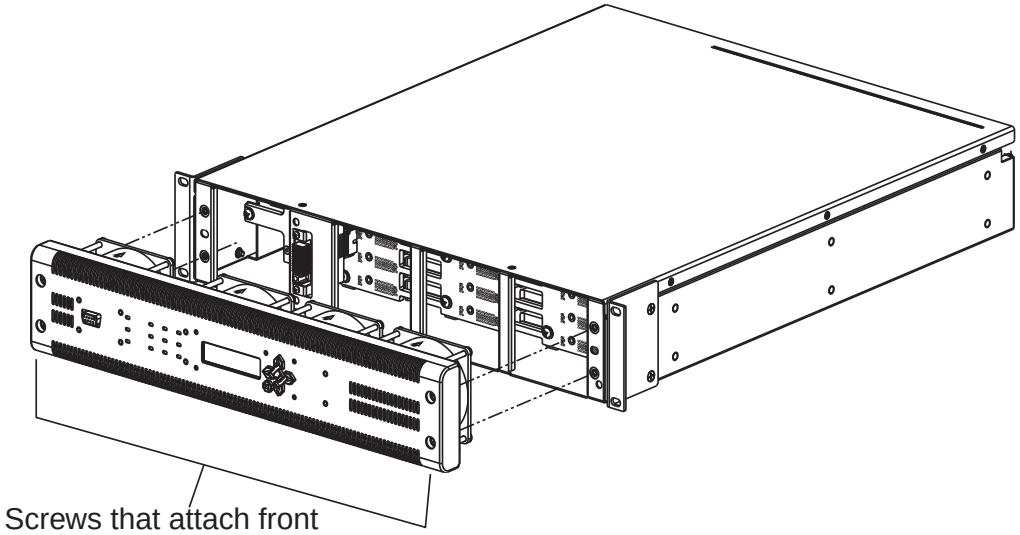
4.1.1.1 Preparation

For removing and replacing the fans, you need the following:

Phillips screwdriver

A new front panel

1. Unscrew all four screws that attach the front panel to the platform. The screws are located on both sides of the front panel. Refer to the figure below.
2. Detach the front panel from the working device.



3. Push the new front panel to snap on the chassis and to allow the mating connector to mate securely with the connector on the chassis.
4. Screw the front panel to the working device.
5. Verify that the alarm *Fan Failure* is remitted.

NOTE: It is recommended to replace the front panel after five years of continuous operation. To order a front panel, use the following part number: NSG-FP-SPR-01-01L.

4.2 Hot Swapping Power Supply Unit

The device uses a two hot swappable power supply units. The following procedure guides you on how to hot swap a power supply unit assuming that both power supply units are mounted in the platform.

Warning: You must disconnect the power cord before removing the power supply.

1. Verify that the functioning power supply unit is connected to the main.
2. Disconnect the power cord of the malfunctioning power supply unit.
3. Turn the locking knob counter-clock wise to unlock the latch.
4. While holding on to the handle of the unit, pull it to disconnected it from the device.
5. Pull the power supply unit until the unit comes out of the platform.

Pull the power supply unit until it comes out.

6. Hold the new unit in its handle and slide it into the slot.
7. Push the unit until its edge-connector mates securely with the connector in the slot.
8. Turn the locking knob counter-clock wise to unlock the latch.
9. Connect the power cord to the unit and to the wall outlet.
10. Verify that the unit is on and operating properly by checking its LEDs as explained in "Power Supply" on page 18.

NOTE: In case only one power supply unit is mounted, install a filler panel in the slot of the unoccupied power supply unit to allow proper air flow.

Appendix A
Wiring the –48 VDC Power Supply

If your NSG 9000 uses the –48 VDC power supply, follow these steps to wire the power supply.

A.1 Getting Started

Before you begin wiring the –48 VDC power supply, make sure that you provide the necessary overcurrent protection, wires, and power connector.

A.1.1 Power Source Specifications

The DC power source feeding the NSG 9000 device must meet the following requirements:

- Electrically isolated from any AC power source
- Positive ground. The Positive bus of the DC power source must be reliably connected to the Ground bus.

Each feed-pair must provide a continuous supply of power that meets the following specifications:

Parameter	Specification
Voltage	36 - 72VDC
Max. operating current	16A

NOTE: For information on over-current, see "Overcurrent protection" on page 27.

A.2 Wiring Requirements

The NSG 9000 is connected to the DC power source using three wires:

- –Vin
- GND
- +Vin

Although Harmonic provides the power input connector with the NSG 9000, you must supply the wires.

The wires to be used must comply with the following specifications:

Parameter	Specification
Suitable conductor material	Copper only
–Vin and +Vin wires	14 AWG rating
Grounding cable	14 AWG rating
Cable insulation rating	Minimum 80 C, low smoke fume (LSF), flame retardant

Parameter	Specification
Cable type	Must comply with at least one of the following standards: • UL 1581 (VW-1) - UL style 1028 or equivalent • EEE 383 • EEE 1202-1991
Branch circuit cable insulation color	Per applicable national electrical codes
Grounding cable insulation color	Green-yellow

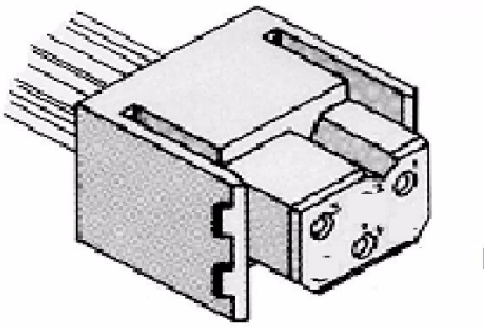
A.2.1 Power Connector

The NSG 9000 is supplied with a special DC power connector plug that matches the DC power socket on the power supply.

This connector is made by Positronics, model number PLB3W3F7105A1.

Use only the original connector for connecting the NSG 9000 to the DC power source. Contact Harmonic Technical Support if you want to use any other type of connector.

The following figure shows the connector and its strain relief housing:



A.3 Assembling the DC Input Power Cable

⇨ To assemble the DC input power cable:

1. Prepare the power wires as specified in "Wiring Requirements" on page 52.
2. Use the disconnect device to make sure that the power supply from the DC power source to the cables is switched off.

CAUTION: Turn off the power before proceeding with these instructions.

3. Unpack the power connector.
4. Identify the three wires coming from the DC power source that are used in the connection to the expansion unit:

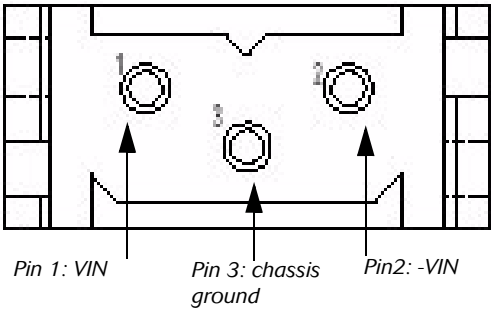
- –Vin
- +Vin
- GND

5. Strip up to 0.3 inches (8 mm) of insulation from each of the wires coming from the DC power source.

   Do not strip more than this length from each wire. Stripping more leaves uninsulated wire exposed outside the DC connector after the assembly is complete.

6. Feed the exposed section of the wires into the matching hole in the DC plug connector according to the following table and pin-out figure to match wires with the required holes.

Pin	Signal Name
1	VIN+
2	VIN-
3	Chassis ground



A.4 Connecting the Power Cable to the NSG 9000

1. Ensure the NSG 9000 is securely installed in a rack and in a Restricted Access Location only.
2. Verify that the NSG chassis is properly grounded, as explained in "Grounding the Mounted Devices" on page 42.

3. Connect the DC input power cable to the DC connector on the NSG 9000 back panel, as the following figure illustrates:

4. Place the Safety bracket on the DC connector as the following figure illustrates:

5. Attach the Safety bracket to the chassis by fastening the Safety bracket screw.

Your NSG 9000 is now connected to power.

6. Complete any other cabling that may still be needed, and engage the disconnect device to start using the device.

Appendix B
Customer Support Information

B.1 Contacting Harmonic for Technical Support

The Harmonic Customer Support group is available to help you with any questions or problems you might have regarding Harmonic products. You can reach them at:

E-mail: techhelp@harmonicinc.com

Phone: (408) 490-6477

1–888–MPEGTWO (673-4896)

Fax: (408) 490-6770

Harmonic Inc.

549 Baltic Way

Sunnyvale, California 94089

Attn: Customer Support

B.2 Documentation Feedback

Harmonic is committed to continually improving the quality of our documentation. To send comments or suggestions for improving this document, please copy the following page, fill it out, and send it to us. You can also send marked-up copies of pages in this document with your comments. Our address is:

Harmonic Inc.

4772 Walnut Street, Suite 100

Boulder, Colorado 80301

Attn: Technical Publications

E-mail: techpubs@harmonicinc.com

Fax: (720) 406-7100

Glossary

A

ASI

asynchronous serial interface. A DVB-defined interface protocol for carrying MPEG-2 transport streams at a constant or defined transmission rate.

B

bandwidth

The maximum amount of data that a transmission device (cable, fiber-optics link, satellite feed, and so on) is capable of carrying.

bandwidth allocation

The process of assigning portions of the total bandwidth on the basis of the requirements of the program material. A channel that requires a high-quality picture, for example, a live sports broadcast, should be allocated a high bandwidth. A channel that can be transmitted with a lower-quality picture, for example, a VCR-quality movie, should be assigned a lower bandwidth.

C

CMTS

Works as an arbitrator for IP communications over RF networks. *See* also INA.

component

A Harmonic hardware product that is a single, self-contained part of the network.

D

data stream

The continuous flow of information from one location to another.

DCE

data communications equipment. A device that communicates with a DTE over EIA-232. For example, a modem is a DCE that sends to and accepts data from a host computer (DTE). *See also* DTE.

downstream

The direction of the communications service data flow. Broadcast services flow downstream from the service provider to the subscriber.

DTE

data terminal equipment. A device that communicates with a DCE device over EIA-232. For example, a DTE is a computer that sends to and accepts data from a modem (DCE). *See also* DCE.

E

Ethernet

A data link (physical interface) developed for local area networks (LANs) that supports transmission rates up to 10 Mbps. Fast Ethernet supports transmission rates up to 100 Mbps.

G

GbE

Gigabit Ethernet. A transmission technology, based on the Ethernet frame format and protocol used in local area networks, that provides a data rate of 1 billion bits per second.

H

headend

The distribution point in a TV system.

Hertz

A unit of frequency defined as one cycle per second. Abbreviated Hz.

Hz

See Hertz.

I

I/O

input/output. Refers to a connection that inputs and outputs data.

INA

Works as an arbitrator for IP communications over RF networks. It is based on the DVB standard. *See* also CMTS.

IP address

An identifier for a computer or device on an Internet Protocol (IP) network. Networks using IP route messages based on the IP address of the destination. An IP address is a 32-bit number written in dotted decimal notation: four 8-bit sections, separated by periods, converted from binary to decimal. Each section is a number from zero to 255.

L

LC

A high-density optical connector used for single-mode and multimode fiber-optic applications.

M

MPEG

Moving Picture Experts Group. A joint working group of the International Standards Organization and International Electrotechnical Committee.

multimode fiber

Optical fiber designed to carry multiple light rays or modes concurrently, each at a slightly different reflection angle within the optical fiber core. Multimode fiber transmission is used for relatively short distances because the modes tend to disperse over longer lengths For longer distances, singlemode fiber is used.

multiplex

The ability to combine multiple signals over a single communications line or channel.

multiplexer

A function where multiple signals are combined into a single signal. A device that merges several lower-speed transmissions into one high-speed transmission, and vice versa.

O

OS

operating system.

P

packet

A block of data used for transmission.

PID

packet identifier. Integer values used in the MPEG-2 standard to identify an elementary stream of a program within a transport stream.

pinouts

The description and purpose of each pin in a connector.

port

A port is an input to or an output from a component, an adapter, or a module.

Q

QAM

quadrature amplitude modulation. Transmits 4 bits (16 QAM) to 8 bits (64 QAM) at the same time by varying the phase and amplitude of a signal. QAM can only be used on very quiet transmission media, such as downstream-only coaxial cable or fiber, because amplitude modulation is susceptible to interfering signals.

R

redundancy

A back-up system of Harmonic components that ensures uninterruptable service in the event of a component failure.

EIA

Electronic Industries Alliance. A U.S. trade organization that is responsible for establishing hardware interface standards.

EIA-232

An EIA standard interface for connecting serial devices (DCEs), such as modems, monitors, mice, and serial printers to a DTE. EIA-232 supports the 25-pin D-type connector (DB-25) and a 9-pin D-type connector (DB-9).

S

SFP

small form factor pluggable transceiver.

singlemode fiber

Optical fiber designed for the transmission of a single ray or mode of light as a carrier and is used for long-distance signal transmission. For short distances, multimode fiber is used.

SNMP

Simple Network Management Protocol. The protocol that Harmonic control and management systems use to configure and monitor Harmonic devices remotely over IP.

subscriber

The end user of a broadcast system; the person who views programs for entertainment purposes.

T

transport stream

One or more multiplexed MPEG-2 programs.

V

VAM

video access manager.