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This equipment generates, uses, and can radiate radio frequency energy. It may cause harmful interference to radio communications if it is not installed and used in accordance with the instructions in this manual. Operation of this equipment in a residential area is likely to cause harmful interference. If this occurs, the user will be required to correct the interference at his or her own expense.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15, Subpart B of the Federal Communications Commission (FCC) rules.

These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment.

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Connections between the Harmonic equipment and other equipment must be made in a manner that is consistent with maintaining compliance with FCC radio frequency emission limits. Modifications to this equipment not expressly approved by Harmonic may void the authority granted to the user by the FCC to operate this equipment.

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Harmonic Inc. intends to comply fully with the European Union’s Directive 2002/96/EC as amended by Directive 2003/108/EC, on Waste Electrical and Electronic Equipment, also known as “WEEE,” and Directive 2002/95/EC, as amended, on the Restriction of use of Hazardous Substances, also known as “RoHS.”

Harmonic will ensure that product which cannot be reused will be recycled in compliance with the WEEE Directive. To that end, users are advised that (1) Harmonic equipment is not to be discarded in household or office garbage, (2) Harmonic Inc. will pay the freight for shipment of equipment to be disposed of if it is returned to Harmonic, (3) customers should call the normal RMA telephone numbers to arrange for such shipment, and (4) for additional and updated information on this process customers may consult the Harmonic website: http://harmonicinc.com/pa_weee_recycle.cfm.

Harmonic will ensure that its products will be either reused or recycled in compliance with the WEEE Directive. For the latest information concerning Harmonic’s WEEE/RoHS Compliance Policy and its Recycling and Take-Back process, please visit our web site.

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### Names and Contents of the Toxic and Hazardous Substances or Elements in the Products if the Part is Present

This table shows those components where hazardous substances may be found in Harmonic products based on, among other things, material content information provided by third party suppliers. These components may or may not be part of the product.

Except for special notes, Harmonic products have an Environmental Protective Use Period (EPUP) of 20 years, unless otherwise displayed on the product. The EPUP period is valid only when the products are operated or stored as per the conditions specified in the product manual.

<table>
<thead>
<tr>
<th>部件名? (Part name)</th>
<th>有毒有害物?或元素 (Hazardous Substance)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>? (PB)</td>
</tr>
<tr>
<td>印刷?路板 (Printed Circuit Assemblies)</td>
<td>X</td>
</tr>
<tr>
<td>机械?件 (Mechanical Subassemblies)</td>
<td>X</td>
</tr>
<tr>
<td>光学?件 (Optical Subassemblies)</td>
<td>X</td>
</tr>
<tr>
<td>电源 (Power Supplies)</td>
<td>X</td>
</tr>
<tr>
<td>缆? / ?束 (Cables, harnesses)</td>
<td>X</td>
</tr>
<tr>
<td>屏幕 / ?示器 (Screens, Monitors)</td>
<td>X</td>
</tr>
<tr>
<td>金属零件 (Metal Parts)</td>
<td>O</td>
</tr>
<tr>
<td>塑料 / 发泡材料 (Plastics, foams)</td>
<td>O</td>
</tr>
<tr>
<td>电池 (Batteries)</td>
<td>O</td>
</tr>
</tbody>
</table>


O: Indicates the content of the toxic and hazardous substances at the homogeneous material level of the parts is below the limit defined in SJ/T11363 2006 standard.


X: Indicates that the content of the toxic and hazardous substances in at least one of the homogeneous materials of the parts is above the limit defined in SJ/T11363 2006 standard.
Standards and Agency Approval

The following tables list regulatory standards and agency approvals:

North America

<table>
<thead>
<tr>
<th>Standards</th>
<th>Agency Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMI: FCC Part 15, Subpart B, ICES-003, Issue 2, Class A</td>
<td>FCC</td>
</tr>
<tr>
<td>Safety: UL 60950, CSA 60950</td>
<td>cTUV-us Mark</td>
</tr>
</tbody>
</table>

Europe

<table>
<thead>
<tr>
<th>Standards</th>
<th>Agency Approval</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMI/EMC: EN55022, Class A, EN55024</td>
<td>CE</td>
</tr>
<tr>
<td>Safety: EN 60950</td>
<td>TUV-GS-Mark, CE</td>
</tr>
</tbody>
</table>

Japan

<table>
<thead>
<tr>
<th>Standards</th>
<th>Agency Approval</th>
</tr>
</thead>
</table>

Australia and New Zealand

<table>
<thead>
<tr>
<th>Standards</th>
<th>Agency Approval</th>
</tr>
</thead>
</table>
Documentation Conventions

This manual uses some special symbols and fonts to call your attention to important information. The following symbols appear throughout this manual:

**DANGER:** The Danger symbol calls your attention to information that, if ignored, can cause physical harm to you.

**CAUTION:** The Caution symbol calls your attention to information that, if ignored, can adversely affect the performance of your Harmonic product, or that can make a procedure needlessly difficult.

**LASER DANGER:** The Laser symbol and the Danger alert call your attention to information about the lasers in this product that, if ignored, can cause physical harm to you.

**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 hyperlinked cross-references in online documents.
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Chapter 1
Main Features and Specifications

1.1 Introduction

NSG™ (Network Services Gateway) 9000-6Gbps is Harmonic’s advanced modular 2-RU platform. The NSG 9000-6G platform is a high density edgeQAM system, capable of scaling up to 144 QAM-RF output transport streams. The number of the delivered transport streams is set according to the device configuration, license and number of QAM-RF modules mounted in the slots of the device.

This guide describes the NSG 9000-6G specifications, and instructs you on how to install and cable the NSG 9000-6G.

1.2 Main Features

The following table describes the main features of the NSG 9000-6G platform:

Table 1-1: NSG 9000-6G Main Features

<table>
<thead>
<tr>
<th>Component</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis</td>
<td>Chassis</td>
<td>2-RU, mounts in Electronic Industries Association (EIA) standard rack</td>
</tr>
<tr>
<td>Hot-swappable Front Panel</td>
<td></td>
<td>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.</td>
</tr>
<tr>
<td>Indication LEDs</td>
<td></td>
<td>2 power, alarm and 9 output status LEDs.</td>
</tr>
<tr>
<td>Processing module</td>
<td>8 x GbE input ports</td>
<td>▪ Provides eight independent ports receiving simultaneously different feeds</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Input rate of up to 1000 Mbps per port</td>
</tr>
<tr>
<td></td>
<td>1 x ASI monitoring port</td>
<td>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.</td>
</tr>
<tr>
<td>Back panel LEDs</td>
<td></td>
<td>Activity and alarm LED pair for each GbE port (12 LEDs in all).</td>
</tr>
<tr>
<td>10Base-T/100Base-T</td>
<td></td>
<td>Two independent Ethernet ports, typically used for management (ETH1) and scrambling (ETH2).</td>
</tr>
<tr>
<td>Ethernet ports</td>
<td>2xDTI ports</td>
<td>Two DTI ports, typically used for M-CMTS applications.</td>
</tr>
</tbody>
</table>
Chapter 1 Main Features and Specifications

Main Features

© 2012 Harmonic Inc. 3 NSG 9000-6G Version 2 and Up, Rev H

### QAM-RF modules

- Up to nine QAM-RF modules, 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.

<table>
<thead>
<tr>
<th>Component</th>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2xRF ports per QAM-RF module, overall up to 18xQAM RF ports</td>
<td>RF bandwidth per port - 48 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number of QAMs per port:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Annex B and C - up to 8xQAM channels</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Annex A - up to 6xQAM channels</td>
<td></td>
</tr>
<tr>
<td>Up to 144 QAM-RF channels</td>
<td>Each port carries up to eight QAM channels combined and upconverted. For further information, refer to page 12.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QAM Mode:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ITU-T J.83 Annex-A (DVB): 8 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ITU-T J.83 Annex-B: 6 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ITU-T J.83 Annex-C (Japan): 6 MHz</td>
<td></td>
</tr>
<tr>
<td></td>
<td>QAM Constellations:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ITU-T J.83 Annex-A: 16, 32, 64, 128, 256</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ITU-T J.83 Annex-B: 64, 256</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- ITU-T J.83 Annex-C: 16, 32, 64, 128, 256</td>
<td></td>
</tr>
<tr>
<td>Maximum output bit rate</td>
<td>For further QAM-RF specifications, see product specification sheet.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ITU-T J.83 Annex-A:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 6xQAM channels per physical port (Triple QAM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 12xQAM channels per module</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Max output bitrate per QAM channel - 51.287 Mbps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ITU-T J.83 Annex-B:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 8xQAM channels per physical port (Quad QAM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 16xQAM channels per module</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Max output bitrate per QAM channel - 38.811 Mbps</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ITU-T J.83 Annex-C:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 8xQAM channels per physical port (Quad QAM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Up to 16xQAM channels per module</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Max output bitrate per QAM channel - 39.171 Mbps</td>
<td></td>
</tr>
</tbody>
</table>
1.3 NSG 9000 Physical and Power Specifications

1.3.1 Physical Dimensions

Table 1-2: Physical Dimensions

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Inches</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>3.47</td>
<td>88.1</td>
</tr>
<tr>
<td>Width</td>
<td>19.00</td>
<td>482.6</td>
</tr>
<tr>
<td>Total Length (front to back)</td>
<td>22.88</td>
<td>581.2</td>
</tr>
<tr>
<td>Depth (from rack mount fixture to back of device)</td>
<td>21.78</td>
<td>553.4</td>
</tr>
</tbody>
</table>

1.3.2 NSG 9000 Weight

The table lists worse case values of weight for several model combinations:

Table 1-3: NSG 9000 Weight

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Weight (lb.)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis with front panel and main processing board</td>
<td>33.00</td>
<td>15.0</td>
</tr>
<tr>
<td>Power Supply AC/DC</td>
<td>4.10</td>
<td>1.9</td>
</tr>
<tr>
<td>QAM-RF blade</td>
<td>2.33</td>
<td>1.1</td>
</tr>
<tr>
<td>Full platform (chassis + 2xPS + 9xQRF)</td>
<td>62.2</td>
<td>28.4</td>
</tr>
<tr>
<td>Full platform (chassis + 1xPS + 9xQRF)</td>
<td>58.2</td>
<td>26.4</td>
</tr>
</tbody>
</table>
1.3.3 Power Supply Specifications

Harmonic sells power supply units that have been thoroughly qualified to operate with the NSG 9000-6G device. Table 1–4 lists power specifications of a fully populated unit together with the Harmonic part numbers for the qualified power supply modules. Use these part numbers for ordering your power supply modules.

NOTE: NSG9000-6G firmware version 2.4 and up, supports also power supply units with the following part number: NSG-PS-AC-03, NSG-PS-DC-03.

Table 1–4: Power Supply Units Specifications

<table>
<thead>
<tr>
<th>Harmonic Part Number</th>
<th>PS Type</th>
<th>Input Voltage Range</th>
<th>Input Line Frequency</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSG-PS-AC-01</td>
<td>AC</td>
<td>85 to 264 VAC</td>
<td>47 to 63 Hz</td>
<td>Supports up to 24 QAM channels per RF port</td>
</tr>
<tr>
<td>NSG-PS-DC-01</td>
<td>DC</td>
<td>-36 to -72 VDC</td>
<td>N/A</td>
<td>Supports up to 24 QAM channels per RF port</td>
</tr>
<tr>
<td>NSG-PS-AC-02</td>
<td>AC</td>
<td>100 to 240 VAC</td>
<td>47 to 63 Hz</td>
<td>Supports up to 24 QAM channels per RF port</td>
</tr>
<tr>
<td>NSG-PS-DC-02</td>
<td>DC</td>
<td>-40 to -60 VDC</td>
<td>N/A</td>
<td>Supports up to 24 QAM channels per RF port</td>
</tr>
<tr>
<td>NSG-PS-AC-03</td>
<td>AC</td>
<td>100 to 240 VDC</td>
<td>47 to 63 Hz</td>
<td>Supports up to 36 QAM channels per RF port</td>
</tr>
<tr>
<td>NSG-PS-DC-03</td>
<td>DC</td>
<td>-40 to -60 VDC</td>
<td>N/A</td>
<td>Supports up to 36 QAM channels per RF port</td>
</tr>
</tbody>
</table>

CAUTION: Both power supply units should be of the same part number. Power supply units with different part numbers, may adversely affect the performance of the QAM–RF output signal.

1.3.4 Power Consumption from Grid

The following table lists the power consumption of a fully populated device. Use the consumption figure of a single module in order to calculate the consumption of a partly-populated chassis:

Table 1–5: Power Consumption

<table>
<thead>
<tr>
<th>Input Voltage</th>
<th>Max Power consumption from Grid (Watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fully Populated Chassis</td>
</tr>
<tr>
<td>110V AC</td>
<td>580</td>
</tr>
<tr>
<td>220V AC</td>
<td>550</td>
</tr>
<tr>
<td>-48V DC</td>
<td>550</td>
</tr>
</tbody>
</table>

For installation details, see 2.2.5.2 Overcurrent protection on page 17.
For cabling details, see 3.7 Connecting Power on page 27.
1.3.5 **Environmental Specifications**

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>0 to 50 °C (32 to 122 °F)</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>–20 to 80 °C (–4 to 176 °F)</td>
</tr>
<tr>
<td>Relative humidity</td>
<td>Maximum 95% non-condensing</td>
</tr>
</tbody>
</table>

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 M³/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 accepts digital MPEG input through its gigabit Ethernet (GbE) ports, then directs the multimedia to different QAMs to create the outgoing transport streams as QAM-RF output signals. The NSG 9000 is also designed to meet the DOCSIS 3.0 M-CTMS requirements for downstream data transmission.

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

NSG9000-6G, firmware version 2.6.3 supports two types of front panel:

- NSG-FP-01-02F
- NSG-FP-02-01F

The following figure illustrates front panel with part number NSG-FP-01-02F:
Figure 1-1: NSG9000-6G Front Panel

The following figure illustrates front panel with part number NSG-FP-02-01F. This front panel comes with the Turbo indication to denote fans with higher speed:

Figure 1-2: NSG9000-6G Front Panel PN NSG-FP-02-01F

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 1.5.5 Air Inlets on page 8.

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-tyf 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.
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. See 4.1.1 *Removing and Replacing the Cooling Fans Unit* on page 30.

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
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:

- 2x Ethernet ports
- 2x DTI ports (optional)
- ASI monitor port
- 8x GbE ports

**NOTE:** In case of processing module malfunction, replace the module as instructed in 2.4 Inserting Processing/QAM-RF Modules on page 19 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. The following table lists the specifications of the Ethernet ports.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>10/100 Base-T ports</td>
</tr>
<tr>
<td>Connector</td>
<td>RJ-45 (1 Management, 1 CAS)</td>
</tr>
</tbody>
</table>
For cabling instructions, see 3.4 Connecting the Ethernet Cables on page 27.

1.6.1.2 DTI Ports

The DTI ports, labeled DTI1 and DTI2, allow the NSG 9000 to operate in an M-CMTS application. The following table lists the DTI ports specifications:

Table 1-9: DTI Ports Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input signal</td>
<td>Complies with DOCSIS 3.0 DTI</td>
</tr>
</tbody>
</table>

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. The following table lists the specifications of the ASI monitoring port.

Table 1-10: ASI Monitoring Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPEG Format</td>
<td>ASI Output</td>
</tr>
<tr>
<td>Connector</td>
<td>Type BNC, 75Ω</td>
</tr>
<tr>
<td>Configuration</td>
<td>Configurable mirroring per QAM</td>
</tr>
<tr>
<td>MPEG Format</td>
<td>188 Bytes per TS packet</td>
</tr>
</tbody>
</table>

For cabling instructions, see *3.6 Connecting the ASI Monitoring Port Cables* on page 27.

1.6.1.4 GbE Input Ports

The NSG 9000 platform includes eight GbE ports labeled GbE 1-8. The ports support Small Form Factor Pluggable (SFP) transceivers for either fiber or copper cables.

The following table lists the GbE port specification:

Table 1-11: GbE Port Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>SFP transceivers for either fiber or copper cables</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Maximum input bitrate</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Line rate up to 1000 Mbps</td>
<td></td>
</tr>
<tr>
<td>Processing up to 960Mbps</td>
<td></td>
</tr>
</tbody>
</table>

| Maintenance          | Swappabe                                         |

The NSG 9000 back panel features two LEDs for each GbE port. The following table describes the LEDs:
1.6.1.5 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:

![SFP Module Image]

**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 1-13* on page 12 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 1-13: SFP Modules

<table>
<thead>
<tr>
<th>Harmonic Part Num.</th>
<th>Fiber/Cable Type</th>
<th>Connector Type</th>
<th>Wave Length</th>
<th>Max. Cable/Fiber Length</th>
<th>Qualified Finisar SFP Model Part Num.</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSF9311-02</td>
<td>Multimode fiber</td>
<td>2 x LC</td>
<td>850 nm</td>
<td>550m</td>
<td>FTLF8519P2BNL</td>
</tr>
<tr>
<td>GSF9322-02</td>
<td>Singlemode fiber</td>
<td>2 x LC</td>
<td>1310 nm</td>
<td>10 km</td>
<td>FTLF1319P1BTL</td>
</tr>
<tr>
<td>GSF9132-02</td>
<td>Singlemode fiber</td>
<td>2 x LC</td>
<td>1550 nm</td>
<td>70 km</td>
<td>FTLF1621P1BCL</td>
</tr>
<tr>
<td>GSF9100-02</td>
<td>Shielded and grounded CAT-6 or CAT-7</td>
<td>1 x RJ-45</td>
<td>N/A</td>
<td>100m</td>
<td>FCLF-8521-3</td>
</tr>
</tbody>
</table>

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 bidirectional topology is used, connect the Tx socket back to the switch.

1.6.2 QAM–RF Modules

1.6.2.1 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:

![Figure 1-6: Slots Arrangement](image_url)
1.6.2.2 QAM-RF Modules

NSG 9000 supports QAM-RF module NSG-8R1G only. 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 eight channels as your license permits. For further details refer to the NSG 9000 Online Help or to the NSG 9000 SW User’s Guide. The following table provides the RF port specifications:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connector</td>
<td>Male F connector</td>
</tr>
<tr>
<td>Cable</td>
<td>RG6 (75 Ohm, 0-3 GHz)</td>
</tr>
<tr>
<td></td>
<td>RG59 (75 Ohm, 0-3 GHz)</td>
</tr>
<tr>
<td></td>
<td>The female RF connectors are designed to accept cables with center pin diameter of 0.68-1.73mm (0.026”- 0.068”). Cables that do not meet this requirement must be mounted with crimp-on connector of the required dimensions.</td>
</tr>
<tr>
<td>Output center frequency</td>
<td>ANNEX A 54 - 998MHz</td>
</tr>
<tr>
<td></td>
<td>ANNEX B 53 - 999MHz</td>
</tr>
</tbody>
</table>

**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 3.3 Connecting the QAM-RF Output Cables on page 26.
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 supply specifications, see "1.3.3 Power Supply Specifications" on page 5.

**CAUTION:** Both power supply units should be of the same manufacturer and with the same power consumption. Power supply units of different manufacturers and power consumption, may adversely affect the performance of the QAM-RFs.

The physical dimensions of the AC/DC power supply unit: 40mmH x 90mmW x 440mmD.

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

<table>
<thead>
<tr>
<th>LED</th>
<th>Color</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Ok</td>
<td>Green</td>
<td>Illuminates when mains input voltage is present.</td>
</tr>
<tr>
<td>Out Ok</td>
<td>Green</td>
<td>Illuminates when output voltage is greater than 80% of the nominal output rate.</td>
</tr>
</tbody>
</table>

For instructions to connect the AC power supply, see 3.7 Connecting Power on page 27.

The -48 VDC power supply unit is supplied with the required 3-pin male connector. See Wiring the –48 VDC Power Supply on page 33 for instructions to connect the power supply.

**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:

- “Unpacking the NSG 9000 Platform” on page 23
- “Installing the NSG 9000 Platform” on page 24
- “Inserting the Modules” on page 29
- “Connecting Power” on page 42

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 19.

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

2.2 Installation Guidelines

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) deep and 40RU high. In addition, recommended rack: 36” (91cm) or 40” (102cm) depth.
- To allow free air flow, the rack must be completely open at its front side. See Table 2-1: Guidelines and Specifications for Mounting a Device on page 16.
- The rack should be mounted with side walls and a back door.
- The back door should have ventilation slots either at its bottom part only or throughout the height of the door.

2.2.2 Rack Ventilation

The top of the rack should be open, enabling free flow of hot air into the air conditioning system intake. No fans are required at the top of the rack.
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.
- Ensure that the front of the rack is not directly exposed to the air-outlet side of any other racks.

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.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupied Space</td>
<td>2 rack unit</td>
</tr>
<tr>
<td>Mounting Order</td>
<td>Partially filled rack - load rack from the bottom to the top with the heaviest component at the bottom of the rack.</td>
</tr>
<tr>
<td>Max Number</td>
<td>According to allowed floor load. See, 2.2.4 Rack Weight on page 16. 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”.</td>
</tr>
<tr>
<td>Mounting Method</td>
<td>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.</td>
</tr>
<tr>
<td>Open space</td>
<td>To prevent hot air circulation, all open spaces below and above the devices should be closed with a blank panel.</td>
</tr>
<tr>
<td>Cabling</td>
<td>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.</td>
</tr>
</tbody>
</table>

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:

<table>
<thead>
<tr>
<th>Table 2–2: Total Load and Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
</tr>
<tr>
<td>Single fully loaded NSG 9000 unit</td>
</tr>
<tr>
<td>Footprint of a typical 23”x30” rack</td>
</tr>
</tbody>
</table>
For partial NSG 9000 configuration, see 1.3.2 NSG 9000 Weight on page 4.

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:

**Table 2-3: Overcurrent Protection**

<table>
<thead>
<tr>
<th>PS Part Number</th>
<th>Max Power Consumption (Watts)</th>
<th>Max Steady State Current (Amp)</th>
<th>In Rush Current Draw (Amp)</th>
<th>Number of Units per CB</th>
</tr>
</thead>
<tbody>
<tr>
<td>110VAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSG-PS-AC-01</td>
<td>580</td>
<td>7</td>
<td>30</td>
<td>15A CB - 1 unit</td>
</tr>
<tr>
<td>NSG-PS-AC-02</td>
<td></td>
<td></td>
<td></td>
<td>20A CB - up to 2 units</td>
</tr>
<tr>
<td>NSG-PS-AC-03</td>
<td>820</td>
<td>9.9</td>
<td>30</td>
<td>15A CB - 1 unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20A CB - 1 unit</td>
</tr>
<tr>
<td>220VAC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSG-PS-AC-01</td>
<td>550</td>
<td>3</td>
<td>40</td>
<td>15A CB - up to 2 unit</td>
</tr>
<tr>
<td>NSG-PS-AC-02</td>
<td></td>
<td></td>
<td></td>
<td>20A CB - up to 4 units</td>
</tr>
<tr>
<td>NSG-PS-AC-03</td>
<td>820</td>
<td>4.6</td>
<td>35</td>
<td>15A CB - up to 2 unit</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20A CB - up to 3 units</td>
</tr>
<tr>
<td>-48VDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSG-PS-DC-01</td>
<td>550</td>
<td>15.5</td>
<td>20</td>
<td>N/A</td>
</tr>
<tr>
<td>NSG-PS-DC-02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSG-PS-DC-03</td>
<td>820</td>
<td>21.0</td>
<td>25</td>
<td>N/A</td>
</tr>
</tbody>
</table>

When using DC power supply, overcurrent protection should be provided by a fuse panel, with a separate fuse for each individual NSG9000 unit. This fuse is meant primarily for protecting the DC power source from damage in case of an internal power supply problem. 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 33.

2.2.5.3 **Grounding**

- 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 3.7.1 Grounding the Mounted Devices on page 27.

2.2.6 **Facility Cooling Requirements**

The following table lists the heat generated by a single fully loaded NSG 9000 device for each power feed.

The required cooling capacity of the facility's air conditioning system assumes 15% general leakage of a typical air conditioning system and 25% latent heat.

**Table 2-4: Facility Cooling Requirements**

<table>
<thead>
<tr>
<th>Power Feed</th>
<th>Generated Heat (Watts)</th>
<th>Generated Heat (BTU/Hour)</th>
<th>Facility A/C Cooling Capacity per NSG (BTU/Hour)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110 VAC</td>
<td>580</td>
<td>1,972</td>
<td>2,835</td>
</tr>
<tr>
<td>220VAC</td>
<td>550</td>
<td>1,870</td>
<td>2,688</td>
</tr>
<tr>
<td>48VDC</td>
<td>550</td>
<td>1,870</td>
<td>2,688</td>
</tr>
</tbody>
</table>

**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 25°C. NSG 9000 can continuously operate in ambient temperature of up to 50°C. However, continuous operation in a high ambient temperature shortens the device lifetime.
2.3 Installing NSG 9000-6G Devices

2.3.1 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.

2.4 Inserting Processing/QAM-RF 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.

2.4.1 Guidelines for Handling Processing/QAM-RF Modules

CAUTION: 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 install 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.
- Take off the RF ports terminators before using the ports only. Unused ports should be terminated.
- When cabling the RF ports, connect both edges immediately. Do not leave the edge to be connected to the RF network unconnected. ESD may damage the module.
2.4.1.1 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:

Table 2-5: Tools for Mounting/Replacing a QAM-RF Module

<table>
<thead>
<tr>
<th>Action</th>
<th>Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Removing Fillers</td>
<td>Socket head Screwdriver 3/32&quot; x 4&quot;</td>
</tr>
<tr>
<td>Fastening QAM-RF module</td>
<td>■ 3/32&quot; Allen wrench (provided with the chassis) P/N 019-0003-001</td>
</tr>
<tr>
<td></td>
<td>■ 3/32&quot; screwdriver bit (provided with the chassis) P/N 019-0004-001</td>
</tr>
<tr>
<td>Fastening Processing</td>
<td>Slotted screwdrivers 5/16&quot; x 4&quot;</td>
</tr>
<tr>
<td>module</td>
<td></td>
</tr>
<tr>
<td>Handling Processing and</td>
<td>ESD-preventing wrist band and a rubber mat</td>
</tr>
<tr>
<td>QAM-RF modules</td>
<td></td>
</tr>
</tbody>
</table>

To insert a module

1. Unscrew the screws that attach the filler to the chassis.
2. While following the ESD guidelines mentioned above, unpack the module.
3. 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.

4. Push the module until its edge-connector mates securely with the connector in the slot. See 1.6.2.2 QAM-RF Modules on page 13.
5. Fasten the screws of the module to secure the module to the chassis.

![Figure 2-2: Inserting QAM-RF Module – Fastening Screws](image)

6. 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.

To replace a module

1. After disconnecting the RF ports, terminate them with the port terminators.

![Figure 2-3: Terminator](image)

2. Unscrew the screws that attach the module to the chassis.

![Figure 2-4: QAM-RF Module – Unscrewing Screws](image)
3. Hold the module by its knob-holders and pull it out of the slot.

![Figure 2-5: Pulling Out QAM-RF Module](image1)

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

5. To insert another module, see *To insert a module* on page 20, Step 2.

To replace the Processing module:

1. Unscrew the screws that attach the Processing module to the chassis in a synchronized manner.

![Figure 2-6: Replacing Processing Module – Unscrewing Screws](image2)
2. Pull the processing module out of its slot and place it in an anti-static container or packaging.

![Figure 2-7: Pulling Out Processing Module](image)

3. While following the ESD guidelines mentioned above, unpack the Processing module to be installed in the device.
4. While holding the module by its edges, insert it into the slot.
5. Push the module until its edge-connectors mate securely with the connectors in the slot.
6. In a synchronized manner, fasten the screws of the module to secure the Processing module to the chassis.
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 "1.6 Back Panel" on page 8 for placement.

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

3.1 Device Dimensions on page 25
3.2 Cabling the GbE Ports on page 26
3.3 Connecting the QAM-RF Output Cables on page 26
3.4 Connecting the Ethernet Cables on page 27
3.5 Cabling the DTI Ports on page 27
3.6 Connecting the ASI Monitoring Port Cables on page 27
3.7.1 Grounding the Mounted Devices on page 27
3.7.2 Connecting the AC Power Cable on page 28
3.7.3 Connecting the –48 VDC Power Supply on page 28
3.1 Device Dimensions

Dimensions are provided in Inches and millimeters as follows:

<table>
<thead>
<tr>
<th>Inch</th>
<th>mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>482.6</td>
<td>19.00</td>
</tr>
<tr>
<td>88.1</td>
<td>3.47</td>
</tr>
<tr>
<td>25</td>
<td>0.98</td>
</tr>
<tr>
<td>580.5</td>
<td>22.86</td>
</tr>
<tr>
<td>581.2</td>
<td>22.88</td>
</tr>
<tr>
<td>17.37</td>
<td>441.3</td>
</tr>
<tr>
<td>1.09</td>
<td>27.8</td>
</tr>
<tr>
<td>22.66</td>
<td>575.4</td>
</tr>
</tbody>
</table>

Figure 3-1: Device Dimensions

3.1.1 Back Panel Measurements

Figure 3-2: 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.

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.
3. Connect the NSG 9000 to a switch or other NSG 9000 as appropriate for your network configuration.

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 1 and 2 and implement the dual upconverter technology. Each port delivers up to eight RF channels.

When cabling the QAM-RF ports, use either of the following cables:

- RG-6 (75 Ohm, 0-3 GHz) coaxial cable equipped with F-type connectors only
- RG-59 (75 Ohm, 0-3 GHz) coaxial cable equipped with F-type connectors only

**NOTE:** The female F-type connectors are designed to accept cables with center pin diameter of 0.68-1.73 mm (0.026” – 0.068”). Cables that do not meet this requirement must be mounted with crimp-on connector of the required dimensions.

**CAUTION:** Using cables other than the cables indicated above may adversely affect the QAM-RF performance.

To connect the RF Cables:
1. Remove the terminators that cover the RF port.
2. Connect the cable to the RF port.
3. Connect the other edge of the cable to your output equipment according to your network schema.
CAUTION: Failing to perform step 3 and having a loose edge of the RF cable, exposes the QAM-RF module to ESD and may severely damage the QAM-RF module.

3.4 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.

3.5 Cabling the DTI Ports

Cabling the DTI card is straightforward. See 1.6 Back Panel on page 8 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.

3.6 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.

3.7 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. In case you upgrade your NSG9000-6G device to NSG9000-40G device, the recommended line cord is 16A/18 AWG.

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 Wiring the –48 VDC Power Supply on page 33 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:

Uboot@9600bps - indicates the first stage of the boot up procedure

Kernel Boot - indicates the second stage of the boot up procedure

Gbe. Init. - indicates the third stage, loading 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 device and a default IP address.

<table>
<thead>
<tr>
<th>Harmonic</th>
<th>NSG9K6G</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.30.20.170</td>
<td></td>
</tr>
</tbody>
</table>

CAUTION: Once you power up the device, the QAM-RF ports should always be connected as explained in 3.3 Connecting the QAM-RF Output Cables on page 26 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.
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.

![Cooling Fans Unit Diagram](image)

**Figure 4-1: Cooling Fans Unit**

**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 two hot swappable power supply units manufactured by Telkoor or Tectrol. 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.

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 clock wise to lock 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 1.6.3 Power Supply on page 14.

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:

Table A-1: Feed-pair Power Supply Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage</td>
<td>36 - 72 VDC</td>
</tr>
<tr>
<td>Max. operating current</td>
<td>16 A</td>
</tr>
</tbody>
</table>

**NOTE:** For information on over-current, see 2.2.5.2 Overcurrent protection on page 17.

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:

Table A-2: DC Wiring Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suitable conductor material</td>
<td>Copper only</td>
</tr>
<tr>
<td>−Vin and +Vin wires</td>
<td>14 AWG rating</td>
</tr>
</tbody>
</table>
Appendix A Wiring the –48 VDC Power Supply

Wiring Requirements

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 and may be purchased directly from Harmonic. Use the following part number for ordering the connector from Harmonic: NSG-9K-ACC-DC-CONN-01.

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 with its hood removed:

![Figure 4-5: DC Connector](image)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grounding cable</td>
<td>14 AWG rating</td>
</tr>
<tr>
<td>Cable insulation rating</td>
<td>Minimum 80 C, low smoke fume (LSF), flame retardant</td>
</tr>
<tr>
<td>Cable type</td>
<td>Must comply with at least one of the following standards:</td>
</tr>
<tr>
<td></td>
<td>- UL 1581 (VW-1) - UL style 1028 or equivalent</td>
</tr>
<tr>
<td></td>
<td>- EEE 383</td>
</tr>
<tr>
<td></td>
<td>- EEE 1202-1991</td>
</tr>
<tr>
<td>Branch circuit cable insulation color</td>
<td>Per applicable national electrical codes</td>
</tr>
<tr>
<td>Grounding cable insulation color</td>
<td>Green-yellow</td>
</tr>
</tbody>
</table>

Table A-2: DC Wiring Specifications
A.3 Assembling the DC Input Power Cable

To assemble the DC input power cable:

1. Prepare the power wires as specified in 3.7.3 Connecting the –48 VDC Power Supply on page 28.
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. Remove the hood of the connector.
7. Feed the exposed section of the wires into the matching hole in the DC plug connector. See step 1 in the following illustration.
8. Fasten the screws to hold securely the wires. See step 2 in the following illustration.

![Figure 4-6: Assembling the DC Input Power Cable](image-url)

9. Place the connector hood back to its place and fasten its screws.
4.3 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 "3.7.1 Grounding the Mounted Devices" on page 27.
3. Connect the DC input power cable to the DC connector on the NSG 9000 back panel, as the following figure illustrates:

![Figure 4-7: DC Connector and Power Cables](image1.png)

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

![Figure 4-8: DC Connector and Safety Bracket](image2.png)

**NOTE:** The Safety bracket is not required for power supply units with the following part number: NSG-PS-DC-03.

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.