Gateway Series G080 Administrator Manual

Compliance Information

Compliance information for this product is available at

http://www.digium.com/compliance

Introduction to Gateway Documentation

This manual contains product information for the Gateway appliances. Be sure to refer to any supplementary documents or release notes that were shipped with your equipment. The manual is organized in the following manner:

Chapter/ Appendix	Title	Description
1	Overview	Identifies the features of your unit.
2	Unit Installation	Provides instructions for installing the unit.
3	Configuration	Provides instructions on how to configure the unit.
4	Troubleshooting	Explains resolutions to common problems and frequently asked questions pertaining to unit installation and usage.
A	Pin Assignments	Describes the states supported by the unit.
B	Specifications	Details unit specifications.

C	Glossary and Acronyms	Defines terms related to this product.

Symbol Definitions

	Caution statements indicate a condition where damage to the unit or its configuration could occur if operational procedures are not followed. To reduce the risk of damage or injury, follow all steps or procedures as instructed.
	The ESD symbol indicates electrostatic sensitive devices. Observe precautions for handling devices. Wear a properly grounded electrostatic discharge (ESD) wrist strap while handling the device.
	The Electrical Hazard Symbol indicates a possibility of electrical shock when operating this unit in certain situations. To reduce the risk of damage or injury, follow all steps or procedures as instructed.
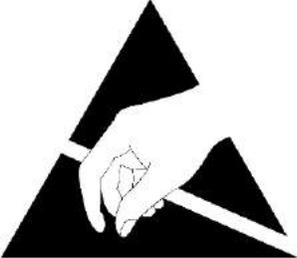
Important Safety Instructions

User Cautions

	Warning *The unit must be used with its case screwed shut.* *Telecommunications network voltages exist inside the unit!* *The unit must be shut down and telecommunications line connection shall be removed before opening the unit.*

	Electrical Shock. *To reduce the risk of injury, damage to the unit or your equipment, do not attempt to touch any of its internal components while it is powered. The unit must be securely closed before is applied to the unit.*
	Alarm Dialing Equipment. If your office has specially wired alarm equipment connected to the telephone line, ensure the installation of the unit does not disable your alarm equipment. If you have questions, consult your telephone company or a qualified installer.
	Servicing. *Do not attempt to service this unit. There are no user-serviceable parts inside. Refer servicing to qualified service personnel.*
	Water and Moisture. *Do not spill liquids on this unit. Do not operate this equipment in a wet environment.*
	Heat. *Do not operate or store this product near heat sources such as radiators, air ducts, areas subject to direct, intense sunlight, or other products that produce heat.*
	Caution. *To reduce the risk of fire, use only No. 26 AWG or larger telecommunication wiring for network connections.*
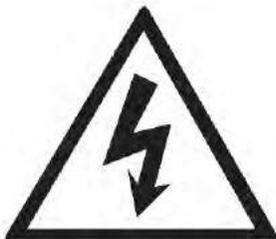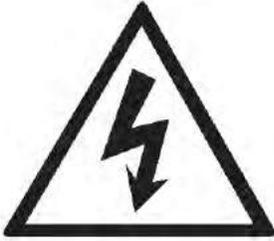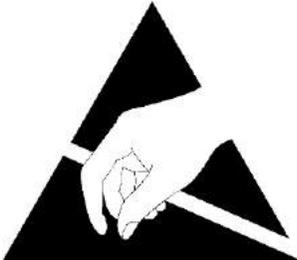
	Caution.
	The unit is not intended for home use. It must be used in restricted access locations and installed in UL Listed I.T.E. only.
	Static Electricity.
	To reduce the risk of damaging the unit or your equipment, do not attempt to open the enclosure or gain access to areas where you are not instructed to do so. Refer servicing to qualified service personnel.

Save these instructions for future reference.

Service Personnel Cautions
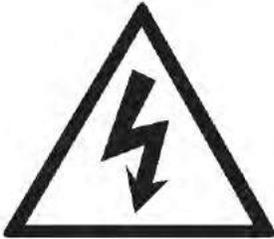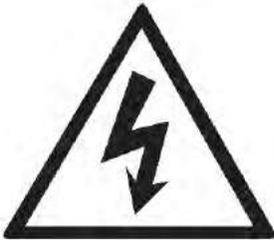
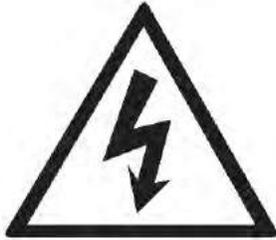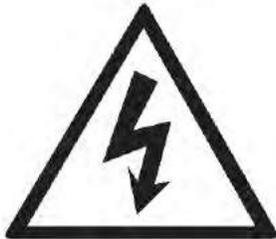|	**Warning.**
	The unit must be used with its case screwed shut.
	Telecommunications network voltages exist inside the unit!
	The unit must be shut down and telecommunications line connection shall be removed before opening the unit.
	Electrical Shock.
	To reduce the risk of injury, damage to the unit or your equipment, do not attempt to touch any of its internal components while it is powered. The unit must be securely closed before is applied to the unit.
	Servicing.
	Disconnect telecommunications network cable before opening the cover or removing any internal components.
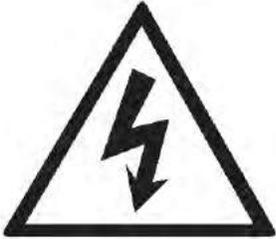
|	
	Labeling. For safety reasons, only connect equipment with a Telecommunications Compliance label. This includes customer equipment previously labelled **Permitted** or **Certified**.
	Caution. Only connect regulatory equipment (approved for use in your specific country) to the telecommunications network voltage circuit ports.
	Caution. The unit is not intended for home use. It must be used in restricted access locations and installed in UL Listed I.T.E. only.
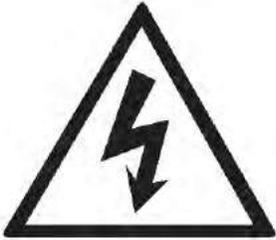
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Chapter 1

Overview

Digium's Gateway is a converged media gateway product line designed to interface between Public Switched Telephone Networks (PSTN) and IP networks (SIP). The Gateway connects legacy telephone systems to IP networks and seamlessly integrates VoIP PBXs with the PSTN. Powered by innovative hardware and software solutions, Digium's Gateways are managed by a simple, intuitive web-based interface.

Supported Voice Modes:

- FXO and FXS
    - Loop Start
    - Loop Start with Disconnect Detect (Kewlstart)

- SIP

Example scenarios utilizing the Gateway are illustrated in Figure 1, Figure 2, and Figure 3.
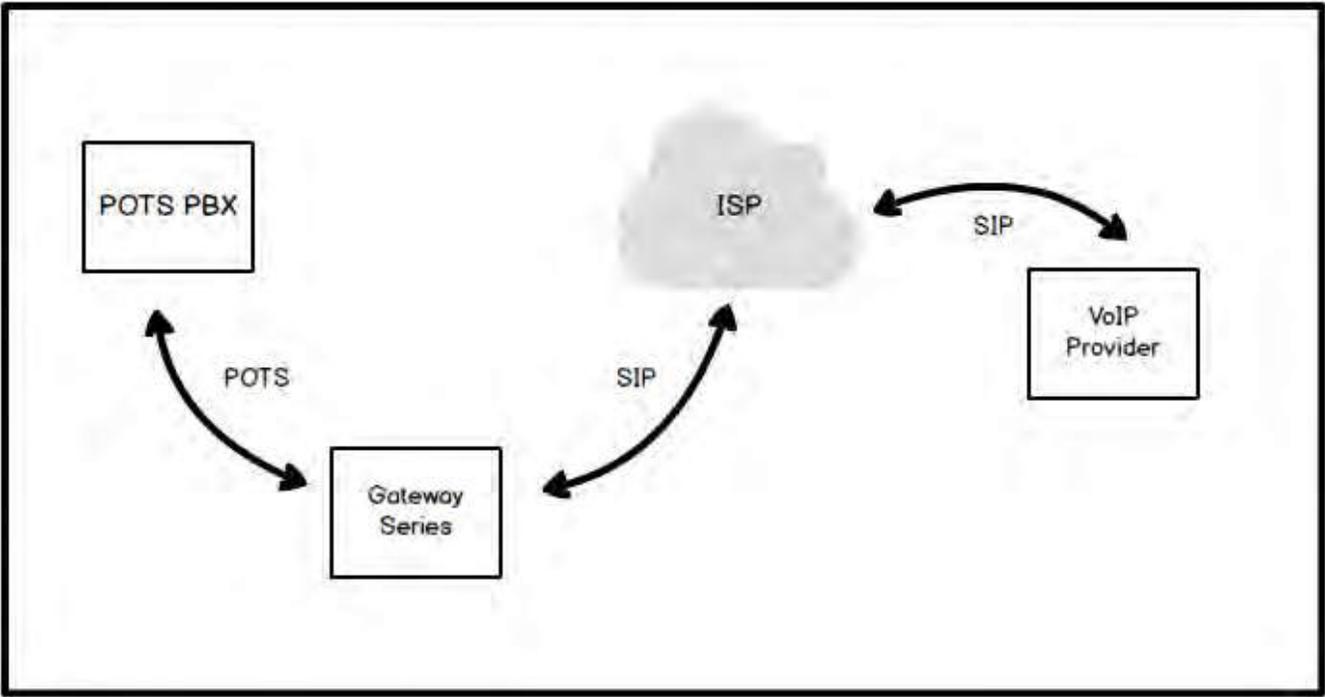
Figure 1: POTS PBX to VoIP Scenario
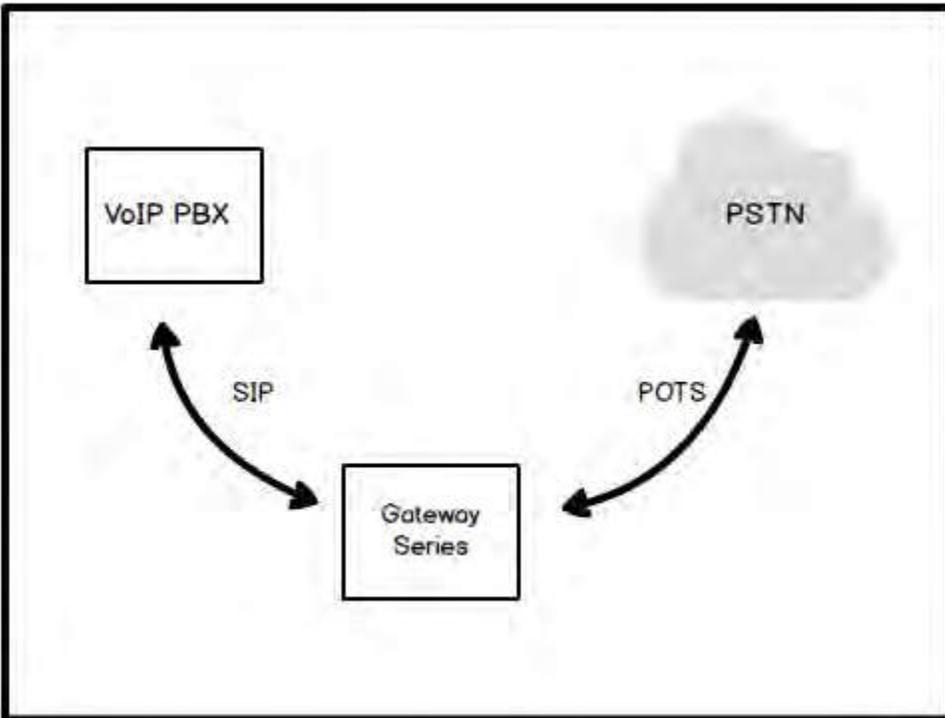
Figure 2: VoIP PBX to POTS Scenario
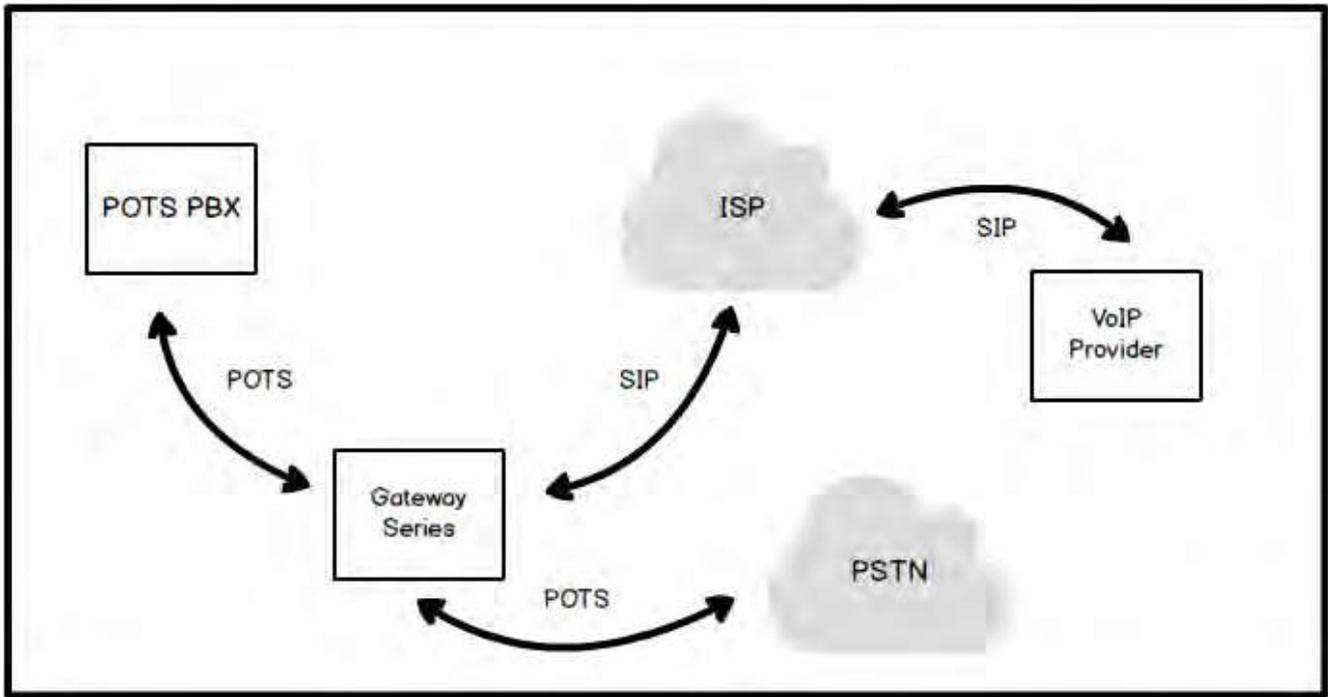
Figure 3: POTS PBX to POTS and VoIP Scenario

Echo-Cancellation

Administrators connecting their Gateway appliances to the PSTN or other devices are likely to be placing calls that will result, at some point, in an unbalanced 4-wire/2-wire hybrid. The result of this hybrid is the reflection of a near-end echo to the calling party. Elimination of this echo is the responsibility of echo cancellation.

The Gateway appliance echo canceller is designed to handle up to 32ms of echo cancellation across all channels.

If not explicitly disabled in the Gateway web GUI, the echo canceller will automatically operate and cancel all network echo within its tail range.

Chapter 2

Unit Installation

This chapter provides the following information:

- Unpacking the Unit
- Shipment Inspection
- Front Panel Identification
- Unit Identification
- Hardware Installation

The Gateway appliance installation instructions are written so that they will apply to any SKU. Examples and SKU-specific information are included as needed.

Unpacking the Unit

When you unpack your unit, carefully inspect it for any damage that may have occurred in shipment. If damage is suspected, file a claim with the carrier and contact the reseller from which the unit was purchased. If the unit was purchased directly from Digium, contact Digium

Technical Support at +1 (256)-428-6161. Keep the original shipping container to use for future shipment or proof of damage during shipment.

> Only qualified service personnel should install the unit. Users should not attempt to perform this function themselves. The installer must ensure that the equipment is reliably earth grounded in accordance with the National Electrical Code.

Shipment Inspection

The following items are included in shipment of a Gateway appliance:

- Gateway appliance
- Power cord
- Mounting brackets (2 each)
- Bracket mounting screws, #8-32 black truss head, Phillips, 3/16" length (6 each)
- Side-by-side mounting screws, #6-32 pan head, Phillips, 3/16" length (3 each)
- Side-by-side mounting shoulder washers (3 each)
- Rubber feet (4 each)
- Ground nut
- Double-crimp ground ring terminal
- Quickstart Guide

> After inspecting the shipment, Digium requires that the appliance be registered for support eligibility. Unregistered appliances are not eligible for Digium support. Please refer to Free Installation Support for additional information on how to obtain assistance from Digium Technical Support.

Front Panel Identification

This section describes the components on the front panel of the Gateway model.
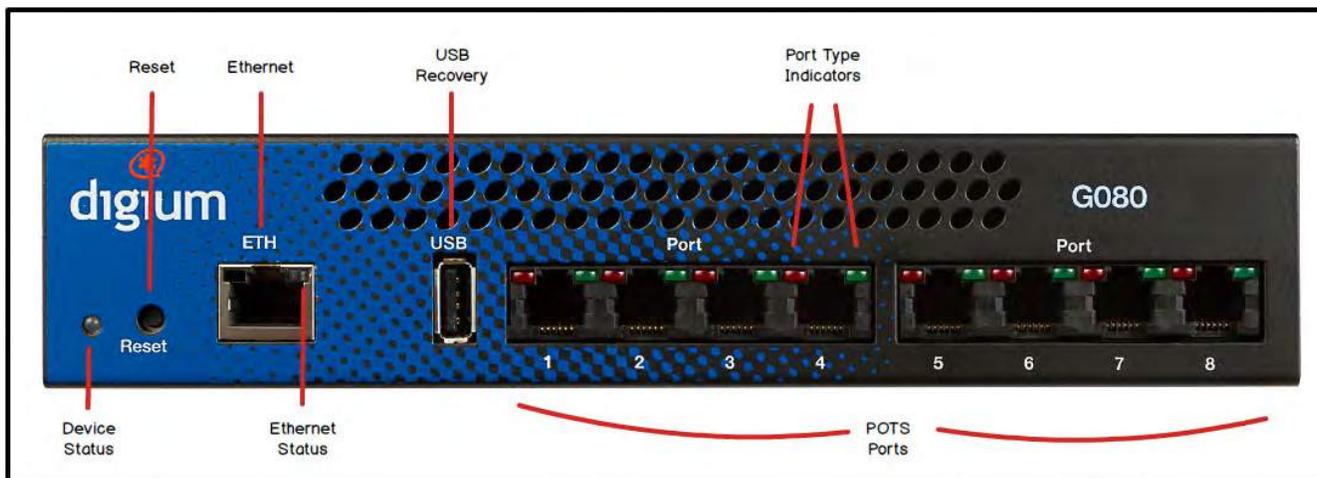
Figure 4: G080 Appliance

- **Device Status** - This LED corresponds to the status of the Gateway appliance. See Frequently Asked Questions for more information.

- **Ethernet** - The 10/100BaseT Ethernet port provides the ability to connect to an internal or external network using an RJ45 interface. It is used to pass Ethernet packetized voice and web management data between the Gateway and the network. See Ethernet Port Pinouts for more information.

- **Ethernet Status** - This LED corresponds to the status of the Ethernet connection. See Frequently Asked Questions for more information.

- **USB Recovery** - This port can be used to perform a firmware recovery and configuration reset. See Firmware Recovery and Configuration Reset for more information.

> The USB Recovery port provides a limited amount of current which is sufficient only to power a USB flash drive. Do not connect

any other type of device to this port. The USB flash drive should be fully USB 2.0 compliant.

- **POTS Ports** - These ports are used for connecting RJ11 cables. See RJ11 Port Connector for more information.

- **Port Type Indicators** - These LEDs correspond to the port type. When the Red indicator is lit, the port is loaded with an FXO interface. When the Green indicator is lit, the port is loaded with an FXS interface.

- **Reset Switch** - This recessed switch is used to restart the Gateway appliance or reset its GUI password. See Frequently Asked Questions for more information.

Unit Identification

The defining characteristic of the Gateway is the number and type of analog interfaces supported. See Table 1 for a list of the various SKUs.

Table 1: Gateway SKUs

SKU	FXS Ports	FXO Ports
GA08	0	8
GA44	4	4
GA80	8	0

Hardware Installation

This section describes how to properly install the hardware for a Gateway appliance.

⚠️	**Caution** *Only qualified service personnel should continue with hardware installation and configuration of the Gateway appliance. Users should not attempt to perform these functions themselves.*

⚠️	**Caution** *This equipment is intended for use in Restricted Access Areas only where equipotential bonding has been applied.*

Grounding

The Gateway appliance must be properly earth grounded for safety reasons. If the unit is not properly earth grounded, the unit and/or other equipment connected to the unit could be damaged. If a Gateway appliance is damaged while it is improperly grounded, the warranty on the Gateway appliance is void.

A ground lug is located on the opposite side from the front panel of a Gateway appliance. Attach an appropriate length and gauge of wire to the double-crimp ground ring terminal. The wire length should be as short as possible, and gauge should be 18 AWG or greater. Stranded or solid wire is acceptable. Wire is not provided with the Gateway appliance. Double crimp the ground ring terminal to the wire. Next, slide the ground ring terminal over the ground lug. Then fasten the ground ring terminal to the ground lug using the ground nut. The ground nut must

be turned clockwise to tighten it onto the ground lug. The opposite end of the wire that is connected to the ground ring terminal should be securely fastened to an unpainted metalic section of a properly earth grounded equipment rack. A connector for the opposite end of the wire is not provided with the Gateway appliance.

> Taking into consideration the requirements of all equipment connected to or sharing the rack, the equipment rack should be properly earth grounded. Refer to the manufacturer of the rack for instructions on how to properly earth ground the rack.

	Important
	Use only a grounded electrical outlet when connecting the Gateway appliance to a power source. If you do not know whether the outlet is grounded, consult with a qualified electrician.

Mounting

The included hardware allows the Gateway appliance to be wall mounted, rack mounted side-by-side with another Gateway appliance, or placed flat on a level surface. If a single Gateway appliance is to be rack mounted, the optional long mounting bracket (not supplied, part number 3244-00042) must be used. The optional long mounting bracket can be ordered by contacting a Digium reseller or Digium directly.

	Important
	Reliable earth grounding of rack-mount equipment should be maintained. Particular attention should be given to provide connection other than direct connections to the branch circuit (e.g., use of power strips).

	Important
	Mounting of the Gateway appliance in a rack should be such that no hazardous condition is achieved due to uneven mechanical loading. Do not place heavy objects on top of the unit, or pull down on the mounted unit. Consider the mechanical loading of external cables. The weight of the cables can pull on the unit and create uneven loading. Secure heavy cables with external cable trays.

	Important
	If rack mounting, install the Gateway appliance in a rack so that the amount of airflow required for safe operation is not compromised.

Important

If the Gateway appliance is installed in a system that is in turn installed in a closed or multi-unit rack assembly, the operating ambient temperature of the rack environment may be significantly greater than the room ambient. While the maximum safe operating temperature is 50°C, consideration should be given to installing the unit in an environment compatible with the maximum recommended ambient temperature of 45°C for long term reliability and maximum performance.

Single Unit Rack Mount:

In order to rack mount the Gateway appliance by itself, place one of the short mounting brackets on the front of one side of the Gateway appliance. Line up the holes from the mounting bracket to the threaded holes on the front side of the Gateway appliance. Two #8 black truss head screws should be inserted and turned clockwise to fasten the mounting bracket. Do not over-tighten. Repeat these steps when installing the optional long mounting bracket (not supplied, part number 3244-00042) on the other side of the Gateway appliance. Then use another 2 #8 black truss head screws on each mounting bracket to secure the Gateway appliance to a rack.

Side-by-side Rack Mount:

In order to rack mount the Gateway appliance side-by-side with another Gateway appliance, place one of the short mounting brackets on the front of the left side of the first Gateway appliance. Line up the holes from the mounting bracket to the threaded holes on the front of the left side of the first Gateway appliance. Two #8 black truss head screws should be inserted and turned clockwise to fasten the mounting bracket. Repeat these steps when installing a short mounting bracket on the front of the right side of the second Gateway appliance.

Each of the three #6 pan head screws should be inserted into a shoulder washer as shown in Figure 7 on page 29. Make sure the narrow side of the shoulder washer is away from the head of the screw. The three screws should then be inserted and turned clockwise to fasten to the side-by-side holes on the right side of the first Gateway appliance. Do not overtighten the screws or the shoulder washers could be damaged. Connect the first and second Gateway appliances together by putting the heads of three screws & shoulder washers into the three keyed insets. Then push down on the second Gateway appliance as shown in Figure 7. Make sure the units are flat against each other before pushing the second unit down. Otherwise the shoulder washers may be damaged. Use two truss head screws (not supplied) on each mounting bracket to secure both Gateway appliances to a rack.
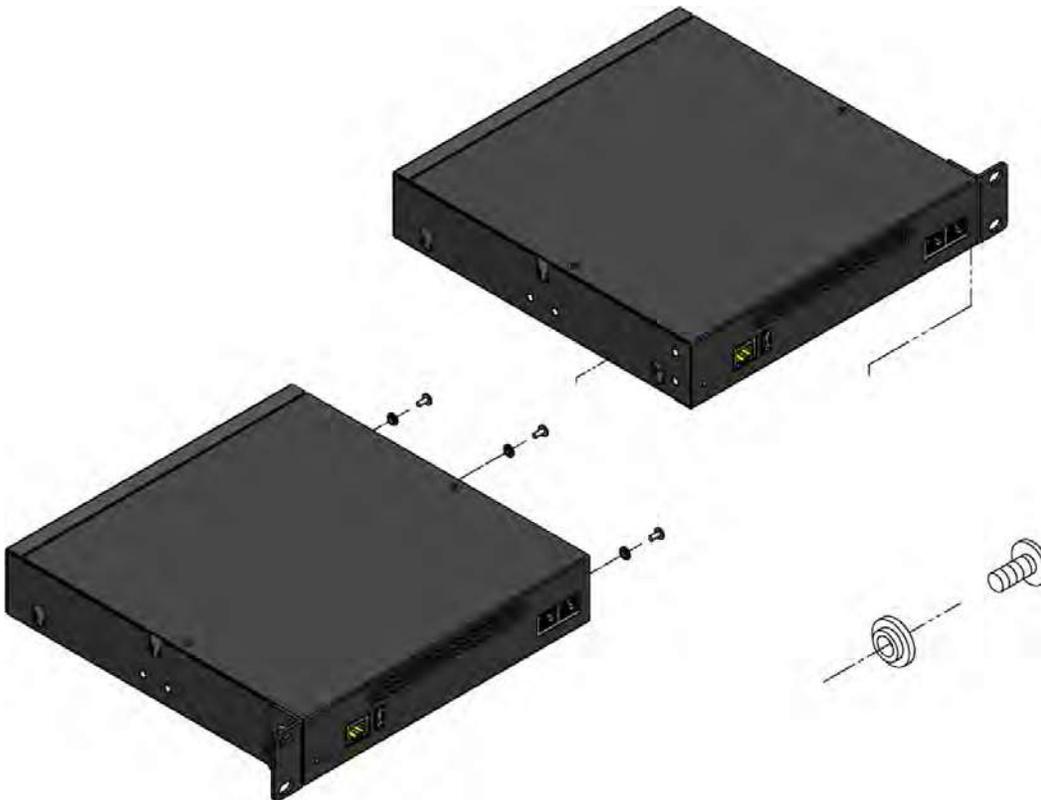
Figure 5: Side-by-side Rack Mounting

Wall Mount:

In order to wall mount the Gateway appliance, the short mounting brackets should be flipped and rotated, and fastened on the middle of the right and left sides of the Gateway appliance as shown in Figure 6. The unit should be mounted at or below eye level to properly view the LEDs. In addition, the Gateway appliance should be properly oriented as shown in Figure 6. Orientations other than what is shown in Figure 6 are not acceptable.

If the Gateway appliance is placed in the "right side down" orientation, the 2 remaining #8 black truss head mounting screws should be fully inserted into the screw holes near the front of the right side of the Gateway appliance. In addition, the three #6 pan head screws should be fully inserted into the side-by-side holes on the right side of the first Gateway appliance.

> The Gateway appliance must be properly grounded for safety reasons. If the unit is not properly grounded, damage could arise to the unit and/or other equipment connected to the unit.
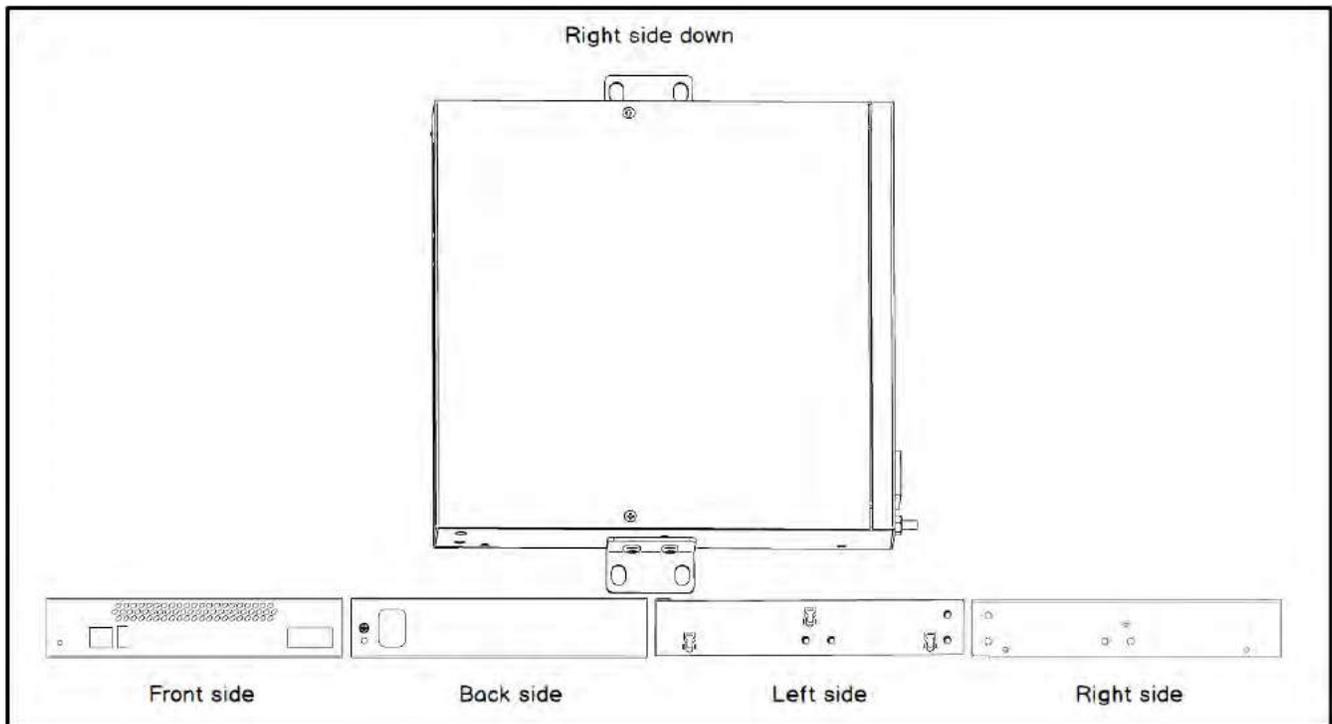
Figure 6: Acceptable Wall Mount Orientation

Level Surface:

In order to place the Gateway appliance flat on a level surface, the rubber feet should be adhered to the 4 corners of the bottom of the Gateway appliance. This will help secure the Gateway appliance to the surface it is placed on.

> The Gateway appliance must be properly grounded for safety reasons. If the unit is not properly grounded, damage could arise to the unit and/or other equipment connected to the unit.

Connecting Ports

A description of each of the front panel connectors on a Gateway appliance is available in the section titled Front Panel Identification. Please refer to that section to determine what should be connected to each connector.

	Caution
	This unit must be connected to the Telecommunications Network in your country using an approved line cord, e.g.: for Australia use only line cords complying with AS/CA S008:2010.

	Caution
	Connect only equipment approved for use in your specific country to the telecommunications network voltage circuit ports.

Connection to a Gateway appliance should be made in the following order.

1. Ethernet Port

Install a ferrite to the Ethernet cable that connects to each Ethernet port to ensure compliance with the EMC standards. An example of a suitable ferrite is part number 28A2025-0A0 from Laird-Signal Integrity Products, available worldwide at www.digikey.com.

2. POTS Ports

Ensure that ringing lines from external telcos or systems are plugged **only** into FXO ports on the Gateway. FXO ports are identified by the **RED** Port Indicator LEDs.

Ensure that telephones are plugged **only** into FXS ports on the Gateway. FXS ports are identified by the **GREEN** port indicator LEDs.

3. Power Cord

Connecting to the Gateway

The Gateway web GUI may be accessed by either its DHCP or statically assigned IP address. The following browsers are supported:

- **Windows XP, Vista, 7, 8, 10:** Chrome 8.0+, Firefox 12+, Internet Explorer 8.*, Safari 5.0+

- **Mac OS X:** Firefox 12+, Safari 5.0+

- **Linux:** Firefox 12+

Connecting via DHCP assigned IP address

1. If a DHCP server exists on the network that the Gateway appli-ance will be placed on, connect one end of an Ethernet cable to the Gateway appliance's Ethernet port, and the other end to Ethernet connection on a network switch or hub. This step will con-nect your Gateway appliance to your network so that the Gate-way web GUI may be accessed from your network.

2. Using a Gateway supported web browser, open a browser window from a computer on your network and enter the IP address for the Gateway appliance using HTTPS (e.g. https://[IP]). If you do not connect using HTTPS, a browser error will be displayed. The IP address for the Gateway Series web GUI will be assigned by the DHCP server on the network. The DHCP server on the network will

need to be accessed to determine the IP address assigned to the Gateway Series appliance. The default username for the Gateway Series web GUI is admin, and the default password is admin.

3. It is highly recommended that the **admin** password be changed using the **System Administrators** menu on the web GUI.

4. Next, the IP configuration options should be configured on the Gateway appliance. See IP configuration.

The Gateway appliance may also be accessed by its hostname. The hostname will be in the format of G080-aa-bb-cc, aa is the 6th to last and 5th to last alphanumeric of the unit's first MAC address, bb is the 4th to last and 3rd to last alphanumeric of the unit's first MAC address, and cc is the 2nd to last and very last alphanumeric of the unit's first MAC address. The MAC addresses of the Gateway Series appliance are printed on a label on the back of the unit. For example, if the first MAC address of a G080 Gateway appliance is B2432B187135, the hostname will be G080-18-71-35. HTTPS (e.g. https://[IP]) must be used. If you do not connect using HTTPS, a browser error will be displayed.

Connecting via Statically assigned IP address

1. If a DHCP server does not exist on the network that the Gateway Series appliance will be placed on, connect one end of an Ethernet cable to the Gateway Series appliance's first Ethernet port, and the other end to an Ethernet connection on a computer. That computer will need to use the network configuration listed below. This step will connect your Gateway Series appliance to your computer so that the Gateway Series web GUI may be accessed from your computer.

    Network settings for computer connecting to Gateway
    IP: 192.168.69.2
    Netmask: 255.255.255.0
    Broadcast: 192.168.69.255

2.   Using a Gateway Series supported web browser, open a browser window and enter the IP address for the Gateway Series appliance using HTTPS (e.g. https://[IP]). If you do not connect using HTTPS, a browser error will be displayed. The default IP address for the Gateway Series web GUI is **192.168.69.1**. The default username for the Gateway Series web GUI is **admin**, and the default password is **admin**.

3. It is highly recommended that the **admin** password be changed using the **System Administrators** menu on the web GUI.

4. Next, the IP configuration options should be configured on the Gateway Series appliance. See **IP Configuration**.

IP Configuration

The general networking and configuration server options in the Gateway Series web GUI should be configured before others. The IP configuration menus for each are described below.
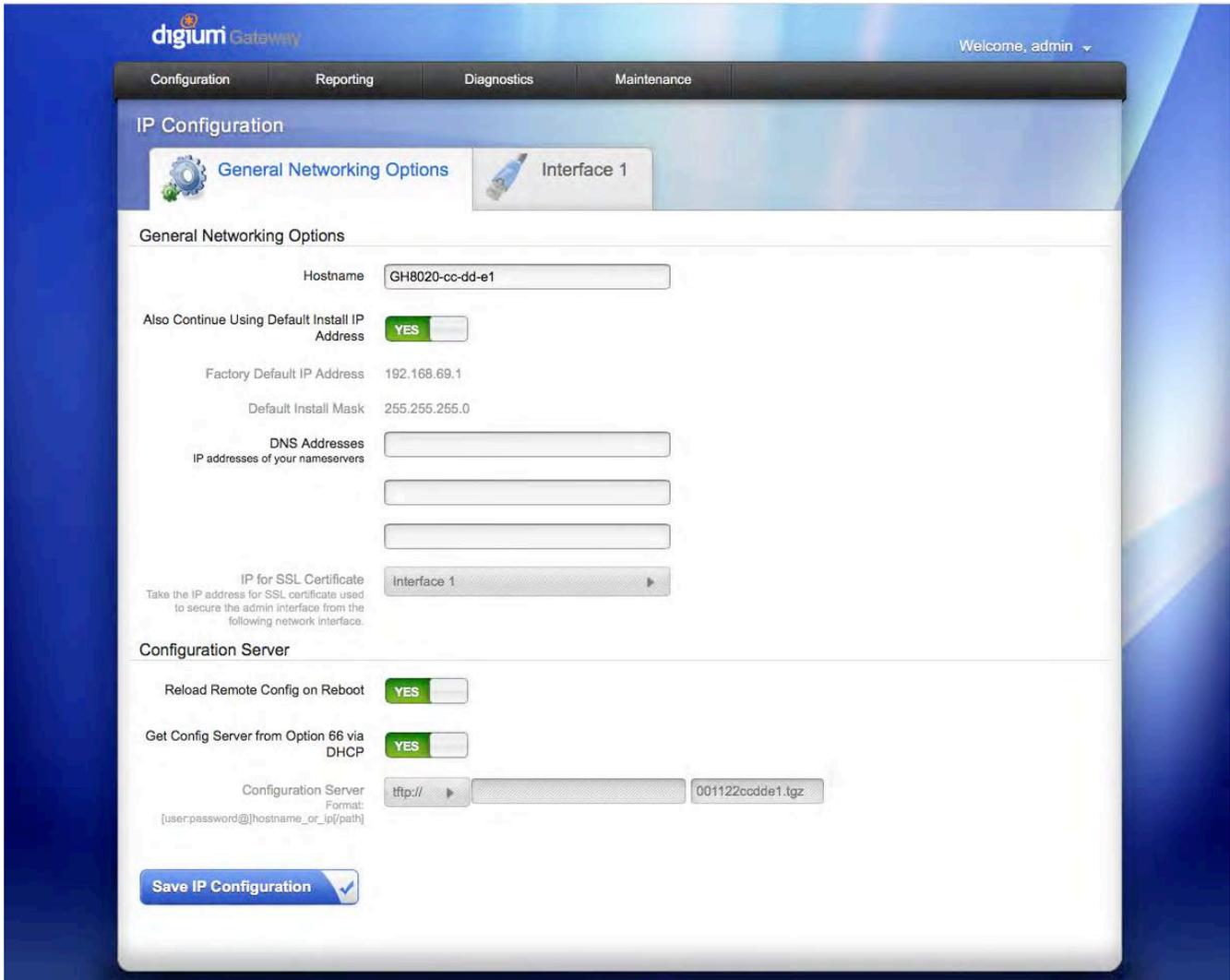
Figure 7: IP Configuration Menu

The **General Networking Options** for the Gateway are described below.

- **Hostname** - Specify the hostname of the Gateway appliance. If a hostname is specified, the G080-aa-bb-cc hostname will no longer be configured.

- **Also Continue Using Default Install IP Address** - Leaving this option enabled will allow the Gateway Series appliance to listen for network requests on its factory default IP address.

  Note: For security purposes, it is recommended that this feature be disabled after initial IP configuration is complete. After this feature is disabled, the Gateway Series appliance will be accessible only from the IP address that is assigned by the DHCP server or statically configured.

  - **Factory Default IP Address** - Displays the factory default IP address assigned to the Gateway appliance. This address is accessible only on the first physical interface for untagged traffic.

- **Default Install Mask** - Displays the factory default network mask of the Gateway Series appliance.

- **DNS Addresses** - Specify up to 3 DNS servers to be used by the Gate-way appliance. A DNS server may also be referred to as a nam-e server.

- **IP for SSL Certificate** - Take the IP address for SSL certificate used to secure the admin interface from a specified Interface #.

The Gateway appliance is capable of loading its configuration from a configuration server on reboot. This allows Gateway appliances to be quickly and easily deployed at multiple locations with minimal interaction from an administrator.

In order to generate a configuration to place on a configuration server, configure a Gateway appliance, generate a backup from the web GUI as described in **Backups**, and place the backup file on the configuration server at the path described below.

> The format of the path to the configuration server is protocol:// [user:password@]hostname_or_ip[/path]. The protocol may be either **tftp**, **ftp**, or **http**. The Gateway appliance will request a configuration database with the filename of xxxxxxxxxxxx.tgz, where xxxxxxxxxxxx is the unit's first MAC address, from the configuration server. The MAC addresses of the Gateway appliance are printed on a label on the back of the unit. FTP and HTTP normally do not require a username and password.

The **Configuration Server** options are specified below.

- **Reload Remote Config on Reboot** - Leaving this option enabled will allow the Gateway appliance to request that its configuration be reloaded from a configuration server on every reboot.
  Note: If this feature will not be used, it is recommend that it be disabled.

- **Get Config Server from Option 66 via DHCP** - If **Obtain and IP Address via DHCP** is enabled on an Interface tab and a DHCP server specifies via DHCP is enabled on an Interface tab and a DHCP server specifies the path and configuration database file on the configuration server using Option 66, this feature may be enabled for all Gateway Series configuration settings to be automatically configured using a configuration server. The **Reload Remote Config on Reboot** option must be enabled in order to activate this feature. Refer to the note for proper syntax when specifying the path and configuration database file.

Configuration Server - If **Obtain an IP Address via DHCP** is enabled on an Interface tab and **Get Config Server from Option 66 via DHCP** is disabled, the path to the configuration server may be statically defined using this option. The **Reload Remote Config on Reboot** op tion must be enabled in order to activate this feature. Refer to the note for proper syntax when specifying the path and configuration database file.

The **Interface** options are specified below.

- **Enable Untagged Traffic** - If disabled, this option will prevent traffic which is not VLAN tagged from passing over this interface.

- **Obtain an IP Address via DHCP** - Obtain an IP Address via DHCP - If a DHCP server exists on the same network as the Gateway Series appliance, this feature may be enabled for the IP address to be dynamically assigned via DHCP.

  Note: It is recommended that this feature be disabled if the DHCP server is not configured to always provide the same IP address based on MAC address. If this is the case, the Gateway appliance's network settings should be manually configured. The MAC addresses of the Gateway appliance are printed on a label on the back of the unit.

- **System IP Address** - If **Obtain an IP Address via DHCP** is disabled, specify the static IP address for the Gateway Series appliance.

  Note: If a static IP address is assigned using this feature, the Gateway Series appliance will immediately be unresponsive from its old IP address. It may take up to 15 seconds for the new IP address to be assigned and functional. The new IP address of the Gateway Series appliance must be entered into the browser and HTTPS (e.g. https://[IP]) must be used. If you do not connect using HTTPS, a browser error will be displayed.

- **Network Mask** - If **Obtain an IP Address via DHCP** is disabled, specify the network mask for the Gateway Series appliance.

- **Gateway Address** - If **Obtain an IP Address via DHCP** is disabled, specify the gateway address for the Gateway Series appliance. The gateway address is usually the address of the router on the network.

- **Static Routes** - This option can be used to force the Gateway appliance to use a specific gateway interface to reach specific networks or group of networks.

- **VLAN Networks Enabled** - If enabled, this option allows you to define a VLAN interface to be associated with the physical interface. For each VLAN, you may select the VLAN ID and IP for the VLAN either statically or via DHCP. Each VLAN has all the capabilities available for untagged interfaces. There can be 2 VLANs configured for each physical interface.

Chapter 3

Configuration

The Gateway appliances have a variety of configuration options. This chapter provides information on how to use the Gateway web GUI to configure an appliance without the need of command-line tools and an overview of the available configuration sections.

Context-sensitive help buttons are provided above most sections of the Gateway Series web GUI. Clicking on a help button will open a new window which contains a detailed description of the options available for that section. The help buttons appear as ❓ .

The Gateway appliance should already be connected to your network or computer, as described in **Connecting to the Gateway**. Using a Gateway supported web browser, open a browser window and enter the IP address for the Gateway appliance using HTTPS (e.g. https://[IP]). If you do not connect using HTTPS, a browser error will be displayed. The login screen will be displayed. An administrator username and password must be entered to proceed. The default username for the Gateway web GUI is **admin**, and the default password is **admin**.

Figure 8: Login Screen

It is highly recommended that the **admin** password be changed using the **System Administrators** menu on the web GUI. In addition, it is highly recommended that the software on a Gateway appliance be updated to the latest version before proceeding with configuration. See **So ftware Updates.**

The Gateway web GUI is divided into the following main sections.

- **Settings and Configuration**
- **Logging and Reporting**
- **Status and Diagnostics**
- **Maintenance**
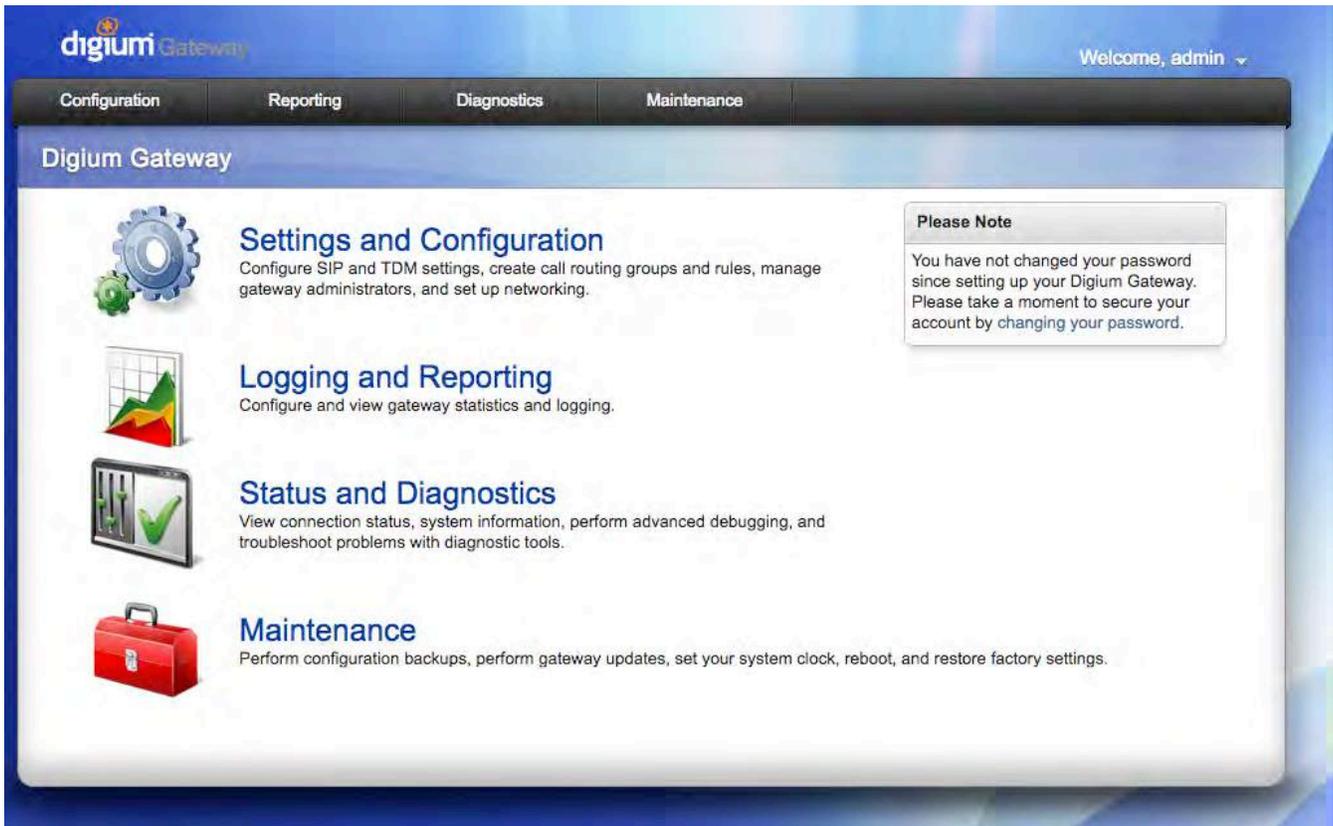
Figure 9: Main Menu

Settings and Configuration

This section provides the ability to configure SIP and POTS Telephony settings, create call routing groups and rules, manage system administrators, set up networking, and create Interconnects to Switchvox. Included are the following sections.

- SIP Endpoints
- Global SIP Settings
- Telephony
- Call Routing Groups
- Call Routing Rules
- System Administrators
- IP Configuration
- HTTPS
- Access Control
- Interconnect

SIP Endpoints

This section provides the ability to add and modify SIP endpoints, , and configure call, media, and fax settings. A SIP endpoint will typically be a SIP PBX or SIP provider connected to the Gateway Series appliance. Included are the following sections.

- **Main** - Primary options for SIP endpoint configuration. The following settings are available
    - Endpoint Settings
        - Enable Advanced Options
        - Name
        - Username
        - Password
        - Registration
        - Destination Number
        - Hostname or IP Address
        - NAT Traversal
        - Endpoint Settings (Advanced)
            - Remote Authentication User
            - Overwrite User in From Header

- Overwrite Domain in From Header
- Override Client URI
- Remote Authentication Password
- Realm
- Port
- Authentication Nonce Lifetime
- Registration Expiration
- Max Registration Retries
- Retry After Failed Authentication
- Registration Retry Interval
- Registration Interval after Forbidden
- Registration Interval after Fatal
- Add 'line' parameter for inbound call matching
- Support Path for outbound REGISTER
- Qualify
- Qualify Frequency
- Qualify Timeout
- Authenticate Qualifies

- **Call Settings (Advanced)** - DTMF, Caller ID, signaling, authentication, and advanced timer settings. The following settings are available.
  - DTMF Settings
    - DTMF Mode
  - Caller ID Settings
    - Trust Remote Party-ID
    - Send Remote-Parity
    - Send Party Immediately
    - Caller ID Presentation
    - Prohibited Outbound Caller ID
    - Connected Line Method
  - Signaling Settings (Advanced)
    - Overwrite Contact header
    - Send Diversion Header
    - Endpoint Identification
    - Send provisional ACK tags
    - Redirect Method
    - ICE Support
    - Allow SUBSCRIBEs
    - Use AVPF
    - Progress Inband
    - Allow Overlap Dialing
    - Append user=phone to URI
    - Allow Transfers
    - Authenticate Incoming Calls
    - Outbound Proxy
    - DID (Called Number) Location
    - SDP Session Name
    - SDP Owner
  - Timer Settings (Advanced)
    - Session Timers
    - Minimum Session Refresh Interval
    - Maximum Session Refresh Interval
    - Session Refresher
    - Minimum SUBSCRIBE Timer Expiration
- **Security (Advanced)** - Settings related to DTLS Encryption. The following settings are available.
  - DTLS Settings
    - DTLS Connection Setup
    - DTLS Certificate File
    - DTLS CA File
    - DTLS Private Key
    - DTLS Cipher String
    - DTLS Fingerprint Hash
    - DTLS Rekey Interval
    - Verify DTLS Client Certificate
- **Media Settings (Advanced)** - Media types and priorities, codecs settings. The following settings are available.
  - Available Media Types
    - ULAW
    - ALAW
    - G722
    - G726
    - G729
    - GSM
  - Media Preferences

- Codec Priority
- Media Encryption
- Optimistic Encryption
- Force 32-byte SRTP Tags
- RTP Timeout
- On-Hold RTP Timeout
- Comfort Noise Keepalive Interval
- Answer using Offer Transport
- Media Address
- DSCP ToS Byte
- 802.1p CoS Bit
- Tone Country
  - Codec Options
    - ALAW Packetization Rate
    - ULAW Packetization Rate
    - GSM Packetization Rate
    - G722 Packetization Rate
    - G726 Packetization Rate
    - G726 Non-standard
    - G729 Packetization Rate
    - Use Requested Packetization Rate
  - Jitter Buffer
    - Jitter Buffer Mode
    - Max Jitter Size
    - Jitter Resync Threshold
    - Adaptive Jitter Buffer Increment
- **Fax Settings (Advanced)** - Fax related settings. The following settings are available.
  - Fax Settings
    - Fax Mode
    - T.38 Error Correction
    - Fax Detect Timeout
    - Enable T.38 NAT Support

Global SIP Settings

This section provides the ability to add and modify global SIP settings. These settings are for experienced administrators only. Please take care when modifying any of these settings. The default values should be sufficient for most applications. Included are the following sections.

- **Networking** - General, NAT, RTP, RTCP, and DTMF settings. The following settings are available.
  - General
    - Enable UDP
    - UDP Bind Address
    - UDP Bind Port
    - Enable TCP
    - TCP Bind Address
    - TCP Bind Port
    - Enable TLS
    - TLS Bind Address
    - TLS Bind Port
    - Enable WSS
    - WSS Bind Address
    - WSS Bind Port
    - Enable SRV DNS Refresh
    - Time Between SRV DNS Name Lookups
  - NAT Settings
    - Local Network
    - Local Network List
    - Nat Settings (Advanced)
      - Externally Mapped UDP Port
      - Externally Mapped TCP Port
      - Externally Mapped TLS Port
      - Externally Mapped WSS Port
      - External Hostname
  - RTP Settings
    - Start of RTP Port Range
    - End of RTP Port Range
    - RTP Settings (Advanced)
      - Enable RTP Checksums
      - Drop RTP Packets Not From Stream Source
      - Packets Required to Change Source
      - ICE Support

- Replace ICE Hosts
- ICE Replacement List
- STUN Server Address
- STUN Server Port
- TURN Server Address
- TURN Server Port
- TURN Server Auth User
- TURN Server Auth Password
- RTCP
  - RTCP Report Interval
- DTMF
  - DTMF Digit Timeout
- **Parsing and Compatibility** - General, SIP methods, Caller ID, timer configuration, and outbound registrations. The following settings are available.
  - General
    - Send Compact Headers
    - Automatically switch to TCP on large requests
    - Maximum Forwards
    - Keep Alive Interval
    - Expired Contacts Check Interval
    - Maximum Initial Quality Time
    - User Agent
    - Ignore SIP URI user field options
    - SDP Session Name
    - SDP Owner
  - Endpoint Identifiers
    - IP
    - Username
    - Anonymous
  - Endpoint Identifier Preferences
    - Endpoint Identifier Priority
  - Timer Configuration
    - SIP Roundtrip packet Timer T1
    - SIP INVITE acknowledge Timer B
- **Security** - SIP domains and authentication settings. The following set-tings are available.
  - Authentication Settings
    - Realm
    - Unidentified Request Period
    - Maximum Unidentified Requests
    - Unidentified Request Pruning Interval
  - TLS Settings
    - TLS Certificate File
    - TLS CA File
    - TLS Private Key
    - TLS Cipher String
    - TLS Client Method
    - Require Client Certificate
    - Verify Client Certificate
    - Verify Server Certifiate
    - Websocket Write Timeout
    - Websocket Session Limit
    - Websocket Session Inactivity Timer
    - Websocket Session Keepalive
- **Media** - Media, QoS/TOS settings. The following settings are available.
  - QoS/ToS
    - DSCP TOS Byte
    - 802.1P CoS Bit
- **Fax** - Fax related settings. The following settings are available.
  - Fax Settings
    - UDPTL Start of Port Range
    - UDPTL End of Port Range
    - Enable UDPTL Checksums
    - UDPTL FEC Entries
    - UDPTL FEC Span
    - Use Only Even Numbered Ports

Telephony

This section provides the ability to configure the FXO and/or FXS hardware in the Gateway appliance. Included are the following sections.

- **General** - General options for hardware configuration. The following settings are available.

- General
    - Locale
    - Operator Country
    - Calibrate FXO Ports
- Analog Options
    - Tone Duration
    - Port Jitter Buffers
    - Companding
    - Reverse Polarity for MWI
    - Maximum Loop Current
    - Boost Ringing Power
    - Fast Ring
    - Battery Reversal Debounce Timer
    - Battery Alarm Timer
    - Battery Threshold
    - Fast Pickup
    - Ringer Debounce
- **Port #** - Port Specific options for interface type and signaling. The following settings are available.
    - Interface type
        - Description
        - Enable Caller ID
        - Use Caller ID as Received (FXO only)
        - Caller ID Name
        - Caller ID Number
        - Interface Type (Advanced)
            - Echo Cancellation
            - RX Gain
            - TX Gain
            - RX Dynamic Range Compression
            - TX Dynamic Range Compression
    - Signaling
        - Signaling (Advanced)
            - Pauses Before Dialing (FXO only)
            - Call Waiting (FXS only)
            - Threeway Calling (FXS only)
            - Call Transfer (FXS only)
            - Automatic Gain Correction
            - Noise Reduction
    - DTMF and Caller ID Options
        - Relaxed DTMF Detection
        - Caller ID Signaling
        - Caller ID Start
        - DTMF Caller ID Energy Level
        - Send Caller ID after Ring Number (FXS only)
        - Call Waiting Caller ID (FXS only)
        - Distinctive Ring Cadence after Caller ID (FXO only)
    - Polarity and Battery Options
        - Answer on Polarity Switch
        - Hangup on Polarity Switch
        - Polarity on Answer Delay (FXO only)
        - Ring Timeout (FXO only)
        - VMWI Type (FXS only)
        - MWI Source (FXS only)
    - Tone Options (FXO only)
        - Wait for Dialtone
        - Detect Dialtone
        - Busy Detection
        - Busy Count
        - Busy Pattern
        - Use Distinctive Ring Detection
        - Experimental Call Progress Detection
    - Fax Options
        - Fax Gateway
        - Number of Audio Buffers
        - Audio Buffering Policy
    - Answer Options (FXS only)
        - Immediate Answer
        - Immediate Extension

Call Routing Groups

This section provides the ability to add and modify SIP and PSTN call routing groups. A call routing group allows a group of channels to be addressed when creating a call routing rule. The following settings are available.

- Group Type
- Group Name
- Group Members

Call Routing Rules

This section provides the ability to add and modify call routing rules. A call routing rule determines how a call is handled based upon certain characteristics such as inbound channel and DID (FXS only). It is also possible to manipulate matched numbers before connecting outbound calls. The following settings are available.

- Call Routing Rule
    - Simple Entry Mode
    - Name
- Match Incoming Calls
    - Call Comes in From
    - Match All Calls
    - Number begins with the digits
    - Number contains between x and y digits
- Manipulate Matched Numbers
    - Before connecting, trim x digits and then prepend y digits
    - Set the Caller ID Name to
    - Set the Caller ID Number to
- How to Handle Matched Calls
    - Send Call Through
    - Add Failover Call Through Provider
    - Fax Fallback Extension

System Administrators

This section provides the ability to add and modify system administrators for access to the Gateway Series web GUI. The following settings are available.

- Gateway Admins
    - Full Name
    - Username
    - Email Address
    - Password
    - Password Confirmation
    - Language

IP Configuration

This section provides the ability to configure IP options for the Gateway Series appliance. The following settings are available.

- General Networking Options
    - Hostname
    - Also Continue using Default Install IP Address
    - DNS Addresses
    - IP for SSL Certificate
- Configuration Server
    - Reload Remote Config on Reboot
    - Get Config Server from Option 66 via DHCP
    - Configuration Server
- Interface #
    - Untagged Traffic
        - Enable Untagged Traffic
        - Obtain an IP Address via DHCP
        - System IP Address
        - Network Mask
        - Gateway Address
        - Preferred Interface
        - Static Routes
        - VLAN Networks Enabled
    - Advanced VLAN Configuration (Primary & Secondary VLAN)

- Manually Set VLAN ID
- Obtain an IP address via DHCP
- System IP Address
- Network Mask
- Gateway Address
- Preferred Interface
- Static Routes

HTTPS

This section provides the ability to supply your own certificate for secure connection to the Gateway web GUI. A self-signed certificate is provided by default. The following settings are available.

- X.509 Certificate in PEM Format
- RSA Private Key in PEM Format
- Intermedia CA Certificate in PEM Format

Access Control

This section provides the ability to limit access to the web GUI and SIP traffic through the Gateway appliance. All other protocols are blocked. The following settings are available.

- Rule Name
- Network
- Allow Admin Web Interface
- Allow SIP

Interconnect

This section allows simplified setup between Gateways and Switchvox systems. The following settings are available:

- Connect
    - Server Name
    - Server Address
    - Username
    - Password
    - Local Interface
    - Default Extension
    - Default Fax Extension
    - Trunk Name
    - FXO / FXS Port Mapping

Logging and Reporting

This section provides the ability to configure and view system statistics and logging of the Gateway appliance. Included are the following sections.

- **Statistics** - Displays statistics for active calls and calls processed, and displays a summary of active calls in progress
- **Remote Logging** - Settings for system logging via Syslog. The following settings are available.
    - Configure Remote Logging
        - Enable Remote Logging
        - Remote Server Hostname
        - Remote Server Port
        - Log to USB Drive Instead of Remote Host
    - Remote Logging Selections
        - Enable Reporting of Call Bridging Events
        - Enable Debug Settings
    - Call Bridging Reporting Settings
        - Call Bridging Reporting Syslog Facility
    - System Debug Settings
        - Kernel Log
        - System Log
    - Gateway Debug Settings
        - Debug Syslog Reporting Facility
        - Gateway Log Level
        - Gateway Debug Level
        - SIP Debug

- DTMF Debug

Status and Diagnostics

This section provides the ability to view connection status, system information, perform advanced debugging, and troubleshoot problems with diagnostic tools. Included are the following sections.

- **Connection Status**
- **System Information**
- **IP Ping/Traceroute**
- **Advanced Debugging**
- **TDM Recording**
- **Technical Support**

Connection Status

This section provides the ability to view the connection status of network interfaces, SIP endpoints, and PSTN interfaces. Included are the following sections.

- **Network** - Status of network interfaces
- **SIP Endpoints** - Status of SIP endpoints
- **PSTN Interfaces** - Status of interfaces per port

System Information

This section provides the ability to view system information on the Gateway Series appliance, including model number, software version, MAC addresses, uptime, system time, and system temperature.

IP Ping / Traceroute

This section allows the Gateway to ping or perform a trace route against a remote IP and to report the results to the web UI. The following settings are available.

- Ping and Route From Gateway
  - Ping IP
  - Ping/IP Route Results
- Traceroute From Gateway
  - Traceroute IP
  - Traceroute Results

Advanced Debugging

This section provides the ability to record and download debug logs for troubleshooting. Included are the following sections.

- **Debugging Sessions in Progress** - Displays existing logs or recording sessions in progress.
- **Start a New Debugging Session** - TCP traffic, gateway logging, and system logging settings for starting a new debugging session. The fol-lowing settings are available.
  - TCP Trafic
    - TCP Traffic
    - Capture Only SIP Packets
    - Length of TCP Packet Capture
  - Gateway Log
    - Gateway Log
    - Gateway Log Length
    - Debug Level
    - SIP Debug
    - DTMF Debug
  - System Log
    - System Log
    - System Log Length

TDM Recording

This section provides the ability to get captures directly from the analog interfaces. The following settings are available:

- Span
- TDM Recording Length, in seconds

Technical Support

This section provides the ability to enable remote access for Digium Support Personnel to access the Gateway Series appliance for support purposes. The following settings are available.

- Remote Access
  - Password

Maintenance

This section provides the ability to perform configuration backups, perform system updates, set the system clock, reboot, and restore factory settings. Included are the following sections.

- **Backups**
- **Software Updates**
- **System Clock**
- **System Reset**

Backups

This section provides the ability to create and restore a backup. Included are the following sections.

- **Download Backup** - Download a backup in database format
  Note: At least one configuration change must be made before a backup can be generated and downloaded. In order to revert to the stock configuration, the factory reset feature referenced in the section titled System Reset may be used.
- **Restore a Backup** - Restore a backup in database format

Software Updates

This section provides the ability to perform a software update for the Gateway appliance. If the Gateway appliance is connected to the Internet, you will be prompted if there is a newer version of the software available, and offered to automatically download and install it. Depending on the speed of your Internet connection, it may take a few minutes to complete downloading. The software update will take about 10 minutes to complete. If the Gateway appliance is not connected to the Internet, the latest software can be obtained at http://downloads.digium.com/pub/telephony/gateway/firmware/. Save the firmware file to your desktop. Then manually install it from the Software Updates section.

> While many software versions may be available on Digium's website, it is recommended to install only the latest version of the software.

System Clock

This section provides the ability to set the system clock on the Gateway appliance and to sync it against a network time server. The following settings are available.

- Timezone
- Time Set Method
- Manually set the Date and Time
- NTP Server

System Reset

This section provides the ability to perform a system reboot, system shutdown, or factory reset of the Gateway appliance. A system shutdown will drop all current calls and cause the Gateway appliance to become unreachable by any method except physical access.

Chapter 4

Troubleshooting

This chapter provides information regarding troubleshooting tools, frequently asked questions, and possible resolutions as identified by

Digium Technical Support. Multiple resources are available to obtain more information about Asterisk and Digium products. Please visit both www.digium.com and www.asterisk.org for more information.

Firmware Recovery and Configuration Reset

If a Gateway appliance is behaving unexpectedly or the password is forgotten, a firmware recovery may need to be performed. The USB Recovery port can be used to perform a firmware recovery using a recovery image. The recovery image reformats the Gateway's root filesystem and reloads the appropriate software on it. It will also overwrite the configuration database, returning the Gateway appliance to its default configuration.

> It is highly recommended to use an image that is equal or greater in version than the firmware that is currently installed on the Gateway appliance.

Every Gateway firmware release will include a recovery image. The recovery image is located inside of a compressed zip file which can be downloaded from http://downloads.digium.com/pub/telephony/gateway/recovery/. After downloading the recovery image, the contents of the compressed zip file must be extracted and copied to the root (i.e. parent) directory of an **empty** USB flash drive.

> A USB flash drive is not provided with a Gateway appliance. It must be purchased separately. The USB flash drive should be at least 2GB in size and formatted with the FAT32 filesystem.

> Some decompression utilities will create a new directory in which to place extracted files. If your decompression utility functions in that way, be certain to copy the contents from that new directory to the root (i.e. parent) directory of an empty USB flash drive. Any new directory created by a decompression utility should not be copied.

Next, power off the Gateway appliance.

Then insert the USB flash drive into the USB Recovery port. Power on the Gateway appliance. The Gateway appliance will boot from the USB Recovery port and process the recovery image which was placed on the USB flash drive.

> Do not disconnect power during this process. The recovery process will take at least 3 minutes to complete.

During this process, the Device Status LED will flash red and green for a few seconds. Then, the Status LED will turn amber for about 20 seconds. Next, the Status LED will turn red for about 2 minutes, and the Port Status Indicator lights will cycle left and right. Finally, the Status LED will turn green, and the Port Status Indicator lights will blink in a green, red pattern. At this point, it is safe to power off the Gateway appliance. Remove the USB flash drive and power cycle the Gateway appliance.

Frequently Asked Questions

What do the colors of the *Device Status* LED indicate?

- **Steady Red** - Hardware is initializing
- **Blinking Red** - A software packet is being checked for validity
- **Steady Amber** - Software is initializing. Hardware is initialized.
- **Steady Green** - Hardware and software are fully initialized and running

What do the colors of the Ethernet Status LEDs indicate?

- **Steady Green** - Active Link
- **Blinking Green** - Network Activity

What do the colors of the Port Type Indicators indicate?

- **Green** - FXS Port
- **Red** - FXO Port

What type of cable do I need for the Telephony ports on a Gateway appliance?

A straight-through RJ11 cable is needed for connecting the RJ11 ports on a Gateway appliance when connecting to the PSTN. Refer to **Table A-2** for pin assignments.

How can the Gateway software be reinitialized without modifying any configuration settings?

The Gateway software can be reinitialized without modifying any configuration settings by following the steps described below.

1. Press the reset switch once
2. The status LED will flash amber for 5 seconds
3. The status LED will flash red for 2 seconds, acknowledging the reinitialization request
4. The Gateway appliance will restart itself
5. The status LED will turn green once the reinitialization is complete

How can the Gateway GUI password be reset to its default without modifying any configuration settings?

The Gateway GUI password can be reset to its default without modifying any configuration settings by following the steps described below.

1. Press the reset switch once.
2. The status LED will start flashing amber.
3. Press the reset switch again while the status LED flashes amber.
4. The status LED will flash green for 2 seconds, acknowledging the reset password request.
5. The password is set back to its default, i.e. "admin"

There is a slight echo. How can I adjust the sound quality?

First, verify that the *Echo Cancellation* option under the *Port #* menu of the *Telephony* settings is enabled. If it is not, enable it. If echo persists, adjust the *RX Gain* and *TX Gain* options on the same menu.

How is the loopback test useful for troubleshooting?

The loopback test verifies the integrity of the data being transmitted and received.

Where can I find answers to additional questions?

Digium Technical Support (+1 256-428-6161), or Toll Free in the U.S. (+1 877-344-4861), is available 8am-5pm Central Time (GMT -6), Monday - Friday. Please refer to **Free Installation Support** for additional information on how to obtain assistance from Digium Technical Support.

Free Installation Support

Digium hardware products include free installation support. In order to receive this support, register your Digium product using the serial number located on the serialization label of your Digium unit.

Steps to receive installation support:

1. Record your product serial number
2. Register your product at http://www.digium.com/register
3. E-mail Digium Support via support@digium.com, or telephone via +1 (256)-428-6000 or Toll-Free +1 (877)-DIGIUM-1.
   Note: Digium does not provide support for unregistered products.
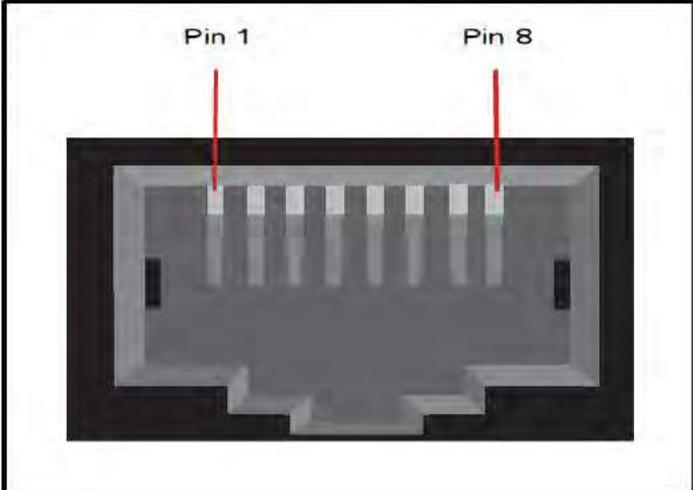
Appendix A

Pin Assignments

All RJ45 (8P8C) ports labeled ETH on the Gateway Series appliance are 8-pin. The pin assignments are identified in Table A-1.
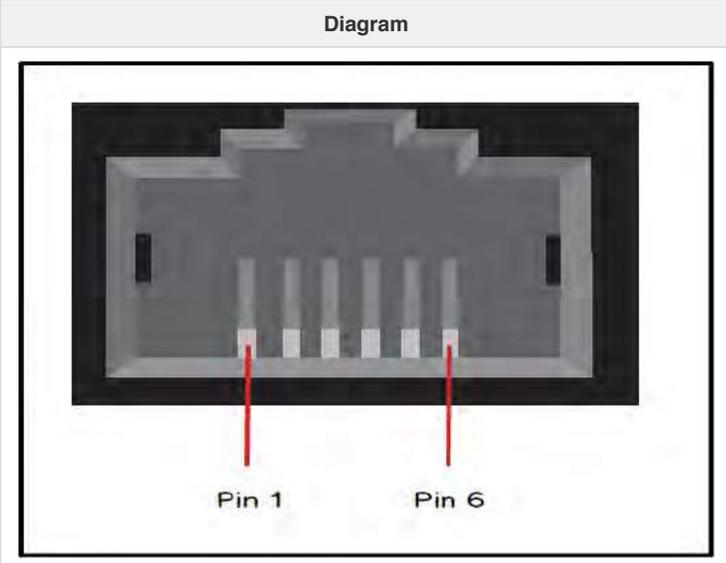
Table A-1: Ethernet Port Pinouts

Diagram	

Pin	Description
1	Bi-directional pair A+
2	Bi-directional pair A-
3	Bi-directional pair B+
4	Bi-directional pair C+
5	Bi-directional pair C-
6	Bi-directional pair B-
7	Bi-directional pair D+
8	Bi-directional pair D-

All RJ11 (6P6C) ports labeled *Ports* on the Gateway appliance are 6-pin. The pin assignments are identified in Table A-2.

Table A-2: RJ11 Telephony Port Connector

Diagram	

Pin	Description
1	Not used
2	Not used
3	Tip
4	Ring
5	Not used
6	Not used

Appendix B

Specifications

This appendix provides specifications, required environmental conditions, and maximum power consumption for the Gateway appliances.

Physical.

Size: 8.6" × 9.0" × 1.72" (21.84 x 22.86 x 4.37 cm)

Weight: 2 lbs 12 oz (1,247.38 gm)

Interfaces.

8x6P6C connectors for telephony

USB: Standard Type A Receptacle

Ethernet Access: 10/100base-T; RJ45

Power: Standard 3-pin IEC320-C13

Environment.

Temperature:

0 to 50° C (32 to 122° F) operation

-20 to 70° C (4 to 158° F) storage

Humidity: 0 to 90% non-condensing

Power Requirements.

Voltage: 100-240VAC, 50/60Hz

Current: 110mA@120V or 55mA@240V maximum.

Power: 13W maximum.

Appendix C

Glossary and Acronyms

8P8C *8 position 8 conductor*

Module connector commonly used to terminate twisted pair.

ANSI *American National Standards Institute*

An organization which proposes and establishes standards for international communications.

asynchronous

Not synchronized; not timed to an outside clock source. Transmission is controlled by start bits at the beginning and stop bits at the end of each character. Asynchronous communications are often found in internet access and remote office applications.

attenuation

The dissipation of a transmitted signal's power as it travels over a wire.

bandwidth

The capacity to carry traffic. Higher bandwidth indicates the ability to transfer more data in a given time period.

bit

The smallest element of information in a digital system. A bit can be either a zero or a one.

bps *bits per second*

A measurement of transmission speed across a data connection.

BRI

Basic Rate ISDN

broadband

Broadband transmission shares the bandwidth of a particular medium (copper or fiber optic) to integrate multiple signals. The channels take up different frequencies on the cable, integrating voice, data, and video over one line.

channel

A generic term for an individual data stream. Service providers can use multiplexing techniques to transmit multiple channels over a common medium.

Cat5

Twisted pair cable for carrying signals for 10/100/1000 Ethernet, telephony, and video. Cat5 was superseded by Cat5e.

Cat5e

Twisted pair cable for carrying signals for Gigabit Ethernet, telephony, and video.

CLEC *Competitive Local Exchange Carrier*

A term for telephone companies established after the Telecommunications Act of 1996 deregulated the LECs. CLECs compete with ILECs to offer local service. See also *LEC* and *ILEC.*

CO *Central Office*

The CO houses local switching equipment. All local access lines in a particular geographic area terminate at this facility (which is usually owned and operated by an ILEC).

CPE *Customer Premises Equipment*

Terminal equipment which is connected to the telecommunications network and which resides within the home or office of the customer. This includes telephones, modems, terminals, routers, and television set-top boxes.

DAHDI *Digium Asterisk Hardware Device Interface*

A telephony project dedicated to implementing a reasonable and affordable computer telephony platform into the world marketplace. In addition, the collective name for the Digium-provided drivers for Digium telephony interface products.

DS0 *Digital Signal, Level 0*

A voice grade channel of 64 kbps. The worldwide standard speed for digitizing voice conversation using PCM (Pulse Code Modulation).

DS1 *Digital Signal, Level 1*

1.544 Mbps in North America (T1) and Japan (J1) -up to 24 voice channels (DS0s), 2.048 Mbps in Europe (E1) - up to 32 voice channels (DS0s). DS1/T1/E1 lines are part of the PSTN.

DS3 *Digital Signal, Level 3*

T3 in North America and Japan, E3 in Europe. Up to 672 voice channels (DS0s). DS3/T3/E3 lines are not part of the PSTN.

DTMF *Dual Tone Multi-Frequency*

Push-button or touch tone dialing.

E1

The European equivalent of North American T1, transmits data at 2.048 Mbps, up to 32 channels (DS0s).

E3

The European equivalent of North American T3, transmits data at 34.368 Mbps, up to 512 channels (DS0s). Equivalent to 16 E1 lines.

EMI *Electromagnetic Interference*

Unwanted electrical noise.

full duplex

Data transmission in two directions simultaneously.

FXO *Foreign Exchange Office*

Receives the ringing voltage from an FXS device. Outside lines are connected to FXO ports.

FXS *Foreign Exchange Station*

Initiates and sends ringing voltage. Phones are connected to FXS ports.

G.711

A recommendation by the Telecommunication Standardization Sector (ITU-T) for an algorithm designed to transmit and receive mulaw PCM voice and A-law at a digital bit rate of 64 kbps.

G.723.1

A recommendation by the Telecommunication Standardization Sector (ITU-T) for an algorithm designed to transmit and receive audio at 6.3 kbps or 5.3 kbps.

G.729a

A recommendation by the Telecommunication Standardization Sector (ITU-T) for an algorithm designed to transmit and receive audio at 8 kbps.

H.323

A recommendation by the Telecommunication Standardization Sector (ITU-T) for multimedia communications over packet-based networks.

HDLC *High-Level Data Link Control*

A bit-oriented synchronous data link layer protocol developed by the International Organization for Standardization (ISO).

IAX *Inter-Asterisk eXchange*

The native VoIP protocol used by Asterisk. It is an IETF standard used to enable VoIP connections between Asterisk servers, and between servers and clients that also use the IAX protocol.

iLBC *internet Low Bitrate Codec*

A free speech codec used for voice over IP. It is designed for narrow band speech with a payload bitrate of 13.33 kbps (frame length = 30ms) and 15.2 kbps (frame length = 20ms).

ILEC *Incumbent Local Exchange Carrier*

The LECs that were the original carriers in the market prior to the entry of competition and therefore have the dominant position in the market.

interface

A point of contact between two systems, networks, or devices.

ISO *International Standards Organization*

IVR *Interactive Voice Response*

An interactive technology that allows a telephone system to detect voice and keypad input.

LED *Light-emitting Diode*

Linux

A robust, feature-packed open source operating system based on Unix that remains freely available on the internet. It boasts dependability and offers a wide range of compatibility with hardware and software. Asterisk is supported exclusively on Linux.

loopback

A state in which the transmit signal is reversed back as the receive signal, typically by a far end network element.

MGCP *Media Gateway Control Protocol*

multiplexing

Transmitting multiple signals over a single line or channel. FDM (frequency division multiplexing) and TDM (time division multiplexing) are the two most common methods. FDM separates signals by dividing the data onto different carrier frequencies, and TDM separates signals by interleaving bits one after the other.

mux *multiplexer*

A device which transmits multiple signals over a single communications line or channel. See multiplexing.

node

A terminal in a computer network.

NT *Network Termination*

A device connecting the customer's telephone or data equipment to the local ISDN exchange carrier's line. NT devices are connected to TE devices.

PBX *Private Branch Exchange*

A smaller version of a phone company's large central switching office. Example: Asterisk.

PCI *Peripheral Component Interconnect*

A standard bus used in most computers to connect peripheral devices.

POP *Point of Presence*

The physical connection point between a network and a telephone network. A POP is usually a network node serving as the equivalent of a CO to a network service provider or an interexchange carrier.

POTS *Plain Old Telephone Service*

The public switched telephone network (PSTN) is the network of the world's public circuit-switched telephone networks. Originally a network of fixed-line analog telephone systems, the PSTN is now almost entirely digital, and now includes mobile as well as fixed telephones.

PPP *Point-to-Point Protocol*

Type of communications link that connects a single device to another single device, such as a remote terminal to a host computer.

PRI

Primary Rate ISDN

PSTN *Public Switched Telephone Network*

A communications network which uses telephones to establish connections between two points. Also referred to as the dial network.

PTMP *Point-to-Multipoint*

A connection where data is broadcast between more than two endpoints.

PTP *Point-to-Point*

A connection restricted to two endpoints.

PTT *Post, Telegraph, and Telephone*

The government agencies in many countries that traditionally operated and monopolized the public postal, telegraph, and telephone services.

QoS *Quality of Service*

A set of quality requirements for telephone service.

RBOC *Regional Bell Operating Company*

The creation of Regional Bell Operating Companies were a result of AT&T's telephone monopoly being broken up in 1983.

REN *Ringer Equivalence Number*

An arbitrary value which denotes the electrical load a telephone ringer has on a line.

RJ11

A six-pin jack typically used for connecting telephones, modems, and fax machines in residential and business settings to PBX or the local telephone CO.

RJ45

8P8C, un-keyed modular connector type for Ethernet over twisted pair. Predominantly used in LAN and uses Unshielded Twisted Pair cable.

RJ48

8P8C modular connector type for T1 and ISDN termination over twisted pair. While RJ45 and RJ48 use the same connector, they differ in their wiring. RJ48 is commonly seen on T1 lines and uses Shielded Twisted Pair cable.

SIP *Session Initiation Protocol*

An IETF standard for setting up sessions between one or more clients. It is currently the leading signaling protocol for Voice over IP, gradually replacing H.323.

T1

A dedicated digital carrier facility which transmits up to 24 voice channels (DS0s) and transmits data at 1.544 Mbps. Commonly used to carry traffic to and from private business networks and ISPs.

T3

A dedicated digital carrier facility which consists of 28 T1 lines and transmits data at 44.736 Mbps. Equivalent to 672 voice channels (DS0s).

TDM *Time Division Multiplexing*

A device that supports simultaneous transmission of multiple data streams into a single high-speed data stream. TDM combines signals by interleaving bits one after the other.

TE *Terminal Equipment*

A device that is established as a point of termination of a communications circuit or channel. Terminal equipment comprises all customer premises equipment (CPE). TE devices are connected to NT devices.

Telco

A generic name which refers to the telephone companies throughout the world, including RBOCs, LECs, and PTTs.

Tip and Ring

The standard termination on the two conductors of a telephone circuit; named after the physical appearance of the contact areas on the jack plug.

Twisted Pair

Two copper wires commonly used for telephony and data communications. The wires are wrapped loosely around each other to minimize radio frequency interference or interference from other pairs in the same bundle.

USB *Universal Serial Bus*

Industry standard defining communication protocols, cables, and connectors used in a bus for connection, communication, and power between electronic devices and computers.

V *Volts*

VoIP *Voice over Internet Protocol*

Technology used for transmitting voice traffic over a data network using the Internet Protocol.