Denali
Routing Application Software

Rev B – May 2012 – 110010-D003B

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Document Revision History

REVISION	DESCRIPTION	DATE
A	Initial release	Oct 2011
B	Various updates for Denali 1.4.1 release	May 2012

Table of Contents

Important User Information

In order to lower the risk of personal injury, electric shock, fire, or equipment damage, users must observe the following precautions as well as good technical judgment, whenever electronic products are installed or used.

All reasonable efforts have been made to ensure the accuracy of this document; however, Eurotech assumes no liability resulting from any error/omission in this document or from the use of the information contained herein.

Eurotech reserves the right to revise this document and to change its contents at any time without obligation to notify any person of such revision or changes.

Safety Notices and Warnings

The following general safety precautions must be observed during all phases of operation, service, and repair of this equipment. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the equipment. Eurotech assumes no liability for the customer's failure to comply with these requirements.

The safety precautions listed below represent warnings of certain dangers of which Eurotech is aware. You, as the user of the product, should follow these warnings and all other safety precautions necessary for the safe operation of the equipment in your operating environment.

Alerts that can be found throughout this manual

The following alerts are used within this manual and indicate potentially dangerous situations.

Danger, electrical shock hazard:
Information regarding potential hazards:
- Personal injury or death could occur. Also damage to the system, connected peripheral devices, or software could occur if the warnings are not carefully followed.
- Appropriate safety precautions should always be used. These should meet the requirements set out for the environment that the equipment will be deployed in.

Information and/or Notes:
Indicates important features or instructions that should be observed

Product Handling and Environmental Guidelines

Warnings:
Electric current from power and communication cables is hazardous. To avoid shock hazard when connecting or disconnecting cables, follow appropriate safety precautions. Ensure that the correct operating voltage is used when powering the device.
Do not open the equipment to perform any adjustments, measurements, or maintenance until all power supplies have been disconnected.

Antistatic Precautions

To avoid damage caused by ESD (Electro Static Discharge), always use appropriate antistatic precautions when handing any electronic equipment.

Batteries

Where products contain batteries, observe the following precautions:

Warning:

To avoid possible injury:

- Do not short circuit the batteries or place in water or on a metal surface where the battery terminals could be shorted. Do not incinerate or heat to more than 100 °C (212 °F). Do not crush or otherwise disassemble the battery or attempt to repair the battery.
- Do not recharge batteries that are non-rechargeable. There is a danger of explosion if a lithium battery is recharged or incorrectly replaced.
- Dispose of used batteries according to the manufacturer's instructions and local ordinances.

Warranty

This product is supplied with a limited warranty. The product warranty covers failure of any Eurotech manufactured product caused by manufacturing defects. Eurotech will make all reasonable effort to repair the product or replace it with an equivalent alternative. Eurotech reserves the right to replace the returned product with an alternative variant or an equivalent fit, form, and functional product. Delivery charges will apply to all returned products.

WEEE

The following information is issued in compliance with the regulations as set out in the 2002/96/CE directive, subsequently superseded by 2003/108/CE. It refers electrical and electronic equipment and the waste management of such products.

When disposing of a device, including all of its components, subassemblies, and materials that are an integral part of the product, you should consider the WEEE directive.

This symbol has been attached to the equipment or, if this has not been possible, on the packaging, instruction literature and/or the guarantee sheet. By using this symbol, it states that the device has been marketed after August 13, 2005 and implies that you must separate all of its components when possible and dispose of them in accordance with local waste disposal legislations.

- Because of the substances present in the equipment, improper use or disposal of the refuse can cause damage to human health and to the environment.
- With reference to WEEE, it is compulsory not to dispose of the equipment with normal urban refuse, and arrangements should be instigated for separate collection and disposal.
- Contact your local waste collection body for more detailed recycling information.
- In case of illicit disposal, sanctions will be levied on transgressors.

Technical Assistance

If you have any technical questions, cannot isolate a problem with your device, or have any enquiry about repair and returns policies, contact your local Eurotech Technical Support Team.

See Eurotech Worldwide Presence on page 99 for full contact details.

Pack the product in anti-static material and ship it in a sturdy cardboard box with enough packing material to adequately protect the shipment.

Any product returned to Eurotech improperly packed will immediately void the warranty for that particular product!

Conventions

The following conventions are used throughout this manual.

Symbol / Text	Pin Definition
NC	Not Connected
Reserved	Use reserved to Eurotech, must remain unconnected

Text in `Courier font` is used to indicate commands entered or responses received at a command prompt in either the Windows or Linux operating system.

Introduction

Denali is an application component of Eurotech's Everyware™ Software Framework (ESF), allowing configuration of a powerful network routing software platform. Eurotech's ESF and Denali software components run on different hardware platforms, providing a complete toolkit that is ready to use for a variety of communication and network applications.

ESF is an inclusive and targeted software framework. ESF allows Eurotech to deliver not only latest generation Pervasive Computer hardware platforms, but to be able to deliver all aspects of the required software stack as well:

- Bootloader/BIOS for hardware platform
- Operating System (Linux, Windows)
- IBM Java Virtual Machine (JVM)
- OSGi application framework
- Extensive set of ready-to-use Java Plug-Ins (Bundles) provided for unique platform supplied hardware, network, cellular and storage applications

All of these components come "integrated" from Eurotech and are based on open standards, tools, and implementations. The amount of 3rd party development is greatly reduced, allowing customers to focus on what they do best – writing their business application logic, without having to spend man years developing the software infrastructure and frameworks upon which those applications can run.

Denali takes the basic tools of the ESF platform and provides an application-ready environment for configuring a cellular routing modem for 4G/HSDPA/UMTS/EDGE/GPRS/GSM, and EvDO/CDMA networks. It is ideally suited for wireless applications such as Internet access, AVL, telemetry, SCADA, mobile computing, and AMR. Denali operates as a fully configurable embedded Linux router, enabling firewall, DHCP, DNS and NAT. Denali provides real-time network access to any Ethernet, 802.11b/g or serial device for mobile and fixed data applications.

A GPS adapter provides a sophisticated tracking program and raw NMEA data strings for mapping applications. The tracking program reports the device location, speed and heading on regular intervals and caches data when out of network. To easily manage the Denali configuration, a Web page presents a simple tool to quickly change settings locally or over-the-air.

This User Manual provides the basic configuration and hardware information required for getting started running Denali. For more detailed information, see
 http://www.eurotech.com/en/solutions/everyware+software+framework for additional technical and addendum documentation. This manual uses the term "Denali" as shorthand to refer to a system consisting of a hardware platform running the Denali software.

Some Denali systems provide built-in (factory fitted) options for cellular modems. In addition, some commercial USB modems are supported, which can be obtained from cellular network carriers and installed by the customer. There is a wide array of cellular technologies, protocols, and network standards currently in use and which are under development. For simplicity, this manual uses the following designations to describe the cellular modem types.

HSDPA – refers to modems based on GSM/GPRS networks, including EDGE, UMTS, & HSDPA

EVDO – refers to modems based on CDMA networks, including CDMA2000 and 1xEV-DO

4G – True 4G networks consist of two types, based on WiMAX and LTE technologies (a third type, HSPA+, is called 4G but is really just an upgraded and faster 3G network.)

Product Overview

Features

The features offered by Denali include:

- Wireless features – provides cellular, WiFi (802.11) and GPS communication.
- Ethernet – two 10/100 base-T ports provide independent wired network ports.
- Networking – takes full advantage of IP networking technologies.
- Firewall – provides data encryption and authentication.
- Security – secure routing of IP data between the cellular network, Ethernet, and 802.11 WLAN.
- Wireless router – can act as gateway for local wired or wireless LAN to access the Internet.
- Serial communication – field equipment can connect via RS-232, RS-422/485, or LAN ports.
- Localization – GPS receiver allows applications or local devices to pinpoint exact location.
- Cloud Computing – the Everyware™ Device Cloud provides publish/subscribe device messaging.

Denali Hardware Platforms

The ESF and Denali software are designed to be compatible across multiple hardware platforms, allowing software development to be reused in different applications. Some of the hardware platforms currently supporting ESF and Denali are:

- Helios
- Duracor 1200
- Duracor 1400
- ISIS
- DynaCOR

The ESF and Denali software are designed to provide consistent operation despite underlying hardware characteristics. However, there are some differences that result in different configuration options for Denali, based on the hardware platform. These are noted where necessary in this manual.

Supported Modems

Cellular modems may be provided as factory-built options, as listed in the model types above, and are also available from cellular providers as plug-in USB sticks added as peripherals to Denali. A list of supported third-party cellular modems is given below. Support for other modems will be developed over time as new modems become available.

Built-in Modem (PCI Express Mini-card)	Cellular Technology	Manufacturer
MC5727	EVDO	Sierra Wireless
MC8790	HSDPA	Sierra Wireless

USB Plug-in Modem	Cellular Technology	Manufacturer
Compass C885	HSDPA	Sierra Wireless
Compass C888	HSDPA	Sierra Wireless
Compass C889	HSDPA	Sierra Wireless
MC760	EVDO	Novatel
USB598 / T598	EVDO	Sierra Wireless
USBConnect Shockwave (USB308)	HSDPA	Sierra Wireless
U600	4G, EVDO	Sierra Wireless

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PART 1: GETTING STARTED

Chapter 1 Interfaces

Understanding Network Interfaces

Denali provides configuration for several different kinds of IP network connections or 'interfaces'. These interfaces are mentioned throughout this manual and on the Denali configuration page. The Linux system assigns each interface a name. The last character of each interface name is a number, 0 (zero) or 1 (one), as listed in the following table. When these interface names are used in the Web configuration page, they must be entered exactly as written (case sensitive). The number and type of interfaces available is dependent on the hardware platform.

NAME	INTERFACE DESCRIPTION
eth0, eth1	Ethernet port 0 or 1 (depending on how many Ethernet ports are detected).
	On the Helios, the 802.11 WiFi network is provided via an internal USB/Ethernet and Ubiquity Ministation WiFi adapter, and is also designated as an "eth_" interface.
	Some cellular modems also use "eth_" interface names.
wlan0	On the Duracor and Isis, etc., the 802.11 WiFi network is provided via an internal wireless LAN adapter module.
ppp0, ppp1, etc.	Cellular network (for some cellular modems)

Chapter 2 Accessing Denali

This section describes how to gain access to Denali for diagnostic and system maintenance purposes, and provides information on some utility software that may be useful for troubleshooting.

What You Will Need

Hardware Requirements

Denali must be connected to a stand-alone computer and/or a network, so that the initial configuration may be loaded via the Web configuration page.

In order to perform the initial configuration, you need the following hardware:

- Denali unit
- Power supply
- Computer with Ethernet network port and Web browser (optionally, RS-232 serial port)
- Ethernet crossover cable, or appropriate network equipment and cables
- Optionally, serial crossover cable, or monitor and keyboard (used for identifying the network address of Denali after it powers on)

Software Requirements

The computer used to perform Denali configuration must have the following software:

- Windows operating system
- Web browser: Internet Explorer ver. 7 or higher, Mozilla Firefox ver. 3, or Google Chrome
- If using serial: serial terminal program, such as PuTTY, Windows HyperTerminal, or Tera Term.

Other operating systems or Web browsers may be used, but they may not work exactly as described in this document.

Network Requirements

Connecting and configuring Denali on a network requires the following:

- Either a direct connection (via Ethernet crossover) or existing network LAN connection from the computer to Denali for the initial setup
- Network configuration of wired LAN, wireless 802.11 WAN, and/or cellular networks depending on the network used after initial configuration
- Knowledge of the final networking address requirements in order to configure Denali
- If using cellular services, a registered SIM card and/or cellular data account

Optional Equipment

Several optional components may be supplied as part of a Denali system, including GPS Receiver and the Wireless LAN 802.11 card. Cellular and 802.11 antennas must conform to applicable regulations in order to ensure compliance with FCC regulations.

Additional Documentation

In addition to this manual, there may be additional documentation or support material relating to Denali configuration. Contact Eurotech Support using the address information at the end of this manual.

Serial/VGA Connection

Denali hardware platforms generally provide a serial console and/or keyboard and VGA monitor connection. This allows a local administrative ('root') login to Denali.

If using a keyboard and monitor, an access panel may need to be removed in order to access these connectors. Connect the keyboard and monitor to the appropriate ports and power on the Denali unit. You should see initial operating system startup messages, and eventually a login prompt (or press the **Enter** key to get a login prompt). The default login is `root` and the default password is `IsiTech` (case-sensitive).
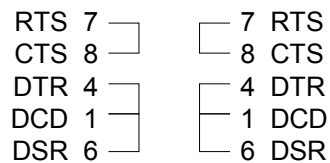
If using an RS-232 serial port, a null modem serial cable is needed, as shown in the next section. The settings for this connection (baud rate, data bits, etc.) may differ depending on the platform. Then see the section Setting Up Software on page 16 to set up a serial terminal program.

RS-232 Null Modem Cable

To connect Denali to another computer (DTE) device using an RS-232 port, such as the console diagnostic port, a null modem serial cable must be used. The pinout for this cable is shown next.

RS-232 Null Modem Cable

PC DB-9		DB-9
RX 2		2 RX
TX 3		3 TX
GND 5	————	5 GND
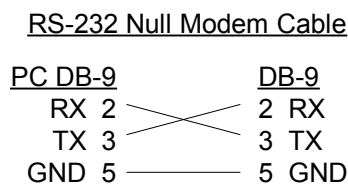
optional (loopbacks required if hardware handshaking enabled)

RTS 7		7 RTS
CTS 8		8 CTS
DTR 4		4 DTR
DCD 1		1 DCD
DSR 6		6 DSR

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Setting Up Software

There are several optional third-party software programs that may be needed for configuring or using Denali. Windows HyperTerminal is one serial terminal program that may be used for accessing serial ports. Tera Term (http://www.ayera.com/teraterm/) is another serial terminal program, but it is not discussed here. PuTTY also allows administrative access to Denali over the network or a serial port, and WinSCP may be used in some cases to upload or download files.

Windows HyperTerminal

Windows provides a serial terminal program, HyperTerminal, for serial communications. This can be used to access the serial console port of Denali for diagnostics. The following steps are the setup instructions for Windows HyperTerminal. (HyperTerminal is not included with Windows 7.)

1. In the Windows Start menu, select Programs>Accessories>Communications>HyperTerminal. The Connection Description window is displayed.
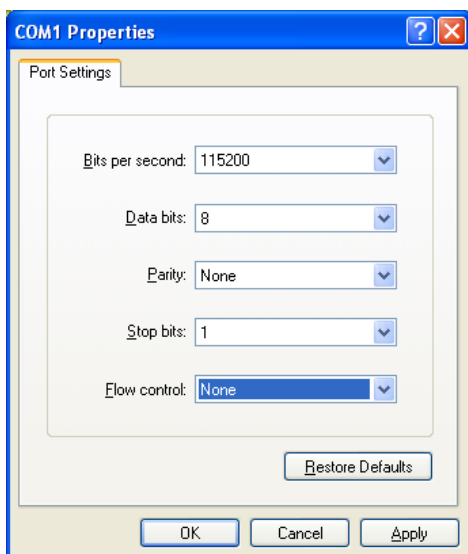
1. Enter a name for this HyperTerminal configuration, as shown next.
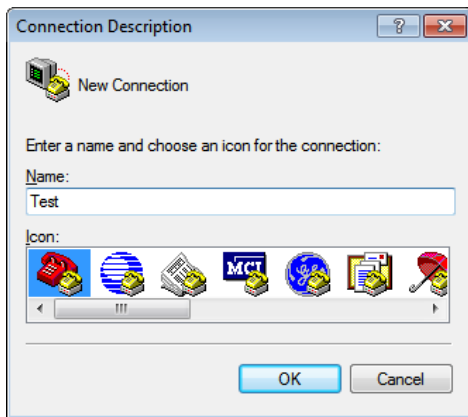
2. Set the *Connect using* option to *COM1* or whatever free RS-232 port exists on this PC.
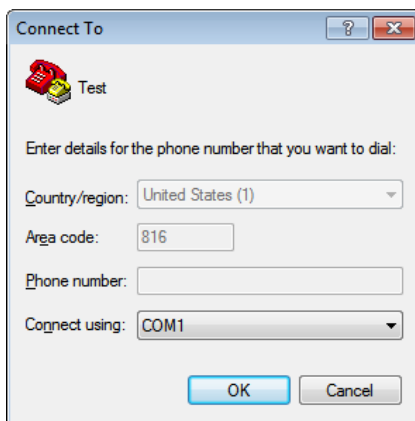
3. Make the correct settings for the serial communication using the correct baud rate for the Denali diagnostics port, then click the **OK** button.

4. If Denali is already started, press the **Enter** key to get a login prompt. The default login is `root` and the default password is `IsiTech` (case-sensitive).

SSH Client, Terminal Program (PuTTY)

Denali systems generally allow remote console logins using Secure Shell (SSH), which requires SSH client software.

For Linux systems, the 'ssh' command is available as an SSH client.

For Windows systems, the PuTTY program is available as a free SSH client. Download and install PuTTY (choose the Windows installer version) from http://www.chiark.greenend.org.uk/~sgtatham/putty/download.html.

Once the PuTTY application is installed on the Windows computer, run the application and enter the IP address of Denali. Set the *Connection type* to *SSH* and the *Port* to *22* (unless the port has been changed on Denali from its factory default). Click the **Open** button to connect.
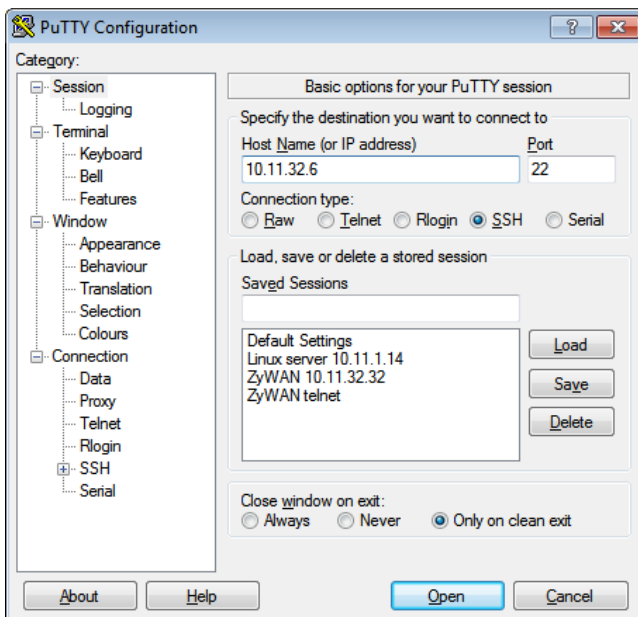
The first time an SSH connection is made with PuTTY, a security warning is given as PuTTY tries to authenticate with Denali. Click **Yes** to continue, as long as you are sure that this is the correct Denali device. Then log in with the correct username and password. The default administrative login is `root` and the default password is `IsiTech` (case-sensitive).

PuTTY also allows for serial terminal access, and so may be used instead of Windows HyperTerminal. Set the *Connection type* to Serial, and the *Speed* to 115200 (or correct baud rate). Click the **Open** button to connect.
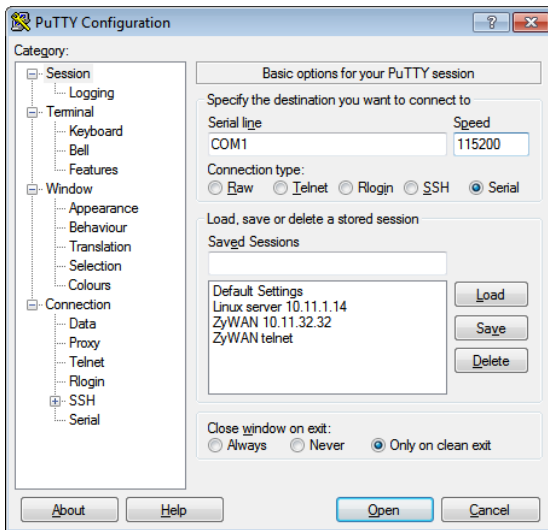

If Denali is already started, press the **Enter** key to get a login prompt. The default login and password are the same as above.

SFTP/SCP Client (WinSCP)

There may be occasions when you wish to upload or download files to/from Denali. This requires the SFTP or SCP (Secure FTP or Secure Copy) protocol, which use an encrypted SSH network connection.

For Linux systems, the 'sftp' and 'scp' commands are available for file transfers to Denali.

For Windows systems, the WinSCP application is available as a free download for SFTP/SCP file transfers. This is available from www.winscp.net. Download and install the latest version of WinSCP from this site. One option presented during installation is the user interface style. Either style can be used, but it is recommended to choose the Norton Commander interface that allows display of both the local and remote directories.
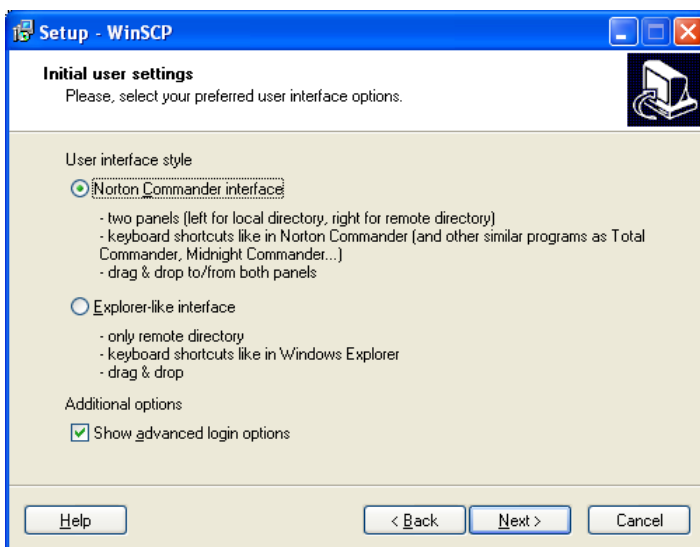
Run WinSCP after installing it. It may be useful to set the option *Remember last used directory* under the Environment>Directories menu.
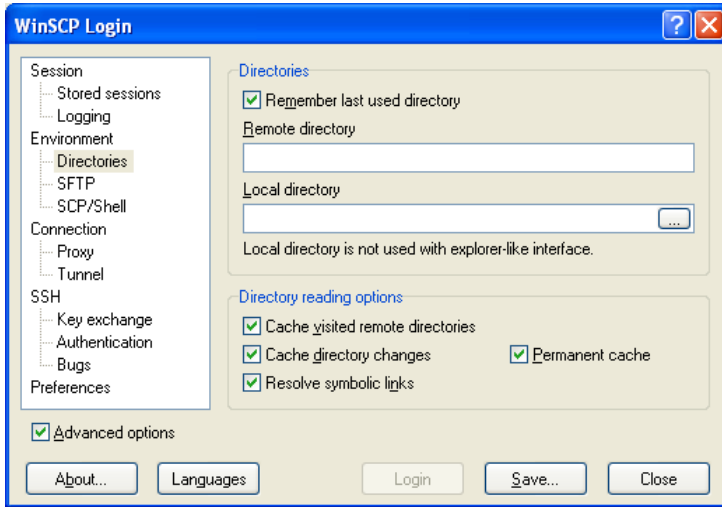
Also, select the *Preferences* option, and then click the **Preferences** button. It may be useful to set the *Remember panels' state when switching sessions* option in the Environment>Panels menu.
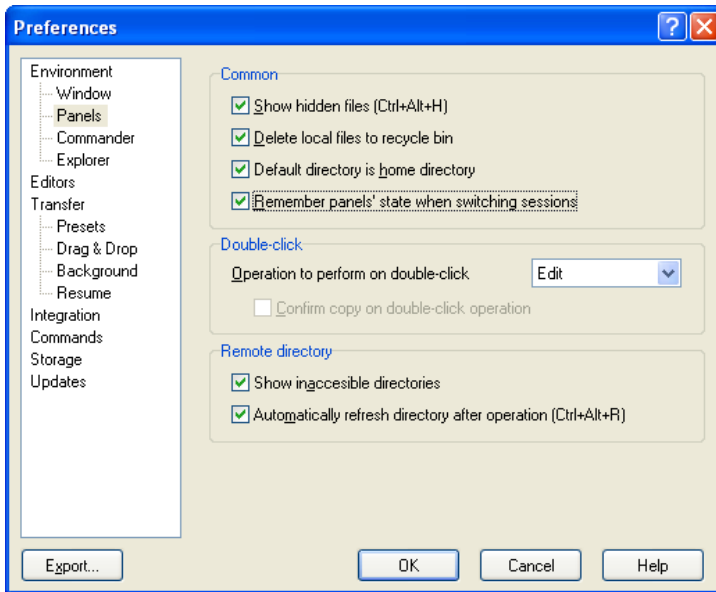
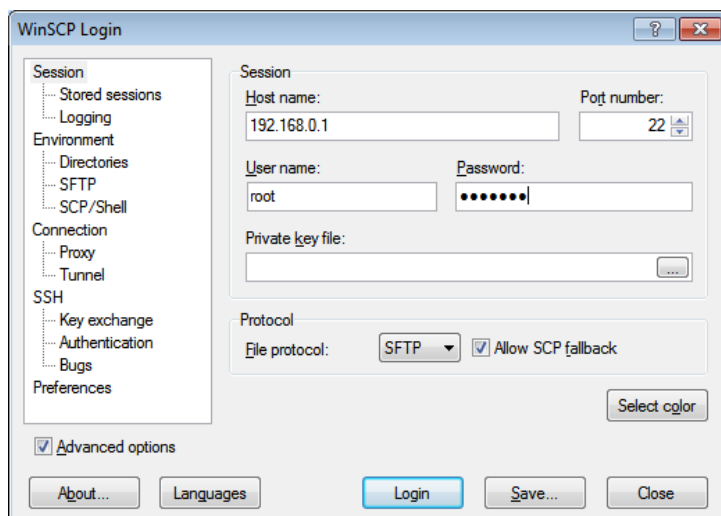In the main window of WinSCP, select the "Session" menu. In the *Host name* field, enter the IP address of Denali. The username and password can also be entered at this time. Individual session configurations may be saved, if repeated connections need to be made to the same address. These will appear in the "Stored sessions" menu of the WinSCP menu.

Click **Login** to connect.

The first time a connection is made with WinSCP, a security warning is given as WinSCP tries to authenticate with Denali. Click **Yes** to continue.
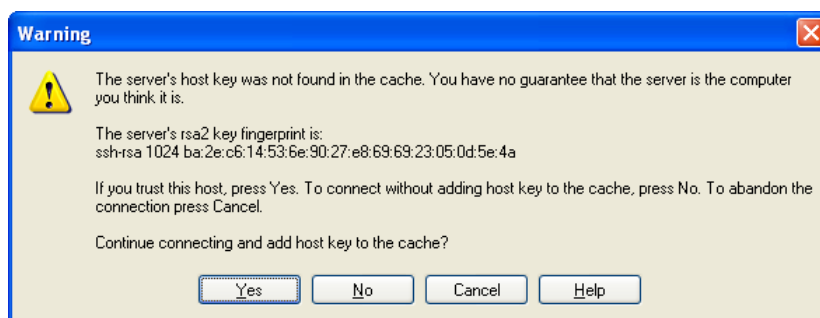
Once connected, WinSCP shows the local directories and files in the left panes. The right panes show the directories and files on Denali (using WinSCP's Norton Commander interface only). If all four panes are not visible, they can be displayed by choosing the *Options>Local Panel>Tree* and *Options>Remote Panel>Tree* menu options.

You can drag and drop files between the panes or other Windows Explorer windows. Navigate through the local or remote directory structures in the upper panes, as needed.
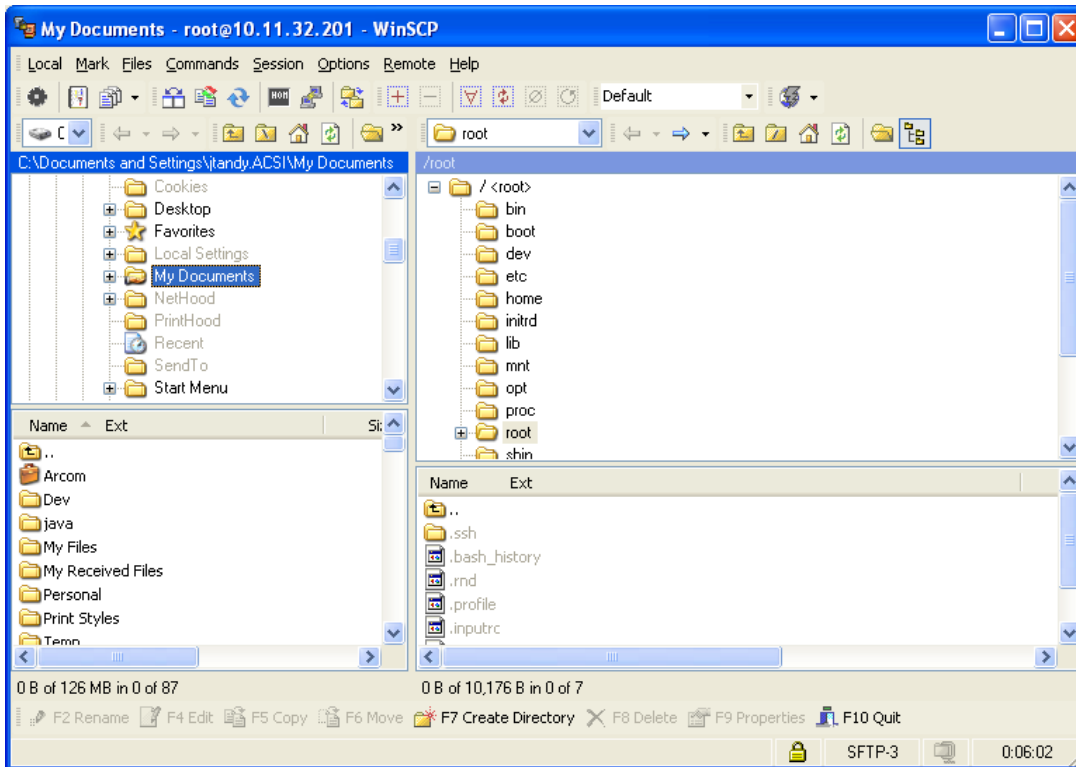
Initial Connection to Denali

Denali typically comes factory loaded with default settings, which need to be configured for the network on which it will ultimately be used. The instructions in this section describe how to set up the hardware and software necessary to perform this initial configuration.

If the Ethernet port is configured to obtain its address automatically from a network using DHCP, you will need to determine or set the Denali address using a serial or keyboard/VGA terminal, as described below.

The Denali unit may also have an Ethernet port configured with a fixed address and operating as a DHCP server. In this case, or if the address is known in some other way, the serial or keyboard/VGA terminal is not necessary to establish an initial connection.

To make an initial connection to Denali, complete the following steps:

1. Connect the Denali unit to a configuration PC directly using a crossover Ethernet cable.
2. Apply power to the Denali unit.
3. Check or set the Denali IP address.
4. Set up the PC's network settings.
5. Configure Denali via its Web page.

The following sections provide detailed explanations of these actions.

1. Connect the Configuration PC

Connect the Denali unit to the configuration PC using a crossover Ethernet cable. The crossover Ethernet cable may be purchased from Eurotech, or it may be obtained from a network equipment supplier. (Both Denali and the configuration PC may be plugged into the same network using a hub/switch/router, but this is beyond the scope of these instructions.)

2. Apply Power

Connect the power supply to a wall outlet and to the power connector on the Denali unit.

2. Check or set the Denali IP address.

If the Denali Ethernet port is set as a DHCP server, or if it has a known Ethernet IP address, move on to the next step.

If Denali is configured to obtain its IP address automatically, and/or if its IP address is not known, you must determine the address using a serial or keyboard/VGA console. See the section for help setting up this connection.

After logging in to Denali, use the `ifconfig` command to either check its current address, or to set a new address that will match the current network and/or PC settings. The example below shows how to verify the current 'eth0' address (following "`inet addr:`").

```
root@localhost:/root> ifconfig eth0

eth0      Link encap:Ethernet  HWaddr 00:60:0C:01:D0:35

          inet addr:10.11.103.32  Bcast:10.11.255.255  Mask:255.255.0.0

          inet6 addr: fe80::260:cff:fe01:d035/64 Scope:Link

          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1

          RX packets:720104 errors:0 dropped:0 overruns:0 frame:0

          TX packets:10604 errors:0 dropped:0 overruns:0 carrier:0

          collisions:0 txqueuelen:100

          RX bytes:52285992 (49.8 MiB)  TX bytes:8699899 (8.2 MiB)

          Interrupt:16 Memory:93100000-93120000
```

If necessary, the address can be set temporarily (until the next reboot) using `ifconfig` with the following command format:

```
ifconfig eth0 ip_address netmask subnet
```

where the actual interface name should be used in place of *eth0*, *ip_address* is the new network IP address, and *subnet* is the subnet mask in dotted notation (such as 255.255.0.0).

3. Set Up the PC Network

To configure the PC network settings, complete the following steps:

1. In the Windows Start menu, select Control Panel>Network Connections. Look at the properties of the *Local Area Connection*.
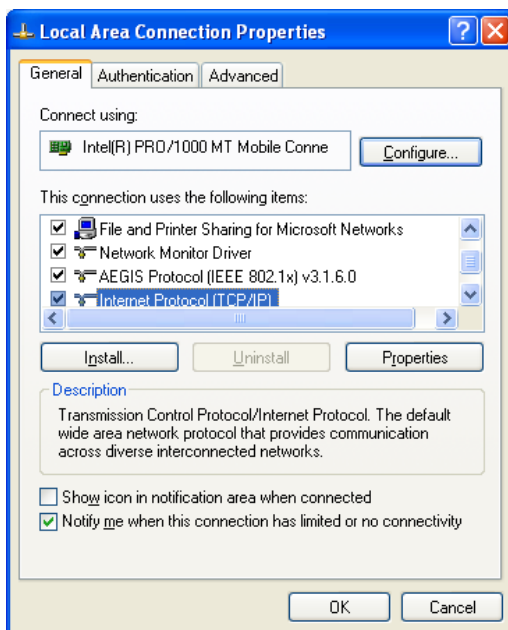
2. Open the properties for the *Internet Protocol (TCP/IP)*.

Make note of the existing PC TCP/IP network settings, so they can be restored later if needed.

If connecting to a Denali Ethernet interface running a DHCP Server, select the **Obtain an IP address automatically** and **Obtain DNS Server address automatically** checkboxes as shown in the following screen capture.
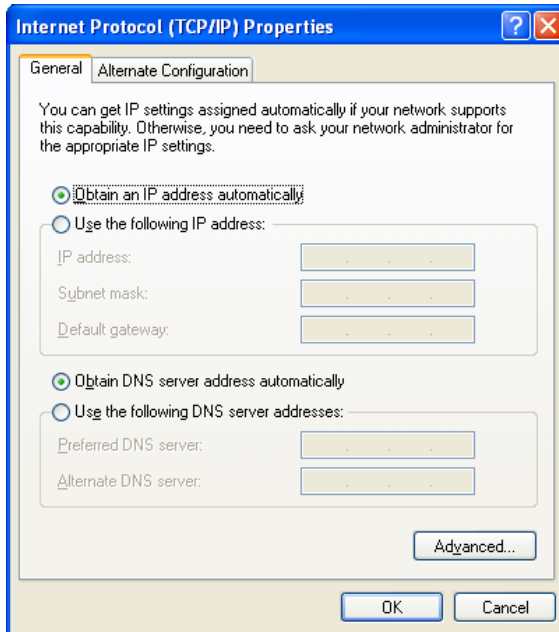
Otherwise, the PC must be configured to a fixed IP address on the same network address range as the Denali unit. In the example below, if the Denali unit address is 192.168.0.1, the PC should be set to something like 192.168.0.*x*.
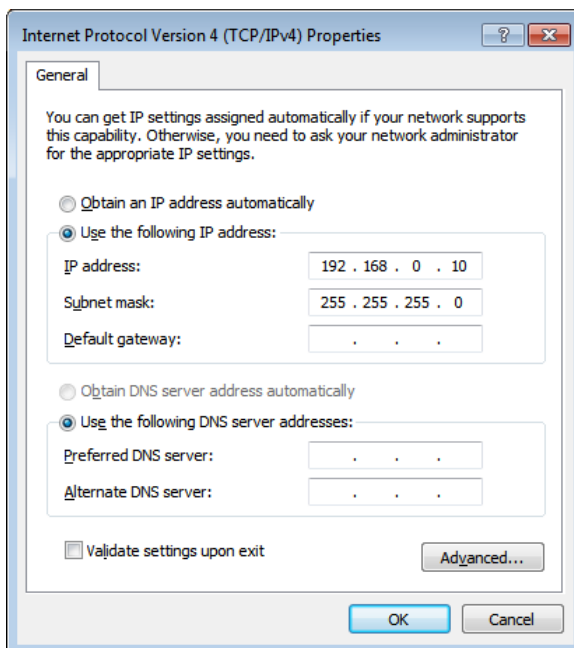
3. Click **OK** to close the *Local Area Connection* properties, and reboot the PC if prompted to do so.

To check the network address of the PC, complete the following steps:

1. In the Windows Start menu, select Accessories>Command Prompt. The Command Prompt window is displayed.

2. Enter the command `ipconfig`.

```
Command Prompt

Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\jon.tandy>ipconfig

Windows IP Configuration

Wireless LAN adapter Wireless Network Connection:

   Connection-specific DNS Suffix  . : kck.eurotech.local
   IPv4 Address. . . . . . . . . . . : 10.11.5.8
   Subnet Mask . . . . . . . . . . . : 255.255.0.0
   Default Gateway . . . . . . . . . : 10.11.1.1

Ethernet adapter Local Area Connection:

   Connection-specific DNS Suffix  . :
   Link-local IPv6 Address . . . . . : fe80::dba:36a6:1604:3f63%10
   IPv4 Address. . . . . . . . . . . : 192.168.0.10
   Subnet Mask . . . . . . . . . . . : 255.255.255.0
   Default Gateway . . . . . . . . . :
```
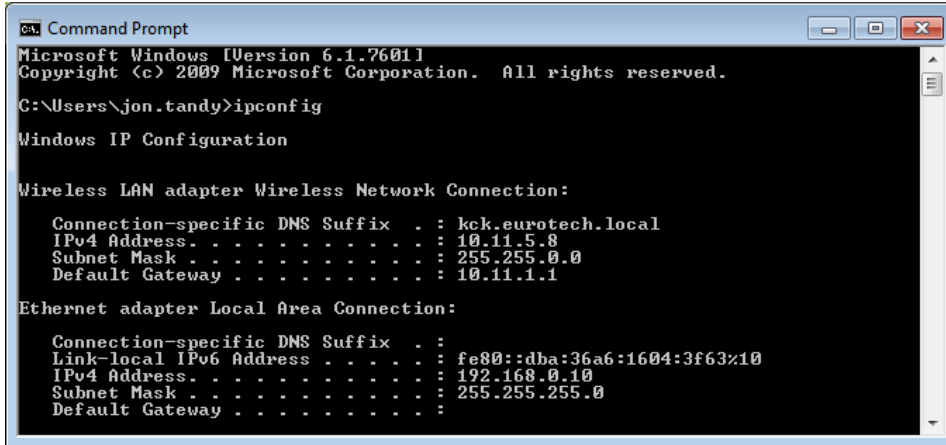
4. Browse Denali Configuration Page

To browse the Denali configuration page, complete the following steps:

1. Open a Web browser and enter the Denali address into the address bar, such as:
   `http://192.168.0.1`
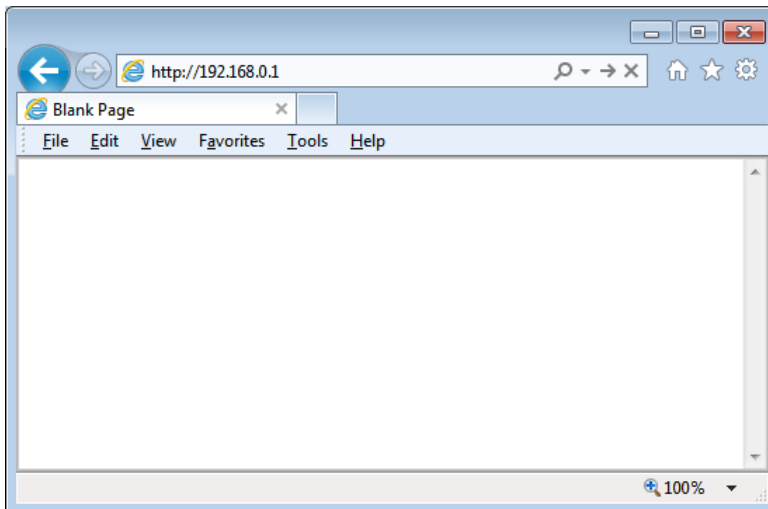
A dialog box is displayed asking for the username and password.

2. Enter your username and password. The default username is `eurotech` and default password is `eurotech`. The Denali configuration page is displayed. See Chapter 1 Web Configuration Page on page 32, for further instructions on configuration.

Troubleshooting Connection Problems

If the Denali Web configuration page does not display, there are several things which can be done to troubleshoot connection problems. Some of these steps may be useful to diagnose communication issues, beyond the step of initial configuration.

Unable to Load Web Page

If the Web configuration page fails to load, the following are common reasons why this might happen.

1. Due to network configuration, the computer making the connection may not be able to reach the Denali system. Check connection to the Web page by doing a ping command (see Ping Denali, on page 27). However, if trying to connect over the Internet/cellular connection, a ping may fail because it is blocked by the cellular network. In this case, try making an SSH connection with the PuTTY application (see SSH Client, Terminal Program (PuTTY) on page 18 for help installing PuTTY), because the SSH connection should work if a connection can be made to the Denali system.

2. If connecting over a cellular network, such as the Sprint network in the United States, it may be that port 80 is blocked. In the Web browser, try entering the full HTTPS address of Denali (https://*ip_address*/cgi-bin/php/main.php, where *ip_address* is the address of Denali), which may work to load the Web page.
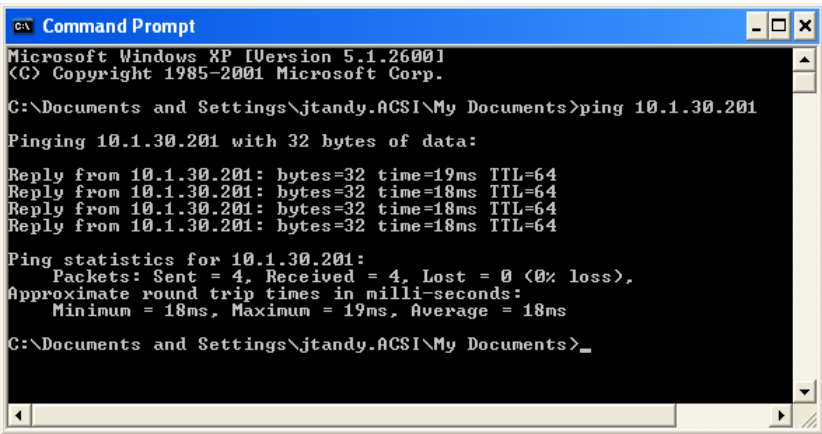
Ping Denali

To ping Denali, complete the following steps:

1. In the Windows Start menu, select Accessories>Command Prompt. The Command Prompt window is displayed.

2. Type the command:

```
ping address
```
where *address* is the numeric address of Denali.

A diagnostic message is sent to Denali to check communication. If successful, the Ping response receives the following reply.

Check the PC's Network Configuration

To check the PC's network configuration, type the command `ipconfig /all` in the *Command Prompt* window. The network interface of the PC is displayed.

```
Command Prompt                                                    _  □  ✕
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\jon.tandy>ipconfig /all

Windows IP Configuration

    Host Name . . . . . . . . . . . . : kck32wks200
    Primary Dns Suffix  . . . . . . . : kck.eurotech.local
    Node Type . . . . . . . . . . . . : Hybrid
    IP Routing Enabled. . . . . . . . : No
    WINS Proxy Enabled. . . . . . . . : No
    DNS Suffix Search List. . . . . . : kck.eurotech.local
                                        eurotech.local

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . :
    Description . . . . . . . . . . . : Intel(R) PRO/1000 MT Mobile Connection
    Physical Address. . . . . . . . . : 00-10-C6-DF-32-19
    DHCP Enabled. . . . . . . . . . . : No
    Autoconfiguration Enabled . . . . : Yes
    Link-local IPv6 Address . . . . . : fe80::dba:36a6:1604:3f63%10(Preferred)
    IPv4 Address. . . . . . . . . . . : 192.168.0.10(Preferred)
    Subnet Mask . . . . . . . . . . . : 255.255.255.0
    Default Gateway . . . . . . . . . :
    DHCPv6 IAID . . . . . . . . . . . : 234885318
    DHCPv6 Client DUID. . . . . . . . : 00-01-00-01-14-99-6C-F3-00-10-C6-DF-32-19

    DNS Servers . . . . . . . . . . . : fec0:0:0:ffff::1%1
                                        fec0:0:0:ffff::2%1
                                        fec0:0:0:ffff::3%1
    Primary WINS Server . . . . . . . : 10.11.1.3
    NetBIOS over Tcpip. . . . . . . . : Enabled
```

If using Denali as a DHCP Server to the PC:

- Make sure the PC's *Dhcp Enabled* is set to *Yes*.
- Make sure that the PC has been given a proper address from Denali, according to how it's configured.

If using the PC in a fixed address mode, check the address and make sure that it is compatible with the address and subnet mask necessary to communicate on the network or direct to Denali, depending on the test being performed.

If Denali is acting as a DHCP Server to the PC and is configured to serve the DNS addresses, these should be displayed in the PC's `ipconfig` settings.

Using Denali Console for Diagnostics

When using a null modem serial cable or keyboard/VGA, as described in Serial/VGA Connection on page 16, several commands can be issued to Denali to diagnose network configuration or operation.

To check network configuration or availability, use the command

```
ifconfig
```

To set a temporary network address on an interface, use the command:

```
ifconfig interface ip_address netmask subnet
```

where *interface* is the network name (eth0, eth1, eth2), *ip_address* is the actual address on the network, and *subnet* is the subnet mask in dotted notation (such as 255.255.0.0).

To send a diagnostic message to another device on a network, use the command:

```
ping address
```

where *address* is the numeric or named address of another device. Press **Ctrl-C** to stop the ping.

To check the route table of Denali, use the command:

```
route -n
```

To make a TCP/IP connection to a port on a device, use the command

```
nc ip_address ip_port
```

where *ip_address* is the device address on the network or 127.0.0.1 for Denali itself, and *ip_port* is the network port.

Check with Network Administrator

If you are still unable to get Denali to connect to a network, check with the network administrator for additional support.

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PART 2: SOFTWARE CONFIGURATION

Chapter 1 Web Configuration Page

Web Page Login

Configuration of Denali is done using a Web browser, either Internet Explorer, Mozilla Firefox or Google Chrome. Other Web browsers have not been tested but may also be compatible with the Denali configuration Web page. This section gives detailed explanations of each configuration parameter.

Make sure the Denali system is connected to the network. To log on to a web page, complete the following steps:

1. Enter 'http://' followed by the correct IP address. See Initial Connection to Denali on page 23 for help getting started.

    If Denali has been configured for a different network configuration from the default, its current numeric IP address should be used. The Web configuration page may be accessed via any available network (cellular, WiFi, Ethernet), unless Web access for that network interface has been blocked by a network firewall.

2. By default, Denali uses HTTPS for secure transfer of configuration data. The browser will display a warning about the certificate.

    To continue past the security warning in Internet Explorer, click on the message **Continue to this website**.
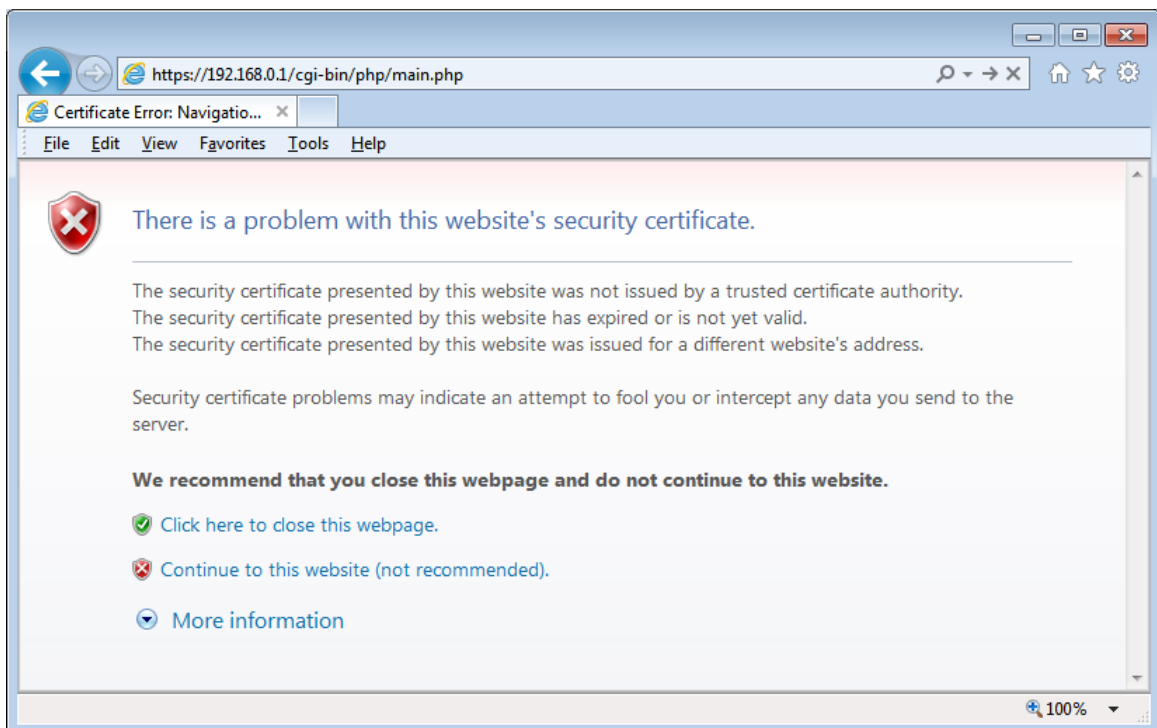
To continue past the security warning in Mozilla Firefox, click "**I Understand the Risks**" or "**Or you can add an exception...**". Then click "**Add Exception**".
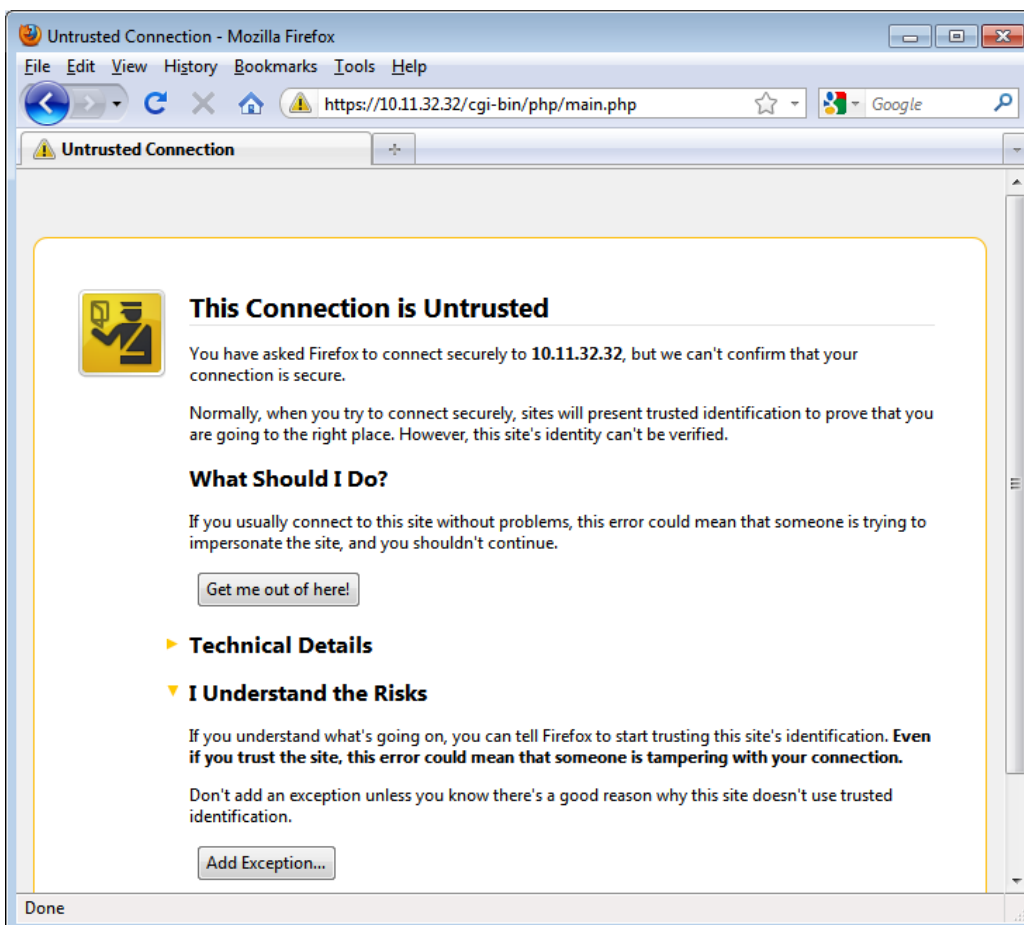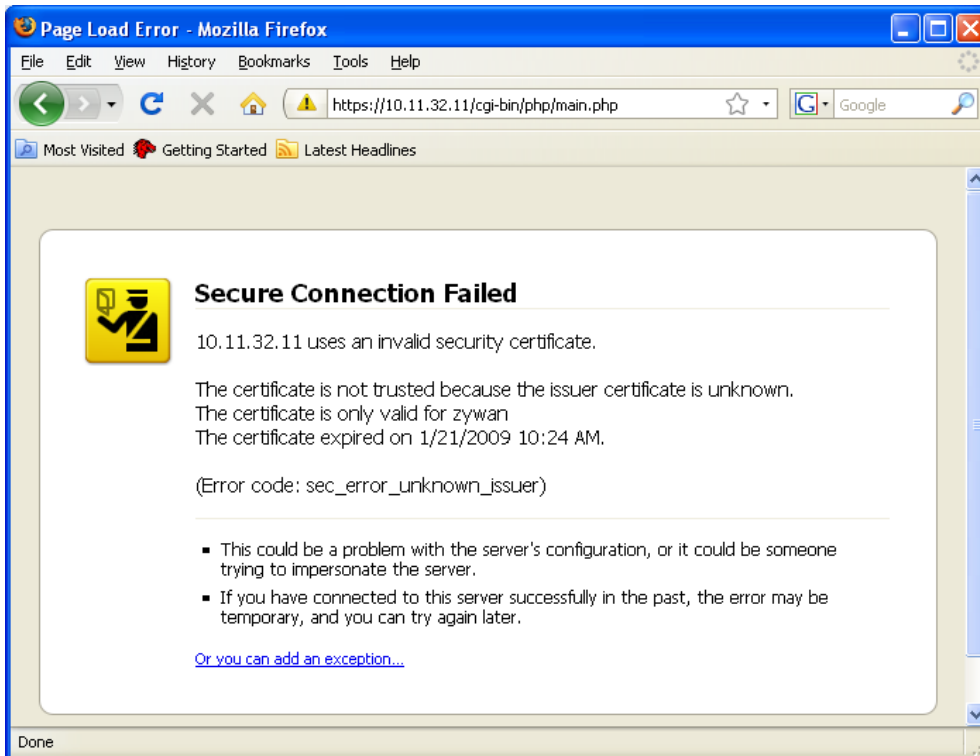
Then in the following dialog box in Mozilla Firefox, click **Get Certificate** and **Confirm Security Exception**.
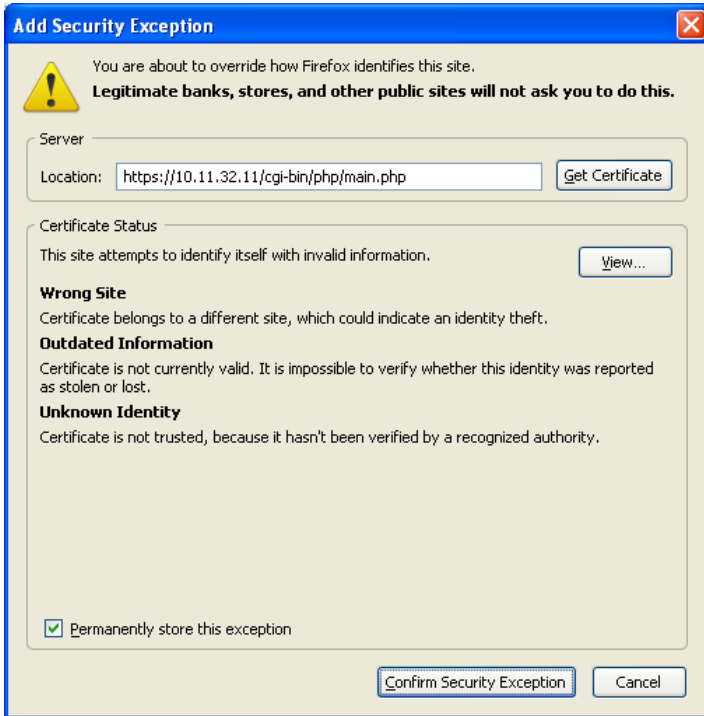
To continue past the security warning in Google Chrome, click **Proceed Anyway**.
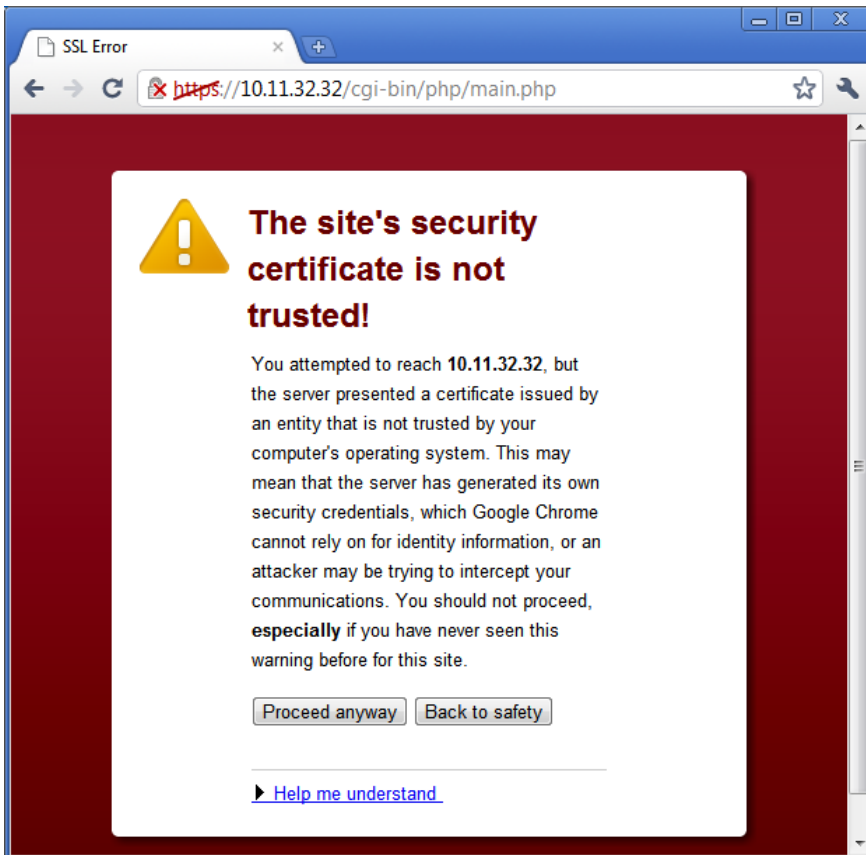
3. Enter your login details when prompted. The default username is `eurotech` and default password is `eurotech`.
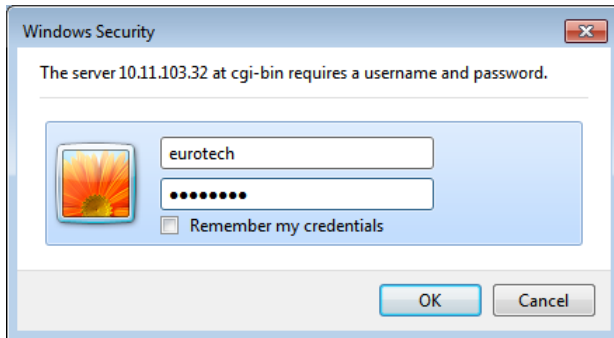
After logging in, the configuration page is displayed, as show in the following screen capture.
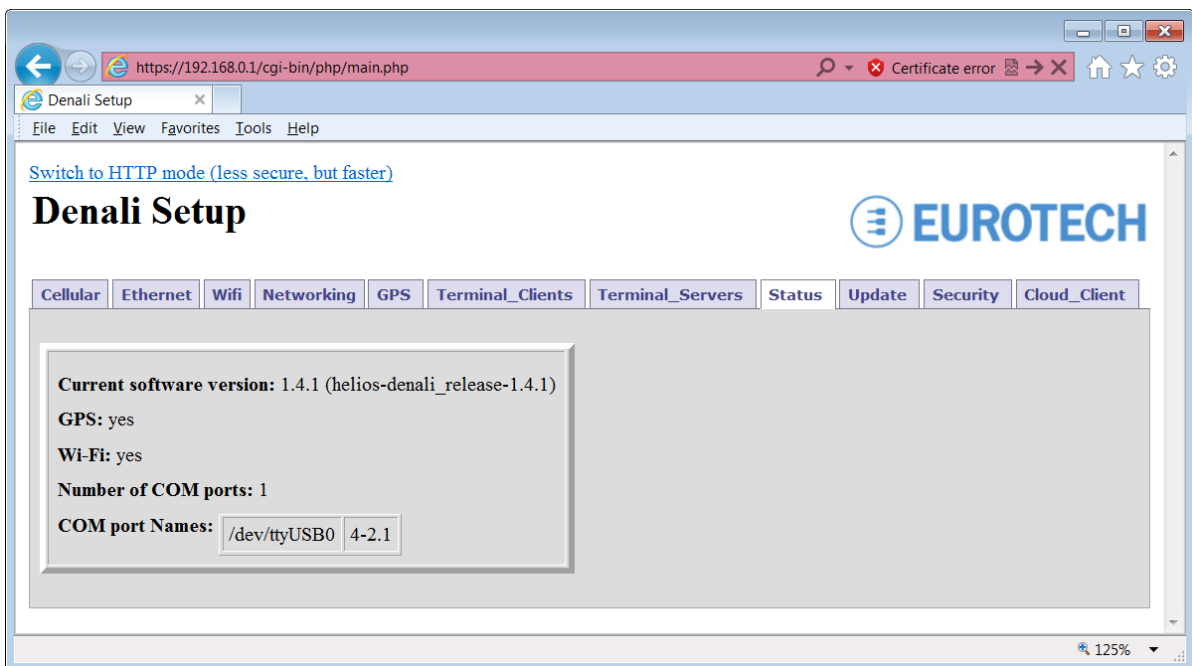
The tabs across the top (Cellular, Ethernet, etc.) identify each section or page of the configuration. The current settings for any page are read from Denali whenever a tab is clicked. Clicking on the tab of a page that is currently displayed reloads the existing configuration.

Switching Between HTTP and HTTPS

By default, Denali uses Secure HTTP (HTTPS) for displaying its Web pages. This uses network IP port 443 and encrypts the data transferred between the computer and the Denali system. This can be switched to standard HTTP (unencrypted, IP port 80) by clicking on the link at the top, *Switch to HTTP mode (less secure, but faster)*. The address URL changes to http://*ip_address*/cgi-bin/php/main2.php.

Switch back to HTTPS by clicking on the link *Switch to HTTPS mode (more secure, but slower)*. The address URL will change back to http://*ip_address*/cgi-bin/php/main.php.

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Clearing the Browser Cache

Note:

Web browsers (Internet Explorer, Firefox) can store cached copies of downloaded Web pages. If unexpected results occur in displaying the Web configuration, it may be due to the browser caching a copy of the files that control the Web interface. To correct this error, delete *Temporary Internet Files*, close all instances of the Web browser, and then re-open the Denali Web page. The following section describes this procedure.

To clear the browser cache in Mozilla Firefox, select Tools>Clear Recent History. Make sure the *Cache* box is checked, and then click the **Clear Now** button.
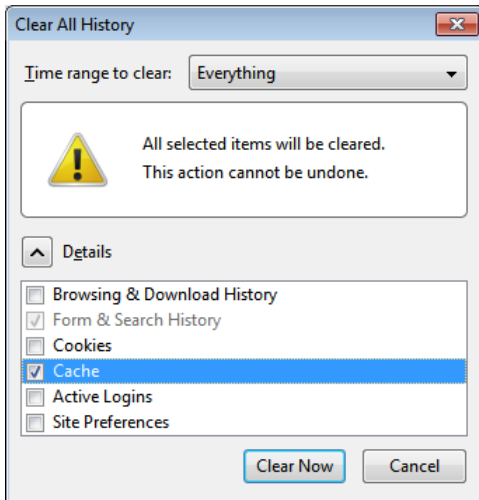
To clear the browser cache in Internet Explorer version 7 or 8, select Tools>Internet Options, and then click the **Delete…** button under *Browsing history*. Click the **Delete** or **Delete files…** button to clear "Temporary Internet files."

To clear the browser cache in Internet Explorer version 6, select Tools>Internet Options, and then click the **Delete Files…**button.
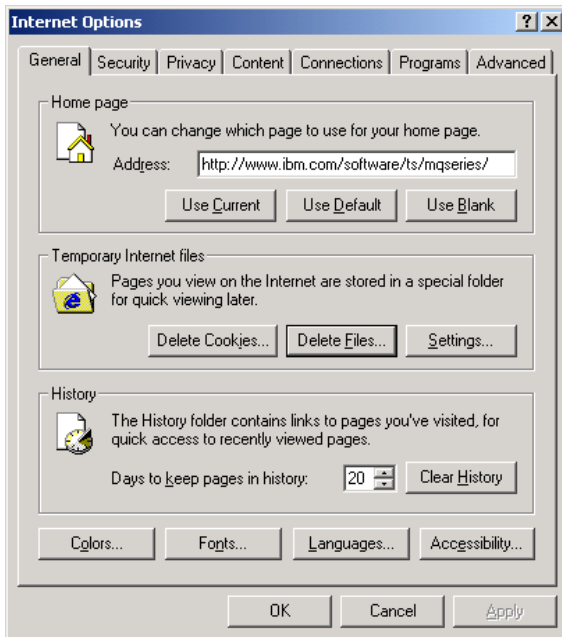
To clear the browser cache in Google Chrome, click the wrench icon on the browser toolbar. Select **Tools**, **Clear browsing data**. Select "Clear browsing history" and "Empty the cache", and choose the period "Everything," then click **Clear browsing data**.
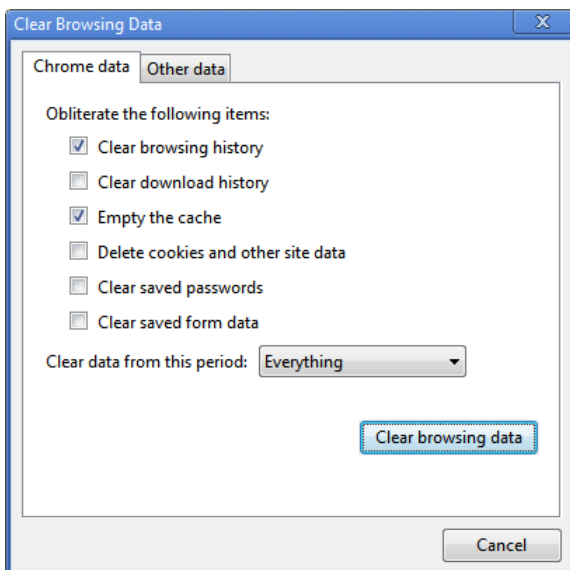
Changing a Configuration

The following sections describe the configuration details for each Web page. To make changes on any page of the configuration, complete the following steps:

1. Changes must be submitted, or they will be lost. If you make changes without submitting, one of the following error messages will be displayed before closing the browser, moving to another page, or clicking on another tab:
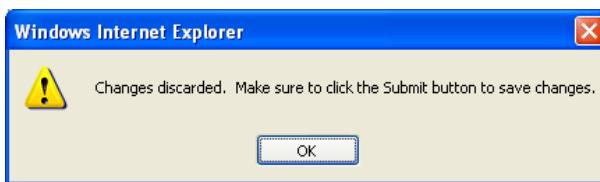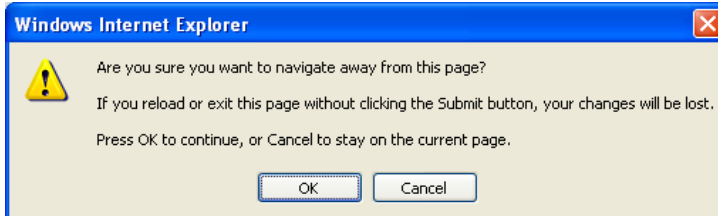
2. Click on any tab or close the browser. Enter the changes you want to make, and then click the **Submit New Configuration** button. For all the tabs except the Cellular and WiFi (Ubiquity Ministation only), the configuration properties and values are displayed in a box with the heading *New Settings*.
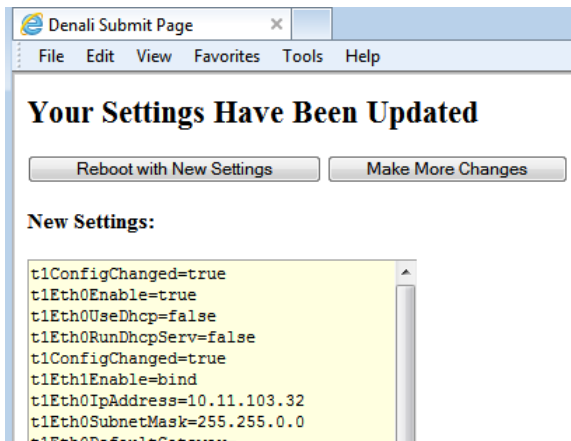
3. If there are more changes to be made on a different page of the configuration, click the **Make More Changes** button. The tab is displayed again so that another page may be selected and modified.

> ⓘ **Important:**
> If the Denali system is not rebooted after all changes have been made, some settings will not take effect until the next reboot.

---

4. For the Cellular and WiFi (Ministation) pages, clicking the **Submit New Configuration** button stores the property values somewhat differently but still in permanent memory. It does not display the page with "Your Settings Have Been Updated," but instead displays a dialog box when the properties have been submitted, such as:
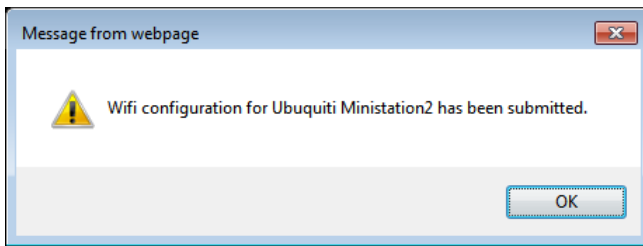
5. After all changes have been made, click the **Reboot with New Settings** button after submitting changes on a tab. The Denali system then reboots so that the changes can take effect. The system shuts down and restarts, which may take a minute or more. The Web page automatically attempts to reload at the same IP address after 90 seconds. If the IP address if the system has changed, you will need to enter the new address in the Web browser address line.
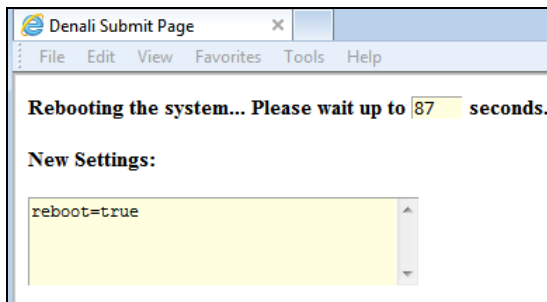
Tip:
Even if no new changes have been made, Denali may be rebooted via the Web page by clicking the **Submit New Configuration** button on any tab except the Cellular or WiFi (Ministation), then clicking the **Reboot with New Settings** button.

Using Default Gateway, DHCP, and DNS

Denali provides support for multiple Ethernet, WiFi, and cellular interfaces. Each of these interfaces can potentially have a Default Gateway address, DHCP, and DNS server addresses. One of these interfaces will be made the default route to reach addresses that are not otherwise available on its local networks.

Configuration Options

The Ethernet interfaces can be configured to be a DHCP client on an existing network (the *Use Dhcp Client?* option set to *Yes*). The WiFi interface can be configured in similar manner (in "managed" or "ad-hoc" mode). In this case, it is likely that Denali will obtain a Default Gateway and DNS server from the network to which it is attached.

Static IP addresses may also be configured. This allows the Ethernet or WiFi to be configured with a Default Gateway and one or two DNS Server addresses for the interface. These items may be left blank if there is no server available, or if it does not make sense to include them in the configuration.

When configured with a static IP address, the Ethernet interface may be configured to *Run DHCP Server*. This will allow Denali to assign an IP address to other devices on the network. The WiFi interface in "master" and "ad-hoc" mode defaults to static IP and also provides a DHCP server to wireless clients.

Default Route

Denali will make one of its interfaces the default route based on the configuration and the availability of each network. The order of preference for the default route is:

- Ethernet (eth0, eth1)
- WiFi (eth1, wlan0)
- Cellular (ppp0, ppp1)

The first interface which has a Default Gateway (static configuration in Web page, or obtained dynamically from a DHCP server) will be the one used for Denali's default gateway. If the Ethernet cable is unplugged or the WiFi is unavailable, the list of interfaces is checked again, and the first available interface will be selected dynamically as the default route, in order of preference.

This means, for instance, that if an application requires the cellular network to be the default gateway for network traffic, any Default Gateway (configured explicitly in the Denali Web configuration or obtained from a DHCP server) will interfere with the intended operation. Therefore, care needs to be taken to avoid this situation. For instance, this may require disabling the Ethernet and WiFi interfaces, or setting them to static IP addresses without the Default Gateway (leaving it blank), to allow the PPP interface to become the default gateway.

DHCP Server and NAT

If either the Ethernet or WiFi (master mode) is running as a DHCP server, then Denali will respond to any client device on the network that requests an IP address. Denali will assign the device an address in accordance with the list of addresses specified in its Web configuration. The client device will use the system's network address as its Default Gateway. Thus, if the Denali system is used on a local network where another DHCP server is already running, the *Run DHCP Server* option should generally be set to *No*.

The *Open Ports* section on the *Networking* page must include UDP port 67 to allow DHCP traffic to the Denali system.

Denali is able to act as a gateway, but in order to route traffic from one interface to another, there must also be a NAT entry configured on the *Networking* page to route from the source network to the destination network.

DNS Server

As a DHCP Server, Denali also acts as a DNS server, responding to client devices' requests to resolve named addresses (URL or FQDN) into numeric addresses. Denali acts as a DNS proxy, so that any DNS requests from the client device are passed to one of the DNS servers known to Denali, and the resulting IP address is returned to the client device.

In order to resolve DNS addresses, Denali needs to know the location of one or more DNS server(s). It obtains the list of these servers in the same way as it obtains its default route, either statically configured or obtained dynamically. On whichever interface is currently the default route (eth0, eth1, eth2, wlan0, ppp0, ppp1, etc.), the DNS servers may be obtained from that network or statically defined in the Web configuration. This list of address(es) is used by the DNS proxy.

The *Open Ports* section on the *Networking* page must include UDP port 53, to allow Denali to receive DNS requests.

Chapter 2 System Status

The following picture shows the *Status* tab of the Denali Web configuration.

Cellular	Ethernet	Wifi	Networking	GPS	Terminal_Clients	Terminal_Servers	Status	Update	Security	Cloud_Client

Current software version: 1.4.1 (helios-denali_release-1.4.1)

GPS: yes

Wi-Fi: yes

Number of COM ports: 1

COM port Names: /dev/ttyUSB0 4-2.1
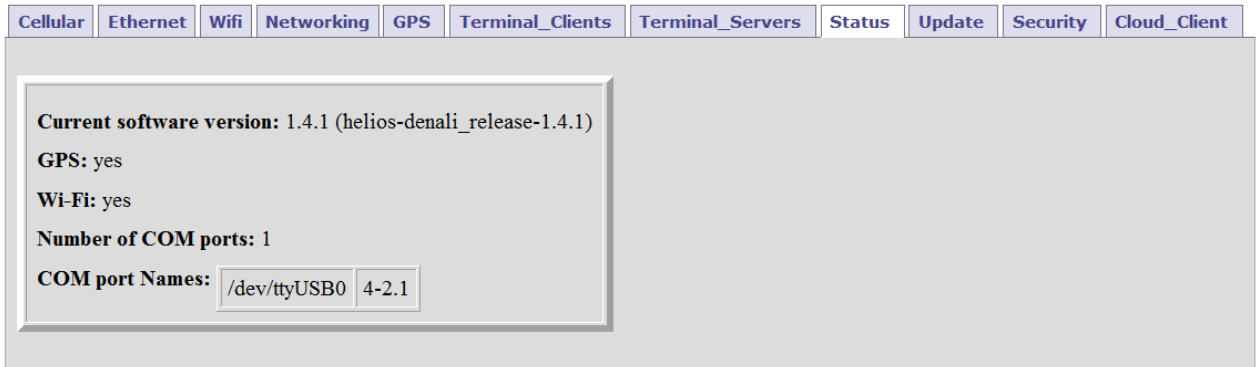
Status Web Page

The *Status* tab includes several items which show the hardware and software configuration of Denali. The hardware configuration is done in factory setup and is provided here for information. Cellular modem status information is given on the *Cellular* tab (see Get Cellular Status on page 46).

The following table lists the fields and options offered on the *Status* tab.

FIELD/OPTION	EXPLANATION
Current software version	The *Current software version* gives the current installed version of Denali software. The full release name such as helios-denali_release-1.4.1 indicates the standard production release of Denali, or it may indicate a customer-specific release. The numeric version (such as 1.4.1) indicates the major, minor and sub-minor version number within the standard or customer-specific release family.
GPS	This option indicates whether or not GPS hardware is installed.
Wi-Fi	This option indicates whether or not an 802.11 WiFi module is installed.
Number of COM ports	This option indicates the number of available COM ports on Denali, which is used in all other configuration menus where a selection of COM ports is allowed.
COM port Names	This option indicates the identification of what COM ports have been detected as available in the system. The second column (such as 4-2.1) indicates the Linux hardware designation for each USB serial port. This will correlate COMx port numbers with physical USB ports if more than one exist in a system.

Chapter 3 Cellular Configuration

The available *Cellular* properties are determined by what model of cellular modem is installed. Some modems are factory-fit options that must be specified at the time of purchase. Other cellular modems may be added by the customer.

On the *Cellular* tab, the items for each modem must be configured in order to enable the cellular data connection. After setting all the *Cellular* properties, click the **Submit Modem Configuration** button before switching to a new tab or closing the window.
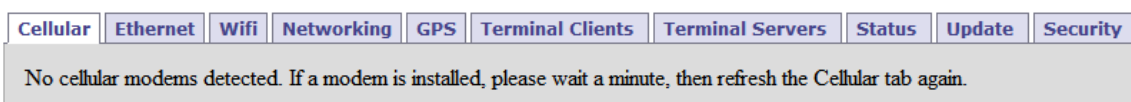
> **Note:**
> Changes made to the *Cellular* configuration page take effect immediately after submitting changes, without requiring a reboot.

The table below indicates which of the following sections of this document should be used for configuring each of the supported modems. The available options are different depending on the modem being configured.

CONFIGURATION HEADING / PAGE	CELLULAR MODEM(S)
EVDO Configuration, page 44	Sierra Wireless MC5727 Novatel MC760 Sierra Wireless USB598/T598
HSDPA Configuration, page 45	Sierra Wireless MC8790 Sierra Wireless USBConnect Shockwave (USB308) Sierra Wireless C885 Sierra Wireless C888 Sierra Wireless C889 Sierra Wireless U600

During startup or when there are no modems detected, selecting the *Cellular* tab will indicate this situation.

| Cellular | Ethernet | Wifi | Networking | GPS | Terminal Clients | Terminal Servers | Status | Update | Security |

No cellular modems detected. If a modem is installed, please wait a minute, then refresh the Cellular tab again.

Try clicking on the Cellular tab again to refresh the screen. Once the system has recognized the presence of the modem and established communication with it, the appropriate configuration options will appear.

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EVDO Configuration

The following screen capture shows the *Cellular* tab on Denali with an EVDO modem.
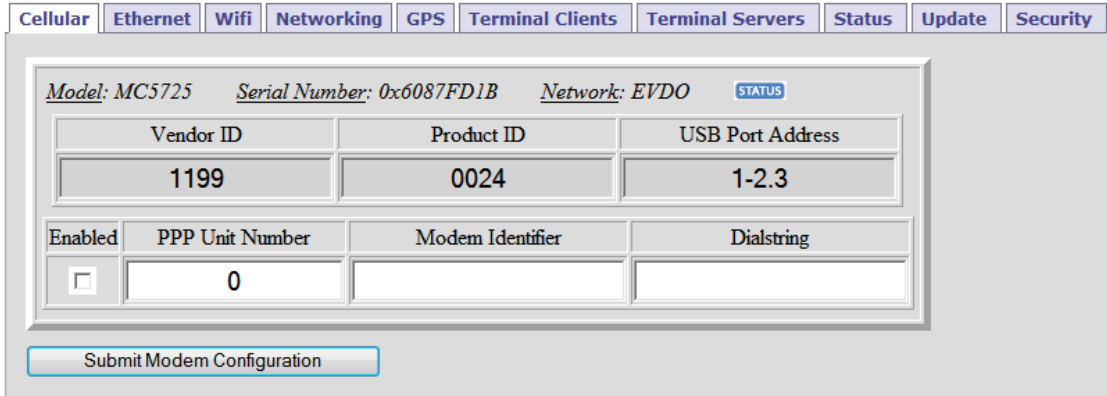
The following options may be configured to configure for an EVDO cellular network.

OPTION	EXPLANATION
Enabled	Check this box to enable the modem to be used for a PPP network session. This box is unchecked by default.
PPP Unit Number	If there is more than one cellular modem installed, this field indicates the order of preference for the modem connections, starting from zero. If Denali is unable to connect to a network with one modem, it will use the next higher number. This number also becomes part of the internal network name (for instance, a PPP Unit Number of zero creates an interface 'ppp0').
Modem Identifier	This is a required text string to uniquely identify each modem in the configuration. It may be used, for instance, to identify which cellular carrier is used (Sprint, AT&T, etc.). The following characters may not be used: `) " / and \
Dialstring	This field sets the modem dial string that is used when Denali initiates its connection to the PPP network. This is optional, as the dial string is pre-programmed for all supported modems; however, it is provided in case it's necessary to set differently in some cases.

In addition, each modem configuration displays the following non-configurable information:

OPTION	EXPLANATION
Model	Modem model, as reported by the modem. (Note that the MC5727 modem reports itself as MC5725.)
Serial Number	Modem ESN (electronic serial number), as reported by the modem.
Network	Which network type is supported by this modem (EVDO, HSDPA).
STATUS button	Display status of the modem and cellular network (see Get Cellular Status on page 46 for details).
Vendor ID	Numeric ID of the modem vendor, as reported by the modem.
Product ID	Modem Product ID, as reported by the modem.
USB Port Address	Denali internal USB port designation where the modem is plugged in.

EvDO modem modules contain the account activation information stored in the modem rather than on a removable SIM card. Generally it is the responsibility of the customer to contact the cellular service provider to set up a billing account for data services being used by the modem. The modem must then be activated on the given network provider.

If the modem has not yet been activated on the network, Denali will automatically attempt three times on startup to initially activate the modem. If unsuccessful, reboot the Denali system and/or contact the service provider for assistance.

Once the modem is activated, Denali will repeatedly attempt to make a data connection using PPP until it's successful.

HSDPA Configuration

The following screen capture shows the *Cellular* tab on Denali with an HSDPA modem.

The following options may be configured to configure for an HSDPA cellular network.

OPTION	EXPLANATION
Enabled	Check this box to enable the modem to be used for a PPP network session. This box is unchecked by default.
PPP Unit Number	If there is more than one cellular modem installed, this field indicates the order of preference for the modem connections, starting from zero. If Denali is unable to connect to a network with one modem, it will use the next higher number. This number also becomes part of the internal network name (for instance, a PPP Unit Number of zero creates an interface 'ppp0').
Modem Identifier	This is a required text string to uniquely identify each modem in the configuration. It may be used, for instance, to identify which cellular carrier is used (Sprint, AT&T, etc.). The following characters may not be used: `) " / and \
Dialstring	This field sets the modem dial string that is used when Denali initiates its connection to the PPP network. This is optional, as the dial string is pre-programmed for all supported modems; however, it is provided in case it's necessary to set differently in some cases.
APN	Enter the APN (Access Point Name) of the cellular provider's data connection. This is supplied by the cellular provider.
Auth Type	Enter the Authentication type used by the cellular provider. Available types are: None, Pap, and Chap.

If the *Auth Type* is set to *Pap* or *Chap*, the following fields are available.

FIELD	EXPLANATION
Username	Enter the username required to log on to the APN of the cellular provider.
Password	Enter the password required to log on to the APN of the cellular provider.

In addition, each modem configuration displays the following non-configurable information:

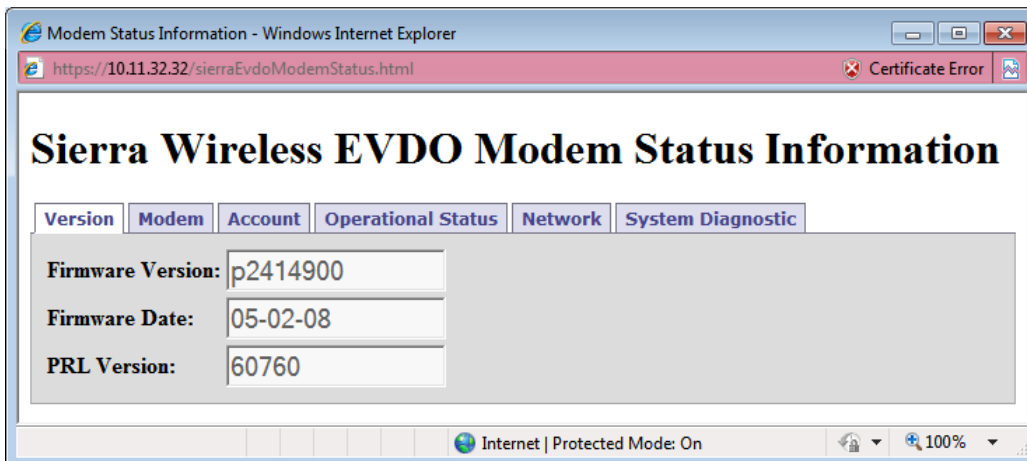| OPTION	EXPLANATION
Model	Modem model, as reported by the modem.
Serial Number	Modem ESN (electronic serial number), as reported by the modem.
Network	Which network type is supported by this modem (EVDO, HSDPA).
STATUS button	Display status of the modem and cellular network (see Get Cellular Status on page 46 for details).
Vendor ID	Numeric ID of the modem vendor, as reported by the modem.
Product ID	Modem Product ID, as reported by the modem.
USB Port Address	Internal USB port designation where the modem is plugged in.

HSDPA modem modules contain the account information on a removable SIM card. Generally it is the responsibility of the customer to contact the cellular service provide to set up a billing account for data services being used by the modem. The cellular provider will supply an APN address to be used by Denali for data services. Once the account has been activated, the SIM card must be installed in the Denali system (MC8790) or in the pluggable USB cellular modem before putting the system into service.

Get Cellular Status

The Denali Web configuration page provides modem status and diagnostic information. Open the *Cellular* tab and locate the correct modem configuration section. If there is more than one modem, each section is identified with a modem Model, Serial Number, and Network type. Click the Status button STATUS to open a window showing the modem status for the cellular module. See the following sub-sections for examples and an explanation of the status fields and their meanings.

Sierra Wireless EVDO Modem Status

Click the *Version* tab to show version details on the EVDO cellular module.
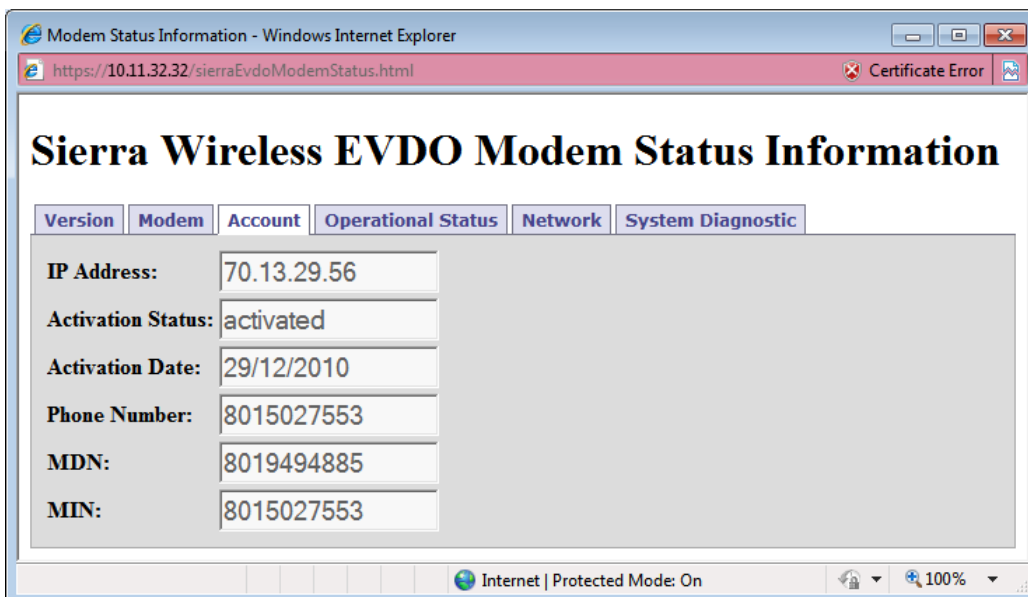
FIELD/OPTION	EXPLANATION
	Version Information
Firmware Version	Firmware version in cellular module
Firmware Date	Date of firmware version in cellular module
PRL Version	Version of the PRL (Preferred Roaming List) stored in the cellular module

Click the *Modem* tab to show modem settings for the EVDO cellular module.
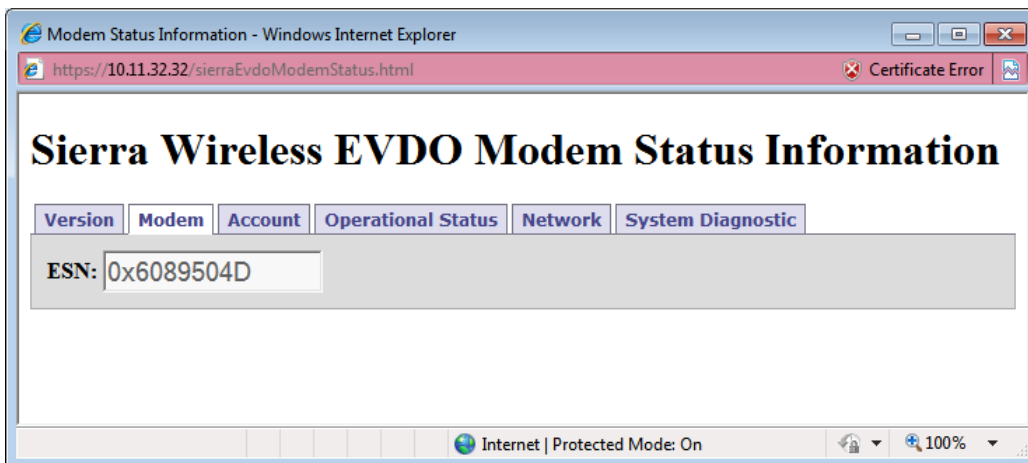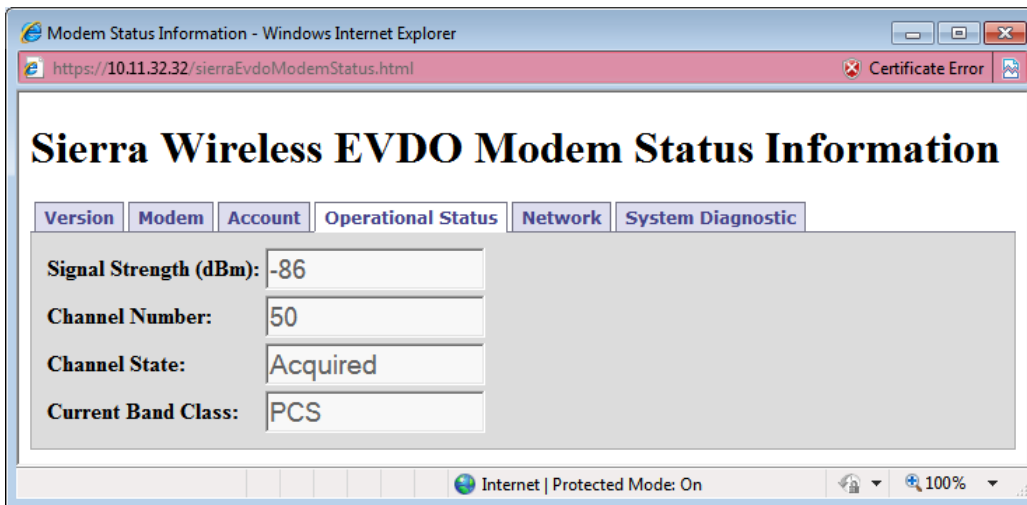

FIELD/OPTION	EXPLANATION
	Modem Information
ESN	ESN (electronic serial number) of cellular module

Click the *Account* tab to show account details for the EVDO cellular module.

FIELD/OPTION	EXPLANATION
	Account Information
IP Address	Public IP address assigned by the cellular data network, if it has successfully connected.
Activation Status	Status of whether the account is activated or not. If the **Activation Status** does not say "activated", there may be a problem with the modem activation that will require contacting the cellular provider.
Activation Date	Date that the cellular module was provisioned and activated on the network
Phone Number	Telephone number of the cellular module
MDN	MDN (Mobile Directory Number) of the cellular module
MIN	MIN (Mobile Station Identification Number) of the cellular module

Click the *Operational Status* tab to show current operational details, such as the EVDO cellular signal strength.

FIELD/OPTION	EXPLANATION
	Operational Status Information
Signal Strength	Received signal strength (RSSI), in dBm. If the signal strength is 0 or a large negative number (larger than about -100), the signal strength is not good and may not be able to maintain a reliable connection.
Channel Number	Current 1xRTT active channel number or zero if digital service is not available
Channel State	Current 1xRTT channel acquisition state with possible states of acquired, not acquired, and scanning for channel
Current Band Class	Current tuning band of the modem (cellular or PCS)

Click the *Network* tab to show information about the EVDO cellular network.
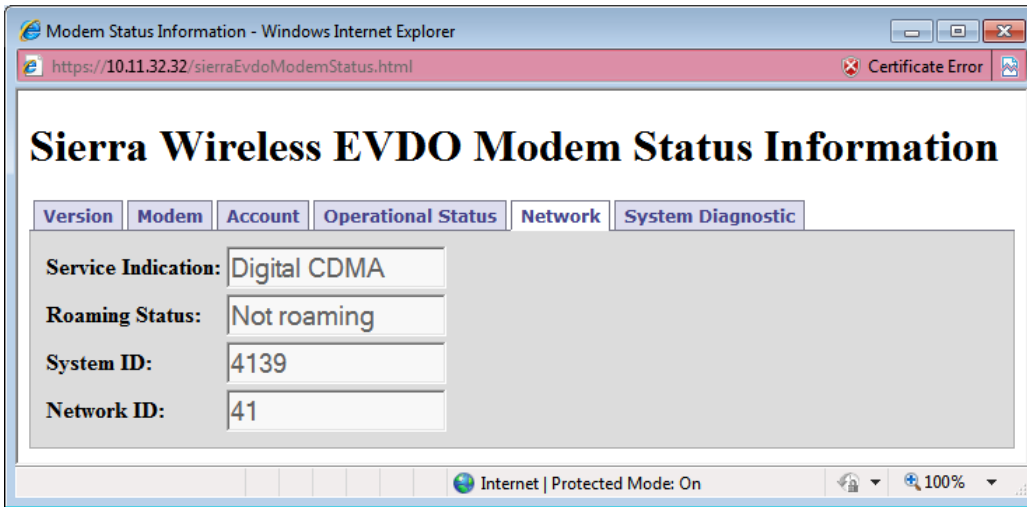
FIELD/OPTION	EXPLANATION
	Network Information
Service Indication	Which type of service is currently available to the modem (No service, Digital CDMA, or GPS service)
Roaming Status	Status of whether roaming is available (Not roaming, Roaming with guaranteed SIDs, Roaming without guaranteed SIDs)
System ID	Current system identifier (SID) of the network providing service
Network ID	Current network identifier (NID) of the station providing service

The SID and NID identify the network providing cellular service. The following table gives some combinations of ID numbers associated with certain several EVDO networks. This is provided for reference only, and is not an exhaustive list.

SID	NID	NETWORK
0	65535	Sprint (United States)
4139	41	Bell Mobility (Canada)
41	65535	Verizon (United States)

Click the *System Diagnostic* tab to show diagnostic data for the EVDO cellular module.
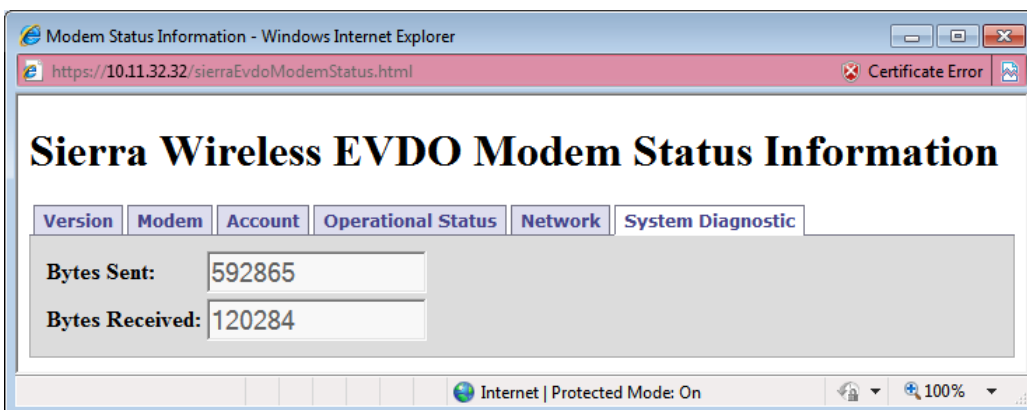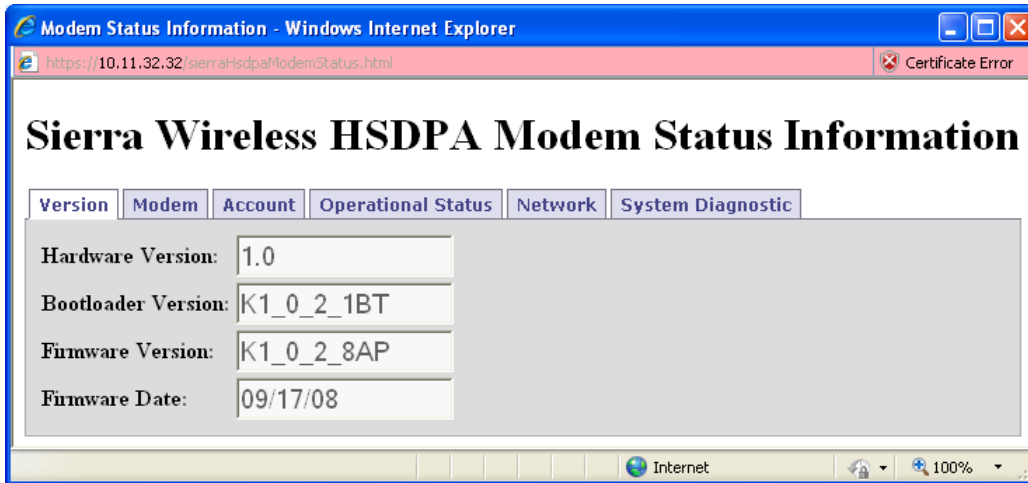
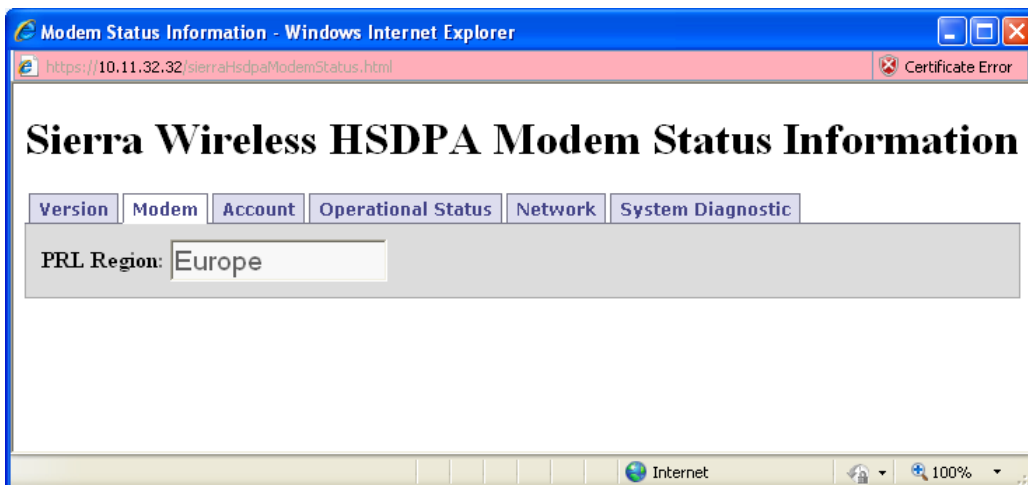| FIELD/OPTION	EXPLANATION
	System Diagnostic Information
Bytes Sent / Bytes Received	Shows bytes of data sent and received on the cellular data session.

Sierra Wireless HSDPA Modem Status

Sierra Wireless cellular modems with HSDPA technology (MC8790, Compass 888, etc.) will display the following status information.

Click the *Version* tab to show modem version details on the HSDPA cellular module.
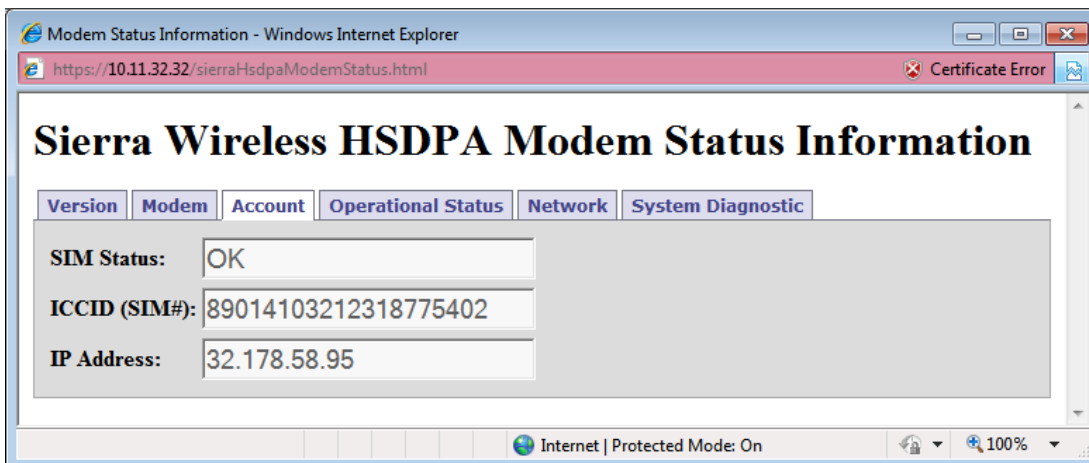

FIELD/OPTION	EXPLANATION
	Version Information
Hardware Version	Hardware version of cellular module
Bootloader Version	Bootloader version of cellular module
Firmware Version	Firmware version in cellular module
Firmware Date	Date of firmware version in cellular module

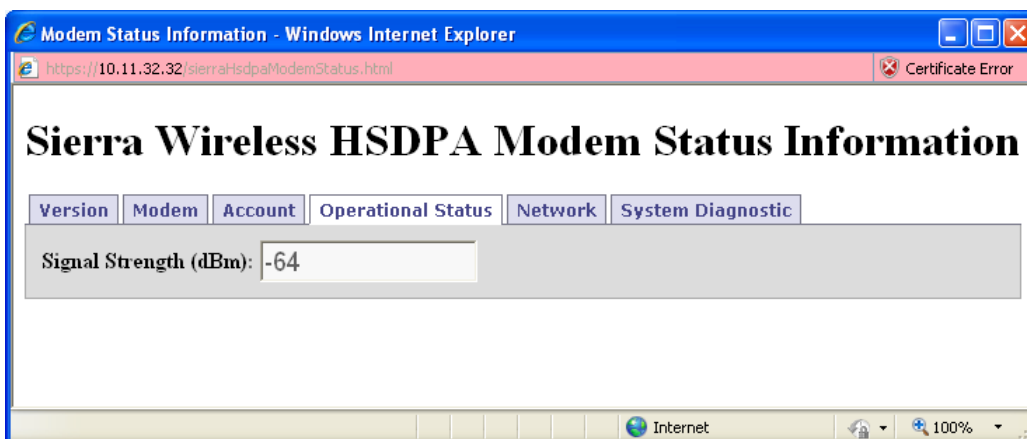Click the *Modem* tab to show modem settings for the HSDPA cellular module.

FIELD/OPTION	EXPLANATION
	Modem Information
PRL Region	Preferred Roaming List, programmed in the modem as a factory option.

Click the *Account* tab to show account details for the HSDPA cellular module.

FIELD/OPTION	EXPLANATION
	Account Information
SIM Status	Ability of the modem to read SIM card. If there is no SIM card installed, it will say "removed".
ICCID (SIM#)	Integrated Circuit Card ID of the installed SIM card (SIM card number).
IP Address	IP address obtained on cellular network, if it has successfully connected.

Click the *Operational Status* tab to show current operational details, such as the HSDPA cellular signal strength.

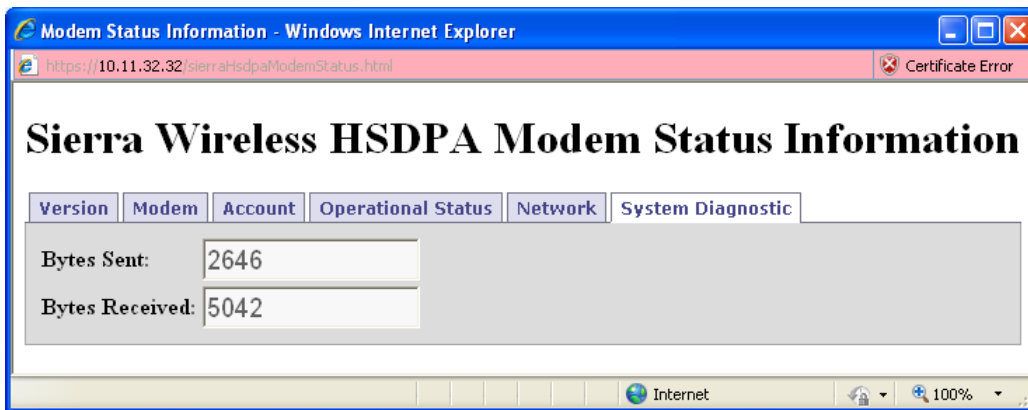| FIELD/OPTION	EXPLANATION
	Operational Status Information
Signal Strength (dBm)	Received signal strength (RSSI), in dBm. If the signal strength is 0 or a large negative number (larger than about -100), the signal strength is not good and may not be able to maintain a reliable connection.

Click the *Network* tab to show information about the HSDPA cellular network.
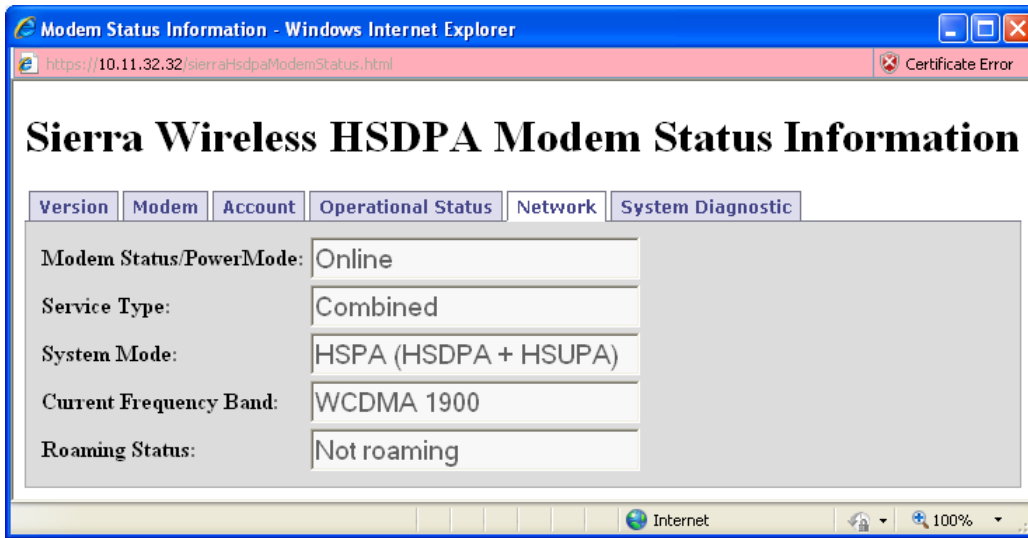
FIELD/OPTION	EXPLANATION
	Network Information
Modem Status/Power Mode	Online/offline status of the modem
Service Type	Circuit-switched, GPRS service, or combined.
System Mode	Current cellular network topology (GPRS, EDGE, UMTS, HSDPA, HSUPA)
Current Frequency Band	Current frequency band of wireless spectrum being used
Roaming Status	Roaming status indicator

Click the *System Diagnostic* tab to show additional diagnostic information.

FIELD/OPTION	EXPLANATION
	Network Information
Bytes Sent / Bytes Received	Shows bytes of data sent and received on the cellular data session.

Chapter 4 Ethernet configuration

The following screen capture shows the *Ethernet* tab.

The following items must be configured in order to enable one or more Ethernet network connections. The number of Ethernet ports available on the configuration page depends on the available hardware.

Enable Ethernet Port

Select *Yes* to enable the Ethernet port configuration. When the Ethernet port is enabled, the options may be configured as described in the following sections.

After setting all the Ethernet properties, click the **Submit New Configuration** button before switching to a new tab or closing the window.

DHCP Client

If *Use Dhcp Client?* is set to *Yes*, Denali acts as a DHCP client to automatically obtain its Ethernet network address settings from a server on the LAN. Otherwise, set this parameter to *No* in order to configure specific TCP/IP addresses.

Fixed Address

When the option *Use Dhcp Client?* is set to *No*, static IP addresses can be configured for the Ethernet interface.

The following table lists the fields available in the *Ethernet* tab if *Use Dhcp Client?* is set to *No*.

FIELD/OPTION	EXPLANATION
IP Address	Enter the specific numeric address for Denali. Each of the four fields must be a number between 1 and 255.
Subnet Mask	Enter the subnet mask for this Ethernet network. Each of the four fields must be a number between 0 and 255.
Default Gateway	Enter the numeric address of the default gateway for this network, if this interface should be used as the default route. Each of the four fields must be a number between 1 and 255. If this interface is not the default route, leave the *Default Gateway* blank.
Preferred DNS Server Alternate DNS Server	Enter the DNS server addresses. Each of the four fields must be a number between 1 and 255. If DNS is not needed or the server is unavailable, the DNS address may be left blank.
Run DHCP Server	This option is used when Denali is to act as a DHCP server on the Ethernet network, assigning network addresses to other devices. Set this to *No* if this option is not used.

Run DHCP Server

To enable the DHCP server on the Ethernet interface, set *Run Dhcp Server* to *Yes*. As a DHCP server, the Denali unit will assign addresses to computers that request it. This should generally not be used if there is another DHCP server already on the same network.

The following table lists the fields and options available in the *Ethernet* tab if *Run Dhcp Server* is set to *Yes*.

FIELD/OPTION	EXPLANATION
Default Lease Time	Enter the default lease time (in seconds) for the assigned DHCP lease to expire. The default time is the time assigned if the client does not request a specific lease time.
Subnet Mask	Enter the subnet mask defining the range of network addresses to be assigned by this DHCP server. Each of the four fields must be a number between 0 and 255.
Range From	Enter the numeric address of the lowest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254.
Range To	Enter the numeric address of the highest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254, greater than the Range From.
Pass DNS servers to DHCP clients	Set this option to *Yes* if Denali should act as a DNS proxy server on the network. Denali will pass requests to whatever DNS server is assigned on its default route, and will pass the responses back to the requesting client.

Note:

If the *Run Dhcp Server* option is set to *Yes*, then UDP port 67 must be included in the *Open Ports* section of the *Networking* page.

In order to act as a DNS server, UDP port 53 must be included in the *Open Ports* section of the *Networking* page.

Chapter 5 WiFi Configuration (Ministation)

To configure the WiFi (802.11) settings, the Denali unit must have appropriate hardware installed. For the Helios platform, WiFi is provided using the Ubiquity Ministation. This section describes the WiFi configuration for the Ministation.

Other platforms (Duracor, etc.), use an embedded WiFi module – see Chapter 6 WiFi Configuration (Module) on page 61 for that WiFi configuration.

Click on the *Wifi* tab to set the operational properties of the Ubiquity Ministation.

Select the mode of operation for the 802.11 network connection.

FIELD/OPTION	EXPLANATION
Wireless Mode	Select the mode of operation of the 802.11 Ministation. Options are: *managed*, *master*, and *Disabled*. A brief description of these modes is given next. *Managed (Station)*: Denali connects to an 802.11 Access Point on a network. *Master (Access Point)*: Denali acts as the wireless router/access point to other network devices.

The internal Ubiquity Ministation is always set to bridge mode, and the *Bridge Management Interface* settings are shown for technical information only.

Depending on the choice of Managed or Access Point mode, different options are available as described in the following sections. After setting all the *WiFi* properties, click the **Submit New Configuration** button before switching to a new tab or closing the window.

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Note:

Changes made to the *WiFi* configuration page take effect immediately after submitting changes, without requiring a reboot.

If you are connected to the Denali WiFi while making configuration changes, the WiFi connection will be lost while the settings are implemented. Be aware that if you are making significant changes, such as changing the WiFi mode or IP address, it is possible to lose communication with Denali entirely after submitting changes.

Managed Mode

When the *Wireless Mode* is set to Managed, the following options are configurable.
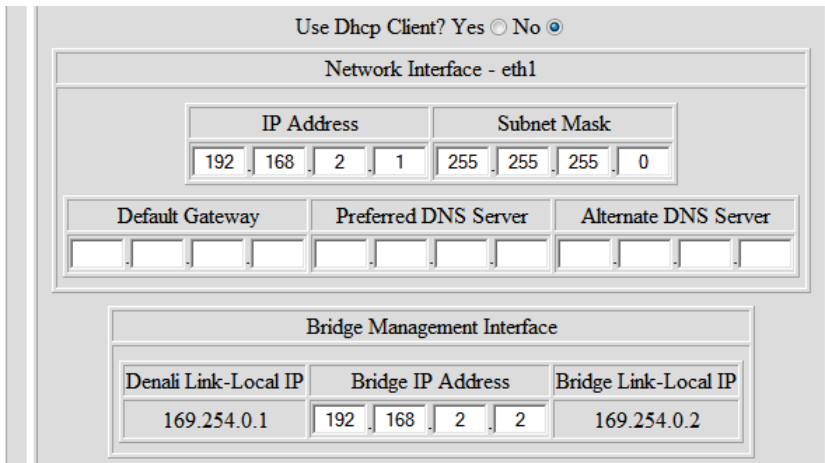
FIELD/OPTION	EXPLANATION
SSID	Enter the network name (domain ID) which is to be used for this wireless network. Enter an SSID of *any* (case-sensitive) to allow roaming in managed or ad-hoc modes.
TX Power	Select the transmit power (10 – 26 dBm). Be aware that certain countries require 802.11 transmit power to be limited at a level below 26dBm. Compliance with local regulations is the responsibility of the user.
Security Type	Select the type of encryption required by the access point: *No Security, WEP (Wired Equivalent Privacy)*, *WPA* (WiFi Protected Access), and *WPA2*. WPA2 is the most secure wireless standard.
Security Key	*If WEP is chosen for the Security Type*, the Security Key must be entered as one of the following: * 5-character alphanumeric or 10-character hexadecimal string (40-bit encryption) * 13-character alphanumeric or 26-character hexadecimal value (104-bit encryption), or * 16-character alphanumeric or 32-character hexadecimal value (128-bit encryption). *If WPA or WPA2 is chosen for the Security Type*, the Security Key must be entered as an 8 to 63 character alphanumeric string, or a 64-character hexadecimal value (256-bit encryption). When entered as hexadecimal, all characters must be numbers, or letters between A and F (upper or lowercase).

DHCP Client

If *Use Dhcp Client?* is set to *Yes*, Denali acts as a DHCP client to automatically obtain its WiFi network address settings from a server on the WiFi network. This will actually obtain two IP addresses, one for Denali and another for the internal Ubiquity Ministation (bridge).

Fixed Address

When the option *Use Dhcp Client?* is set to *No*, static IP addresses can be configured for the WiFi interface. The table below lists the field and options available in this mode.

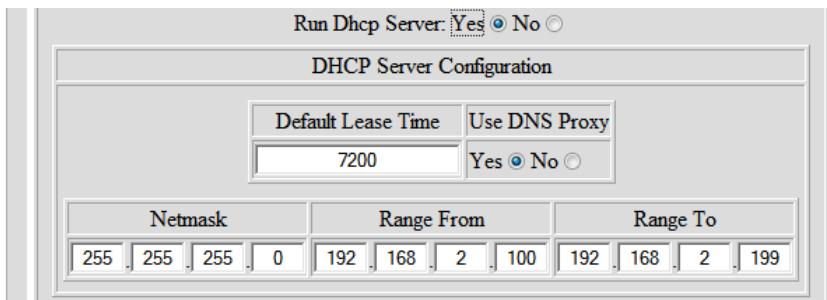| FIELD/OPTION	EXPLANATION
IP Address	Enter the specific numeric address for Denali on the wireless network. Each of the four fields must be a number between 1 and 255.
Subnet Mask	Enter the subnet mask for this WiFi network. Each of the four fields must be a number between 0 and 255.
Default Gateway	Enter the numeric address of the default gateway for this network, if this interface should be used as the default route. Each of the four fields must be a number between 1 and 255. If this interface is not the default route, leave the *Default Gateway* blank.
Preferred DNS Server Alternate DNS Server	Enter the DNS server addresses from which to obtain DNS name resolution. Each of the four fields must be a number between 1 and 255. If DNS is not needed or the server is unavailable, the DNS address may be left blank.
Bridge IP Address	The internal WiFi Ministation has its own address on the wireless network, in addition to the Denali address. Set the bridge IP to another unused address on the local WiFi network.

Access Point (Master) Mode

When the *Wireless Mode* is set to Master (Access Point), the following options are configurable.

FIELD/OPTION	EXPLANATION
IP Address	Enter the specific numeric address for Denali on the wireless network. Each of the four fields must be a number between 1 and 255.
Subnet Mask	Enter the subnet mask for this WiFi network. Each of the four fields must be a number between 0 and 255.
Default Gateway	Enter the numeric address of the default gateway for this network, if this interface should be used as the default route. Each of the four fields must be a number between 1 and 255. Normally in Master mode, this field should be left blank.
Bridge IP Address	The internal WiFi Ministation has its own address on the wireless network, in addition to the Denali address. Set the bridge IP to another unused address on the local WiFi network.
SSID	Enter the network name (domain ID) which is to be used for this wireless network. Enter an SSID of *any* (case-sensitive) to allow roaming in managed or ad-hoc modes.
Channel	Select the frequency (channel) to use for the wireless network. Typically the channels used in the United States are 1, 6, and 11.
TX Power	Select the transmit power (10 – 26 dBm). Be aware that certain countries require 802.11 transmit power to be limited at a level below 26dBm. Compliance with local regulations is the responsibility of the user.
Security Type	Select the type of encryption required by the access point: *No Security, WEP (Wired Equivalent Privacy)*, *WPA* (WiFi Protected Access), and *WPA2*. WPA2 is the most secure wireless standard.

Security Key	*If WEP is chosen for the Security Type*, the Security Key must be entered as one of the following: * 5-character alphanumeric or 10-character hexadecimal string (40-bit encryption) * 13-character alphanumeric or 26-character hexadecimal value (104-bit encryption), or * 16-character alphanumeric or 32-character hexadecimal value (128-bit encryption). *If WPA or WPA2 is chosen for the Security Type*, the Security Key must be entered as an 8 to 63 character alphanumeric string, or a 64-character hexadecimal value (256-bit encryption). When entered as hexadecimal, all characters must be numbers, or letters between A and F (upper or lowercase).

DHCP Server

If *Run DHCP Server* is set to *Yes*, the *DHCP Server Configuration* table is displayed.

The following table lists the fields and options available in the *DHCP Server Configuration* table.

FIELD/OPTION	EXPLANATION
Default Lease Time	Enter the *Default Lease Time* (in seconds) for the assigned DHCP lease to expire. The default time is the time assigned if the client does not request a specific lease time.
Use DNS Proxy	Set this option to Yes if Denali should act as a DNS proxy server on the network. Denali will pass requests to whatever DNS server is assigned on its default route, and will pass the responses back to the requesting client.
Netmask	Enter the *Netmask* defining the range of network addresses to be assigned by this DHCP server. Each of the four fields must be a number between 0 and 255.
Range From	Enter the numeric address of the lowest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254.
Range To	Enter the numeric address of the highest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254, greater than the *Range From*.

Note:

If the *Run Dhcp Server* option is set to *Yes*, then UDP port 67 must be included in the *Open Ports* section of the *Networking* page.

In order to act as a DNS server, UDP port 53 must be included in the *Open Ports* section of the *Networking* page.

Chapter 6 WiFi Configuration (Module)

To configure the WiFi (802.11) settings, the Denali unit must have appropriate hardware installed. For the Duracor and other platforms, WiFi is provided using an embedded WiFi module. This section describes the WiFi configuration for this module.

The Helios device uses the Ubiquity Ministation for its WiFi hardware – see for that WiFi configuration.

Click on the *Wifi* tab to set the operational properties of the WiFi module.

Select the mode of operation for the 802.11 network connection.

FIELD/OPTION	EXPLANATION
Mode	Select the mode of operation of the 802.11 module. Options are: *ad-hoc*, *managed*, *master*, and *Disabled*. A brief description of these modes is given next. *Ad-hoc:* Network composed of only one group of wireless devices and without an Access Point. *Managed (Station)*: Denali connects to an 802.11 Access Point on a network. *Master (Access Point)*: Denali acts as the wireless router/access point to other network devices. Depending on the option selected, several of the main configuration options change, as shown in the table below: <table><tr><th>MODE</th><th>DHCP/FIXED IP</th><th>RUN DHCP SERVER</th></tr><tr><td>*Ad-hoc*</td><td>Selectable</td><td>Selectable, fixed IP only</td></tr><tr><td>*Managed*</td><td>Selectable</td><td>Not an option</td></tr><tr><td>*Master*</td><td>Fixed IP only</td><td>Selectable</td></tr></table>
SSID	Enter the network name (domain ID) which is to be used for this wireless network. Enter an SSID of <u>any</u> (case-sensitive) to allow roaming in managed or ad-hoc modes.
Channel	Select the frequency (channel) to use for the wireless network.
Use Encryption?	Select whether to use wireless encryption of data sent through this wireless network. It is strongly recommended to use encryption, unless the application does not support it.
Encryption Type	Select the type of encryption required by the access point: No Security, WEP (Wired Equivalent Privacy), WPA (WiFi Protected Access), and WPA2. WPA2 is the most secure wireless standard.
Key	If WEP is chosen for the Security Type, the Security Key must be entered as one of the following: * 5-character alphanumeric or 10-character hexadecimal string (40-bit encryption) * 13-character alphanumeric or 26-character hexadecimal value (104-bit encryption), or * 16-character alphanumeric or 32-character hexadecimal value (128-bit encryption). If WPA or WPA2 is chosen for the Security Type, the Security Key must be entered as an 8 to 63 character alphanumeric string, or a 64-character hexadecimal value (256-bit encryption). When entered as hexadecimal, all characters must be numbers, or letters between A and F (upper or lowercase).

Depending on the choice of Ad-hoc, Managed or Access Point mode, different options are available as described in the following sections. After setting all the *WiFi* properties, click the **Submit WiFi Configuration** button before switching to a new tab or closing the window.
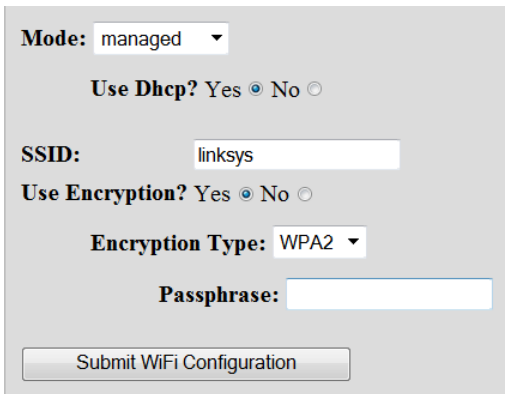
Note:

Changes made to the *WiFi* configuration page take effect immediately after submitting changes, without requiring a reboot.

If you are connected to the Denali WiFi module while making configuration changes, the WiFi connection will be lost while the settings are implemented. Be aware that if you are making significant changes, such as changing the WiFi mode or IP address, it is possible to lose communication with Denali entirely after submitting changes.

Managed Mode

When the *Wireless Mode* is set to Managed, the following options are configurable.

DHCP Client

If *Use Dhcp?* is set to *Yes*, Denali acts as a DHCP client to automatically obtain its WiFi network address settings from a server on the WiFi network.

Fixed Address

When the option *Use Dhcp?* is set to *No*, static IP addresses can be configured for the WiFi interface. The table below lists the field and options available in this mode.

FIELD/OPTION	EXPLANATION
IP Address	Enter the specific numeric address for Denali on the wireless network. Each of the four fields must be a number between 1 and 255.
Subnet Mask	Enter the subnet mask for this WiFi network. Each of the four fields must be a number between 0 and 255.
Default Gateway	Enter the numeric address of the default gateway for this network, if this interface should be used as the default route. Each of the four fields must be a number between 1 and 255. If this interface is not the default route, leave the *Default Gateway* blank.
Preferred DNS Server Alternate DNS Server	Enter the DNS server addresses from which to obtain DNS name resolution. Each of the four fields must be a number between 1 and 255. If DNS is not needed or the server is unavailable, the DNS address may be left blank.

Access Point (Master) Mode

When the *Wireless Mode* is set to Master (Access Point), the following options are configurable.

Fixed Address

In Master mode, the WiFi address must be set as a fixed address.

FIELD/OPTION	EXPLANATION
IP Address	Enter the specific numeric address for Denali on the wireless network. Each of the four fields must be a number between 1 and 255.
Subnet Mask	Enter the subnet mask for this WiFi network. Each of the four fields must be a number between 0 and 255.
Default Gateway	Enter the numeric address of the default gateway for this network, if this interface should be used as the default route. Each of the four fields must be a number between 1 and 255. Normally in Master mode, this field should be left blank.
Preferred DNS Server Alternate DNS Server	When running a DHCP Server, Denali will always pass its WiFi address to DHCP clients as DNS proxy. In some cases it may be necessary to include one or two additional hard-coded DNS server addresses that will be passed to DHCP clients, and if so one or both sets of the DNS Server fields can be entered. If not left blank, each of the four fields must be a number between 1 and 255.

DHCP Server

If *Run DHCP Server* is set to *Yes*, the *DHCP Server Configuration* table is displayed.

The following table lists the fields and options available in the *DHCP Server Configuration* table.

FIELD/OPTION	EXPLANATION
Default Lease Time	Enter the *Default Lease Time* (in seconds) for the assigned DHCP lease to expire. The default time is the time assigned if the client does not request a specific lease time.
Subnet Mask	Enter the *Subnet Mask* defining the range of network addresses to be assigned by this DHCP server. Each of the four fields must be a number between 0 and 255.
Range From	Enter the numeric address of the lowest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254.
Range To	Enter the numeric address of the highest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254, greater than the *Range From*.
Pass DNS servers to DHCP clients	Set this option to Yes if Denali should act as a DNS proxy server on the network. Denali will pass requests to whatever DNS server is assigned on its default route, and will pass the responses back to the requesting client.

Note:

If the *Run Dhcp Server* option is set to *Yes*, then UDP port 67 must be included in the *Open Ports* section of the *Networking* page.

In order to act as a DNS server, UDP port 53 must be included in the *Open Ports* section of the *Networking* page.

Ad Hoc Mode

When the *Wireless Mode* is set to Ad hoc, the following options are configurable.

DHCP Client

If *Use Dhcp?* is set to *Yes*, Denali acts as a DHCP client to automatically obtain its WiFi network address settings from its peer on an ad hoc WiFi network.

Fixed Address

When the option *Use Dhcp?* is set to *No*, static IP addresses can be configured for the WiFi interface. The table below lists the field and options available in this mode.

FIELD/OPTION	EXPLANATION
IP Address	Enter the specific numeric address for Denali on the wireless network. Each of the four fields must be a number between 1 and 255.
Subnet Mask	Enter the subnet mask for this WiFi network. Each of the four fields must be a number between 0 and 255.
Default Gateway	Enter the numeric address of the default gateway for this network, if this interface should be used as the default route. Each of the four fields must be a number between 1 and 255. If this interface is not the default route, leave the *Default Gateway* blank.
Preferred DNS Server Alternate DNS Server	Enter the DNS server addresses from which to obtain DNS name resolution. Each of the four fields must be a number between 1 and 255. If DNS is not needed or the server is unavailable, the DNS address may be left blank.

DHCP Server

If *Run DHCP Server* is set to *Yes*, the *DHCP Server Configuration* table is displayed.

The following table lists the fields and options available in the *DHCP Server Configuration* table.

FIELD/OPTION	EXPLANATION
Default Lease Time	Enter the *Default Lease Time* (in seconds) for the assigned DHCP lease to expire. The default time is the time assigned if the client does not request a specific lease time.
Subnet Mask	Enter the *Subnet Mask* defining the range of network addresses to be assigned by this DHCP server. Each of the four fields must be a number between 0 and 255.
Range From	Enter the numeric address of the lowest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254.
Range To	Enter the numeric address of the highest DHCP address to be assigned by this DHCP server. Each of the four fields must be a number between 1 and 254, greater than the *Range From*.
Pass DNS servers to DHCP clients	Set this option to *Yes* if Denali should act as a DNS proxy server on the network. Denali will pass requests to whatever DNS server is assigned on its default route, and will pass the responses back to the requesting client.

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Note:

If the *Run Dhcp Server* option is set to *Yes*, then UDP port 67 must be included in the *Open Ports* section of the *Networking* page.

In order to act as a DNS server, UDP port 53 must be included in the *Open Ports* section of the *Networking* page.

Chapter 7 Networking configuration

The following screen capture shows the *Networking* tab.

The following items must be configured in order to enable open ports, port forwarding, network address translation, or NTP services.

Open Ports

Select *Yes* if you wish to open the Denali firewall to inbound TCP or UDP connections. This applies to any traffic from other devices that terminates at Denali, not port forward or NAT traffic.

Note:

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The *Open Ports* section must include UDP port 67 if *DHCP Server* is used for Ethernet or WiFi. UDP port 53 must be included if *Pass DNS Servers to DHCP Clients* is set to *Yes* for Ethernet (or *Use DNS Proxy* for WiFi).

Any configured ports on the *Terminal Server* page, GPS UDP, or GPS Terminal Server ports will also need to have those ports configured in the *Open Ports* page. If not, the firewall will block those connections.

The following screen capture shows the *Networking* tab if *Open Ports* is set to *Yes*.

> **Note:**
>
> Changes made to the *Open Ports, Port Forwarding* and *NAT* portions of the *Networking* page take effect immediately after submitting changes, without requiring a reboot.

The following table lists the buttons available.

BUTTON	EXPLANATION
Insert Row#	Each of the table rows is numbered. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row needs to be filled in with all data required.
Delete Row#	In order to delete a row in the table, enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.

The following table lists the fields available in the *Networking* tab if *Open Ports* is set to *Yes*.

FIELD	EXPLANATION
Inbound Port	Enter the port number of the incoming connection. Port numbers must be a number between 1 and 65535.
Protocol	Enter the protocol of the incoming port (TCP or UDP).
Optional fields:	The following optional fields configure the firewall to filter allowed incoming connections to the Denali unit.
Permitted Source Port Range	Enter the range of source port numbers allowed for the incoming connection. Normally source ports are randomly assigned, so this field should only be used when the source port is specified.
Permitted External Network	Enter the numeric IP address, or range of addresses, which is the source of the connection to the Denali unit. Each of the four fields must be a number between 0 and 255. For instance, entering an IP address network of 172.16.11.0 limits incoming connections from addresses 172.16.11.1 through 172.16.11.255.
Permitted External Network Mask	Enter the subnet mask for the *Permitted External Network*. Each of the four fields must be a number between 0 and 255.
Permitted MAC Address	Enter the MAC address, in hexadecimal format, of a specific computer which is allowed to make a connection to the configured *Inbound Port*.

Enable Port Forwarding

Select *Yes* if you wish to forward individual IP ports. If a host connection comes in on one network interface at a given port, its communication is redirected to the IP address and port number on one of the Denali interfaces.

> **Note:**
>
> When forwarding a port number from one interface to another, there must usually also be a NAT rule created on the *Networking* page, from the local IP network to the external (public) interface.

The following screen capture shows the *Networking* tab if *Enable Port Forwarding* is set to *Yes*.

Note:

Changes made to the *Open Ports, Port Forwarding* and *NAT* portions of the *Networking* page take effect immediately after submitting changes, without requiring a reboot.

The following table lists the buttons available.

BUTTON	EXPLANATION
Insert Row#	Each of the table rows is numbered. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row needs to be filled in with all data required.
Delete Row#	In order to delete a row in the table, enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.

The following table lists the fields available in the *Networking* tab if *Enable Port Forwarding* is set to *Yes*.

FIELD	EXPLANATION
Inbound Interface	Enter the name of the network interface on which to monitor the incoming connection to an IP port, such as *eth0* or *ppp0*. See Understanding Network Interfaces on page 14 for a description of the available interfaces on Denali.
Inbound Port	Enter the port number of the incoming connection. Port numbers must be a number between 1 and 65535.
Destination Address	Enter the numeric IP address to which the network traffic is redirected. Each of the four fields must be a number between 1 and 255.
Destination Port	Enter the destination port number to which the network traffic is redirected. Port numbers must be a number between 1 and 65535.
Optional fields:	The following optional fields configure the firewall to filter allowed incoming connections to the Denali unit.
Permitted Source Port Range	Enter the range of source port numbers allowed for the incoming connection. Normally source ports are randomly assigned, so this field should only be used when the source port is specified.
Permitted External Network	Enter the numeric IP address, or range of addresses, which is the source of the connection to the Denali unit. Each of the four fields must be a number between 0 and 255. For instance, entering an IP address network of 172.16.11.0 limits incoming connections from addresses 172.16.11.1 through 172.16.11.255.
Permitted External Network Mask	Enter the subnet mask for the *Permitted External Network*. Each of the four fields must be a number between 0 and 255.
Permitted MAC Address	Enter the MAC address, in hexadecimal format, of a specific computer which is allowed to make a connection to the configured *Inbound Port*.

Enable NAT

Select *Yes* if you wish to enable Network Address Translation, also referred to as IP Masquerading. This allows devices on one interface of Denali ('internal' side) to access the network on a second interface ('external' side), typically to allow devices to connect to the Internet via a single external IP address. Denali re-writes the source and/or destination Internet addresses in a packet as they pass through, so that they appears on the external side as from a single IP address, but on the internal side there may be multiple addresses which are hidden from the external network. NAT keeps track of outbound TCP connections and distributes incoming packets to the correct machine.

The following screen capture shows the *Nat Table* if *Enable NAT* is set to *Yes*.

The following table lists the buttons available.

BUTTON	EXPLANATION
Insert Row#	Each of the table rows is numbered. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row needs to be filled in with all data required.
Delete Row#	In order to delete a row in the table, enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.

The following table lists the fields available in the *Nat Table* if *Enable NAT* is set to *Yes*.

FIELD	EXPLANATION
Source Network / Address	Enter the numeric IP address, or range of addresses, which Denali translates from the source (internal) network. Each of the four fields must be a number between 0 and 255. For instance, entering an IP address network of 172.16.11.0 translates all addresses from 172.16.11.1 through 172.16.11.255.
Source Netmask	Enter the subnet mask for the *Source Network/Address*. Each of the four fields must be a number between 0 and 255.
Source Interface	Enter the name of the network interface which contains the source network (above).
Destination Interface	Enter the name of the network interface which is the destination (external) side of the network address translation. The public IP address on that interface has already been defined in the *Ethernet* or *WiFi* sections of the configuration, or it might be assigned by the cellular provider as part of the data services activation on that network. The interface names must be entered such as *eth0* or *ppp0*. See Understanding Network Interfaces on page 14 for a description of the available interfaces on Denali.
Masquerade	The normal setting for *Masquerade* is Yes, providing forwarding and Network Address Translation between the two interfaces.
	There may be rare cases where this should be set to *No*, which retains the internal forwarding of packets between the two interfaces, but disables the network address translation.

Time Synchronization

Select the method of synchronizing the internal clock of the Denali unit. Available options are: *None*, *GPS*, and *NTP*. The GPS option allows the time to be acquired from the GPS receiver (if installed). The NTP (Network Time Protocol) updates the clock using NTP protocol from a network server. The following screen capture shows the *Table of NTP Servers* table available if *Time Synchronization* is set to *NTP*.

The following table lists the buttons available.

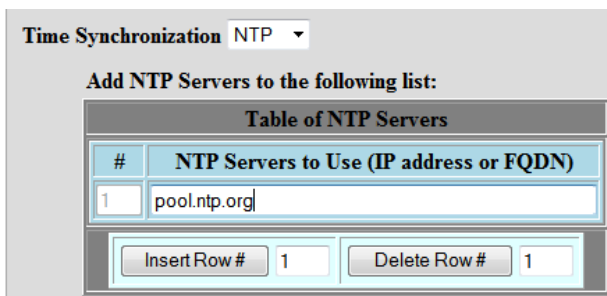| BUTTON	EXPLANATION
Insert Row#	Each of the table rows is numbered. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row needs to be filled in with all data required.
Delete Row#	In order to delete a row in the table, enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.
	Note: If the clock is not retained after loss of power, it may either be that the battery link on the main circuit board is not fitted or that the coin cell battery has failed and needs to be replaced.

The following table lists the fields available in *Table of NTP Servers* if *Time Synchronization* is set to *NTP*.

FIELD	EXPLANATION
NTP Servers to Use (IP address or FQDN)	Enter either the numeric address or named address (Fully Qualified Domain Name, FQDN) of an NTP server to use for synchronizing the system date and time. Insert additional rows if more NTP servers are desired. The best time server to use is one available on a local network, if available. This avoids using public Internet resources and gives more accurate time. The second best option is to use a time server which is located on the Internet somewhere close (small roundtrip time). Otherwise, some possible addresses are: 0.pool.ntp.org, 1.pool.ntp.org, and 2.pool.ntp.org (these addresses point to three randomly assigned servers, which change every hour), or simply pool.ntp.org.

After setting all the properties, click the **Submit New Configuration** button before switching to a new tab or closing the window.

Chapter 8 GPS configuration

The following screen capture shows the *GPS* tab.

GPS (Global Positioning System) data is gathered from the GPS receiver using the standard NMEA protocol and may be redirected to either a serial or TCP port. See the NMEA Web site (www.nmea.org) for more information on the NMEA protocol standard. The GPS data may also be cached and delivered to a server in another format using the UDP protocol.

The following table lists the options that may be configured to enable the collection and distribution of GPS data.

OPTION	EXPLANATION
Forward GPS to physical COM Port?	Select *Yes* for this item to send GPS data to a physical serial port on the Denali unit in *NMEA format*. See page 74.
Enable GPS Terminal Server?	Select *Yes* to enable a terminal server on Denali, which allows a host to connect and obtain streaming GPS data over a network connection in *NMEA format*. See page 75.
GPS UDP Message Format?	Select a data format to enable Denali to send GPS data over a network connection using UDP protocol. Available options are *None*, *Arcom Format*, and *ActSoft Format*. See page 76. When selecting the *ActSoft Format*, the server address is sent to a Comet Tracker server by Actsoft™ Inc. (www.actsoft.com). When selecting the *Arcom Format*, a server is required which is able to handle the Arcom GPS data format. See Arcom Format for GPS Messages (UDP) on page 77 for further details.

After setting all the properties, click the **Submit New Configuration** button before switching to a new tab or closing the window.

Forward GPS to Physical COM Port

The following screen capture shows the *GPS* tab if *Forward GPS to Physical COM Port* is set to *Yes*.

The following table lists the options offered.

OPTION	EXPLANATION
Outbound COM Port	Select the serial COM port to which the GPS data is sent. **Important:** Make sure this COM port is not configured for another service in Denali. Otherwise, both services may conflict for the port and not operate correctly.
Baud Rate	Select the baud rate to use for the serial GPS output. Baud rate options range from 1200 to 115,200 bps.
Data Bits	Select the number of data bits to use for the serial GPS output. Options are *5*, *6*, *7*, and *8*.
Parity	Select the parity to use for the serial GPS output. Options are *None*, *Odd*, *Even*, *Mark*, *Space*.
Stop Bits	Select the number of stop bits to use for the serial GPS output. Options are *1*, *1.5*, and *2*.
Flow Ctrl	Select whether to use hardware flow control for the serial GPS output. Options are *None*, and *RTS/CTS* (hardware flow control).

The *Enable* options determine which NMEA messages are sent through the COM port. The following table describes these options.

OPTION	EXPLANATION
Enable GPGLL?	Select *Yes* to enable the *GPGLL* message in the NMEA data stream.
Enable GPGGA?	Select *Yes* to enable the *GPGGA* message in the NMEA data stream.
Enable GPVTG?	Select *Yes* to enable the *GPVTG* message in the NMEA data stream.
Enable GPRMC?	Select *Yes* to enable the *GPVTG* message in the NMEA data stream.
Enable GPRMC?	Select *Yes* to enable the *GPRMC* message in the NMEA data stream.
Enable GPGSA?	Select *Yes* to enable the *GPGSA* message in the NMEA data stream.
Enable GPGSV?	Select *Yes* to enable the *GPGSV* message in the NMEA data stream.

Enable GPS Terminal Server

The following screen capture shows the window if *Enable GPS Terminal Server?* is set to *Yes*.

Enable GPS Terminal Server? Yes ⦿ No ○

    TCP Port To Listen On: `4000`

    Maximum Number of Connections Allowed: `4`

    Enable GPGLL? Yes ⦿ No ○
    Enable GPGGA? Yes ⦿ No ○
    Enable GPVTG? Yes ⦿ No ○
    Enable GPRMC? Yes ⦿ No ○
    Enable GPGSA? Yes ⦿ No ○
    Enable GPGSV? Yes ⦿ No ○

Note:

If the GPS Terminal Server is configured here, it must also be included as a TCP port in the *Open Ports* section of the *Networking* page, so the firewall will allow connections to be made to Denali.

The following table lists the fields offered if *Enable GPS Terminal Server?* is set to *Yes*.

FIELD	EXPLANATION
TCP Port To Listen On:	Enter the port number to use for the terminal server which delivers GPS data to a host. Port numbers must be an unused port number between 1 and 65535.
Maximum Number of Connections Allowed:	Enter the maximum number (between 1 and 8) of simultaneous host connections which are allowed to connect to Denali to receive streaming GPS data.

The *Enable* options determine which NMEA messages are sent through the network port. The following table describes these options.

OPTION	EXPLANATION
Enable GPGLL?	Select *Yes* to enable the *GPGLL* message in the NMEA data stream.
Enable GPGGA?	Select *Yes* to enable the *GPGGA* message in the NMEA data stream.
Enable GPVTG?	Select *Yes* to enable the *GPVTG* message in the NMEA data stream.
Enable GPRMC?	Select *Yes* to enable the *GPRMC* message in the NMEA data stream.
Enable GPGSA?	Select *Yes* to enable the *GPGSA* message in the NMEA data stream.
Enable GPGSV?	Select *Yes* to enable the *GPGSV* message in the NMEA data stream.

GPS UDP Message Format

The following screen capture shows the window if *GPS UDP Message Format?* is set to *Arcom Format* or *ActSoft Format*.

GPS UDP MessageFormats?	Arcom Format ▼
Server IP Address:	
Server Port Number:	8502
Request Interval:	60
Send Threshold:	1
Unit ID:	TESTUNIT01
Enable Cache?	Yes ○ No ●

Note:

If the *GPS UDP* option is configured here, its UDP server port must also be included in the Open Ports section of the *Networking* page as UDP, so the firewall will allow acknowledgements to be sent back to Denali. This is required for the *Actsoft Format* mode, and for *Arcom Format* where the *Enable Cache* option is set to *Yes*.

The following table lists the fields and options offered.

FIELD/OPTION	EXPLANATION
Server IP Address:	Enter the numeric IP address or fully qualified domain name (FQDN) to which the UDP packets are sent containing GPS data. This is the address of the host computer, which must be available on the network (such as the Internet) to receive this data. Each of the four fields must be a number between 1 and 255. If the ActSoft Format is used, this IP address should generally be gps.comettracker.com.
Server Port Number:	Enter the destination port number on the host computer which receives the GPS data over UDP. Port numbers must be a number between 1 and 65535. If the ActSoft Format is used, the port number should generally be 8502.
Request Interval:	Enter the interval (in seconds) for how often the GPS data is obtained from the GPS receiver. Range is 1 to 65535 seconds for the Arcom mode, 30 to 65535 for ActSoft mode. Multiple GPS positions can be collected and buffered, to be sent all together as determined by the *Send Threshold*, in order to reduce the network traffic.
Send Threshold:	Enter the *Send Threshold* as a number between 1 and 19. The *Send Threshold* is a numeric value which indicates how many GPS positions should be sent in one position message. The position message will not be sent until the specified number of GPS positions have been obtained from the GPS receiver.
Unit ID:	Enter the unit ID which identifies the GPS data from Denali when reported to a host computer. This allows the host computer to have unique identifiers for data coming from multiple remote units. When using the *Actsoft Format*, this Unit *ID* must be a unique 10-character serial number to identify this device in the Actsoft system. For all other models: The *Unit ID* is a unique 10-character serial number, with format to be specified by ActSoft. ⚠ **Warning:** It is essential to observe that this *Unit ID* field is entered correctly. If not and if duplicate ID's are reporting from any other device, both remote devices may suffer loss of data and an interruption of GPS reporting service.

Enable Cache?	Select Yes to enable caching of GPS data. When caching is enabled, Denali stores 100 positions in non-volatile memory. After this cache is filled, the oldest positions are discarded. Once the network connection is re-established, positions in the cache will transmitt in a first-in, first-out order. This is the only option for ActSoft mode, and the option is not available to set to *No*.
	When *Enable Cache?* is set to *Yes*, a UDP acknowledgement is required from the host computer, which allows Denali to verify the data has been received. If the UDP acknowledgement is not received, the data points begin to be cached.
	The *Enable Cache?* option requires that the Denali network address must be accessible to the host computer, since the host must initiate a one-way UDP acknowledgement message to Denali. If the acknowledgement is not received (due to network problems, etc.), Denali caches the GPS points based on the Request Interval and Send Threshold parameters (above) and continues trying to send the next point every 10 seconds.
	When *Enable Cache?* is set to *No* (Arcom format only), a UDP acknowledgement is not required. Denali simply sends out the GPS points when it can and does not store them locally. If the host computer does not receive the position message, those positions are lost.

Arcom Format for GPS Messages (UDP)

When using the *Arcom Format* for GPS data, the position message is transmitted using the User Datagram Protocol (UDP). If caching is enabled, Denali waits a minimum of 10 seconds to receive an acknowledgement message after transmission of a position message. If a response message is received that does not contain the characters *ACK* or no message is received within the timeout period, the position message is retransmitted. This process continues indefinitely. The *ACK* must be 3 ASCII characters (0x41 0x43 0x4B).

The position message is defined next. The first 12 bytes are a header, followed by 19-byte portions containing the timestamp and position information. The number of these 19-byte portions is determined by the *Send Threshold* parameter. All data is in binary big-endian format, unless otherwise specified.

Message header:

som(1)	snum(10)	npos(1)

Position data (repeated):

sval(1)	time(4)	stat(1)	sats(1)	lat(4)	lon(4)	psrc(1)	speed(1)	head(2)

The following table describes the fields of the position message.

FIELD	BYTES	DESCRIPTION
som	1	This field indicates the start of message and is always set to 0x7E.
snum	10	This field contains the unit serial number in ASCII left justified and null(0) filled to the right.
npos	1	This field gives the number of positions in this message.
sval	1	The field contains the sequence value for each position transmitted. The sequence value for the first position transmitted is 0. The sequence value is incremented by 1 for each subsequent position transmitted. Since this value is only one byte, the maximum sequence value is 255.
time	4	This field contains the UTC timestamp of the GPS position and its value is in seconds since 1/1/1970.
stat	1	This field contains a code representing status of the position from the GPS receiver. In addition, bits 5-7 are used as flags for other conditions. *Status Codes:* Bit 0: Condition: No response from GPS receiver. Bit 1: Condition: Error in response from GPS receiver. Bit 2: Condition: Good position response from GPS receiver Bit 3,4: unused *Flag Bits:* Bit 5: UTC TIME FLAG – This bit must be set to indicate that the TIMETAG represents UTC time. Bit 6: OVERFLOW FLAG – This bit is set to indicate that this position, after being added to the store and forward cache, caused an existing position in the store and forward cache to be deleted. Bit 7: FIRST POSITION FLAG – This bit is set to indicate that this is the first position to be transmitted after the device was powered on. For all subsequent positions, this bit must be cleared.
sats	1	This field contains the number of satellites currently being tracked.
lat	4	This field contains the latitude of the position in 1/100,000 minutes. For example, the 'North 26 Degrees 8.767840 Minutes' is represented as (26 * 60 * 100000 + 8.767840 * 100000) = 156876784.
lon	4	This field contains the longitude of the position in 1/100,000 minutes. For example, the 'WEST 80 Degrees 15.222400 Minutes' is represented as - (80 * 60 * 100000 + 15.222400 * 100000) = - 481522240.
psrc	1	This field contains ASCII 'G'(0x47) if this is a valid GPS position. Otherwise, it contains ASCII 'N'(0x4E).
speed	1	This field contains the speed in miles per hour.
head	2	This field contains the heading in degrees.

Chapter 9 Terminal Clients

The following screen capture shows the *Terminal Clients* tab.
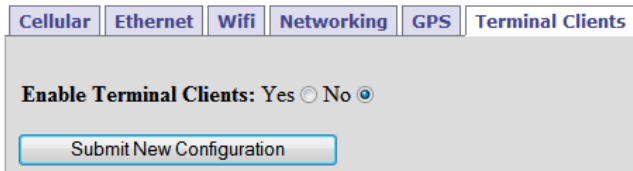
The Terminal Client makes an outbound TCP/IP connection to a remote server, allowing pass-through communication with a local serial port. Its serial port also provides AT command emulation to act similar to a dial modem. The Terminal Client requires the hardware platform to have at least one serial port installed.

After setting all the *Terminal Clients* properties, click the **Submit New Configuration** button before switching to a new tab or closing the window.

> ℹ️ **Note:**
>
> Changes made to the *Terminal Clients* page take effect immediately after submitting changes without requiring a reboot.

To allow one or more Terminal Client services to be configured, set *Enable Terminal Clients* to *Yes*. The *Table of Terminal Clients* is displayed, as shown in the following screen capture.

The following table lists the buttons available.

BUTTON	EXPLANATION
Insert Row#	Each of the Terminal Clients exists as a large set of properties in a numbered table row. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row must be filled in with all data required. Note that this table can get very large, with inner tables on each Terminal Client table row. When adding or deleting a Terminal Client configuration, make sure to click the **Insert Row#** or **Delete Row#** buttons at the very bottom of the main table.
Delete Row#	In order to delete a Terminal Client configuration (a row in the main table), enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.

The following screen capture shows a Table of Terminal Clients containing the *Terminal Client* configuration.
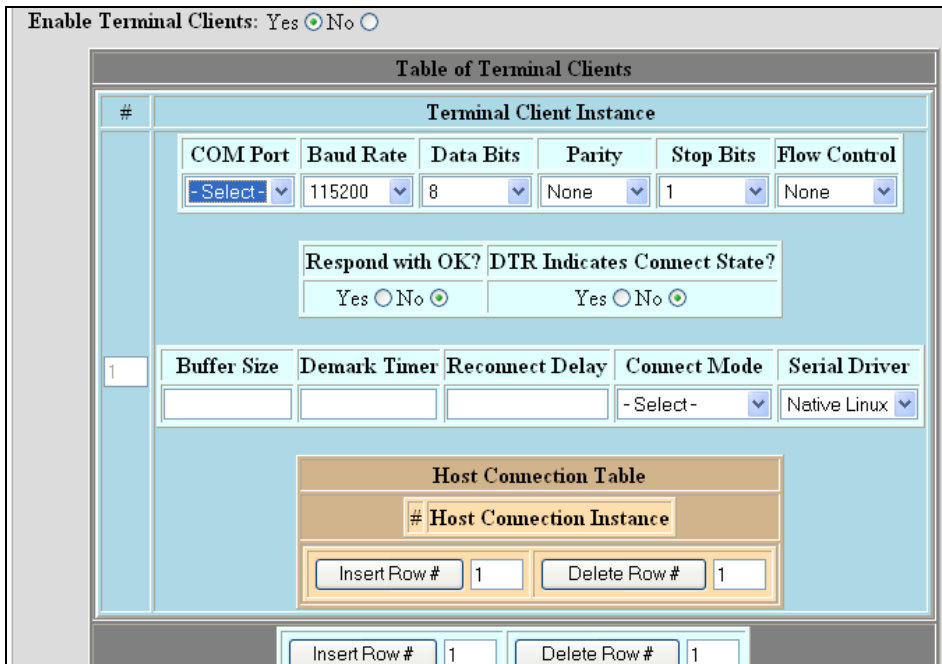
The following table lists the fields and options that are available and that must be set for each configured *Terminal Client* configuration.

FIELD/OPTION	EXPLANATION
COM Port	Select the serial COM port to which the Terminal Client data is sent. **Important:** Make sure this COM port is not configured for another service in Denali. Otherwise, both services may conflict for the port and not operate correctly.
Baud Rate	Select the baud rate to use for the Terminal Client port. Baud rate options range from 1200 to 115,200 bps.
Data Bits	Select the number of data bits to use for the Terminal Client port. Options are *5*, *6*, *7*, and *8*.
Parity	Select the parity to use for the Terminal Client port. Options are *None*, *Odd*, *Even*, *Mark*, *Space*.
Stop Bits	Select the number of stop bits to use for the Terminal Client port. Options are *1*, *1.5*, and *2*.
Flow Ctrl	Select whether to use hardware flow control for the Terminal Client port. Options are *None*, and *RTS/CTS* (hardware flow control).
Respond with OK?	Choose whether an OK message is sent in response to AT commands entered at the Terminal Client serial port. The OK response is similar to the way in which a modem responds to a computer over its serial port.
DTR Indicates Connect State	Specify whether DTR indicates the IP connection state. If set to Yes, the serial port's DTR output is asserted to a positive voltage when the IP connection is established, and is de-asserted when the IP connection is lost. This is meant to operate similar to a Carrier Detect (CD) output from a dial modem, which is asserted after a data connection is established.
Buffer Size	Enter the maximum number of data bytes (between 1 and 4095) which are allowed in an IP packet. The actual amount may be less if the *Demark Timer* times out before the serial buffer is full. This *Buffer Size* works both ways –network originated packets are sent to the serial port in blocks of bytes, and data coming in the serial port are broken into network packets of the configured number of bytes.

FIELD/OPTION	EXPLANATION
Demark Timer	Enter the maximum time (in milliseconds, between 10 and 30000) Denali waits for non-activity on the serial port before sending whatever serial data has been received.
Reconnect Delay	Enter the length of time (in seconds, between 1 and 65535) the Terminal Client waits before attempting to re-establish a lost connection with the server, if the connection has been dropped for any reason. This option only applies when the *Connect Mode* is set to *Continuously*.
Connect Mode	Choose the connection mode. The options available are: *Continuously*: Connect automatically upon system restart or upon either device dropping the IP connection. There must be only one Host Connection row, and its *Matching Dial String* field must be left empty. *Any Data*: Connect only when data is received from a serial device connected to the COM Port. There must be only one Host Connection row, and its *Matching Dial String* field must be left empty. *ATDT String*: Connect only if an *ATDT###* message is received on the serial port, where ### is some alphanumeric string. There may be many Host Connection rows configured under this Terminal Client, with their *Dial String* set to unique *ATDT###* values. The ATDT mode acts as a modem emulator, whereby each ATDT dial sequence initiates a connection to an IP address. Until a matching dial string is received, Denali does not make an outbound Terminal Client connection. See *Matching Dial String* for more details. *Use DCD Pin*: Connect if the Data Carrier Detect (DCD) input signal on the serial port is raised to a positive RS-232 voltage. This must be used with an RS-232 port and does not apply when COM3 uses the RS-485 hardware option. There must be only one Host Connection row, and its *Matching Dial String* field must be left empty. *ATDT or DCD*: Connect if either *ATDT###* message is received or if the Data Carrier Detect (DCD) signal on the serial port is asserted. If the ATDT message is received, it is compared against the *Matching Dial String* in the Host Connection rows to find which IP address to use for connection. If the DCD is received, Denali is connected to the IP address of the first Host Connection row with an empty field for the *Matching Dial String*.
Serial Driver	Select whether to use the Native Linux (ttyS) serial driver or the ACSCOMM Eurotech driver. The *ACSCOMM* option allows for half-duplex RS-485 communication, and it can provide better handling of hardware flow control if needed.

Host Connection Table

The *Host Connection Table* is part of the Terminal Client configuration, as shown in the following screen capture.
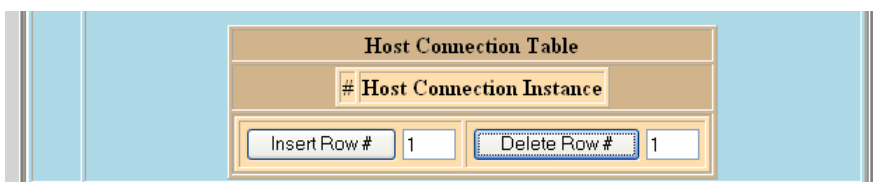
At least one row must be configured in the *Host Connection Table* for it to work properly.

Note:

When adding or deleting rows of a *Host Connection Table*, make sure to click the **Insert Row#** or **Delete Row#** buttons within the brown section of the Terminal Client, not the buttons at the very bottom of the main table.

The following table lists the buttons available in the *Host Connection Table*.

BUTTON	EXPLANATION
Insert Row#	Each row of the *Host Connection Table* exists as a set of properties in a numbered table row within the Terminal Client configuration. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row must be filled in with all data required.
Delete Row#	In order to delete a row of the *Host Connection Table*, enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.

The following screen capture shows the *Host Connection Table*.
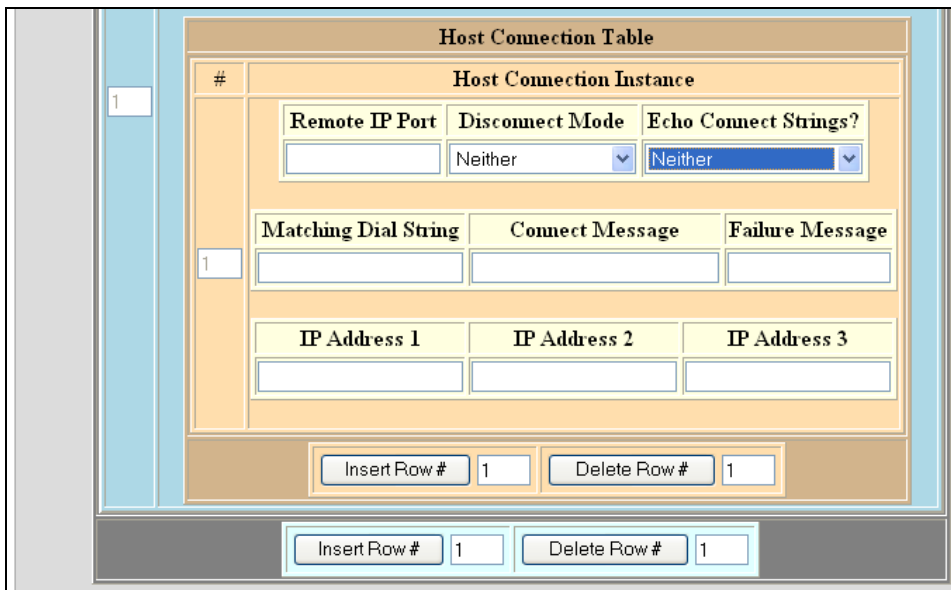
The following table lists the fields and options available for each row of the *Host Connection Table*. Multiple rows may be added if necessary:

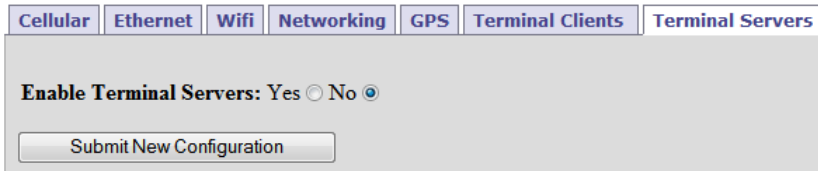| FIELD/OPTION	EXPLANATION
Remote IP Port	Enter the port number (between 1 and 65535) to which the Terminal Client connects. The same port number is used to attempt connections to each of the three IP Addresses, if configured. There is no option to connect to different port numbers for each address in the Host Connection row.
Disconnect Mode	Select when to disconnect from the remote address. In any case of a session disconnect, the *Connect Mode* (above) determines how a reconnection occurs. Options available are: *On +++*: Disconnect if three characters +++ (and no more than three) are received on the serial port within the *Demark Time*. This emulates the modem attention string often used prior to hanging up a dial connection. *On Dropped DCD*: Disconnect when the Data Carrier Detect (DCD) input on the serial port goes to a low (inactive) state. *Either*: Disconnect either on receiving +++ at the serial port or on an inactive serial DCD line. *Neither*: Never disconnect from the remote server. Connections may still be lost due to the remote side dropping its connection or due to network interruptions.
Echo Connect Strings?	Choose whether to echo all commands. The options are: *To Async*: Echo the Connect Message and Failure Message to the serial port after a connection attempt or after the Terminal Client disconnects. *To Async and Socket*: Echo the *Connect Message* and *Failure Message* to the serial port and to the remote server after a connection attempt or after the Terminal Client disconnects. *Neither*: Do not echo the strings to the serial or TCP port.
Matching Dial String	Enter the ATDT string that is used to make a connection if the *Connect Mode* option is set to *ATDT* or *ATDT* or *DCD*. Otherwise, this field must be left empty. If used, the string must always start with the letters *ATDT* and be followed by some unique text (uppercase/lowercase text is treated identically, and spaces are ignored). For instance, the Host Connection rows may contain *Matching Dial Strings* of ATDT1, ATDT555-1212, ATDTDIAL. When any of these strings is received on the serial port, Denali attempts to connect to the first configured IP address of its Host Connection row.
Connect Message	Enter a text message (such as "CONNECT") sent to the network and/or serial port when a network connection is established to the remote address. This text is only sent when the *Echo Connect Strings?* is set to something other than *Neither*. This option emulates a modem's option to echo a connect message to a dialing computer. This field may be left blank if no message is desired.
Failure Message	Enter a text message (such as "NO CARRIER") sent to the network and/or serial port when the Terminal Client disconnects from a network connection and to the serial port when a connection attempt fails. This text is only sent when the *Echo Connect Strings?* is set to something other than *Neither*. This option emulates a modem's option to echo a fail message to a dialing computer. This field may be left blank if no message is desired.
IP Address 1, IP Address 2, IP Address 3	Enter the IP address or fully qualified domain name (URL or FQDN) to which the Terminal Client connects.

Chapter 10 Terminal Servers

The following screen capture shows the *Terminal Servers* tab.

The Terminal Server sets up a listening port for inbound TCP/IP connection, allowing communication directly to a local serial port. The Terminal Client requires the hardware platform to have at least one serial port installed.

After setting all the Terminal Server properties, click the **Submit New Configuration** button before switching to a new tab or closing the window.

> *i*
>
> **Note:**
> Changes made to the *Terminal Server* page take effect immediately after submitting changes without requiring a reboot.

To allow one or more Terminal Server services to be configured, set *Enable Terminal Servers* to *Yes*. This makes the items shown in the following screen capture available in the *Table of Terminal Servers*.
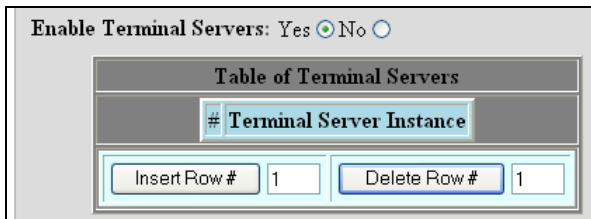
The following table lists the buttons available in the *Table of Terminal Servers*.

BUTTON	EXPLANATION
Insert Row#	Each of the Terminal Servers exists as a large set of properties in a numbered table row. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row must be filled in with all data required.
Delete Row#	In order to delete a Terminal Server configuration (a row in the table), enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.

The following screen capture shows the *Table of Terminal Servers*.
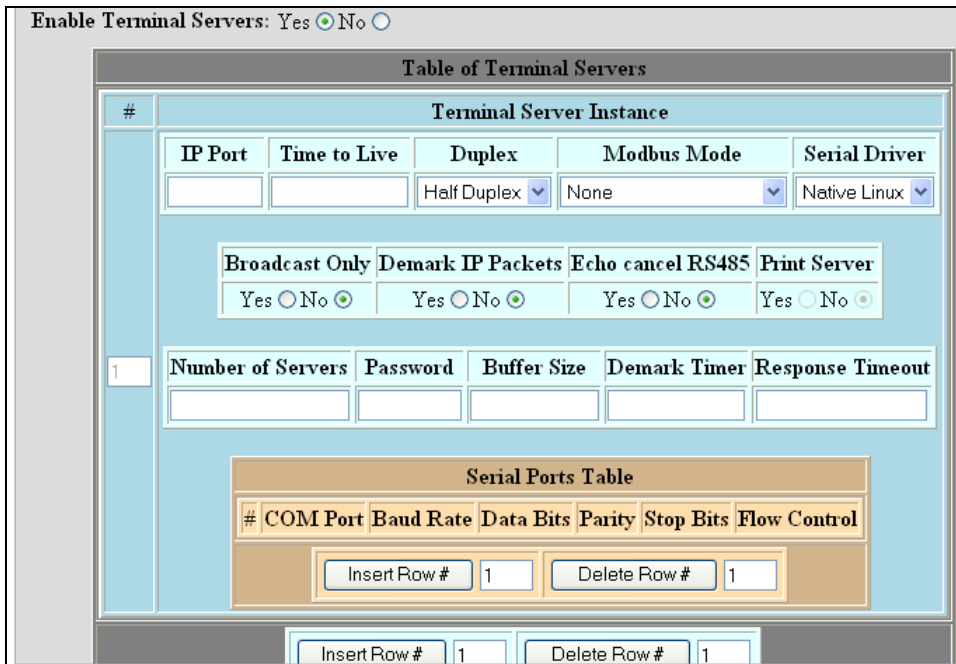
Note:

Any Terminal Server (TCP) ports configured here must also be included in the *Open Ports* section of the *Networking* page, so the firewall will allow connections to be made to Denali.

The following table lists the fields and options that are available and that must be set for each configured *Terminal Server* configuration.

FIELD/OPTION	EXPLANATION
IP Port	Enter the IP port number (between 1 and 65535) to be used on Denali for incoming TCP/IP connections from a network client application. The IP address to which the client connects may be any valid address configured for Denali on any interface.
Time to Live	Enter the *Time To Live* for the connection (in seconds). This is the maximum time of no activity from the network-connected client, before Denali closes the Terminal Server connection. The range for *Time To Live* is 1 to 65535 seconds. (Setting the value to zero (0) will cause the Terminal Server to never shut down upon no activity, which is not recommended.)
Duplex	Select the duplex mode for the Terminal Server. This selects a mode of operation for handling bi-directional communication with a serial device. *Full Duplex*: This mode is designed for unsolicited data from serial devices, full bi-directional communication, or any serial protocol which may send large or multiple responses to a request. In this mode, the Terminal Server is always able to receive data on both the serial and network ports, as long as a client is connected to the *IP Port*. *Half Duplex*: This mode is designed for simple request-response networks, especially where serial port sharing with another Terminal Server may be required. After a request is received from the network and sent to the serial port, one response is expected (with a number of bytes less than the *Buffer Size*). After data is transmitted to the serial port and the *Response Timer* times out with no data or after one response is received and returned to the network client, the Terminal Server does not read any more serial data until the next request.

FIELD/OPTION	EXPLANATION
Modbus Mode	Select the mode of operation, if Modbus protocol translation is required. Modbus protocol translation is only needed if the network client is sending *Open Modbus/IP* protocol requests. Translation is not needed for other types of data or if the standard serial Modbus (ASCII or RTU) is encapsulated within the TCP/IP requests. Options available are: *None*: This is the normal option for most applications. *Open Modbus to ASCII*: Converts Open Modbus/IP protocol requests to serial Modbus ASCII protocol, and converts the ASCII response to an Open Modbus/IP response. *Open Modbus to RTU*: Converts Open Modbus/IP protocol requests to serial Modbus RTU (Binary) protocol, and converts the RTU response to an Open Modbus/IP response.
Serial Driver	Select whether to use the Native Linux (ttyS) serial driver or the ACSCOMM driver. The ACSCOMM allows for half-duplex RS-485 communication and can provide somewhat better handling of hardware flow control if required.
Broadcast Only	Select *Yes* to only send to the serial port. This option allows the network computer to send data to the serial port without waiting for a response. The *Response Timeout* and *Duplex* mode are ignored.
Demark IP Packets	If a large network packet is sent to Denali and gets broken up over the network, the fragments can sometimes arrive at slightly different times. Each packet is sent to the serial port, but if the time difference is too great, the serial device may not react properly. Set this value to *Yes* to allow delayed IP packets to be put together before sending to the serial port. The value for *Demark Timer* is used to specify the time to wait for additional IP data. Set this value to *No* if this feature is not needed.
Echo Cancel RS-485	This option is used when the internal (COM4) or an external RS-485 converter is used in half-duplex mode. Set this option to *Yes* to block the reception of echo bytes on the serial port which get echoed back from the RS-485 device.
Print Server	This option is used when the Terminal Server is used as a print server to a serial printer. Setting this option to *Yes* causes the Terminal Server to operate in *Print Server* mode. The Terminal Server absorbs as much IP data as it can within the available memory and sends data to the serial port until it is all delivered, regardless of whether the host disconnects. When this option is set to *No* (default mode), if a host disconnects and data is still in the Terminal Server buffer, the remaining data is discarded and will not be sent to the serial port.
Number of Servers	Enter the number of simultaneous clients which can connect to this Terminal Server simultaneously. Values must be between 1 and 8. If this is set to 1, the Terminal Server is pre-emptive. This means that if a second client connects to the port, an already-connected client is disconnected. With *Number of Servers* set to 2 or greater, any further connections are blocked when the number of simultaneous connections have been made.
Password	Enter a non-blank field as a password for the Terminal Server, if desired. The password must be no longer than 15 characters. When this is set, making a connection to the Terminal Server port returns a prompt for 'Password'. If the correct password (case-sensitive) is not entered within a minute, the connection is dropped.
Buffer Size	Enter the maximum number of bytes (between 1 and 4095) which are allowed in a response to a network client. (The actual number of bytes sent may be less if the *Demark* timer times out before the serial buffer is full.)
Demark Timer	Enter the maximum time (in milliseconds, between 10 and 30000) Denali waits for inactivity on the serial port before sending a response to the network client, if at least one byte has been received.
Response Timeout	This option only applies if the *Duplex* option is set to *Half Duplex*. Otherwise, this field is ignored. Enter the *Response Timeout* (in milliseconds, between 10 and 30000). For simple request-response networks (half-duplex), the request from a network client is sent to the serial port. If no serial response is received within the *Response Timeout*, the Terminal Server does not read any more serial data until the next request and the serial port is released.

Serial Ports Table

The *Serial Ports Table* is part of the Terminal Server configuration as shown in the following screen capture.
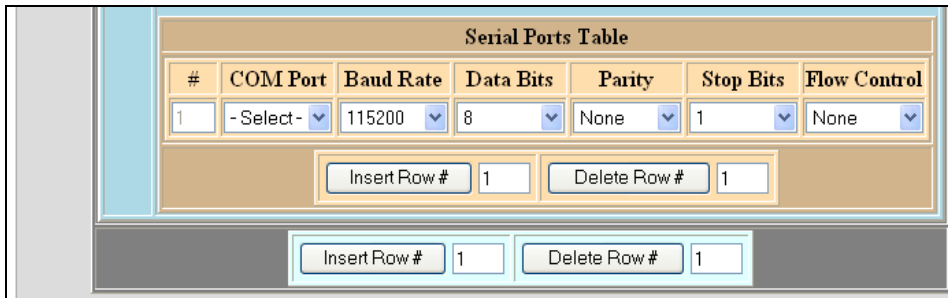
At least one row must be configured in the *Serial Ports Table* for the Terminal Server to work properly.

Note:

When adding or deleting rows of a *Serial Ports Table*, make sure to click the **Insert Row#** or **Delete Row#** buttons within the <u>brown</u> section of the *Serial Ports Table*, not the buttons at the very bottom of the main table.

The following table lists the buttons available in the *Serial Ports Table*.
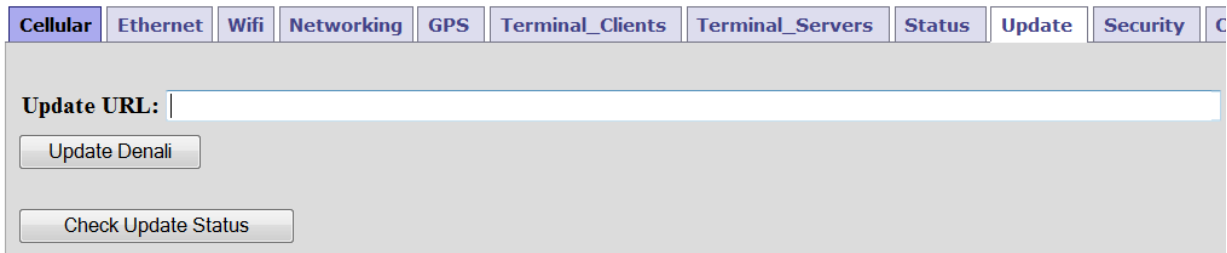
BUTTON	EXPLANATION
Insert Row#	Each row of the *Serial Ports Table* contains the definition of a serial port to use for this Terminal Server configuration. One Terminal Server may send data received from the network client to multiple serial ports simultaneously. In order to insert a row in the table, enter a number in the box between 1 and one greater than the highest number of rows. Then click the **Insert Row#** button to insert a blank row. This row must be filled in with all data required.
Delete Row#	In order to delete a row of the *Serial Ports Table*, enter a number in the box between 1 and the highest number of rows. Then click the **Delete Row#** button to delete the row. Once a row is deleted, it cannot be restored without inserting a row and entering the data again.

The following table lists the options available for the *Serial Ports Table*. At least one row of the *Serial Ports Table* is required for the Terminal Server to operate.

FIELD/OPTION	EXPLANATION
COM Port	Select the serial COM port to which the Terminal Server data is sent. *i* **Important:** Make sure this COM port is not configured for another service in Denali. Otherwise, both services may conflict for the port and not operate correctly. It is possible in some applications to configure two Terminal Servers to use the same COM port. In order for this to work, the *Demark* option must be set to *Half Duplex* or *Broadcast*. In *Half Duplex* mode, the clients connecting to each port may need to wait much longer for a response, since the *Demark* and *Response Timeout* times for all connections are observed, in the order that the requests are received from each client.
Baud Rate	Select the baud rate to use for the Terminal Server port. Baud rate options range from 1200 to 115,200 bps.
Data Bits	Select the number of data bits to use for the Terminal Server port. Options are *5*, *6*, *7*, and *8*.
Parity	Select the parity to use for the Terminal Server port. Options are *None*, *Odd*, *Even*, *Mark*, *Space*.
Stop Bits	Select the number of stop bits to use for the Terminal Server port. Options are *1*, *1.5*, and *2*.
Flow Control	Select whether to use hardware flow control for the Terminal Server port. Options are *None*, and *RTS/CTS* (hardware flow control).

EUROTECH

Chapter 11 Update

The following screen capture shows the *Update* tab.

The *Update* tab on the Web interface provides one method to update the Denali firmware to a later version. See the following section, Updating Using WinSCP on page 91, for another recommended method of updating, especially for systems where the default network is a cellular or private network.

Warning:

The update process may take a significant amount of time, possibly several minutes, depending on the size and number of updates that have to occur. Do not remove power or perform a Linux command line 'reboot' until the updates have completed.

In some cases, Denali will be required to reboot automatically in the middle of its update process. If this occurs, it will continue installing additional files after the reboot. Do not reboot Denali or remove power while software updates are installing, or else unpredictable results may occur.

Updating Via the Web Interface

In the *Update URL* field, enter the network address URL (Uniform Resource Locator) from which an update file may be downloaded. The address must be accessible through the default network interface of Denali and must point to a file server location containing update files for Denali. Some examples of addresses which could be used are:

http://***network_address/pathname***   (HTTP download from **ip_address** which must be an HTTP server, with the files existing in **pathname**)

--ftp-user=***username*** --ftp-password=***password*** ftp://**ip_address/somepath**
(for FTP download from ***ip_address/somepath***, using ***username*** and ***password***)

An example URL address is shown below for the Helios product. For other products, the address will indicate the product name and/or a customer-specific site name:

http://files.eurotech-inc.com/ESF/product_updates/eurotech/helios-denali

---

Note:

The default URL address listed above should only be used with a factory standard Helios using Denali, or similar for other hardware platforms, because only the main branch of "standard" releases is stored in those locations.

Customer-specific software releases may have entirely different sets of updates and software; therefore, trying to apply the standard Denali updates to them is likely to cause unpredictable results. Take care to enter an appropriate *Update URL* before clicking the **Update Denali** button.

The server location must contain the latest versions of Denali software release files appropriate to the hardware platform, such as:

```
helios-denali_releases.txt
```
text file containing list of releases

```
helios-denali_update-x.y.z.star.bin
```
update file for specific release

When the **Update Denali** button is pressed, the files are downloaded and installed. After the update is complete, Denali will be rebooted automatically if needed.

If more than one update is available at the update site, all updates will occur in numerical order, one after the other. This may require some time to complete, and may require multiple reboots in between updates. The **Check Update Status** button may be clicked whenever Denali is available on a network address, to check on the status of an in-progress update. A prominent warning message will also be given on the *Status* and *Update* tabs, to warn the user that a software update has started but not yet completed.

Note:
If Denali is rebooted in the middle of an update, there is a possibility that software corruption of the file system can occur. Make sure the update process is finished before removing power or rebooting.
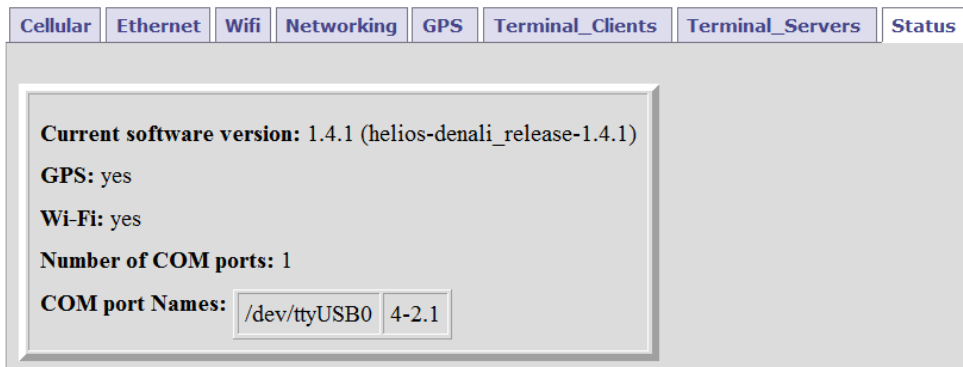

Updating Using WinSCP

Some version updates for Denali could be fairly large. For this reason, it may not be recommended to use the *Update* Web interface described in the previous section, because of the cost or length of time required to load files over a cellular network. There may also be cases where Denali doesn't have access to the appropriate update site because of limitations on its network access.
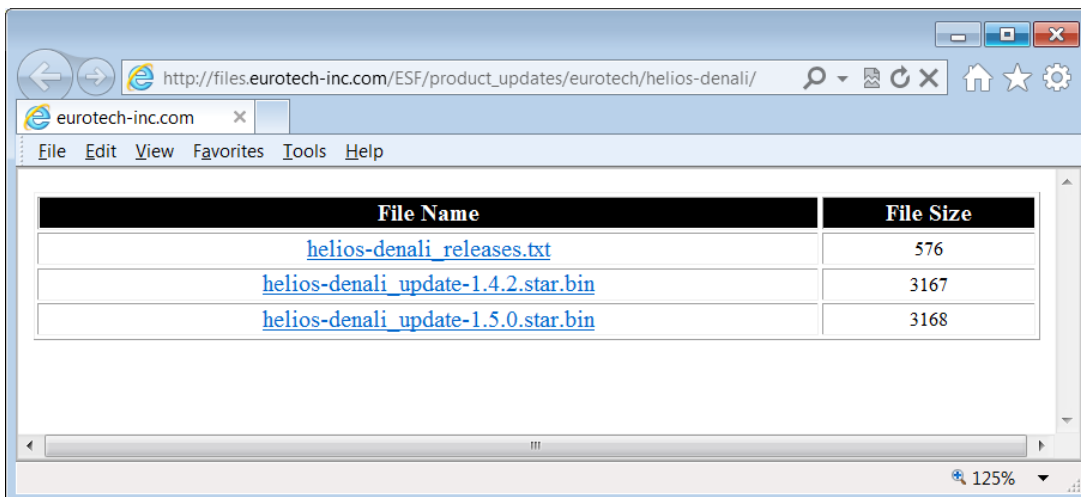
The following method describes how to load Denali update files locally over Ethernet or WiFi and to install them manually.

See the section SFTP/SCP Client (WinSCP) on page 19 for information on installing the WinSCP file transfer program. This program provides a free and secure means of loading the required files, although other programs may be used which support the SFTP or SCP protocols.
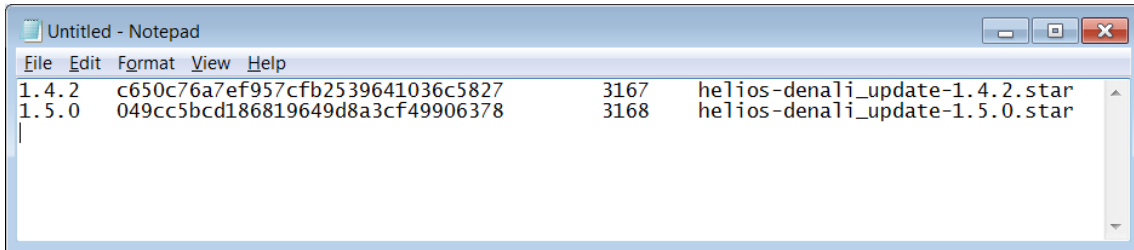
Determine the current software revision by viewing the *Status* tab of the Denali Web configuration page. The following screen capture shows an example indicating Denali at software revision level 1.2.0.

| Cellular | Ethernet | Wifi | Networking | GPS | Terminal_Clients | Terminal_Servers | Status |

Current software version: 1.4.1 (helios-denali_release-1.4.1)

GPS: yes

Wi-Fi: yes

Number of COM ports: 1

COM port Names: /dev/ttyUSB0 4-2.1

The required files can be obtained upon request from Eurotech, or they may be downloaded from a site such as http://files.eurotech-inc.com/ESF/product_updates/eurotech/helios-denali (standard releases for Helios only, not customer-specific). Other hardware platforms will have a different download location.

http://files.eurotech-inc.com/ESF/product_updates/eurotech/helios-denali/

eurotech-inc.com

File   Edit   View   Favorites   Tools   Help

File Name	File Size
helios-denali_releases.txt	576
helios-denali_update-1.4.2.star.bin	3167
helios-denali_update-1.5.0.star.bin	3168

125%

From this Web site, download the "**product**-denali_releases.txt" file (where **product** is the hardware platform). This file lists all sequential release files for the standard Denali product. A typical example is shown below (note, this is a sample only, <u>not</u> the actual release list).


Then download all the listed ".star.bin" files that have higher numbered revisions above the current version number of the Denali system being upgraded. Rename them to remove the ".bin" extension.

If you are installing updates to a customer-specific Denali, instead of the standard platform, contact Eurotech to obtain the list of correct .star file updates for the system.

Installing Updates Individually

Use WinSCP to connect to Denali, and browse to its `/tmp/` (or `/var/tmp/`) folder. Download all the needed .star files to Denali as shown in the following screen capture.
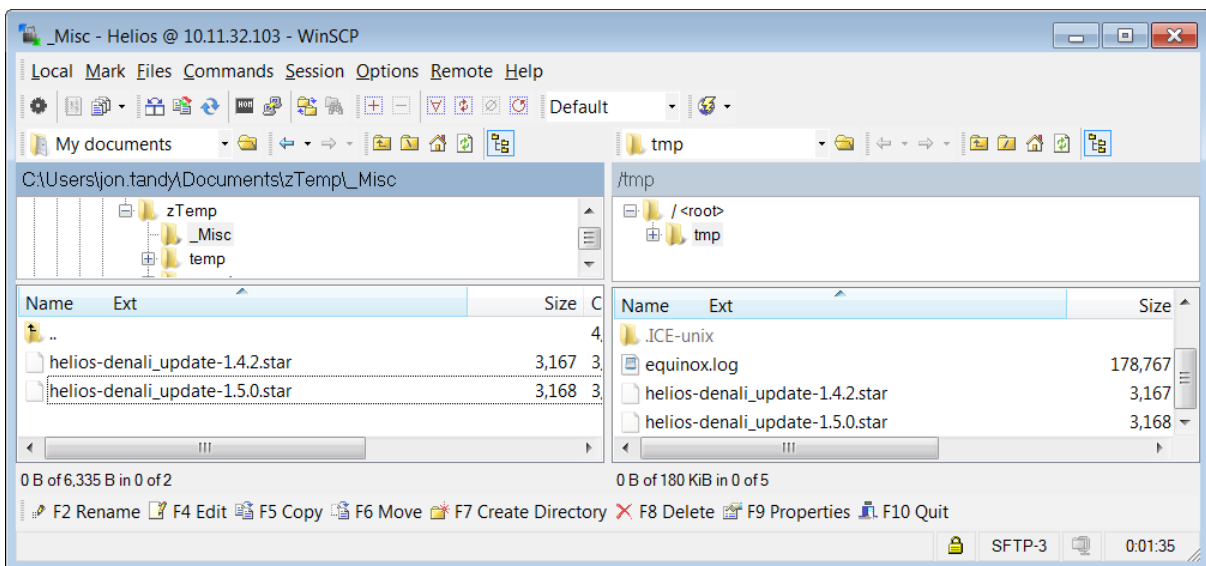
After the files are loaded, connect to the Denali system using PuTTY or HyperTerminal on the COM1 diagnostics port, or using PuTTY over the network. See the section Setting Up Software on page 16, for help setting up HyperTerminal or PuTTY.

From the Denali command line, issue the following commands:

```
cd /tmp
touch update.log
tail -f update.log &                    (Notice the ampersand '&' at the end.)
sh helios-denali_update-1.4.2.star      (Use appropriate filename)
sh helios-denali_update-1.5.0.star      (Repeat for all .star files to be installed)
```

A series of diagnostic messages will be displayed. If any of the .star update files requires a system reboot, it will restart automatically. After the reboot, the remaining .star files will need to be loaded into /tmp/ again, and repeat the above commands to install them.

Once the updates have been applied, the system version can be verified on the Web configuration *Status* page, or by typing the command:

```
ls /etc/esf/*.xml
```

The response should give the version as part of an .xml filename, something like:

/etc/esf/helios-denali_release-1.5.0.xml

Chapter 12 Security

The following screen capture shows the *Security* tab.

The *Security* tab provides an option to change the Denali Web configuration password. The following table lists the fields available in this tab.

FIELD/OPTION	EXPLANATION
Current Username	Enter the current username for logging into the Web configuration page.
Current Password	Enter the current password.
New Username	Enter a new username for logging into the Web configuration page.
New Password	Enter a new password.

After entering these values, click the **Change Web Password** button. A prompt will confirm whether to change the password, as shown in the following screen capture.
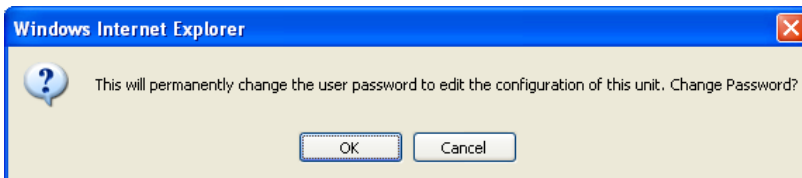
If the current username and password have been entered correctly, a confirmation will be displayed, as shown in the following screen capture.
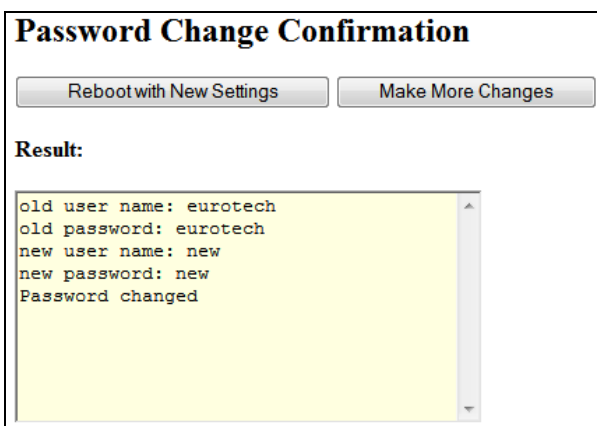
Otherwise, a negative confirmation will indicate that the change password operation was not successful. The following screen capture illustrates this case.
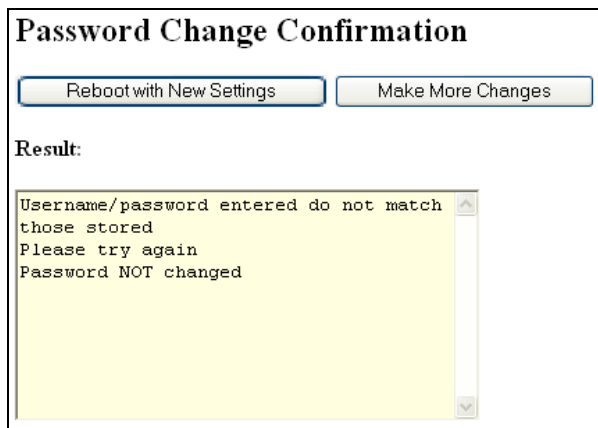
Chapter 13 MQtt Cloud Client

The Eurotech Everyware™ Device Cloud offers a robust, reliable and flexible communication infrastructure leveraging the Device Cloud technology and services. Coupled with the hardware running the Eurotech Everyware™ Software Framework (ESF), the Everyware™ Device Cloud provides a complete data management and delivery solution for comprehensive distributed device platform support including sensors, scalable edge nodes and networking devices – whether mobile, stationary, portable, or wearable devices. The Eurotech offers a broad range of standard interfaces and APIs that make the Device Cloud ideal for any business application integration.

For more information on the Everyware™ Device Cloud solution, see:
http://www.eurotech.com/en/solutions/device+to+cloud

If the Denali version includes the Device Cloud option, there will be a configuration tab for *Cloud Client* setup.

A user must register with the Everyware™ Device Cloud by contacting Eurotech to receive account credentials. Once the registration has been completed, an e-mail will be sent to the registered e-mail address for validation, containing the registration key and other information to allow device(s) to connect to the cloud.

An Everyware™ Device Cloud account typically contains multiple user accounts, which may have different passwords and system permissions. Each user account name, password, and permission levels may be configured separately. For instance, for the account name "myaccount", there would be created three users by default:

myaccount	Administrator privileges
myaccount_apis	Data access only, through REST APIs
myaccount_broker	Data access and MQtt broker connections allowed

The *Cloud Client* tab is then configured on each device with the registration key and other properties of the device connection to the cloud.

Cloud Client

To configure the Denali unit to connect to the device cloud, it must be set to use the username and password from the registration e-mail, as well as other parameters of the cloud communication. The Everyware™ Device Cloud uses the MQtt publish/subscribe protocol to make connections from the end devices and other client systems to a cloud-based message broker.

When a device initially powers on and connects to a TCP/IP socket in the cloud, it includes a keep-alive time, specified in seconds. If the client fails to publish anything to the cloud during the keep-alive time, the cloud assumes the client has been disconnected and closes the client connection. Denali can also publish and subscribe to other types of data, which is beyond the scope of this document.

The following screen capture shows the *Cloud Client* tab. Click on the question mark icons to see help text associated with each field.

The following table lists the fields available in this tab.

FIELD/OPTION	EXPLANATION
Username	Username on EDC cloud, used to authenticate with the Everyware™ Cloud MQtt broker. This is provided in the registration e-mail. One account on the cloud can have multiple username/password logins for broker connections.
Password	Password of the account username. This is provided in the registration e-mail

Account Name	Name of main user account on the EDC cloud. This field was formerly referred to as the "Prefix," and is used as an identifier representing the top level of the MQtt pub/sub topic hierarchy. This is provided in the registration e-mail.
	
	For instance, a device may log in with username "myaccount_broker", which is one user on the "myaccount" Account Name, The published topics from that device would take the form:
	Topic: myaccount/00600c80e029/us/kansas/stilwell
	    (where "00600c80e029" is a unique ID on the cloud broker.
	    Denali uses the eth0 MAC address by default for the unique ID.)
	Payload: "This is my data"

Device Display Name	A user-selectable description, which is how the device is listed in the Cloud console when connected and reporting data.
Broker URL	The URL and port number of the Everyware™ Cloud MQtt Broker. This will generally be in the form: mqtt://broker-sandbox.everyware-cloud.com:1883
Keep Alive	The number of seconds between keep-alive pings with the Everyware™ Cloud MQtt Broker.
Reconnect Interval	Number of seconds between reconnect attempts on the part of the client, when the connection with the Everyware™ Cloud MQtt Broker is lost.
Connection Lost Timeout	Number of seconds that the Everyware™ Cloud MQtt Client can be disconnected (due to a connection lost event) before the device will get rebooted. A value of -1 will allow the client to remain disconnected indefinitely without rebooting.
Master Client Enabled	Specify whether or not the Cloud MQtt Master Client is enabled. This value is "Yes" by default. The Master Client causes the data traffic to the cloud to be sent through a single socket connection, rather than different socket connections for different threads or transaction types.
Master Client Autoconnect	Specify whether or not the Cloud MQtt Master Client will automatically connect on startup. This value is "Yes" by default.
Clean Start	Specify whether or not the MQtt client should establish a clean connection, where all previously subscribed topics will be ignored. This value is "Yes" by default. If set to "No", the Everyware Cloud MQtt Broker will persist subscriptions across disconnects.

After entering these values, click the **Submit Cloud Client Configuration** button.

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AMERICAS	EUROPE	ASIA
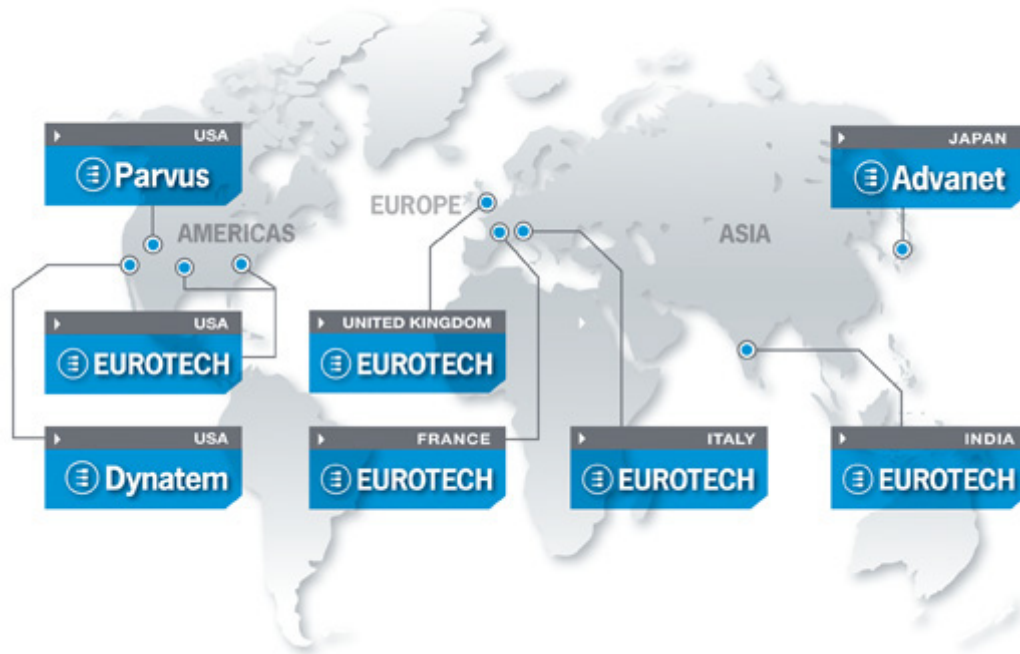
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