



***NovaRoam™ EH900***  
**Mobile Router**

**User Manual**

**Revision 1.1**



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## Introduction

### About Nova Engineering

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Nova Engineering, a 100% employee owned digital and wireless communication systems company, designs, develops, and manufactures high speed data processing and transmission equipment. Since 1989, Nova Engineering, Inc. has pioneered a variety of leading edge projects in both the commercial and government sectors.

Designs include miniature, low power RF communications equipment, waveform development software, high performance modems, ultra-low phase noise synthesizers, embedded real-time signal processing systems, and communication products development tools.

Nova supports the total development cycle from systems engineering, analysis, and computer simulation to printed circuit board design, prototyping, production, and automated testing.

Visit Nova Engineering's website [<http://www.nova-eng.com>] or contact us at 513-642-3000.

### About this Manual

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This manual introduces you to the capabilities, features, and operation of the NovaRoam. The manual describes how to install and configure the NovaRoam and how to facilitate efficient integration into a fully functional wireless network.

This document also explains how to troubleshoot problems that may arise during installation or operation.

This manual is designed for system managers, device installers, and network managers, and assumes a working knowledge of local area networking and routing functions.

Additional technical support is available either directly from Nova Engineering or partners.

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## Kit Contents

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Each *NovaRoam EH900* Kit includes the following items:

**Table 1: *NovaRoam EH900* Kit Contents**

Item	Description	Part Number
<i>NovaRoam EH900</i>	Wireless router	NR-EH900
DC Power Cable	Power input cable	NR-AC12-1
Ethernet Cable	Ethernet crossover cable	NR-AC-1102
NovaRoam CD-ROM	Includes User Manual and NovaFind Software Utility	NR-CDEH-1

## Introducing ***NovaRoam EH900***

### **About NovaRoam**

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*NovaRoam* is a wireless IP router featuring unique ad hoc (mesh) networking capabilities for mobile and stationary applications. In a typical wireless network, the *NovaRoam* is as transparent as a hardwired router. Configuration of the *NovaRoam* is made simple through use of its embedded browser-based configuration software.



**Figure 1: NovaRoam EH900**

### **System Requirements**

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To begin configuring your *NovaRoam*, the following is required:

- An Ethernet connection point (10/100BaseT)
- Power connection
- Computer for configuration

## NovaRoam Connections and LEDs

The rear panel of the *NovaRoam* has four connectors, one each for the antenna, DC Power, RS-232 serial port, and Ethernet. The *NovaRoam* Ethernet interface features “auto crossover”, which allows you make Ethernet connections using either straight or crossover Ethernet cables. The *NovaRoam* rear panel is shown in Figure 2.

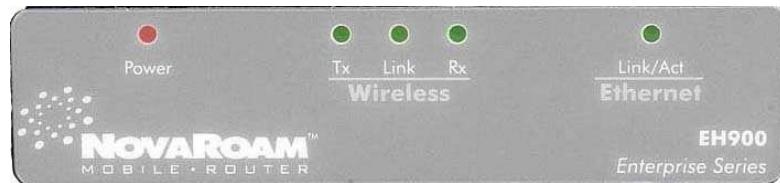


**Figure 2: NovaRoam EH900 Rear View**

Name	Device	Description
Antenna	Connector	Antenna, TNC Connector
12 VDC	Connector	Power Connection, 12 VDC
RS-232	Connector	RS-232 Serial Port
Ethernet	Connector	10BaseT Connection

The front panel of the *NovaRoam* has five LEDs as shown in Figure 3. The Power LED denotes that power has been applied and the firmware is loaded. The Tx LED indicates that a packet is being sent over the wireless interface. The Link LED indicates the quality of the wireless link. This LED glows at four levels of brightness; each brighter level indicating a better link. If the LED is off, no wireless link is established. The Rx LED indicates that a packet was received

successfully over the wireless link. The Ethernet Link/Act LED indicates if an Ethernet connection is established and if there is any traffic on the link.



**Figure 3: NovaRoam EH900 Front View**

Name	Device	Description
Power	LED (Red)	Power Applied and firmware loaded
TX	LED (Green)	Active RF Transmit
Link	LED (Green/Yellow)	Active RF Link
RX	LED (Green)	Active RF Receive
Link/Act	LED (Green)	Active Ethernet Link/Activity

## **Security**

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*NovaRoam* uses Frequency Hopping Spread Spectrum (FHSS) technology. While FHSS makes it difficult for a casual interceptor or eavesdropper to gain access to the network data flows, a determined adversary can passively intercept or even actively disrupt your network using other *NovaRoam* transceivers or similar types of FHSS equipment. For this reason, if the value of the information flows is significant, the prudent network designer will implement additional mechanisms to authenticate messages and protect the network content from exploitation. One such mechanism for securing TCP/IP connections is the Secure Socket Layer (SSL) protocol. Other mechanisms and protocols can be implemented depending upon your needs.

Contact Nova Engineering for additional security options.

**Table 2: NovaRoam EH900 Radio Frequency Modes**

Mode	Data Rate (kbps)	Modulation Type	Transmitter Power (dBm)	Receiver Sensitivity with FEC (dBm)
1	100	GFSK	+30	-108
2	400	GFSK	+30	-103

The *NovaRoam EH900* operates in the 902-928 MHz frequency band, with 16 user selectable Network ID's.

## Installing the *NovaRoam*

### Installation Checklist

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**This device must be professionally installed. It is the responsibility of the installer to ensure that proper antenna and cable combinations are used in order to remain within FCC Part 15 limits.**

- Unpack and inspect contents of the Kit.
- Connect an approved antenna to the *NovaRoam*.
- Connect power to the *NovaRoam*.
- Connect a computer and *NovaRoam* via the Ethernet cable.
- Configure the *NovaRoam* using its Browser-based Configuration Webpage. For configuration details, refer to the section titled *Configuring the NovaRoam* in this manual.

## Preinstallation Planning

### Choosing a Location

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If operating in a mobile platform, the *NovaRoam* should be mounted firmly. Also, avoid locating the *NovaRoam* near a heat source or in a damp or dusty location.

#### CAUTION

For fixed installations, Nova Engineering recommends lightning protection.

### General Planning

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To install your *NovaRoam*, follow these general steps:

- Plan Network setup
- Plan *NovaRoam* configuration
- Connect antenna
- Connect cables
- Connect power

## **Network Planning**

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*NovaRoams* can be used in a wide variety of network configurations. Therefore, it would be impossible to explain how to plan for each configuration in this manual. Planning your network in advance is recommended. Doing so provides an opportunity to develop an IP addressing scheme that makes the most sense for your particular application. Depending on the type of network, several factors may influence your planning.

- Mobile vs. stationary network
- Point-to-point vs. mesh
- Standalone Network vs. Internet connection

Once the network topology is known, the *NovaRoams* can be configured appropriately.

Refer to Appendix A for an example *NovaRoam* network.

## **Planning NovaRoam Configuration**

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There are multiple router modes to choose from. The best router mode for any given situation depends on the particular needs of the wireless network. After obtaining details about the wireless network, the appropriate *NovaRoam* router mode can be determined.

Refer to Appendix B for more details about routing modes and operation of the *NovaRoam*.

## Configuring the *NovaRoam*

### Connecting to the *NovaRoam*

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The *NovaRoam* provides web browser-based configuration. The *NovaRoam* can be configured using Internet Explorer 5.5 or later. To configure the *NovaRoam*:

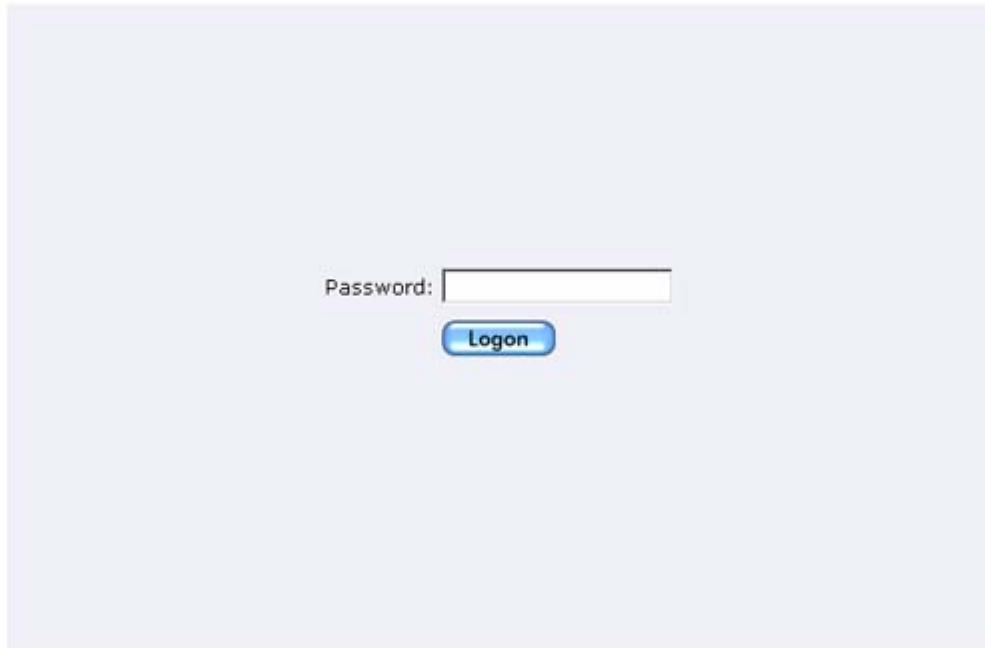
- Open a web browser.
- In the browser's address field, enter the IP address of the *NovaRoam* to which you wish to connect. The default IP address is 192.168.200.1.
- Press Enter (or the Go button) to connect.

Note: Your computer must have an IP address from the same subnet as the *NovaRoam* to which you are attempting to connect.

## **Logging into the *NovaRoam***

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Once connected to the *NovaRoam*, the logon page displays.



**Figure 4: *NovaRoam* Configuration Software Logon Page**

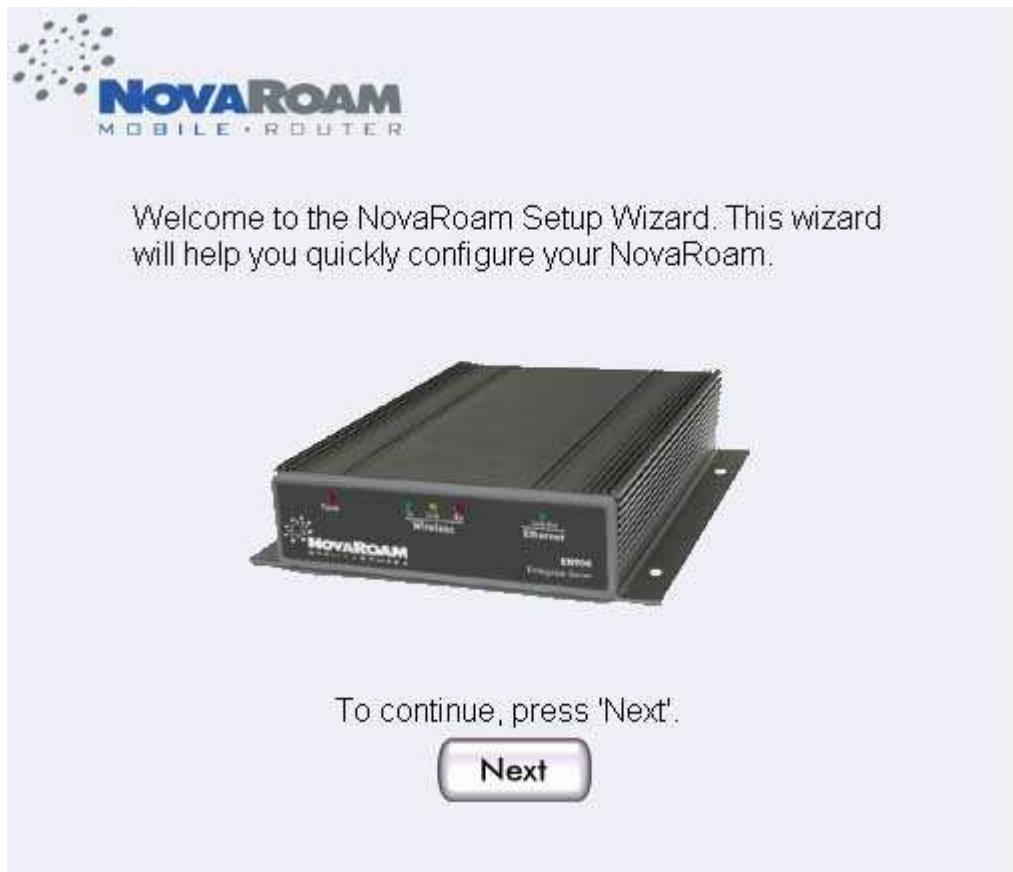
- Enter the password. The default password is **novaroam**. It is strongly recommended that you change the default password.
- Press the Logon button or the Enter key. The main configuration page is displayed.

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## Using the Setup Wizard

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The Setup Wizard simplifies *NovaRoam* configuration by presenting common setup parameters in an easily understandable format. The Setup Wizard can be started by pressing the Setup Wizard button on the Main configuration page.



**Figure 5: Setup Wizard Start page**

At the opening screen of the setup wizard, press the Next button to start configuring the *NovaRoam*.



**Figure 6: Setup Wizard Date Rate selection page**

The *NovaRoam EH900* can be configured to one of two data rates: 100 kbps or 400 kbps. After specifying the Data Rate, press the Next button.

**Note:** All *NovaRoams* that are required to communicate with each other must specify the same data rate.



**Figure 7: Setup Wizard Network ID selection page**

Specify the Network ID for the NovaRoam. In order for NovaRoams to communicate with each other, they must use the same Network ID. Networks can be collocated by using a separate Network ID for each individual network.

After specifying the Network ID, press the Next button.



**Figure 8: Setup Wizard Ethernet IP Address configuration page**

Specify the IP address and corresponding Subnet Mask for the Ethernet Interface. After specifying the address, press the Next button.



**Figure 9: Setup Wizard Wireless Interface IP Address configuration page**

Specify the IP address and corresponding Subnet Mask for the Wireless Interface. After specifying the address, press the Next button.



**Figure 10: Setup Wizard Finish page**

Press the Finish button to complete the setup wizard and return to the main configuration page. If more detailed configuration is required, additional setup options are available from the main configuration page.

## User Interface Configuration

### Main Configuration Page

The Main configuration page allows you to start the Setup Wizard. Selecting one of the navigation buttons on the left side of the configuration page allows you to configure the various elements of the *NovaRoam*.



Figure 11: *NovaRoam* Configuration Main Page

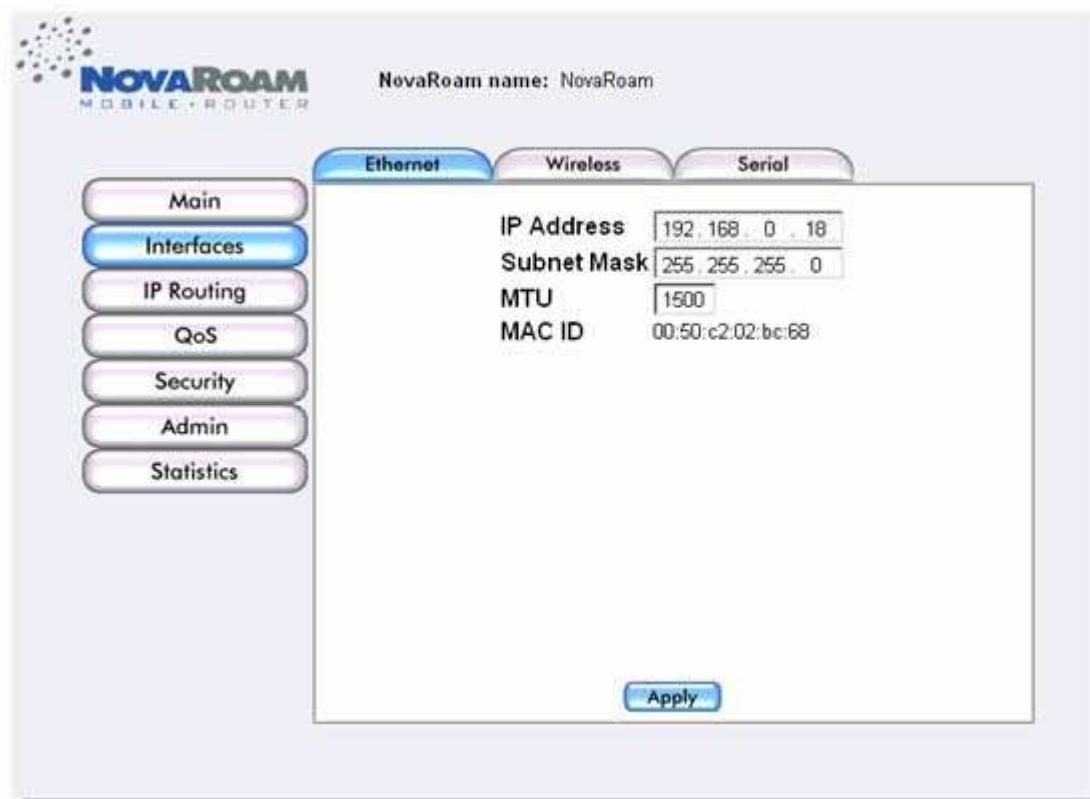
Option Name	Description
<b>Main</b>	Opens the Main configuration page
<b>Interfaces</b>	Opens the Interfaces configuration page
<b>IP Routing</b>	Opens the IP Routing configuration page
<b>QoS</b>	Opens the QoS (Quality of Service) configuration page
<b>Security</b>	Opens the Security configuration page
<b>Admin</b>	Opens the Admin configuration page
<b>Statistics</b>	Opens the Statistics page
<b>Setup Wizard</b>	Starts <i>NovaRoam</i> Setup Wizard
<b>NovaRoam Name</b>	Displays the NovaRoam Name. The NovaRoam Name can be changed to best suit your application.

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## Interfaces Configuration Page

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The Interfaces Configuration page allows configuration of the Ethernet, Wireless, and Serial interfaces of the *NovaRoam*.



**Figure 12: NovaRoam Configuration Interfaces Page**

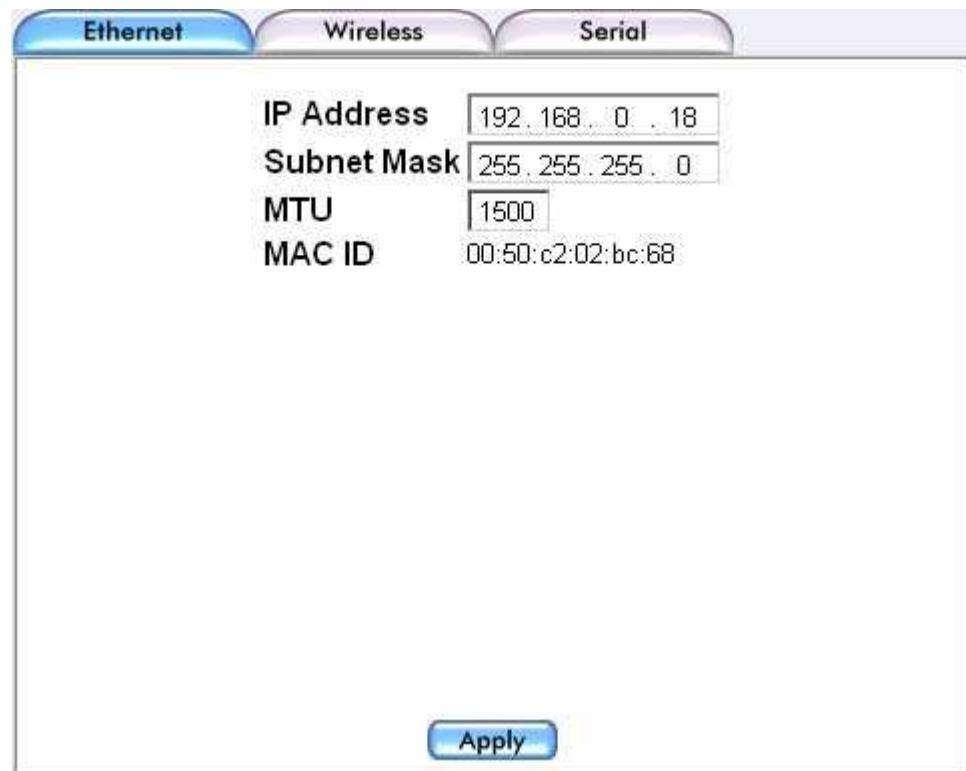
Option Name	Description
<b>Main</b>	Opens the Main configuration page
<b>Interfaces</b>	Opens the Interfaces configuration page
<b>IP Routing</b>	Opens the IP Routing configuration page
<b>QoS</b>	Opens the QoS (Quality of Service) configuration page
<b>Security</b>	Opens the Security configuration page
<b>Admin</b>	Opens the Admin configuration page
<b>Statistics</b>	Opens the Statistics page

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Option Name	Description
<b>Ethernet</b>	Opens the Ethernet Interface Configuration tab
<b>Wireless</b>	Opens the Wireless Interfaces Configuration tab
<b>Serial</b>	Opens the Serial Interface Configuration tab
<b>NovaRoam Name</b>	Displays the NovaRoam Name. The NovaRoam Name can be assigned to best suit your application.

## **Ethernet Tab**

The Ethernet tab lets you specify the IP address, subnet mask, and maximum transfer unit (MTU) for the Ethernet network interface.



The image shows the NovaRoam Configuration interface with the 'Ethernet' tab selected. The tab bar at the top has three tabs: 'Ethernet' (highlighted in blue), 'Wireless', and 'Serial'. Below the tabs, there are four configuration fields:

- IP Address:** 192.168.0.18
- Subnet Mask:** 255.255.255.0
- MTU:** 1500
- MAC ID:** 00:50:c2:02:bc:88

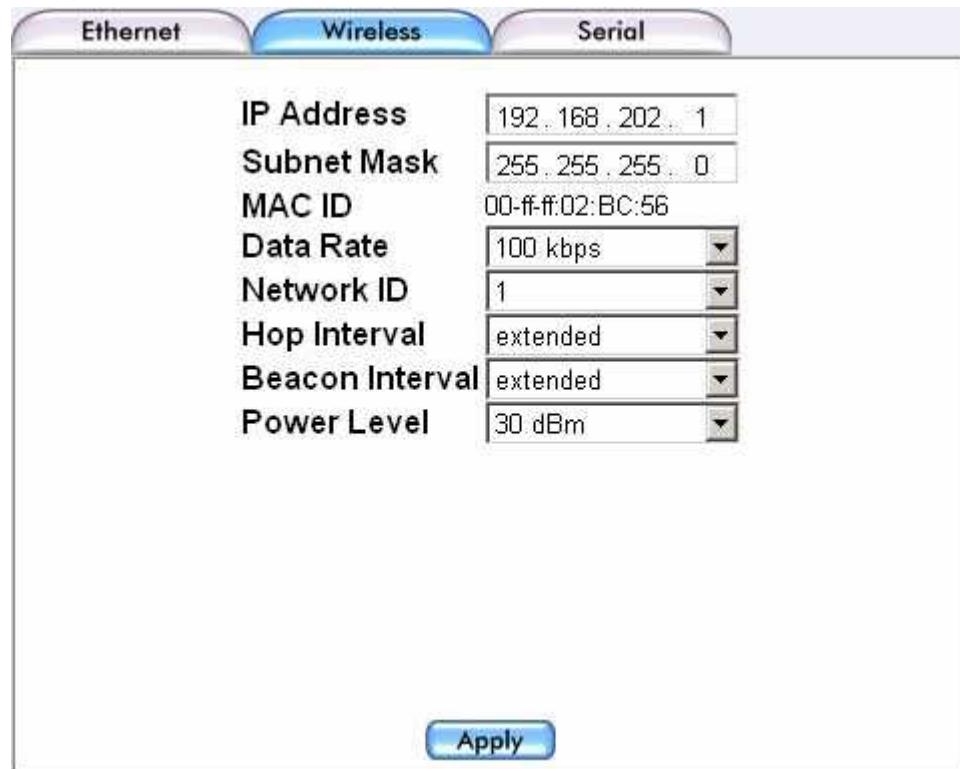
At the bottom right of the configuration area is a blue 'Apply' button.

Figure 13: NovaRoam Configuration Ethernet Tab

Option Name	Description
<b>IP Address</b>	Specifies the IP address of the Ethernet Interface. The default IP address is 192.168.200.1.
<b>Subnet Mask</b>	Specifies the Subnet Mask of the Ethernet Interface
<b>MTU</b>	Maximum Transmit Unit. Specifies the maximum packet size able to be transmitted without being fragmented. This setting is specified in bytes. The default MTU is 1500 bytes.
<b>MAC ID</b>	This <i>read-only</i> field specifies the unique Media Access Control (MAC) address of the NovaRoam Ethernet interface.
<b>Apply</b>	Applies changes made to the Ethernet Interface configuration page

## Wireless Tab

The Wireless tab lets you specify the IP address and subnet mask for the wireless network interface. This is also where the Network ID, data rate, and various wireless options are configured.



The image shows the 'Wireless' tab of the NovaRoam Configuration interface. The tab is highlighted in blue. The configuration fields are as follows:

<b>IP Address</b>	192.168.202.1
<b>Subnet Mask</b>	255.255.255.0
<b>MAC ID</b>	00-ff-ff-02:BC:56
<b>Data Rate</b>	100 kbps
<b>Network ID</b>	1
<b>Hop Interval</b>	extended
<b>Beacon Interval</b>	extended
<b>Power Level</b>	30 dBm

At the bottom right of the configuration area is a blue 'Apply' button.

Figure 14: NovaRoam Configuration Wireless Tab

Option Name	Description
<b>IP Address</b>	Specifies the IP address of the Wireless Interface. The default IP address is 192.168.202.1.
<b>Subnet Mask</b>	Specifies the Subnet Mask of the Wireless Interface.
<b>MAC ID</b>	The <i>read-only</i> field specifies the unique Media Access Control (MAC) address of the NovaRoam Wireless interface.

Option Name	Description
<b>Data Rate</b>	Specifies the over-the-air (burst) Data Rate of the NovaRoam. Data Rates can be specified as 100 kbps or 400 kbps. The default data rate is 100 kbps.
<b>Network ID</b>	Specifies the Network ID for the NovaRoam. In order to communicate with each other, NovaRoams must use the same Network ID. Networks can be collocated by using a separate Network ID for each individual network.
<b>Hop Interval</b>	The amount of time a NovaRoam will remain on a single hopping frequency. Options are short, medium, long, extended.
<b>Beacon Interval</b>	Amount of time between beacon transmissions. Options are short, medium, long, extended.
<b>Power Level</b>	Specifies the output power of the NovaRoam. Options are 10 dBm, 20 dBm, 25 dBm, and 30 dBm.
<b>Apply</b>	Applies changes made to the Wireless Interface configuration page

## Serial Tab

The serial interface of a *NovaRoam* can be used to tunnel raw asynchronous serial data to another *NovaRoam*. The Serial tab allows you to configure the various port settings of the asynchronous serial interface as well as the destination *NovaRoam* address and port number.

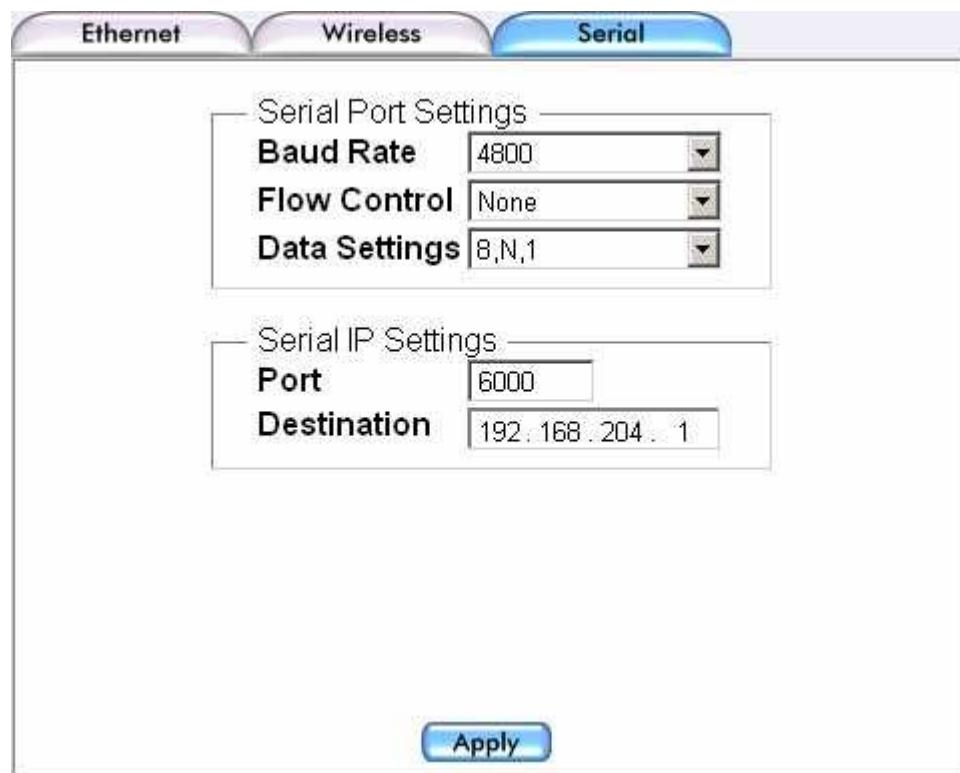


Figure 15: NovaRoam Configuration Serial Tab

Option Name	Description
<b>Baud Rate</b>	Specifies the baud rate of the serial interface. Available baud rates are 2400, 4800, 9600, 19200, 38400, 57600, 115200. The default setting is 4800.
<b>Flow Control</b>	Determines whether or not flow control is used on the NovaRoam serial interface. Options are None or Hardware. The default setting is None.
<b>Data Settings</b>	Specifies the data settings, specifically data bits, parity, and stop bits. Options are 8,N,1 / 7,E,1 / 7,O,1. The default setting is 8,N,1.

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Option Name	Description
<b>Port</b>	Specifies the port that serial data is sent to and received from. The default port number is 6000. In order for multiple NovaRoams to communicate serial data, the same port must be specified on each NovaRoam
<b>Destination IP Address</b>	The Destination IP address to which all serial data is sent. The default Destination IP address is 192.168.204.1. Specifying the Wireless Interface of a NovaRoam will cause serial data to be sent out the serial port of the receiving NovaRoam. Specifying the Ethernet Interface of a NovaRoam or other device will cause serial data to be sent out the Ethernet Interface of the receiving NovaRoam
<b>Apply</b>	Applies changes made to the Serial Interface configuration page

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## IP Routing Configuration Page

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The IP Routing configuration page allows configuration of the IP Routing settings, such as Ad Hoc Routing mode and AODV. Static routes and ARP entries can be viewed or modified on the IP Routing Configuration page.

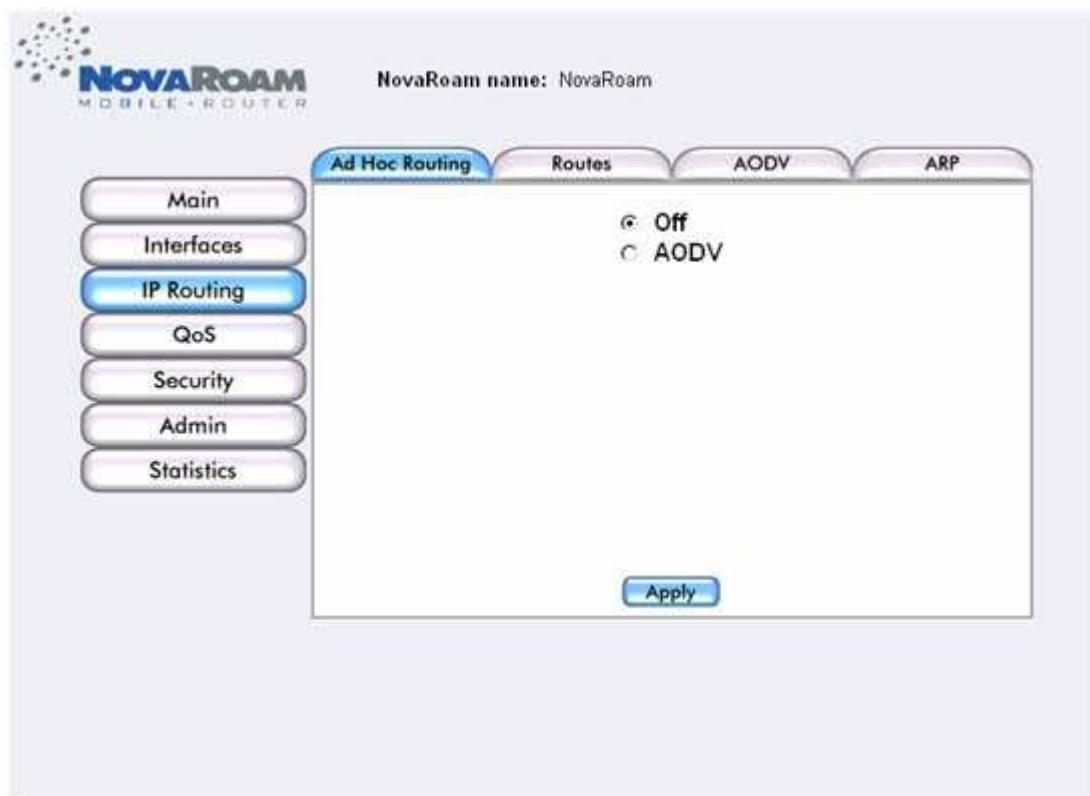


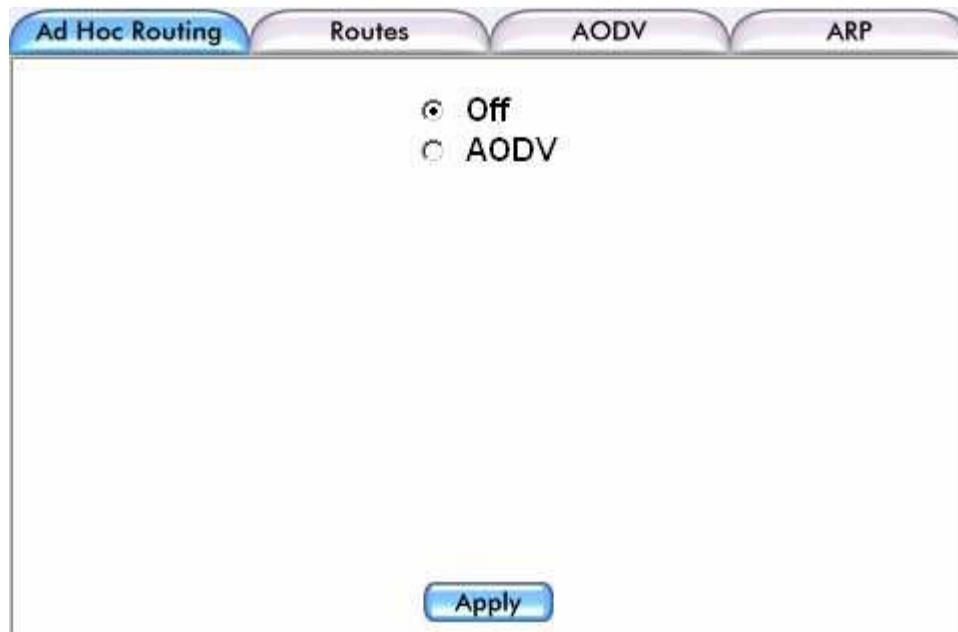
Figure 16: *NovaRoam Configuration IP Routing Page*

Option Name	Description
<b>Main</b>	Opens the Main configuration page
<b>Interfaces</b>	Opens the Interfaces configuration page
<b>IP Routing</b>	Opens the IP Routing configuration page
<b>QoS</b>	Opens the QoS (Quality of Service) configuration page
<b>Security</b>	Opens the Security configuration page
<b>Admin</b>	Opens the Admin configuration page

Option Name	Description
<b>Statistics</b>	Opens the Statistics page
<b>Ad Hoc Routing</b>	Opens the Ad Hoc Routing Configuration page
<b>Routes</b>	Opens the Routes Configuration page
<b>AODV</b>	Opens the AODV Configuration page
<b>ARP</b>	Opens the ARP (Address Resolution Protocol) Configuration page
<b>NovaRoam Name</b>	Displays the NovaRoam Name. The NovaRoam Name can be assigned to best suit your application.

## Ad Hoc Routing Tab

The Ad Hoc Routing tab lets you select the protocol to use for mobile ad hoc routing. Currently, AODV is the supported protocol.



**Figure 17: NovaRoam Configuration Ad Hoc Routing Tab**

Option Name	Description
Off	Specifies manual routing mode. In this mode, static routes must be entered manually. Routes can be entered manually from the Routes tab.
AODV	Enables the AODV routing algorithm. AODV allows NovaRoam networks to become self-forming and self-healing. Routes are created, maintained, and deleted automatically. Refer to Appendix B for detailed information regarding AODV.
Apply	Applies changes made to the Ad Hoc Routing configuration page

## Routes Tab

The Routes tab lets you view current routes in the *NovaRoam* routing table. It also allows you to add and remove static routes.

Ad Hoc Routing	Routes	AODV	ARP
Destination Network	Subnet Mask	Gateway	Interface
192.168.200.0	255.255.255.0	0.0.0.0	Ethernet
192.168.202.0	255.255.255.0	0.0.0.0	Wireless

[Add Route](#) [Add Default](#) [Delete Route](#)

Figure 18: *NovaRoam Configuration Routes Tab*

Option Name	Description
<b>Add Route</b>	Opens the Add Route window. Used to manually enter static.
<b>Add Default</b>	Opens the Add Default window. Used to manually enter default gateways.
<b>Delete Route</b>	Used to manually delete routes. To delete a route, select the route from the route table. Once the route is highlighted, press the Delete Route button. The route will then be deleted from the route table.



Figure 19: *NovaRoam Configuration Add Route Window*

Option Name	Description
<b>Network</b>	Specifies the destination network for the route being created
<b>Subnet Mask</b>	Specifies the subnet mask of the destination network for which the route is being created
<b>Gateway</b>	Specifies the next hop gateway of the destination network for which the route is being created
<b>Apply</b>	Adds the route to the route table. Static routes will remain in the route table until they are manually deleted.
<b>Cancel</b>	Closes the Add Route window without adding a route to the route table



Figure 20: *NovaRoam Configuration Add Default Window*

Option Name	Description
<b>Gateway</b>	Specifies the default gateway. This is the IP address to which all data packets without an existing route are sent.
<b>Apply</b>	Adds the default gateway to the route table. The default gateway will remain in the route table until it is manually deleted.
<b>Cancel</b>	Closes the Add Default window without adding a default gateway to the route table

## AODV Tab

The AODV tab lets you configure parameters associated with the operation of the AODV (Ad hoc On-demand Distance Vector) ad hoc routing algorithm. The default settings have been set for a typical mobile network environment and should not need to be changed. However, modification of these parameters is

supported in the event that your wireless network requires tweaking of the internal algorithm values to best match your network architecture.

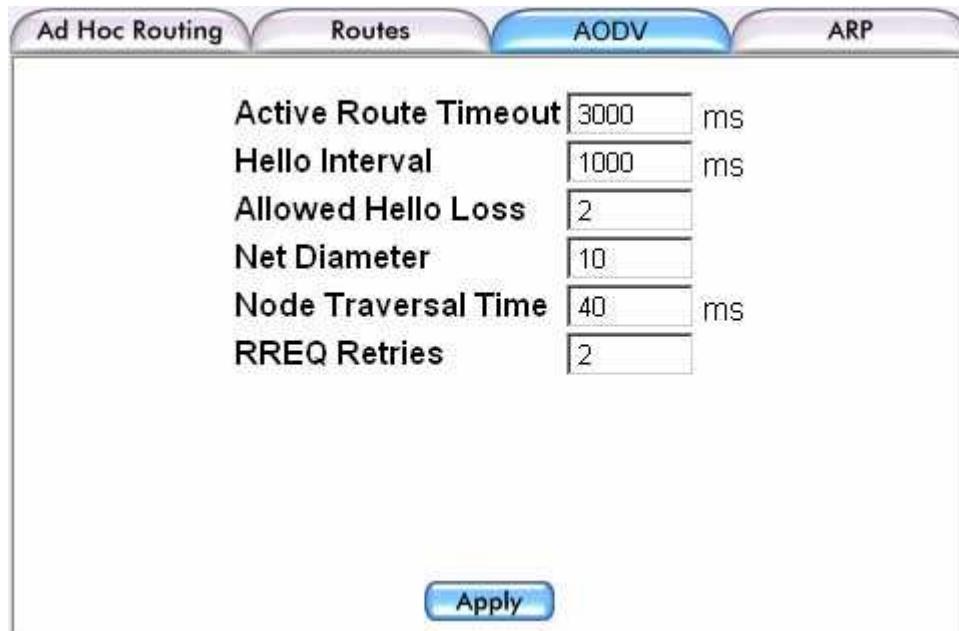


Figure 21: **NovaRoam Configuration AODV Tab**

Option Name	Description
<b>Active Route Timeout</b>	Determines the time period that a route will remain in the routing table when no traffic is being sent to the destination. The valid range of values is between 1000 and 100000 milliseconds. The default value is 3000 milliseconds.
<b>Hello Interval</b>	Time between “hello” beacon messages. This valid range of values is between 1000 and 100000 milliseconds. The default value is 1000 milliseconds.
<b>Allowed Hello Loss</b>	Specifies the number of “hello” messages which, when missed, determines a link failure. The valid range of values is from 1 to 10. The default value is 2.