iR1600 Rugged Modem
iR1600 GPS-Enabled Modem

NEXTEL.Done. ™

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> **IMPORTANT!**
> **Please Read Safety Notice on Page 69 before using the iR1600 Modem.**

RFM-6000-5015 Rev 1

June 2004

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FCC COMPLIANCE

DECLARATION OF CONFORMITY
Per FCC CFR 47 2.989

Responsible party name: **eLutions, Inc.**
Address: **5905 Breckenridge Parkway**
         Suite F
         Tampa, FL 33610
Phone number: **1-800-836-9909**

Hereby declares that the product:

     Product name: **iR1600 GPS-Enabled Modem**
     Model Number: **6000-C5-RFM**

     Product name: **iR1600 Rugged Modem**
     Model Number: **6100-C5-RFM**

Conforms to the following regulation:

FCC Part 15, subpart B
FCC Part 90, subpart S
Class B Digital device

Date: **March 8, 2004**

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 and 90 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. The equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference or by one or more of the following measures:
   -- Reorient or relocate the receiving antenna.
   -- Increase the separation between the equipment and receiver.
   -- Connect the equipment into an outlet on a circuit different from that to
     which the receiver is connected.
   -- Consult the dealer or an experienced radio/TV technician for help.

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REQUIRED COMPONENTS

This chapter contains information about the required components for successful installation and operation of the iR1600 modem. This chapter includes:

Box Contents

The iR1600 modem ships with the following:

- iR1600 Modem
- CD with documentation
    - Installation Guide
    - Configuration Guide
    - Quick Reference Guide (for operators/end users)
    - Warranty Card
    - Getting Started - Installation and Usage Requirements
    - Remote Configuration Tool Kit
        - Remote Configuration (Over-the-Air) Guide

Documentation

Documentation for the iR1600 consists of three guides, an Installation Guide, Configuration Guide and a Remote Configuration Guide. This document, the iR1600 Installation Guide provides you with instructions on installing the hardware and describing how to:

- Mount the modem in a mobile environment (vehicle installation).
- Mount the modem in a fixed environment.
- Install and connect the required components (e.g. power cables, antennas, etc.).
- Connect and configure your computer and I/O devices (e.g. Remote Terminal Units (RTU), sensors, controllers, etc.).
- Verify the installation.
- Troubleshoot common installation problems.

The iR1600 Configuration Guide provides you with instructions on how to:

- Install the iDEN® Packet Data Applet (for data services).
- Set up Windows Components.
- Configure the modem's operating modes.
- Configure data encryption parameters.
- Configure the Access Control List for IP Address.
- Configure BSAP protocol for translation to IP Address.
- Use AT Commands to configure the modem.

The iR1600 Remote Configuration Guide provides you with instructions on how to:

- Install the Over the Air Tool Kit.
- Retrieve and view remote device parameters.
- Perform remote over the air (OTA) configuration changes.
- Perform firmware updates remotely.

Required Components for Installation (sold separately)

⚠	IMPORTANT: Before you begin installing the iR1600 Rugged Modem or the iR1600 GPS-Enabled Modem, you must obtain the necessary components.

Components for Mobile Environment (sold separately)

Either the iR1600 GPS-Enabled or iR1600 Rugged Modems are typically used for mobile installation environment. The following table lists the components required for this type of installation:

• Approved Cellular Antenna
• Vehicle Power Harness
• Data Cable for computer (laptop/MDT)
• Approved GPS Antenna (for iR1600 GPS Enabled Modem only)
• Data cable for GPS (for iR1600 GPS-Enabled Modem only)

Components for Fixed Environment (sold separately)

The iR1600 Rugged Modem is typically used for fixed installation environment. The following table lists the components required for this type of installation:

• Approved Cellular Antenna
• AC Power Adapter
• Data Cable for computer (laptop/MDT)

Approved Components List

The following table lists the components that have been approved for use with the iR1600 modem:

Part Number	Product Name
	Antennas
5000-C5-RFM	Cellular Antenna Magnetic Mount (Motorola)
5010-C5-RFM	Cellular Antenna Magnetic Mount (spring wire)
5020-C5-RFM	Cellular Antenna Direct Mount (soft rubber)

5030-C5-RFM	GPS Antenna Magnetic Mount (Lassen LP)
5040-C5-RFM	Cellular Antenna Fixed Mount
5050-C5-RFM	Dual Cellular/GPS Antenna Fixed Mount
5060-C5-RFM	Dual Cellular/GPS Antenna Covert
5070-C5-RFM	Cellular Antenna Glass Mount
5080-C5-RFM	Dual Cellular/GPS Antenna Glass Mount
5085-C5-RFM	Dual Cellular/GPS Antenna Fixed Mount Radome
5090-C5-RFM	Dual Cellular/GPS Antenna Magnetic Mount
	Power Harnesses and Adapters
5110-C5-RFM	Vehicle Power Harness for iR1600
5260-C5-RFM	AC Power Adapter Kit for iR1600
5290-C5-RFM	AC Power Adapter Kit for iR1600 (Extended temperature)
	Optional Hardware Components
5220-C5-RFM	Ignition Bypass Plug
5230-C5-RFM	Coaxial Antenna Adapter, Mini UHF Male/TNC Female
5240-C5-RFM	USB to Serial Adapter
5400-C5-RFM	2M DB9M to DB9F Serial Cable
5410-C5-RFM	3M DB9M to DB9F Serial Cable
5300-C5-RFM	Solar Panel Kit (sizing required)

> ⚠️ **IMPORTANT:** eLutions updates the list of approved components as needed to accommodate the variety of installation environments and industry solutions. Please check eLutions' web site for an up to date components list.

Required Components for Operation

In order for you to begin using your modem and connect to the iDEN® network, you must have the following components:

- iDEN® Packet Data Applet
- Activated Data Account with Nextel

> ⚠ **IMPORTANT: Before you can begin using the iR1600 Rugged Modem or the iR1600 GPS-Enabled Modem in normal mode, you must have an activated data account with Nextel.**

iDEN® Packet Data Applet

The iDEN® Packet Data Applet must be downloaded and successfully installed on the computer (laptop/MDT) that the modem is connected to. Please refer to the "Installing iDEN® Packet Data Applet" section of the Configuration Guide for detailed instructions on how to install and configure the data applet.

NOTE: This component is only required if the modem is operating in Normal Mode. Packet data service is required if the modem is operating in Gateway or AVL mode. Please refer to the "Modem Operating Mode" topic located on page 15 for a description of the operating modes.

Data Account Activation

For information on how to obtain a data account, please contact your technology administrator or designated field care representative.

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INTRODUCTION

Thank you for purchasing the Nextel® iR1600 modem. Once installed and configured, the iR1600 modem provides you with reliable, wireless data communication within the iDEN® network. This chapter includes:

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Nextel® Coverage

For details on Nextel digital cellular and data coverage, visit **nextel.com**.

Nextel® Customer Care

For network issues contact:

- Nextel Customer Care Center at 1-800-639-1111

For installation or device issues contact:

- eLutions Wireless Support Center by phone at 1-888-349-4338 or by email at customersupport@elutions.com

To Order Components

Components for the iR1600 modem can be ordered online at www.elutions.com/wireless or by calling eLutions' Wireless Support Center.

When you call, please have a detailed description of your problem. To provide you with fast and quality support, our Customer Care representative may ask for the following:

- Computer operating system (Windows 95/98/NT/2000/CE)
- Version of the operating system (e.g. NT 4, Windows 95 Version B, CE 2.1, etc.)
- Information regarding the modem (most can found on the diagnostic menu)
- Geographic location of use
- The modem's operating mode
- Other configuration settings

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PRODUCT OVERVIEW

This chapter contains general product information for the iR1600 modem. This chapter includes:

General Overview

The iR1600 modem includes capabilities such as embedded TCP/IP stack, alternate serial protocol conversion, store-and-forward for GPS coordinates and three (3) operating modes (Normal, AVL or Gateway). The expanded features make the iR1600 even more powerful while still maintaining the same ruggedized, flexible and reliable form factor.

Figure 1 – iR1600 GPS-Enabled Modem

Modem Characteristics

The iR1600 modem provides you with the following features/ characteristics:

- **Integrated GPS Receiver (optional)** – The iR1600 has an integrated receiver for GPS communication for Automatic Vehicle Location (AVL). With GPS, vehicle location or "positions" can be determined. GPS data is used with mapping software so that vehicle location and movement can be visually represented.

- **Store and Forward Capabilities** – The iR1600 has a total of 120kbytes of serial flash memory for data storage, giving the iR1600 data logging and store/forward capabilities. If a unit loses communication, the data being collected through GPS and from the inputs will be stored in memory and forwarded when communication is reestablished.

- **I/O Interfaces** – The iR1600 has five (5) I/O ports: (2) Analog inputs (4-20mA/0-10V configurable) and (3) digital inputs. These signals provide a means of monitoring and controlling third party devices that are external to the modem.

- **TPC/IP Stack** – The TCP/IP Stack allows the iR1600 to receive serial data, encapsulate it into UDP or TCP packets and send it over the iDEN® packet data network to a pre-defined IP address. This also allows the modem to receive appropriately addressed packets from the iDEN® network, parse the data, and send it to the user via the serial port.

- **Internal GPS Loop Back** – The addition of the TCP/IP Stack has enabled the iR1600 with the capability of sending GPS data to a remote server without a resident application. The GPS data is also communicated via a serial connection to a local data terminal.

- **Data Security** – The modem provides a 128-bit AES (Advanced Encryption Standard) data security feature when the modem is operating in either the Gateway or AVL mode.

- **Remote Over the Air (OTA) Configuration Toolkit (optional)** – The iR1600 modem can be remotely configured by using this toolkit. This optional toolkit is a GUI (Graphic User Interface) application allows an administrator the ability to remotely configure or change the modem's operating modes or perform remote firmware updates. This feature is enabled when the modem is operating in either the Gateway or AVL mode.

- **Access Control List (ACL)** – The modem has a look-up table that can store a range of IP addresses and up to 30 individual IP addresses within the Access Control List. When the modem is in either Gateway or AVL operating mode and configured as a TCP client or UDP, it will act as a "listener" and will use the ACL to verify that a remote node may send packets to the modem.

- **Protocol to IP Address Translation** – The iR1600 has capabilities of translating a Bristol Babcock BSAP hex address (ID) into an IP address. Once converted, the BSAP messages (data) is packetized and sent over the iDEN® network using UDP**.**

Modem Operating Modes

The iR1600 provides three separate modes of operation or communication described below.

> NOTE: The iR1600 is configured to default to the Normal mode. You can switch to a different mode by changing parameters through the modem's diagnostic menu. Please refer to the "Configuring for Gateway/AVL Mode" chapter in the Configuration Guide for detailed instructions on how to switch operating modes.

- **AVL:** In this mode, the modem uses the internal GPS receiver to send GPS NMEA sentences over the packet data network to a specific IP address and port number. The data is encapsulated into UDP or TCP packets, which allows it to be transmitted over the iDEN® packet data network to a pre-defined IP address. The modem maintains a non-volatile revolving history of the GPS information and provides a 'store and forward' capability for periods when communication within the iDEN® network is lost. When AVL mode is activated, the GPS port on the modem is also active.

> NOTE: Only the iR1600 GPS-Enabled modem can operate in the AVL mode and send AVL messages.

- **GATEWAY:** In this mode, the modem receives basic serial data from the host device via the user port, and encapsulates it into UDP or TCP packets. The data is sent out over the iDEN® packet data network to a pre-defined IP address. Similarly, the modem receives appropriately addressed packets from the iDEN® network, parses the data, and sends it to the user via the serial port.

- **NORMAL**: In this mode, an IP enabled host device may utilize the iDEN® packet data network via a PPP connection to the iR1600 modem. Alternately, a non-IP enabled host may make an iDEN® circuit switched connection using standard Hayes AT commands.

Data Connections

The iR1600 provides the following data connections:

- **Packet Data:** A wireless modem connection used for accessing the Internet, sending and receiving e-mail, and transferring small files over the packet data network using standard IP protocols. Data is sent in packets (blocks) of data at high speed.

- **Circuit Switched Data:** A wireless modem connection for sending and receiving data (faxes, files, etc.) over the circuit-switched cellular channel, providing a direct point-to-point connection with the destination device.

Modem Types

Nextel offers two models of the iR1600 Modem. Both are designed to provide wireless communication for rugged environments. The distinction between the two models is the optional GPS feature. The iR1600 modem is available in the following models:

- **iR1600 Rugged Modem (Base Model) -** Available in bulk or individual packaging.

- **iR1600 GPS-Enabled Modem -** Available in bulk or individual packaging.

Modem Components

Front Panel Views

The following diagrams display the components that exist on the front panel for both the iR1600 GPS-Enabled and iR1600 Rugged Modems.
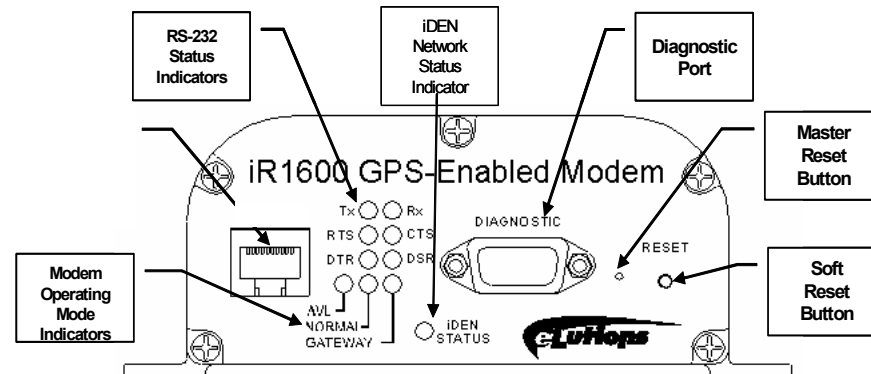
Figure 2 – Front Panel of iR1600 GPS-Enabled Modem
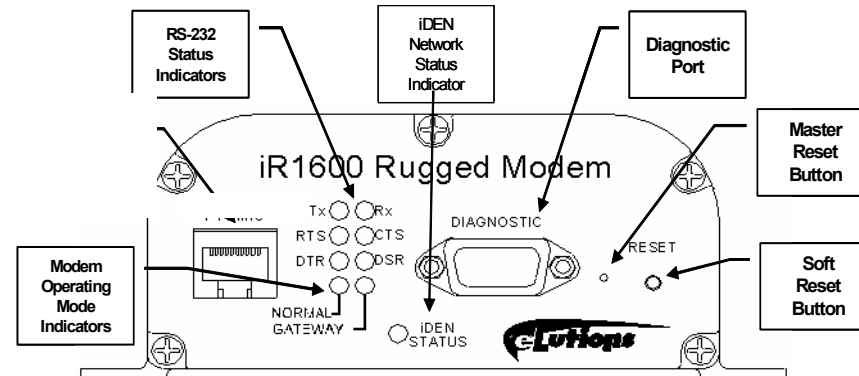
Figure 3 – Front Panel of iR1600 Rugged Modem

Rear Panel Views

The following diagrams show the components that exist on the rear panel of the iR1600 GPS-Enabled and iR1600 Rugged Modems.
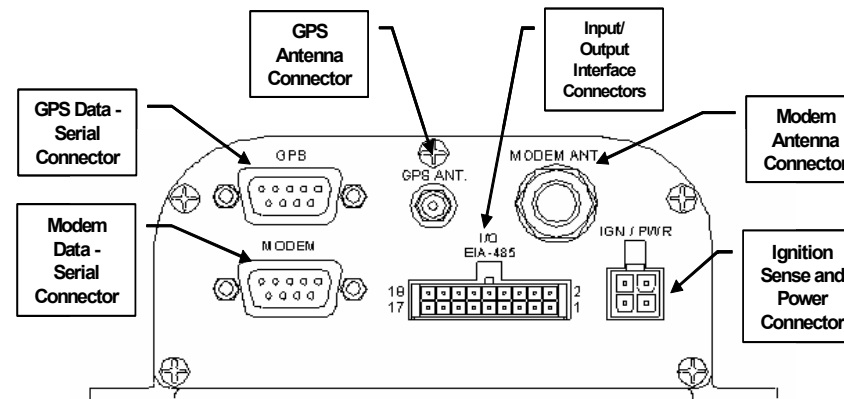
Figure 4 – Rear Panel of iR1600 GPS-Enabled Modem
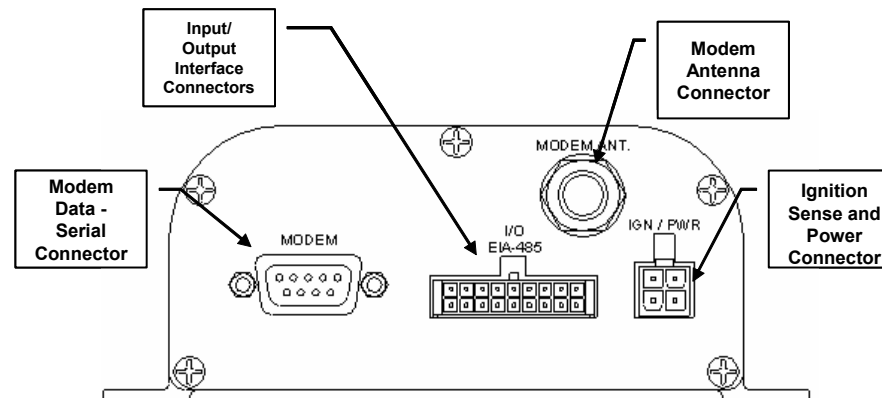
Figure 5 – Rear Panel of iR1600 Rugged Modem

Modem Technical Specifications

The following section outlines the technical specifications of the iR1600 modems.

Product Characteristics	
Modem Data Interface	RS-232 port utilizing a DB9 female pin serial connector
Diagnostics Data Interface	RS-232 port utilizing a DB9 female pin serial connector
Optional GPS Interface	RS-232 port utilizing a DB9 female pin serial connector
Input/Output Interfaces	5 external I/O signals: 2 analog inputs (0-10Vdc or 4-20mA current input), 3 digital inputs (+12V/Open or Open/Grnd)
External Input/Output Connector	18 Pin external I/O connector
Power/Ignition Sense Input Connectors	4 Pin Molex power/ignition connector combined
Antenna Interface	Mini UHF female for modem and MCX female for GPS
LED indicators	6 SIGNAL and 3 OPERATING MODE and 1 bi-color STATUS indicators
Reset Button	YES
Master Reset Button	YES (recessed)
Operational Characteristics	
Data Security	128-bit AES
Protocol Conversion	YES, BSAP
Over the Air (OTA) Remote Configuration	YES
Processors	
Program Flash	128k bytes of program flash
Data Logging and Storage	120k bytes of data flash
Real Time Clock	YES
TCP/IP Stack	YES
Physical Characteristics	
Weight	625 grams
Dimension	5.04"Wx2.25"Hx7"D
Case	Dust and water resistant, black aluminum extrusion
Electrical Characteristics	
Power Input	13 VDC ± 40%
Input Current – OFF Mode	70 uA steady state to 2.5 mA transient peak

Input Current - ON Mode	100 mA steady state to 1.5A transient peak
Input Current - SLEEP Mode	40 mA max
Tx Output	600 mW Typical
Communication	
Communication Networks	iDEN®
Operating Modes	3 Operating Mode options: MODEM, AVL and GATEWAY.
Radio Frequency	Tx 806-825 MHz Rx 851-870 MHz
GPS Characteristics	
GPS Receiver	8 channel with 32 correlators
GPS Data Protocols	NMEA 0183 v3.0, optional TSIP and TAIP
GPS Engines	Trimble
GPS Messages	GGA, VTG, GLL, RMC, ZDA, GSA, GSV
Update Rate	Up to 1 Hz
Environmental Parameters	
Operating Temperature	-25°C to +60°C
Storage Temperature	-40°C to +85°C
Operating Humidity	0-95% non-condensing @ +50°C
Shock & Vibration Conformance	Per MIL-STD-810E
EMI/EMC	FCC Part 15, Part 90

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INSTALLATION PREPARATION

In this chapter, you will learn how to begin installing your iR1600 modem. This chapter includes:

Before You Start Installing

Only experienced technicians familiar with installing similar types of hardware equipment should install the modem. For safety and to avoid damage to the modem or vehicle wiring, the installer should have knowledge of the following subjects.

- Antenna location

- Automotive wiring (if applicable)

- Vehicle cable routing (if applicable)

- Configuration tools (i.e. serial cable, data terminal with HyperTerminal software)

Installation Planning

Planning is the key to a quick and simple installation. Before drilling holes or running wires, you should inspect the vehicle or area of the building to determine how and where you intend to mount the modem, antenna and components.

Planning Modem Location

Factors to consider when planning for the location or placement of your iR1600 modem:

- **Easily Accessible** – You should allow easy access to the modem (for troubleshooting purposes).

- **Easily Visible** – You should allow a clear view of the modem's LED indicators.

- **Proximity of the Cables** – The distance between connections, especially that between the modem and antenna, affects performance. The shorter the distance between these components, the better the signal. **(Please refer to the antenna's Safety Warranty for proper installation of the antenna.)**

- **Environment Considerations:**

⚠️	▪ **Heat** - Placing the modem, antenna or cables near a heat source can cause several problems, including radio interference. Select a location away from a source of heat and make sure the modem has at least a 1-inch clearance on all sides for cool air to circulate**.** ▪ **Wetness –** The modem should not be mounted in an area where it could be directly exposed to water**.** ▪ **Direct Sunlight –** The modem should not be mounted in direct sunlight**.**

Modem Dimensions

Consider the size of the modem. Will the modem fit in the area where you want to perform the installation?

The following diagram outlines the modem's dimensions:

NOTE: This diagram depicts the overall view of the iR1600 Rugged and iR1600 GPS-Enabled Modems. This diagram is not intended to be used as a template for mounting the modem. Please refer to the Table of Dimensions located on page 24 for the modem's approximate dimensions.
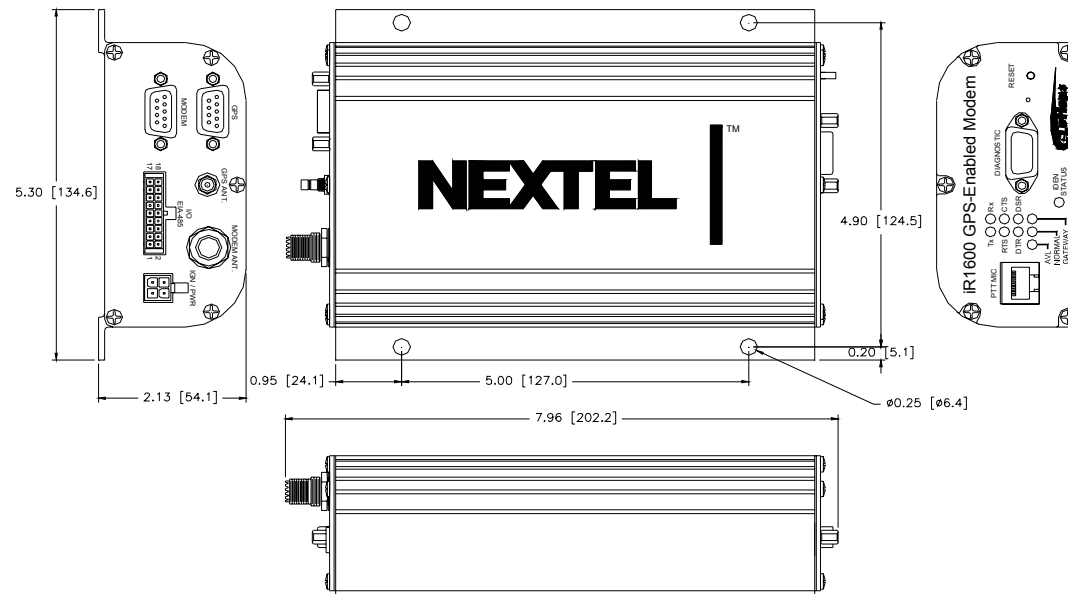
Figure 6 – Overall view of iR1600 GPS-Enabled Modem

Table of Dimensions

The following table describes the overall dimensions of the iR1600 modem.

Component	Dimension
Overall dimensions from connector to connector	7.96in. [202.2mm]
End panel to end panel	7.09in. [180.14mm]
Width (including mounting tabs)	5.30in. [134.62mm]
Width of enclosure	4.30in. [109.22mm]
Height of enclosure	2.13in. [54.10mm]

Planning Antenna Location

Factors to consider when planning for the location or placement of the antenna:

- Choose a location with easy access to cable routing to ease the process of connecting the antenna to the modem.

- In mobile installation, mount the modem antenna on the center of the outside trunk for optimum signal reception.

- If you are installing the iR1600 GPS-Enabled Modem in a fixed (building or desk) environment, ensure that the GPS antenna is positioned where it has a direct line-of-sight to the sky. In some cases, this can be accomplished by placing the antenna adjacent to a window. In most cases it will require mounting outside of the building.

CAUTION	The cellular antenna(s) used for this transmitter must not be co-located or operated in conjunction with any other antenna or transmitter. This device is approved with emissions having a source-based time-averaging duty factor not exceeding 67.5%. **Vehicle – Antenna Installation:** - Antennas used for this transmitter must not exceed an antenna gain of 5 dBd (commonly specified as 3dB gain). - For rear deck trunk and rooftop installations, the antenna must be located at least 20 cm away from rear-seat passengers and bystanders in order to comply with the FCC RF exposure requirements.

IMPORTANT: Failure to observe these restrictions will result in exceeding the FCC RF exposure limits.

Planning Cable Layout

Once you have chosen the location of the modem and antenna, and before installing, layout the cables to determine:

- If the cables can reach the modem and antenna.

- If the distance between components is adequate and allows you to make adjustments to receive a better signal. (Please refer to the manufacturer's installation manual for safe installation of your antenna).

- If there are kinks or bends in the cable or obstructions in the vehicle that could affect routing.

Serial Cable Routing

Serial cable routing is the most important factor to ensure a trouble-free operation. The serial cable should be as stable as possible (e.g., it should experience little to no movement and have few or no bends or kinks).

NOTE: The majority of problems occur because of serial cable failure.

Installation Tools

You will need these tools to install the iR1600 modem.

- Portable Drill
- Phillips Screwdriver
- Connector Crimp tool

- Center Punch
- Hammer
- Four #10 self-tapping sheet metal screws

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MOBILE INSTALLATION

This chapter includes instructions on how to install your iR1600 modem and hardware components (i.e. antennas, serial cables, etc.) within a mobile environment.

Installation Steps

To install, you must perform the following steps:

- **Mount Modem** – Mount the modem in the desired location.

- **Mount Antenna** – Mount the antenna using the instructions included with your selected antenna's installation guide.

- **Route and Connect Ignition/Power** – route the power cable from modem to the vehicle's power supply (ignition switch).

- **Connect Antenna Cable** – Connect the cable to the mounted modem and antenna.

- **Connect Data Cable** – Connect the data cable from the modem to the mobile device.

⚠	IMPORTANT: We recommend that the modem be configured prior to mobile/vehicle installation. This process requires that you have knowledge of TCP/IP communication and modem operation. Please refer to the iR1600 Configuration Guide for detailed instructions on how to configure the iR1600 modem.

Mounting the Modem

Select Modem Location

The following describes typical locations that you should consider for mounting the modem:

- Under seat
- Under dashboard
- In trunk

- Inside dashboard
- Center console
- In accessory compartment

Example of iR1600 mounted on side of console

Example of iR1600 mounted on side wall of trunk

Mount the Modem

The following steps describe how to mount the iR1600 data modem in a mobile environment.

1. Determine a convenient location in the mobile environment.

2. Use the iR1600 modem and mark the positions of the holes on the mounting surface.

3. Drill the holes in the marked location.

4. Mount the unit using the #10 sheet metal screws.

Mounting the Antenna(s)

The location of the antenna should be chosen carefully.

⚠️	**IMPORTANT: Things to consider when installing the antenna equipment.**
	• Equipment must be installed in accordance with the manufacturer's instructions
	• To ensure compliance with United States FCC regulations on RF exposure, equipment must be installed in such a way as to maintain a separation of at least 8 inches (20 cms) between the antenna and the human body.
	• Ensure that the antenna is properly installed external to the mobile environment and in accordance with the requirements of the antenna manufacturer/supplier.
	• Use only an approved antenna. Unauthorized antennas, modifications or attachments could impair call quality, damage the modem, or violate FCC mandates.

Approved Antennas (sold separately)

For a list of tested and approved antennas that can be used with the iR1600 modems, please refer to the Approved Components List on page 7 of this document.

> NOTE: Antennas with gain exceeding 5dBd (commonly specified as 3dB gain) do not comply with FCC RF exposure and are not allowed for use with this product.

Select Antenna Location

The following are some common layouts for co-locating an external antenna and the iR1600 modem.

- **Roof to trunk** – This layout accommodates a trunk-mounted modem and antenna that is attached to the roof.
- **Trunk to trunk** – This layout accommodates a trunk-mounted modem and antenna that is attached to the trunk.
- **Roof to console or dashboard** – This layout accommodates a console or dashboard mounted modem and the antenna attached to the roof. This setup gives you access to the modem from inside the vehicle.

CAUTION	**The cellular antenna(s) used for this transmitter must not be co-located or operated in conjunction with any other antenna or transmitter. This device is approved with emissions having a source-based time-averaging duty factor not exceeding 67.5%**

<div style="border: 1px solid;">

factor not exceeding 67.5%.
Vehicle – Antenna Installation:

- Antennas used for this transmitter must not exceed an antenna of 5 dBd (commonly specified as 3dB gain).

- For rear deck trunk and rooftop installations, the antenna must be located at least 20 cm away from rear-seat passengers and bystanders in order to comply with the FCC RF exposure requirements.

IMPORTANT: Failure to observe these restrictions will result in exceeding the FCC RF exposure limits.

</div>

Mount the Antenna(s)

> NOTE: Each antenna has specific installation instructions. Please refer to the antenna installation instructions for specific requirements and details.

Mount Modem Antenna

The following steps describe how to mount a modem antenna.

1. Use an antenna suitable for the cellular band of frequencies (806-870 MHz) with Mini UHF jack and matched for 50-ohm impedance.

2. Mount the antenna according to the manufacturer's specifications or instructions.

Mount GPS Antenna (optional)

The iR1600 GPS-Enabled modem comes equipped with a connector for a GPS antenna. The following steps describe how to mount a GPS antenna.

1. Use an antenna suitable for the GPS of frequency 1575 MHz with an MCX connector and matched for 50-ohm impedance.

2. Position the antenna where it has a direct line-of-sight to the satellite.

3. Mount the antenna according to the manufacturer's specifications or instructions.

> NOTE: Because of the operating frequencies involved with the GPS signal, splicing or using adapters to extend the length of the antenna coaxial cable is not recommended and will likely prevent the system from operating properly. We recommend that a single length of coax without splices or adapters be used.

Route and Connect Cables

Approved Power Cable (sold separately)

The following DC power cable was designed specifically for use with the iR1600.

> 5110-C5-RFM – Vehicle Power Harness (iR1600)

> ⚠ IMPORTANT: Only approved and tested components should be used with the iR1600 modem. Use of unapproved components violates the modem's warranty.

The following diagram illustrates typical installation wiring of the iR1600 into a mobile environment.
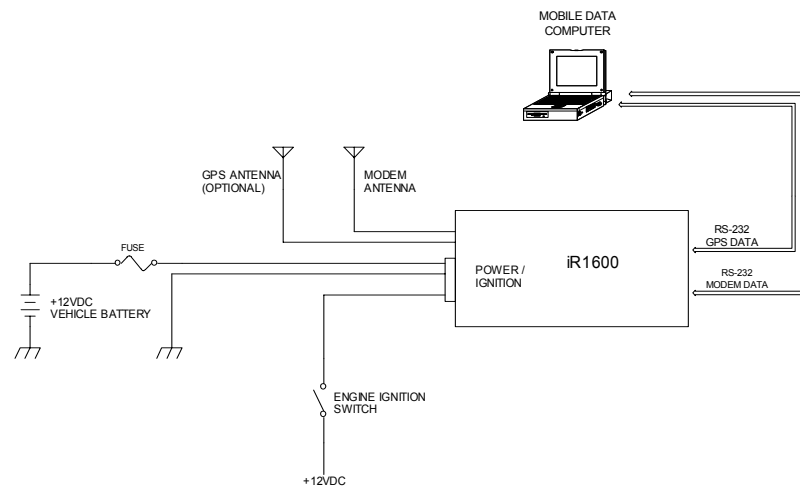
Figure 7 – iR1600 Installation Wiring Diagram (Mobile)

Route and Connect Ignition/Power

Route the ignition/power cable using the following diagram as a guideline:
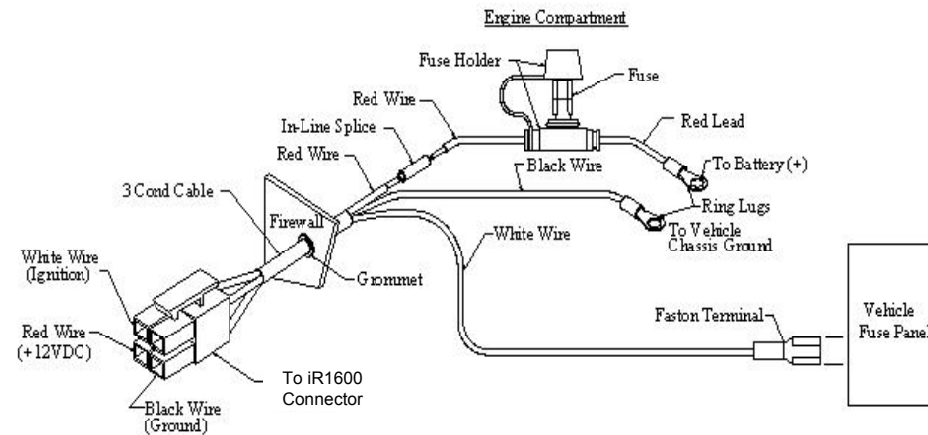
Figure 8 – Modem Power Wiring Diagram

The following steps describe how to route and connect the power cable:

1. Determine a cable routing plan that will allow you to connect the DC power cable between the modem and the vehicle battery. Connect the male end of the power cable to the 4-prong connector labeled IGN/PWR on the rear panel of the modem.

2. Route the free end of the cable to the vehicle battery. If necessary, drill a hole in the vehicle firewall and route the cable through it using the supplied grommet. (Refer to Figure 8 on page 32).

3. Locate an available chassis ground mounting point near the battery and shorten the black lead to remove any excess cable length.

4. Crimp on the ring tongue terminal and connect the black lead directly to the chassis ground.

5. Position the fuse holder as close to the battery as possible, and away from any potentially hot components.

6. Mount the fuse holder by tie wrapping it to the other cabling wires and dress wires as necessary.

7. Shorten the red lead of the DC power cable to remove any excess length and crimp the fuse holder's red lead to it using the in-line splice.

8. Connect the ring tongue terminal from the fuse holder to the positive (+) battery terminal.

9. Connect the free end of the ignition wire to a vehicle circuit that provides 12VDC when the vehicle is running or in ACC, and no 12VDC when the vehicle is OFF or not in ACC.

Route and Connect Antenna Cable(s)

The following steps describe how to connect the antenna cable(s) to the modem:
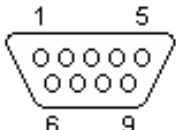
1. Insert the male end of the modem antenna cable to the connector labeled **MODEM ANT** on the rear panel of the modem.

2. Insert the male end of the GPS antenna (optional) cable to the connector labeled **GPS ANT** on the rear panel of the modem.

Route and Connect Data Cable(s) – sold separately

The iR1600 modem can be connected to the host DTE equipment using standard "straight through" 9-pin male to a 9-pin female serial cable(s).

Serial Connector (DB9) Pinouts
The following diagrams and table outlines the iR1600 RS232 pin assignments.

MODEM	1. Data Carrier Detect (DCD)
	2. Transmitted Data (TXD)
	3. Received Data (RXD)
	4. Data Terminal Equipment Ready (DTR)
	5. Signal Ground (GND)
1 5 / 6 9	6. Data Communications Equipment Ready (DSR)
	7. Request to Send (RTS)
	8. Clear to Send (CTS)
	9. Ring Indicator (RI)

The following step describes how to connect the data cable:

1. Connect the 9-pin male end of the cable to the iR1600 MODEM communication connector, located on the rear panel of the modem and the 9 pin female end of the cable to the data terminal equipment (DTE).

2. Connect the 9-pin male end of the cable to the iR1600 GPS communication connector, located on the rear panel of the modem and the 9 pin female end of the cable to the data terminal equipment (DTE).

Other Mobile Installation Configurations

Continuous Power Configuration

There is no on/off switch on the iR1600. It is turned on and off through the application of voltage to the ignition sense input, typically supplied by the vehicle's ignition switch. The Continuous Power Configuration allows the iR1600 to remain ON even when the vehicle ignition is off.

> **NOTE:** **You will need to purchase a SPST toggle switch. Please refer to the following table for the specifications of the required toggle switch for this configuration.**

Switch Feature:	12 VDC SPST Toggle Switch
Switch Function:	SPST (Single Pole, Single Throw)
Switch Circuit:	On-Off
Current Rating:	Minimum of 20Vdc at a current of 5mA.

Figure 9 – Continuous Power Configuration

Mounting the Modem

Mount the modem as described for the standard mobile installation on page 28.

Mounting the Antenna(s)

Mount the antenna(s) as described for the standard mobile installation on page 30.

Route and Connect Ignition/Power

Route and connect the ignition/power cable as described in the following steps.

1. Determine a cable routing plan that will allow you to connect the DC power cable between the modem and the vehicle battery. Connect the male end of the power cable to the 4-prong connector labeled IGN/PWR on the rear panel of the modem.

2. Route the free end of the cable to the vehicle battery. If necessary, drill a hole in the vehicle firewall and route the cable through it using the supplied grommet. (Refer to Figure 8 – Modem Power Wiring Diagram on page 32).

3. Locate an available chassis ground mounting point near the battery and shorten the black lead to remove any excess cable length.

4. Crimp on the ring tongue terminal and connect the black lead directly to the chassis ground.

5. Position the fuse holder as close to the battery as possible, and away from any potentially hot components.

6. Mount the fuse holder by tie wrapping it to the other cabling wires and dress wires as necessary.

7. Shorten the red lead of the DC power cable to remove any excess length and crimp the fuse holder's red lead to it using the in-line splice.

8. Connect the ring tongue terminal from the fuse holder to the positive (+) battery terminal.

9. Connect the free end of the ignition wire to a fused, continuously energized +12VDC circuit through a user-supplied SPST toggle switch (see Figure 9 on page 35). This switch shall be rated for a minimum of 20Vdc at a current of 5mA.

Route and Connect Antenna Cable(s)

Connect the antenna cable(s) as described for the standard mobile installation on page 33.

Route and Connect Data Cable(s)

Connect the data cable(s) as described for the standard mobile installation on page 33.

Docking Station Configuration

This configuration allows the power supplied to the modem to be controlled by a docking station that may be mounted inside the vehicle.

NOTE: Please refer to the manufacturer's instructions for proper installation of your specific docking station.
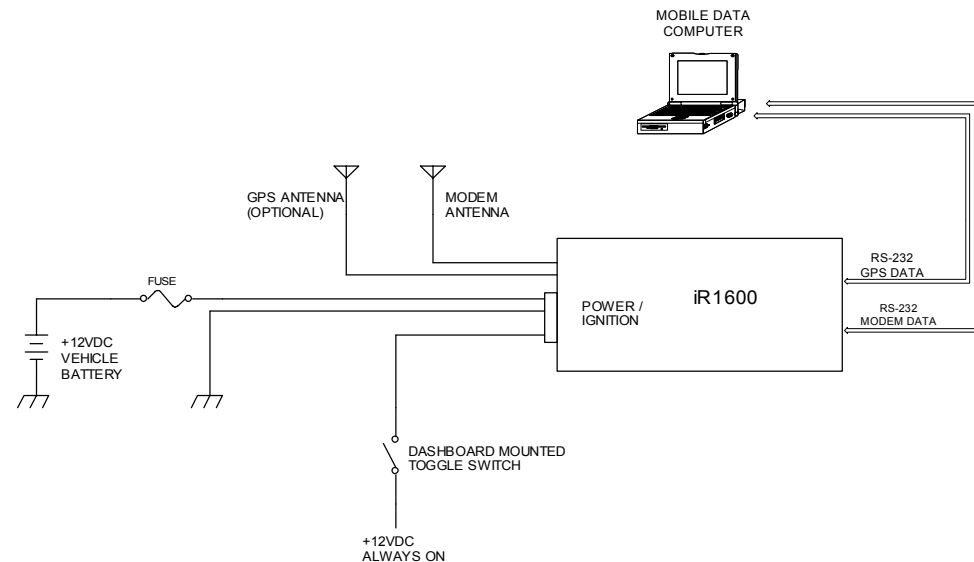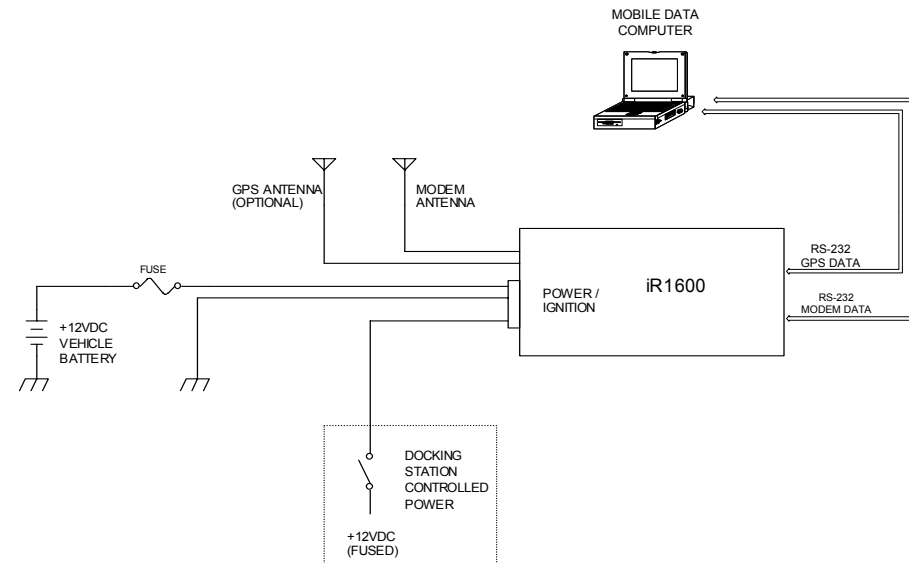

Figure 10 – Docking Station Configuration

Mounting the Modem

Mount the modem as described for the standard mobile installation on page 28.

Mounting the Antenna(s)

Mount the antenna(s) as described for the standard mobile installation on page 30.

Route and Connect Ignition/Power

Route and connect the ignition/power cable as described in the following steps.

1. Determine a cable routing plan that will allow you to connect the DC power cable between the modem and the vehicle battery. Connect the male end of the power cable to the 4-prong connector labeled IGN/PWR on the rear panel of the modem.

2. Route the free end of the cable to the vehicle battery. If necessary, drill a hole in the vehicle firewall and route the cable through it using the supplied grommet. (Refer to Figure 8 – Modem Power Wiring Diagram on page 32).

3. Locate an available chassis ground mounting point near the battery and shorten the black lead to remove any excess cable length.

4. Crimp on the ring tongue terminal and connect the black lead directly to the chassis ground.

5. Position the fuse holder as close to the battery as possible, and away from any potentially hot components.

6. Mount the fuse holder by tie wrapping it to the other cabling wires and dress wires as necessary.

7. Shorten the red lead of the DC power cable to remove any excess length and crimp the fuse holder's red lead to it using the in-line splice.

8. Connect the ring tongue terminal from the fuse holder to the positive (+) battery terminal.

9. Connect the free end of the ignition wire to a fused +12VDC circuit controlled by the laptop/MDT docking station (see Figure 10 on page 37). This circuit shall nominally output 12VDC @ 5mA when the modem is intended to be ON, and 0Vdc (open circuit) when the modem is intended to be OFF.

Route and Connect Antenna Cable(s)

Connect the antenna cable(s) as described for the standard mobile installation on page 33.

Route and Connect Data Cable(s)

Connect the data cable(s) as described for the standard mobile installation on page 33.

FIXED INSTALLATION

This chapter includes instructions on how to install your iR1600 modem in a fixed (i.e. building/desktop) environment.

Installation Steps

To install, you must complete the following steps:

- **Mount Modem** – Mount the modem in the desired location.

- **Mount Antenna** – Mount the antenna using the instructions included with your selected antenna's installation guide.

- **Route and Connect Power Cables** – route the power cables from modem to the power supply.

- **Connect Antenna Cable(s)** – Connect cables to the mounted modem and antenna.

- **Connect Data Cable(s)** – Connect the data cables from the modem and GPS to the mobile device.

Mounting the Modem

The iR1600 modem can be mounted on different types of surfaces. You should determine if the surface is able to support the weight of the iR1600 modem. The area should allow sufficient space around the modem for cool air to circulate.

Select Modem Location

The iR1600 modem within a building or fixed environment is typically installed in an area where the antenna has a direct line-of-sight to the sky for maximum reception.

Mount the Modem

The following steps describe how to mount the iR1600 data modem in a fixed environment.

1. Determine a convenient location within the fixed environment.

2. Use the iR1600 modem and mark the positions of the holes on the mounting surface.

3. Drill the holes in the marked location.

4. Mount the unit using the #10 sheet metal screws.

Mounting the Antenna(s)

The location of the antenna should be chosen carefully.

⚠	**IMPORTANT: Things to consider when installing the antenna equipment.**
	• Equipment must be installed in accordance with the installation instructions.
	• To ensure compliance with United States FCC regulations on RF exposure, equipment must be installed in such a way as to maintain a separation of at least 8 inches (20 cms) between the antenna and the human body.
	• Ensure that the antenna is properly installed external to the vehicle and in accordance with the requirements of the antenna manufacturer/supplier.
	• Use only an approved antenna. Unauthorized antennas, modifications or attachments could impair call quality, damage the modem, or violate FCC mandates.

Approved Antennas – sold separately

For a list of tested and approved antennas that can be used with the iR1600 modems, please refer to the Aproved Components List on page 7 of this document.

> NOTE: Antennas with gain exceeding 5dBd (commonly specified as 3dB gain) do not comply with FCC RF exposure and are not allowed for use with this product.

Select Antenna Location

The antenna must be positioned where it has direct line-of-sight to the sky. In some cases, this can be accomplished by placing the antenna adjacent to a window. In most cases it will require mounting outside of the building.

<table>
<tr><td>CAUTION</td><td>The cellular antenna(s) used for this transmitter must not be co-located or operated in conjunction with any other antenna or transmitter. This device is approved with emissions having a source-based time-averaging duty factor not exceeding 67.5%.

Antenna Installation:

• Antennas used for this transmitter must not exceed an antenna of 5 dBd (commonly specified as 3dB gain).

• For rear deck trunk and rooftop installations, the antenna must be located at least 20 cm away from rear-seat passengers and bystanders in order to comply with the FCC RF exposure requirements.</td></tr>
<tr><td colspan="2">IMPORTANT: Failure to observe these restrictions will result in exceeding the FCC RF exposure limits.</td></tr>
</table>

Mount the Antenna(s)

Mount Modem Antenna

The following steps describe how to mount an antenna.

1. Use an antenna suitable for the cellular band of frequencies (806-870 MHz) with Mini UHF jack and matched for 50-ohm impedance.

2. Mount the antenna according to the manufacturer's specifications or instructions.

> NOTE: Each antenna has specific installation instructions. Please refer to the antenna installation instructions for specific requirements and details.

Mount GPS Antenna (optional)

The iR1600 GPS-Enabled modem is equipped with a connector for a GPS antenna. The following steps describe how to mount a GPS antenna.

1. Use an antenna suitable for the GPS of frequency 1575 MHz with an MCX connector and matched for 50-ohm impedance.

2. Position the antenna where it has a direct line-of-sight to the sky.

3. Mount the antenna according to the manufacturer's specifications or instructions.

   NOTE: Because of the operating frequencies involved with the GPS signal, splicing or using adapters to extend the length of the antenna coaxial cable is not recommended and will likely prevent the system from operating properly. We recommend using a single length of coax without splices or adapters.

Route and Connect Cables

The following diagram illustrates typical installation wiring of the iR1600 in a fixed environment.
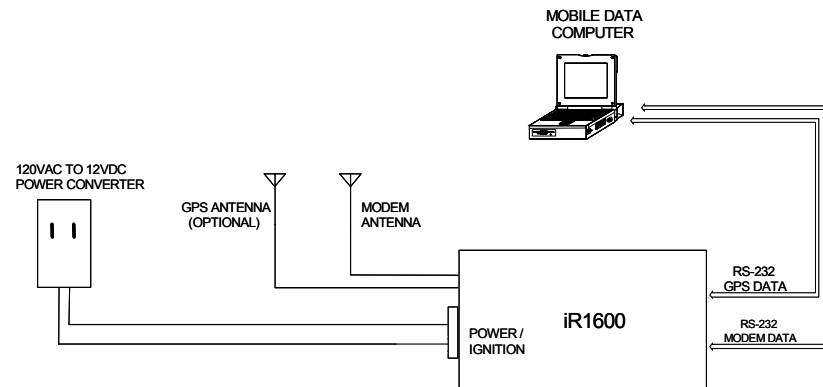

Figure 11 – iR1600 Installation Wiring Diagram (Fixed)

Approved Cables – sold separately

The following DC power cable was designed specifically for use with the iR1600.

5260-C5-RFM – AC Power Adapter (iR1600)
5290-C5-RFM – AC Power Adapter (iR1600) for Extended Temperatures

> ⚠ ! IMPORTANT: Only approved and tested components should be used with the iR1600 modem. Use of unapproved components violates the modem's warranty.

Route and Connect Ignition/Power Cable

The following steps describe how to route and connect the power cable:

1. Connect male end of the AC Power Adapter cable to the 4-prong connector labeled IGN/PWR on the rear panel of the modem.

2. Connect the free end of the power cable to a 120VAC-power outlet.

Route and Connect Antenna Cable(s)

The following steps describe how to connect the antenna cables to the modem.

1. Insert the male end of the modem antenna cable to the connector labeled MODEM ANT on the rear panel of the modem.

2. Insert the male end of the GPS antenna (optional) cable to the connector labeled GPS ANT on the rear panel of the modem.
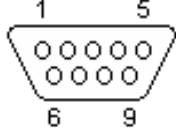
Route and Connect Data Cable(s)

The iR1600 modem can be connected to the host DTE equipment using a standard "straight through" 9-pin male to a 9-pin female serial cable.

Serial Connector (DB9) Pinouts

The following diagrams and table outlines the iR1600 RS232 pin assignments.

MODEM	1. Data Carrier Detect (DCD)
	2. Transmitted Data (TXD)
	3. Received Data (RXD)
	4. Data Terminal Equipment Ready (DTR)
	5. Signal Ground (GND)
1 5 / 6 9	6. Data Communications Equipment Ready (DSR)
	7. Request to Send (RTS)
	8. Clear to Send (CTS)
	9. Ring Indicator (RI)

The following steps describe how to connect the data cable:

1. Connect the 9-pin male end of the cable to the iR1600 MODEM communication connector, located on the rear panel of the modem and the 9 pin female end of the cable to the data terminal equipment (DTE).

2. Connect the 9-pin male end of the cable to the iR1600 GPS communication connector, located on the rear panel of the and the 9 pin female end of the cable to the data terminal equipment (DTE).

CONNECTING I/O DEVICES

In this chapter, you will learn how to connect external I/O devices to the iR600 modem and configure them to communication with the modem. This chapter includes:

Connector Pinouts

The iR1600 modem currently provides two (2) channels of analog inputs that can be utilized to monitor a variety of 0-10VDC or 4-20mA environmental sensors. The modem also provides three (3) channels of digital inputs that can be used to monitor Open/Gnd or +12v/Open discretes.

There are currently 12 active pins that can be used to connector external I/O devices. These are indicated in the diagrams and table below.
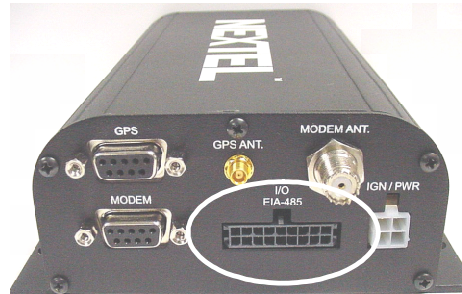
Figure 12 – I/O Connectors on iR1600 Rear Panel

18	16	14	12	10	8	6	4	2
17	15	13	11	9	7	5	3	1

Connector Pin	Signal
1	Analog Input 1 RTN
2	Analog Input 1
3	Analog Input 2 RTN
4	Analog Input 2
5	Digital Input 1 RTN
6	Digital Input 1
7	Digital Input 2 RTN
8	Digital Input 2
9	Digital Input 3 RTN
10	Digital Input 3
11	485B (*reserved for future release*)
12	485A (*reserved for future release*)
13	GND
14	+12Vdc
15	Digital Output1B (*reserved for future release*)
16	Digital Output1A (*reserved for future release*)
17	Digital Output2B (*reserved for future release*)
18	Digital Output2A (*reserved for future release*)

I/O Wiring Options

Connect the desired sensors to the iR1600 using minimum 26 AWG wire as show in the diagrams below.

Wiring Options for Analog Inputs
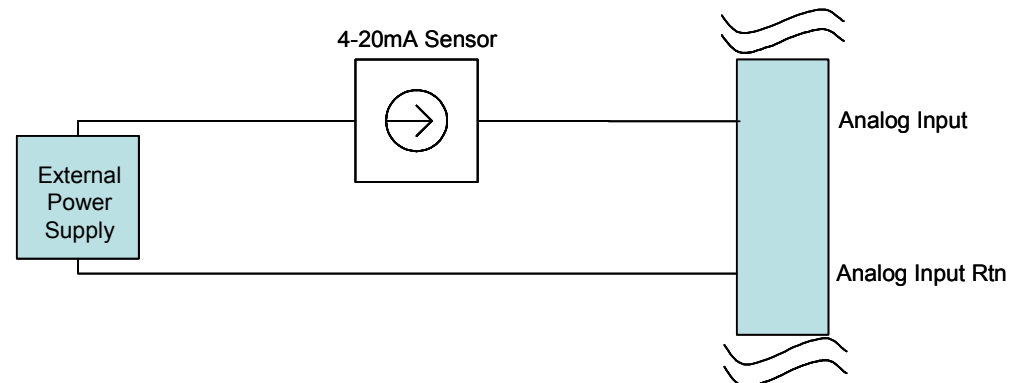

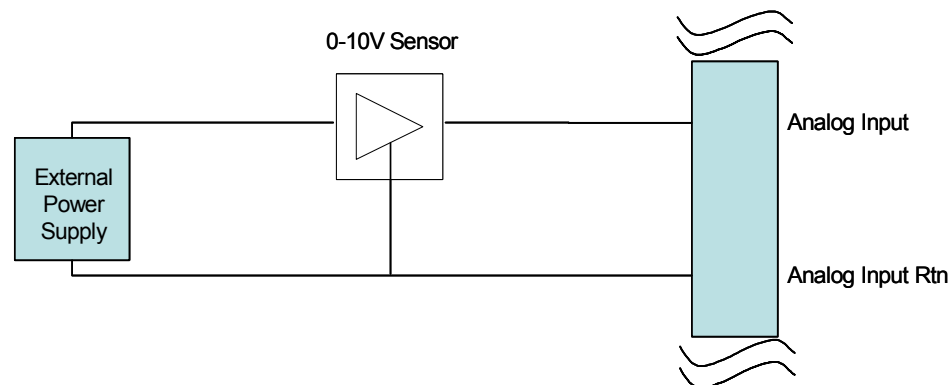**Figure 13 – Diagram for Connecting 4-20mA Sensors**

Figure 14 – Diagram for Connecting 0-10V Sensors

Wiring Options for Digital Inputs
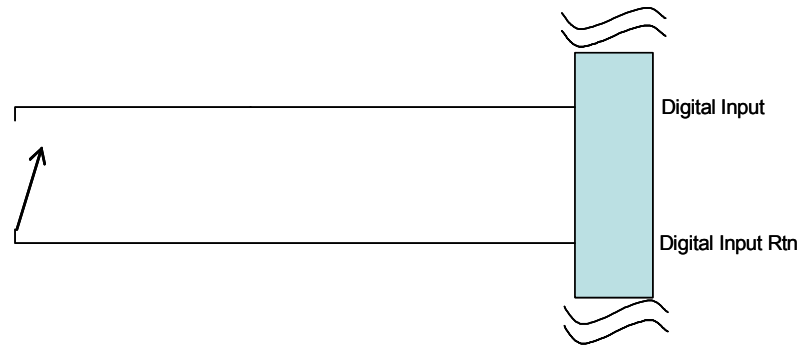
Figure 15 – Diagram for Connecting Open/Gnd Input Discrete
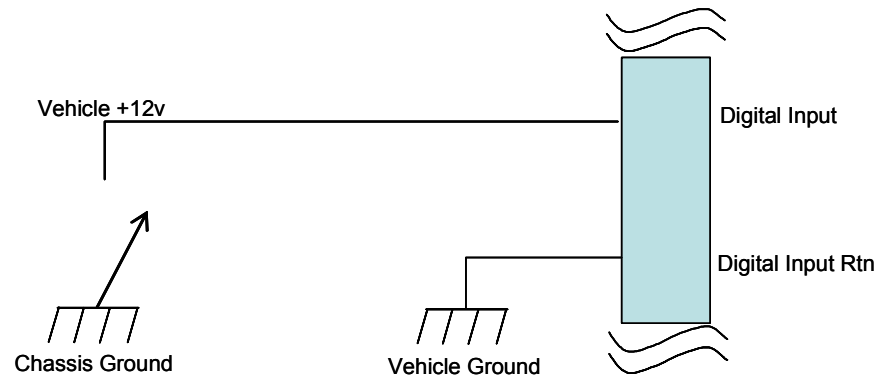
Figure 16 – Diagram for Connecting Open/Gnd Input Discrete
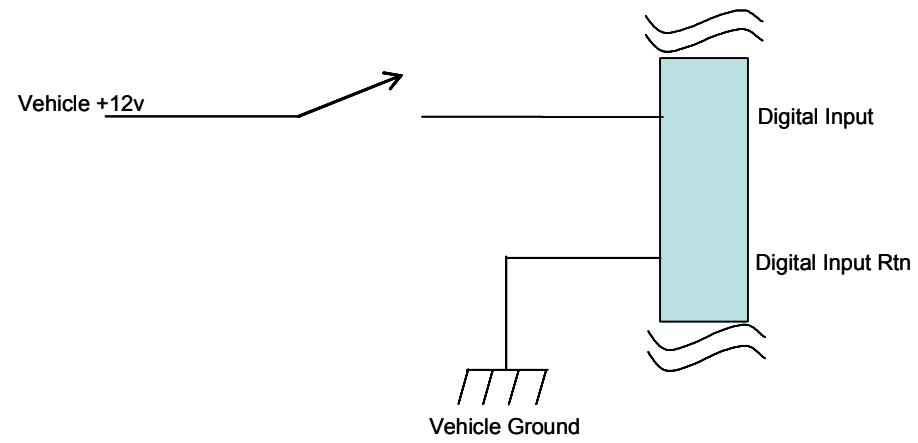
Figure 17 – Diagram for Connecting +12V/Open Input Discrete

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VERIFYING INSTALLATION

Once you have installed the modem's hardware components and connected all the power cables, you will want to power up the modem to ensure that the installation was successful. This chapter contains instructions on how to verify that the installation of the iR1600 modem was successful.

Communication Indicators

Your iR1600 modem is equipped with six (6) single color LED indicators (see Figure 18 on page 52) that identify the modem's various communication statuses and one (1) LED to indicate the status of the iDEN® network. Additionally, the iR1600 GPS-Enabled modem has three (3) LEDs and the iR1600 Rugged modem has two (2) LEDs that indicate their mode of operation.

iDEN® Network Status Indicators

These LEDs and their statuses are described in the following table.
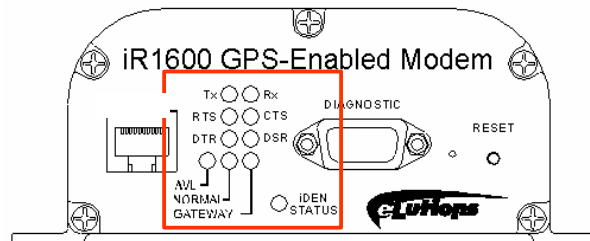
Figure 18 – LEDs on Front Panel of GPS-Enabled Modem

Color	Indication
Blinking Red	Modem is attempting to connect to the iDEN® network
Solid Red	Out-of-Range – the modem is not connected to the iDEN® network or is searching for signal within the Nextel network. If the modem status changes from blinking green back to solid red, the signal has been lost and the modem is attempting to re-acquire. **NOTE: If after a period of several minutes the status does not return to green, you may be out of range. The modem will attempt to re-acquire automatically when you are back in range.**
Blinking Green	In-Range – the modem is connected to the iDEN® network.
Solid Green	In Use – iDEN® network communications is in progress. This LED will only reflect solid green when the modem is operating in circuit switched mode.
Off	Off – vehicle ignition is off or has experienced loss of 12V input power.

The iDEN® STATUS indicators differ, depending on the type of connection the modem is operating in. The following tables describe the iDEN® STATUS indicators for the Packet Data and Circuit Switched Data connection modes.

Packet Data

Signal	Color	Indication
iDEN® STATUS	Blinking Green	In-range (modem is connected to the iDEN® network) but idle (not passing data).
iDEN® STATUS	Blinking Green	The modem is in use – IDEN® network communication is active and is passing data.

Circuit Switched Data

Signal	Color	Indication
iDEN® STATUS	Blinking Green	In-range (modem is connected to the iDEN® Network) but idle (not passing data).
iDEN® STATUS	Solid Green	The modem is in use – iDEN® network communication is active and is passing data.

Signal Status Indicators

Signal	Color	Indication
Tx	Green	Modem is transmitting data to the host system.
Tx	Off	Modem is not transmitting data.
Rx	Green	Modem is receiving data from the host system.
Rx	Off	Modem is not receiving data.
RTS	Green	Request To Send from host system has been asserted.

Signal	Color	Indication
RTS	Off	Request To Send is not asserted.
CTS	Green	Clear To Send from modem is asserted.
CTS	Off	Clear To Send is not asserted.
DTR	Green	Host system is ready.
DTR	Off	Host system is not ready.
DSR	Green	Modem is ready.
DSR	Off	Modem is not ready.

Operating Mode Indicators

Signal	Color	Indication
AVL	Solid Red	The modem is operating in AVL mode.
Normal	Solid Red	The modem is operating in Normal Mode.
Gateway	Solid Red	The modem is operating in Gateway Mode.

Note: When the modem is in diagnostic mode, all of the operating mode indicators will be off.

Verify Mobile Installation

If ignition sense is utilized, the modem will automatically power-up when the vehicle's engine is started. The following steps describe how to power up the modem for a mobile installation and verify that the modem is successfully communicating within the iDEN® network.

Power up the Modem

1. Turn on the vehicle's ignition.

2. The iDEN® STATUS LED light will initially blink Red. This indicates that the modem is searching for a signal within the iDEN® network.

   NOTE: The iDEN® Status LED should blink Green within 3 minutes from the time the vehicle's ignition was turned ON.

Verify Communications

3. A blinking Green light indicates that a signal has been found the modem has successfully connected.

Verify Fixed Installation

To turn on the iR1600 modem, an ignition signal is required at the ignition connector. The ignition/power connector provides power and an ignition signal to the modem. The following steps describe how to power up the modem for a fixed installation and verify that the modem is successfully communicating within the iDEN® network.

Power up the Modem

1. Insert the ignition/power jack into the 4-prong IGN/PWR connector located on the rear panel of the modem (refer to Figures 4 and 5 on Page 17).

2. Plug the AC power cord into a standard 2-prong polarized wall socket.

3. The iDEN® STATUS LED light will initially blink Red. This indicates that the modem is searching for a signal within the Nextel® network.

Verify Communications

4. A blinking Green light indicates that a signal has been found the modem has successfully connected.

   NOTE: The iDEN® Status LED should blink Green within 3 minutes from the time the vehicle's ignition was turned ON.

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CONFIGURING THE MODEM

⚠ !	**IMPORTANT: Once the all the hardware for the modem is successfully installed, the next step is to configure the modem. This process requires that you have knowledge of TCP/IP communication and modem operation. Please refer to the iR1600 Configuration Guide for detailed instructions on how to configure the iR1600 modem.**

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TROUBLESHOOTING

This chapter includes instructions on how to troubleshoot and resolve common installation problems.

Common Problems

The following table outlines the most common installation issues and instructions for resolution.

What's the Problem?	What it means:	How to Resolve:
Nothing happens when I power up the modem.	This indicates that there is no power being supplied to the modem.	There are several things that could be wrong. Go through this list and eliminate all the possible problems: • Is the ignition on? • Check the power supply and make sure that everything is connected properly. • Is the battery voltage at least 12 volt? • Check the cables and wiring.
The modem has power but the LED light is not blinking green.	- You may not be within coverage area. - Signal strength may be weak.	• Antenna may be loose. Check to make sure the antenna is properly connected. • Reposition antenna.
The modem doesn't appear to	This could indicate a number of things (see	• Is the data cable plugged into the diagnostic port?

What's the Problem?	What it means:	How to Resolve:
be communicating.	How to Resolve column to eliminate the possibilities).	• Is the data cable connected properly to the mobile device or computer? • Check that the iDEN status LED is blinking green. • Verify signal quality (option 3 on Diagnostic Menu). • Check that the modem has been • Verify signal strength (option 4 on Diagnostic Menu). • Check the RSSI. • Check coverage. • Move to another location to see if coverage is not affected. • Verify that the packet data has been registered (option 5 on Diagnostic Menu). • Verify that your account has been activated. Contact your technology administrator or designated field care representative. • Perform a master reset then check option R on the Diagnostic Menu and make sure that the modem is registered.
GPS does not operate.	Either: - Coverage in the area is bad. - Antenna may be improperly installed or defective.	• Verify that the antenna has direct line of sight to satellite. GPS does not operate effectively indoors. • Move to another area.

What's the Problem?	What it means:	How to Resolve:
GPS is slow.	It is normal for GPS to take up to 5 minutes to acquire the first reading.	• Wait for an appropriate amount of time for communication to take place. If attempts are taking longer than 5 minutes, contact your system administrator.
Modem will not power up or down	The wiring to the modem may not be connected properly.	• Check the ignition sense wiring to be sure that it is connected. • Verify that the diagnostic port is plugged in correctly. • Check iDEN® STATUS LED to see if the modem is communicating.

NOTE: The Status LED remains red for up to 3 minutes after power is applied to the iR1600 or immediately after the Reset button is pressed.

Connect to Diagnostic Port

The diagnostic port located on the front panel of the iR1600 modem (see Figures 2 or 3 on page 16) is used to retrieve data from the modem that will help to analyze and diagnose possible communication issues. The following steps describe how to connect to the diagnostic port:

1. Insert the 9-pin male end of a serial signal cable into the RS-232 connector labeled DIAGNOSTIC port located on the modem's front panel, and tighten the screws.

2. Connect the other end of the serial signal cable to a serial COM port on the back of your computer or mobile device and tighten the screws.
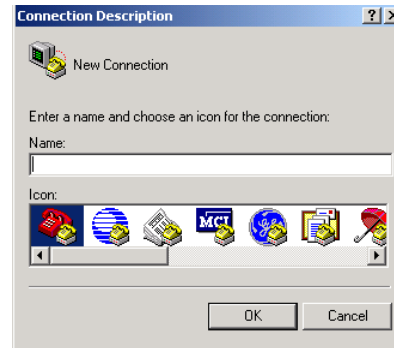
Set up HyperTerminal Session

The following steps describe how to set up a HyperTerminal session for the iR1600 modem:

1. From your computer, locate and select the HyperTerminal program.

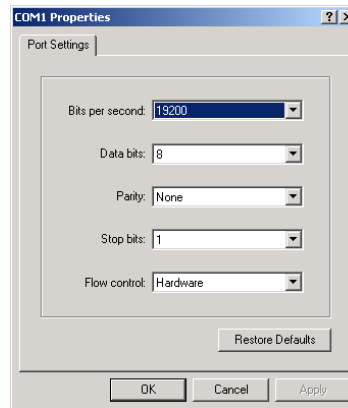**2.** The **Connection Description** screen appears.

3. Type a description of the connection in the "Name:" box (i.e. iR1600).

4. Select the dial function (red and yellow phone icon) and click **OK**.

5. The **Connect To** screen appears.

6. Select the appropriate communication port (typically COM1) from the "Connect Using:" drop-down list then Click **OK**.

7. The **COM1 Properties** screen appears.

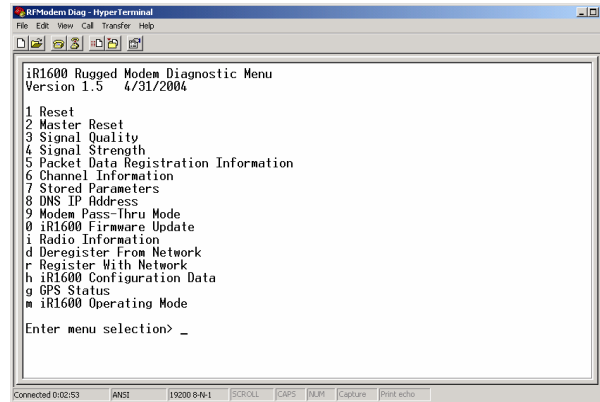**8.** Select the following parameters from each of the drop-down lists on the Port Settings tab:

- **19200** for Bits per second
- **8** for Data bits
- **NONE** for Parity
- **1** for Stop bits

9. **None or Hardware** for Flow control

10. Click **OK** when all the parameters have been selected.

11. Once the connection to the modem is successful, the **iR1600 Rugged Modem Diagnostic Menu** appears.

12. Click on **File** and **Save as**. Name this HyperTerminal Session (i.e. "iR1600 Modem Diagnostics") and save to your desktop for future use.

Modem Diagnostic Menu

The following table outlines the types of information that can be retrieved with commands on the diagnostic menu.

Command	Action	Reply
1 – Reset	This command performs a soft reset to the modem via RALP commands.	
2 – Master Reset	This command is used when certain changes are made to the firmware and the modem needs to acquire the changes.	**WARNING:** We do not recommend that you perform this command unless otherwise instructed by a Nextel Customer Care representative.
3 – Signal Quality	This determines the quality of the signal.	Signal quality can be 0 – 100.
4 – Signal Strength	This determines the signal strength of the modem.	Signal strength can be 0 – 100.

Command	Action	Reply
5 – Packet Data Registration Information	This will check for packet data registration status.	• Service type: PACKET • VALID NEI: (IP Address of the Modem) • Registration Status: REGISTERED or UNREGISTERED • MIP Registration Status: REGISTERED or UNREGISTERED
6 – Channel Information	This determines if channel data has been obtained.	• Area • RSSI • Channel • State • TX Level
7 – Stored Parameters	This provides the modem's preset parameters.	• Flow Control • Character Framing • Service Class • DTE-side Stack • WDS-side Stack • Mobile IP Activation • Mobile UP Registration Lifetime • Security Parameter Index • Home Agent IP Address • +WPNEI Prefix Length • Request Broadcast Datagrams • DCE IP Addresses • DTE IP Addresses • Data Encryption • Data Compression • Header Compression
8 – DNS IP Address	Displays the address of the Domain Name Server.	
9 – Modem Pass-Thru Mode	Allows you to issue Hayes compatible AT commands to the modem through the diagnostic port.	

Command	Action	Reply
0 – iR1600 Firmware Update	Sends updates to the firmware.	**WARNING:** We do not recommend that you perform this command unless otherwise instructed by a Nextel Customer Care representative.
i – Radio Information	Obtains information specific to the modem.	• Serial Number • IMEI • SIM ID • Software Version
d – Deregister From Network	Forces the modem to deregister from the Nextel Network.	DEREGISTERED
r – Register with Network	Forces the modem to register with the Nextel network.	REGISTERED
H – iR1600 Configuration Data	Provides the modem's build configuration information.	• Hardware Part ID • Serial number • Boot Loader • Application ID
g- GPS Status	Provides the modem's GPS information.	• UTC • Latitude • Longitude • Fixed Type • Satellites Used
m – iR1600 Operating Mode	Allows for verification and configuration of the modem's operating mode. (Refer to Configuration Guide for details of the menus and options).	• Operational Mode (Normal, Gateway, AVL) • Gateway/AVL Protocol Mode • TCP/UDP Configuration • DTE Port Configuration • PAD Configuration • AVL Configuration • Send Device ID • Remote Support Configuration • Security Configuration • BSAP Router Configuration • Ignition Shutdown Delay

Unsolicited Firmware Updates

We want to emphasize that this diagnostic option should be executed only when instructed by a Nextel® Customer Care Representative. However, there are certain sequences of events that will prompt you for a firmware update.

 IMPORTANT: The following lists the sequence of events that will cause HyperTerminal to prompt you for firmware update.

The following steps describe how an unsolicited firmware update is trigger and how to correct the problem.

1. Modem is OFF (all cables are connected except for the power connector).

2. The computer is ON and the HyperTerminal is active.

3. Modem is switched ON (power connector is inserted into the power slot).

4. HyperTerminal automatically presents the **option 0 – Update Firmware (y/n)?** prompt.
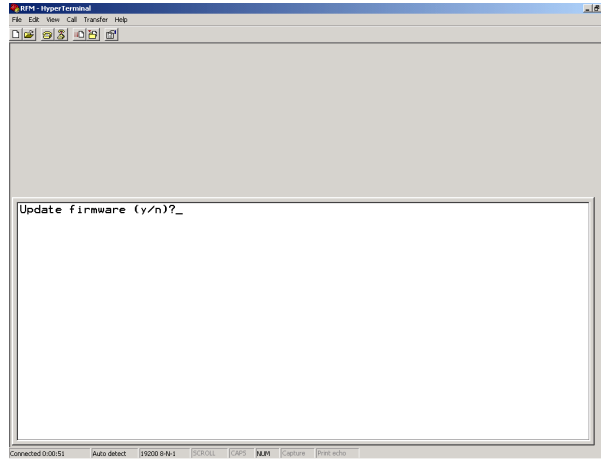
5. To safely exit out of the update firmware mode, enter "**N**" at the **Update Firmware (y/n)?** prompt. There will be about a 1-minute delay before the system returns you to the diagnostic menu. This because the modem is attempting to register with the iDEN network.

6. Once the modem has successfully registered with the network, the HyperTerminal will present you with the Diagnostic Menu.

SAFETY NOTICE

The following information is important for the safe and efficient operation of the iR1600 modem. Please read this safety notice before operating the modem.

Safe and Efficient Operation Guidelines

Your modem contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency (RF) energy. The modem operates in the frequency range of 806 MHz to 870 MHz and utilizes the digital modulation techniques. This product is authorized by FCC Rule Part 47CFR2.989 (b) which states that it should be used in such a way that it maintains a distance of at least 8 inches (20 cms) between the human body and the radio's antenna or modem. When you use your modem, the system handling your call controls the power level at which your modem transmits. The output power level typically varies from 0 mW to 700 mW.

Exposure to Radio Frequency Energy

Your modem is designed to comply with the United States Federal Communications Commission, Code of Federal Regulations; FCC part 90-sub part S, and FCC-part 15, Class B. The modem complies with FCC's national standards and guidelines regarding exposure of human beings to radio frequency electromagnetic energy.

Medical and Personal Electronic Devices

Most electronic equipment is protected from RF energy. However, certain equipment may not be shielded against RF signals being emitted from your modem.

Pacemakers

Operators should not use the modem if individuals with pacemakers are within 6 inches (0.15 meters) of the antenna.

Hearing Aids

The modem may interfere with hearing aid devices. Individuals who experience such interference should consult the hearing aid manufacturer to discuss alternative solutions.

Other Medical Devices

Individuals who have other medical devices not specifically mentioned in this safety notice should consult their physician or the manufacturer of the device to determine if it is adequately protected from external RF energy.

Interference with Other Electronic Devices

RF energy may affect improperly installed or inadequately protected electronic operating and entertainment systems in motor vehicles. Check with the manufacturer or representative to determine if these systems are adequately shielded from external RF energy. It is recommended that you also check with the manufacturer of any equipment that has been added to the vehicle.

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APPENDIX A: GLOSSARY

This glossary contains terms and definitions used within this guide. It is by no means exhaustive of terms that you may come across.

ASCII

American Standard Code for Information Interchange. A standard set of 128 characters, symbols and control codes used for computer communications. ASCII characters require 7 bits of data to send, but are often sent 8 bits at a time with the extra bit being a zero.

Asynchronous Communication

A method of sending data in which the bits can be sent at random times. Data transmission is not synchronized to a clock. With asynchronous transmission, each character is transmitted one at a time with a "start" bit at the beginning and one or more "stop" bits at the end. Any amount of time can elapse before the next character can be sent.

AT Command

An order entered into the computer to request your modem to perform certain actions, such as dial a telemodem number. AT commands are Hayes-compatible modem commands.

Baud

The signaling rate of a line, which is the number of transitions (voltage or frequency changes) that are made per second.

Baud Rate

Signaling speed of the modem. Common baud rates are 2400, 4800, 9600, 19200, and 56k.

Byte

A data unit of eight bits.

Circuit Switched Data

A networking technology that provides a temporary, but dedicated, connection between two stations no matter how many switching devices the data is routed through. Circuit Switch was originally developed for the analog-based telephone system in order to guarantee steady, consistent service for two people engaged in a phone conversation.

Command Mode

The mode that accepts AT commands. Also known as Terminal Mode. When your modem is in this mode, it is waiting to receive AT commands that you type from your communication software.

Communication Software

A computer program designed to connect your computer to an external source, such as another computer or a fax machine.

Configuration

The term configuration defines the hardware components that comprise a subsystem and system. It is a set of conditions or parameters that define the structure of an item such as the GPS processing and characteristics of the RS-232 interface ports.

Data Services

One of the functions of your iDEN modem. Data services uses both circuit-switched and packet data transmissions.

DCD

Data Carrier Detect. An acceptable carrier signal received by the modem over the modem line. Also known as Received Line Signal Indicator (RLSI).

DCE

Data Communication Equipment. The equipment that establishes, maintains, and terminates a connection. It converts data into units of sound and vice versa for communication over telemodem or cellular networks.

Default

A factory preset choice that, under normal circumstances, works best for your system. You can either accept the default or change it.

Differential Capable

A term used to describe a GPS receiver capable of receiving and applying differential GPS corrections.

Differential GPS

A procedure of correcting GPS solutions to achieve improved position accuracy. Differential GPS provides 2 to 5 meter position accuracy. Differential accuracy is obtained by applying corrections determined by the stationary Differential Reference Station to the GPS data collected by the RPU (receiver processing unit) on-board the vehicle.

DNS

Domain Name Server. This is what converts names of domains (ex. : www.nextel.com) into IP addresses (ex. : 170.206.225.22). The DNS server that you use is generally situated with your access provider.

DTE

Data Terminal Equipment. A computer or hand-held device that generates and receives data, and provides functions that control data communications through a device like the modem.

Dial Up Networking (DUN)

A component in Windows that enables you to connect your computer to a network via modem. If your computer is not connected to a LAN and you want to connect to the Internet, you need to configure Dial-Up-Networking (DUN) to dial a Point of Presence (POP) and log into your Internet Service Provider (ISP). Your ISP will need to provide certain information, such as the gateway address and your computer's IP address.

Firmware

A set of software computer/processor instructions permanently or semi-permanently resident in read-only memory.

Frequency

The number of vibrations per second of an audio or radio signal. Measured in hertz (Hz), Kilohertz (kHz), or megahertz (MHz). GPS frequencies are L1= 1575.42 MHz or L2= 1227.60 MHz.

GPS

(**G**lobal **P**ositioning **S**ystem) is a "constellation" of 24 well-spaced satellites that orbit the Earth and make it possible for people with ground receivers to pinpoint their geographic location. The location accuracy is anywhere from 100 to 10 meters for most equipment. Accuracy can be pinpointed to within one (1) meter with special military-approved equipment. The GPS is owned and operated by the U.S. Department of Defense but is available for general use around the world.

GPS Antenna

An antenna designed to receive GPS radio navigation signals.

GPS Processor

An electronic device that interprets the GPS radio navigation signals (received by the GPS antenna) and determines a location solution. The GPS processor may also be able to apply (and determine) differential GPs corrections.

GPS Receiver

The combination of GPS antenna and GPS processor.

Hand-Held Devices

Small computing appliances, such as palmtops, personal digital assistants and pen-based computers.

Hertz (Hz)

A frequency unit equal to one cycle per second.

Home Agent

The carrier or router responsible for determining the next network point to which a packet (data) should be forwarded toward its destination.

Internet

A series of interconnected local, regional, national and international networks, linked using TCP/IP. The Internet links many government, university, research and commercial sites. It provides e-mail, Web browsing and file transfer services.

Internet Service Provider (ISP)

Provides your computer with Internet access. Also known as Service Provider.

Intranet

A network based on TCP/IP protocols (an internet) belonging to an organization, usually a corporation, accessible only by the organization's members, employees or others with authorization. An Intranet's Web sites look and act just like any other Web sites, but the firewall surrounding an intranet fends off unauthorized access.

Kbps

Kilobits per second. Generally represented at 1000 bits per second.

Laptops

Portable computers, such as notebooks and sub-notebooks.

Local Area Network (LAN)

A computer network that spans over a relatively small area. Most LANs are confined to a single building or group of buildings.

Mobile IP

An IP enhancement that provides forwarding of traffic to moving users. It uses agents in the user's home network and in all foreign networks. When logging on to a remote network, users register their presence with the foreign agent, and the home agent forwards the packets to the remote network. Mobile IP permits mobile devices to inform a "visited" network that it is present and then arrange to have its home network forward data to it automatically.

Modem

An electronic device enabling digital data to be sent over analog transmission facilities. Converts a digital signal to analog and back to digital again. Modem stands for Modulator/De-Modulator.

NMEA

National Marine Electronics Association. An association that defines marine electronic interface standards for the purpose of serving the public interest.

Non-Routable IP

A communications protocol that contains only a device address and not a network address. It does not incorporate an addressing scheme for sending data from one network to another. Examples of non-routable protocols are NetBIOS and DEC's LAT protocols. Also some TCP'IP addresses are considered non-routable.

Non-Volatile Memory

Memory that holds its content without power. Permanently stored information that is not lost when you power off. ROMs, PROMs, EPROMs and flash memory are examples.

Packet of Data

A bundle or block of data, organized in a specific way for transmission.

Parallel Port

A low speed port, usually located on the rear of a computer which usually connects to printers. Parallel ports transmit data simultaneously over eight "parallel wires" one byte at a time (as opposed to a serial port, which transmits data one bit at a time).

Parity Bit

Parity is a process for detecting whether bits of data have been altered during transmission. A Parity Bit is a non-data bit that is added to a group of data bits to check for transmission errors. Parity Bits are used in Parity checking which is an error-checking method in asynchronous transmission. The parity bit tells the receiving end of a transmission whether there should be an even or odd number of bits contained in that transmission.

PIN

Personal Identification Number.

PING

(Packet INternet Groper) An Internet utility used to determine whether a particular IP address is online. It is used to test and debug a network by sending out a packet and waiting for a response. A program used to test whether or not a network component is available.

PPP

(Point-to-Point Protocol) The most common method for connecting to the Internet. PPP provides serial line (dial-up) connectivity, authentication, compression and encryption between two computers and can handle several protocols simultaneously.

Protocol

Hardware and software standards that govern transmission between two communications devices. There are several layers, or levels, of functionality in a protocol. Each layer may be available, as a separate software component, or several layers may be combined into one.

Public IP Address

See Routable IP Address.

RAM

Random Access Memory is the working memory of the computer where you can enter information and call up data.

Routable IP Address (Public IP Address)

A communications protocol that contains a network address as well as a device address, allowing data to be routed from one network to another. Examples of routable protocols are SNA, OSI, TCP/IP, XNS, IPX, AppleTalk and DECnet.

RS-232

A communication standard for digital data. Specifies a number of signal and control lines. RS-232 is often associated with a 25-pin connector called DB-25.

Serial Port

An input/output (I/O) port transmits data one bit at a time, as opposed to a parallel port that transmits multiple (usually eight) bits simultaneously. RS232C is a common serial interface standard.

Service Specific Software

A program designed for a designated online service such as AOL.

Start Bit

A data bit used in asynchronous transmission to signal the beginning of the character.

Stop Bit

A data bit used in asynchronous transmission to signal the end of the character.

System Administrator

The person responsible for monitoring computer activity in a specified area, such as a company.

Synchronous Communication

A method of sending digital data in which the bits come at fixed, rather than random, times and are synchronized to a clock.

TCP/IP (Transmission Control Protocol/Internet Protocol)

The two best-know Internet protocols, often erroneously thought of as one protocol. TCP enables two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and guarantees that packets will be delivered in the same order in which they were sent. IP acts as a postal system, allowing you to address a package and drop it in the system, but doesn't provide a direct link between you and the recipient. TCP/IP, on the other hand, establishes a connection between two hosts so that they can send messages back and forth for a period of time.

Terminal Mode

The mode that accepts AT commands. Also known as Command Mode. When your modem is in this mode, it is waiting to receive AT commands that you type from your communications software.

Transmission Rate

The rate at which data is transferred measured in bits per second. Common transfer rates are 9.6bps / 19200bps / 57600bps / 115200bps

UTC

Universal Time Coordinated. Uniform atomic time system/standard that is maintained by the US Naval Observatory. UTC defines the local solar mean time at the Greenwich Meridian.

UTC Offset

The difference between local time and UTC (Example: UTC – EST = 5 hours).

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