1.0 INTRODUCTION

This guide provides installation instructions for MDS iNET Series transceivers (Figure 1). It covers both MDS iNET-II and iNET models. **For detailed product information, refer to the *Reference Manual*, part no. 05-2806A01. It contains important notices on the safe and effective use of this product and should be reviewed prior to any operation.**

Electronic copies of all GE MDS manuals are available free of charge at www.gemds.com.

Figure 1. MDS iNET Series Transceiver

2.0 PRODUCT DESCRIPTION

MDS iNET transceivers provide wireless connectivity for local area networks (LANs) with easily installed hardware. The units come in two primary models—**Access Point (AP)** and **Remote**.

An AP is a wireless "hub" that normally provides connectivity into a wired Ethernet LAN/WAN. It serves as the network's "master station" providing synchronization data to all associated Remotes within the network.

Three types of Remotes are available—the Ethernet Bridge, the Serial Gateway, and the Dual Gateway which supports both IP/Ethernet and serial services. Table 1 summarizes the different interface abilities for each AP and Remote radio type.

Table 1. Tranceiver Models & Interfaces

Model	Type	LAN[1]	COM1[1]	COM2
Access Point[2]	N/A	Yes	Yes	Yes
Remote…	Ethernet Bridge[3, 4]	Yes	No	No
	Serial Gateway[3, 4]	No	Yes	Yes
	Dual Gateway[3]	Yes	Yes	Yes

NOTES
1. Provides PC access to the Menu System on all units.
2. Can be configured as an Access Point or Dual Gateway.
3. An Ethernet Bridge can be configured as a Serial Gateway and vice versa.
4. Can be upgraded to Dual Gateway with an Authorization Key.

A given transceiver may be configured to operate as an Access Point or a Remote with certain restrictions. The following rules apply to unit configuration:

1. A Serial or Ethernet Remote can be changed from one to the other without an Authorization code.

2. If both the Serial and Ethernet Authorization Codes are entered, the Remote becomes a Dual Gateway. Each code is associated with the serial number of a particular radio.

3. A Dual Gateway Remote can be reconfigured as an Access Point. by entering an Access Point Authorization Code from the Factory.

4. An Access Point can be reconfigured as a Dual Gateway by changing the device mode in the management interfaces.

2.0.1 Differences Between iNET-II and iNET

The iNET-II and iNET Transceivers, while similar in many respects, do have important differences and are *not* over-the-air compatible. Key differences are summarized in the table below:

Table 2. Transceiver Differences (iNET-II vs. iNET)

Characteristic	iNET-II	iNET
Data Rate	512 kbps/1 Mbps	256/512 kbps
FCC Certification Type	DTS	FHSS
Encryption	AES-128	RC4-128
Channel size	600 kHz	316.5 kHz
Channel operation	Channels	Zones
Firmware	Specific for iNET-II	Specific for iNET

2.1 SECURITY FEATURES

The transceiver is capable of dealing with many common security issues. Table 3 profiles security risks and how the transceiver provides a solution for minimizing vulnerability. In all cases, the **Security Configuration** Menu should be reviewed and set to the required parameters for your environment. Consult with your network administrator if you are unsure of the required settings.

Table 3. Cyber Security Highlights

Security Level	Specification
• MDS Cyber Security Suite, Level 4	• AES-128 encryption (iNET-II only) • 802.1Q VLAN • Includes Level 3 features listed below
• MDS Cyber Security Suite, Level 3	• RC4-128 encryption (iNET only) • Automatic rotating key algorithm • Authentication: 802.1x, RADIUS, EAP/TLS, (PKI is a requirement of the TLS), PAP, CHAP. • Local Device authentication using MAC address "white lists" on the AP and Remote • Management: SSL, SSH, HTTPS • Failed login lockdown • 900 MHz operation and proprietary data framing

3.0 INSTALLATION

3.0.1 General Requirements

There are three main requirements for installing the transceiver:

1. Adequate and stable primary power
2. A good antenna system
3. The correct interface between the transceiver and connected equipment

Figure 2 shows a typical installation for a Remote site. AP sites are similar, but typically use an omnidirectional antenna to allow for communication with widely distributed Remote stations.

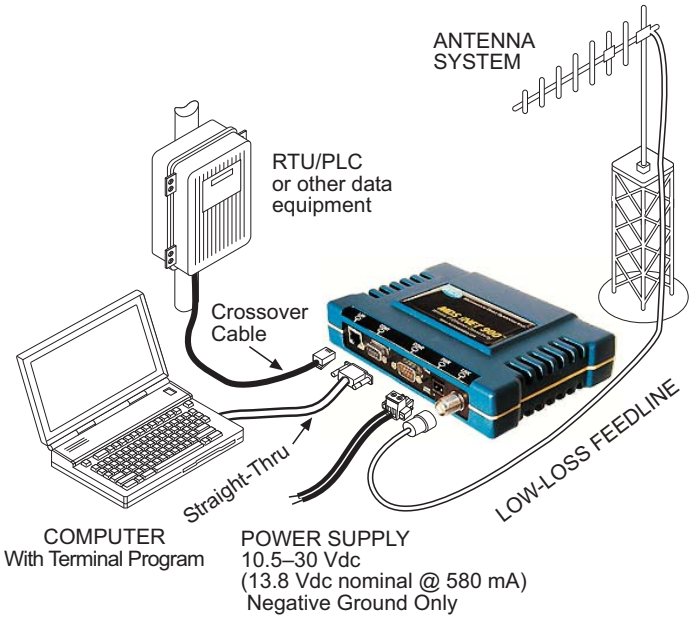

Figure 2. Typical Transceiver Installation
(COM2 port can also be used in serial applications)

3.1 STEP-BY-STEP INSTRUCTIONS

It is recommended that the Access Point radio be installed first. In this way, the operation of each associated Remote can be checked as it is placed on the air.

NOTE: Transceivers are shipped from the factory set to the "Remote" mode unless marked differently.

3.1.1 Step 1—Mount the Transceiver

NOTE: To prevent moisture from entering the radio, it should **not** be mounted with the connectors pointing up. Also, cables should be routed in a manner that prevents moisture from running along their surfaces and into the radio.

Attach the mounting brackets to the bottom of the radio with the screws provided. Mount the radio to a stable surface with appropriate fasteners (not supplied). Figure 3 shows the mounting dimensions of the radio.

CAUTION
POSSIBLE EQUIPMENT DAMAGE

The screws holding the mounting brackets to the radio are SAE 6-32 and must not extend farther than 1/4 inch (6 mm) into the case or internal damage may result.

The radio chassis should be bonded to a common station ground. If the mounting surface is not grounded, a ground wire may be attached to one of the screws on the radio's enclosure.

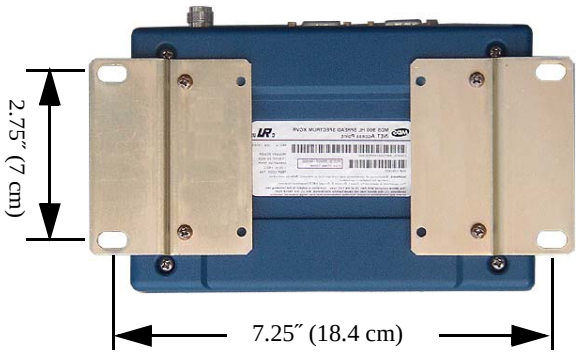

Figure 3. Transceiver Mounting Dimensions

3.1.2 Step 2—Install the Antenna

The antenna should be mounted in the clear, with an unobstructed path to all associated stations. To minimize RF interference, it should be mounted at least nine inches (> 23 cm) from connected device(s), sensors and other components of the system. The use of low loss, high quality coaxial cable is recommended, and it should be kept as short as possible to minimize loss.

3.1.3 Step 3—Measure & Connect Primary Power

The primary power at the power connector must be within 10.5–30 Vdc and be capable of continuously providing up to 580 mA of current. A power connector with screw-terminals is provided with each unit. Strip the wire leads to 6 mm (0.25") before inserting them in the connector. Be sure to observe proper polarity as shown in Figure 4 with the positive lead (**+**) on the left side.

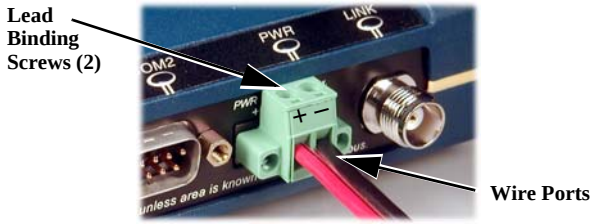

Figure 4. Power Connector
(Polarity: Left +, Right –)

CAUTION
POSSIBLE EQUIPMENT DAMAGE

The transceiver is designed for use in negative-ground power systems.

The power supply used with the transceiver should be equipped with overload protection (NEC Class 2 rating), to protect against a short circuit between its output terminals and the unit's power connector.

3.1.4 Step 4—Connect the Required Data Port(s)

The ports used will differ depending on the application for the radio. Figure 5 shows connection information for each port.

LAN
- 10BaseT
- IP/Ethernet Port
- IP Address: 192.168.1.1

COM1
- DCE Console/Terminal
- 19,200 bps/8N1
- No Handshaking
- RS/EIA-232
- Straight-through to PC

COM2
- DTE Serial Data Equip.
- 9,600 bps/8N1
- Full Handshaking
- RS/EIA-232
- Crossover to PLC/RTU

PRIMARY POWER
- 10.5–30 Vdc
- Negative Ground
- + Left – Right

ANTENNA
- 50 Ohm Impedance
- TNC connector
- +30 dBm/1W Out (Max.)
- –30 dBm Input (Max.)

LAN: ETHERNET (12345678)

Pin Functions
1.....Transmit Data (TX)
2.....Transmit Data (TX)
3.....Receive Data (RX)
4.....Unused
5.....Unused
6.....Receive Data (RX)
7.....Unused
8.....Unused

10BaseT Supported

COM1: DB-9 M / DCE (5 1 / 9 6)

Pin Functions
1.....Unused
2.....Receive Data (RXD)
3.....Transmit Data (TXD)
4.....Unused
5.....Signal Ground (GND)
6.....Unused
7.....Unused
8.....Unused
9.....Unused

RS/EIA -232

COM2: DB-9F / DTE (1 5 / 6 9)

Pin Functions
1.....Data Carrier Detect (DCD)
2.....Receive Data (RXD)
3.....Transmit Data (TXD)
4.....Data Terminal Ready (DTR)
5.....Signal Ground (GND)
6.....Data Set Ready (DSR)
7.....Request-to-Send (RTS)
8.....Clear-to-Send (CTS)
9.....Unused

RS/EIA-232

Figure 5. Port Information
(All pinouts as viewed from outside the radio)

4.0 INITIAL CONFIGURATION

4.0.1 PC Connection and Login

Initial radio configuration is performed by connecting a computer to the unit's COM1 port via a serial connection. The LAN port may also be used if the IP address of the unit is known (default is 192.168.1.1). (If not, begin with connection to the COM1 port as described here. Refer to the Reference Manual for details.)

Perform the steps below to connect to the radio and access the built-in menu system. It is recommended that the Access Point be configured first, followed by each Remote unit.

a. Connect a computer's serial communications port to the radio's COM1 Port.

NOTE: Not all PCs have a serial port. If one is not available, it will be necessary to use a USB port with a USB-to-Serial adapter.

b. Launch a terminal emulator program, such as HyperTerminal, on the computer. Configure the terminal settings to: 19,200 bps/8N1/no handshaking/VT100.

c. Press the **ENTER** key a few times to receive the login prompt (**password:**). Enter the password (default password: **admin**).

d. The radio's menu system appears. The menu may now be used to set key parameters of the radio.

Review the menu for appropriate selections and change settings as required. Key considerations include Device Mode, Network Name, IP Address, RF Output Power, Data Rate, and unit password. Security options should also be reviewed and set as required. Additional detail on key menu settings is provided below.

NOTE: When configuring a large number of radios, the use of "Configuration Files" is recommended. See the *Reference Manual* for details.

4.0.2 Key Menu Settings

The settings listed below must be known/set before placing the unit into service:

- **Device Mode**—Access Point or Remote (default=**Remote**).
- **Network Name—**Common identifier used by all units that are part of the same network. The Network Name must be set to enable Remote units to associate with the Access Point.
- **IP Address**—Must be a unique address to allow for IP access through the LAN port or over-the-air. (Default is **192.168.1.1**)

Other parameters commonly needing review or adjustment are:

- **RF Output Power** —Check and adjust as necessary to comply with regulatory requirements. In general, the lowest power necessary for reliable communications should be be used. (Defaults: iNET=+**30 dBm**, iNET-II=**+30 dBm**.)
- **Data Rate**—Defaults to **256 kbps** (iNET) or **512 kbps** (iNET-II). **AUTO** allows for maximum data rate for the current signal level. (The stronger the signal, the higher the data rate.) iNET-II data rates are 512 kbps or 1 Mbps; iNET rates are 256 kbps or 512 kbps.
- **Password**—Used for remote access to the menu system.

NOTES: The default unit password is **admin**. For web access, a username is also required. The default username is **iNET** or **iNET-II** in accordance with the radio model being used.

A unique IP address and subnet are required to access the Menu System, either through the LAN port, or remotely over-the-air.

4.0.3 Menu Reset to Factory Defaults

This procedure may be useful when several menu parameters have been changed, and there is no track of changes. It causes the transceiver to return to a known-operational state. It should be used with care, as *all* parameters will be reset to default settings.

To reset all menu parameters back to the factory defaults, including the password, select **Reset to Factory Defaults** from the Maintenance/Tools Menu.

Forgotten Password?

If a password has been forgotten, a special Authorization Code from the factory can be entered in place of the password at the time of login. As with the method above, this resets *all* parameters to factory defaults.

5.0 CONNECTING DATA EQUIP.

The transceiver is designed to connect to both Ethernet and serial-based data equipment. This section outlines connection requirements and menu settings for proper operation.

Ethernet Example: Connect Ethernet-compatible data equipment to the unit's LAN port (10BaseT). Use a *straight-through* Ethernet cable to connect the LAN port to a hub, or a *crossover* cable if the unit is connected to another Ethernet host device (PLC, Computer, etc) that does not have auto-MDIX capability.

IP-to-Serial Example: From the PC, establish a TCP connection to the IP address of the iNET unit to which the serial device is connected. A Telnet client application can be used to establish this connection. Data may now be sent between the PC and the RTU or other connected device. Configure the port as shown in Table 4.

Table 4. Serial Port Configuration
(IP-to-Serial Connection)

Transceiver Type	Menu Item	Setting
AP or Remote, except for Ethernet Remote, which cannot be configured in this way.	IP Address	192.168.0.2 (Example)
	Status	Enabled
	IP Protocol	TCP
	Baud Rate	9,600 (Example)
	Flow Control	None
	Local IP Port	30011

5.0.1 Operational Check

This step verifies wireless communication between an Access Point and its associated Remotes.

NOTE: 30 seconds is typically required for the transceiver to power up, and 20 seconds to associate with another unit.

At All Units...

Observe the transceiver's LED panel for proper indications. In a normally operating system, the radio will typically associate in less than one minute from start-up. After association, the following LED indications should be seen:

PWR— Lit continuously
LAN— On or flashing intermittently with LAN traffic
LINK (RM)— On when connected with an AP.
LINK (AP)— Radio is Operational
COM1/COM2—Flashing with serial traffic

At the Access Point...

a. If the Access Point unit is the first unit you are installing, send a **PING** command to it through the LAN port. This verifies basic LAN connectivity with the host.

b. If a Remote has been installed, send a **PING** command to it to verify connectivity. If unsuccessful, check for proper Remote configuration and association with the AP.

At Remote Units...

a. Look for the LINK LED to light and stay on. This indicates the unit has successfully associated with the AP.

b. Check the **Starting Information** screen for the **Device Status**. It will show one of the following conditions:

Scanning—The unit is looking for an Access Point beacon signal.

Exp(ecting) Sync(hronization)—The unit has found a valid beacon signal for its network.

Hop Sync—The unit is changing its frequency hopping pattern to match that of the Access Point.

Connected —The unit has a radio (RF) link with the Access Point, but has not obtained cyber-security clearance to pass data.

Associated —This unit has successfully synchronized and associated with an Access Point. This is the normal status.

Alarmed—The unit has detected one or more alarms that have not been cleared.See the *Reference Manual* for alarm descriptions.

c. When the network is operating properly based on observation of the LEDs, connect a computer to the transceiver's data port that will be used by the local terminal equipment. Send the **PING** command to verify the communications link integrity with the Access Point.

d. After the **PING** command is successful, connect the terminal equipment to the radio's data port and verify normal operation.

If all checks are OK, you are finished with the installation.

6.0 OPTIMIZING PERFORMANCE

Once the basic operation of the network has been verified, performance can often be optimized using the suggestions below. The effectiveness of these techniques will vary with the amount of data being handled.

Optimize Received Signal Strength

At Remotes, check the received signal strength indicator (RSSI) of the AP using the menu system. In the absence of interference, signal levels sufficient to provide reliable operation (with a nominal 15 dB fade margin) are: ≥ –84 dBm @ 256 kbps, ≥ –75 dBm @ 512 kbps ≥ –65 dBm @ 1 Mbps. If the signal levels are weaker than these levels, repositioning of the station antenna may be required. Follow the steps below to do this.

1. Verify the Remote is associated with an Access Point unit by observing the LINK LED. It should be solid.
2. View and record the Wireless Packets Dropped and Received Error rates. This information will be used later.

   Main Menu>Performance Information>Packet Statistics>Wireless Packet Statistics

3. Read the RSSI level at the Remote.

   Main Menu>Performance Information>RSSI by Zone

4. Optimize RSSI by *slowly* adjusting the direction of the antenna. Watch the RSSI indication for several seconds after each adjustment to ensure the RSSI accurately reflects any change in the link signal strength. The less negative the number, the stronger the radio signal.
5. View the *Wireless Packets Dropped* and *Received Error* rates at the point of maximum RSSI level. They should be the same or lower than the previous reading.

   Main Menu>Performance Information>Packet Statistics>Wireless Packet Statistics

   If the RSSI peak results in an increase in the Packets Dropped and Received Error, the antenna may be aimed at an undesired signal. Try a different antenna orientation.

Minimize Packet Retries

If the Wireless Packet Statistics retry counter is unacceptably high, several techniques can be used to improve it. These include identifying interference and taking corrective actions such as skipping some radio frequencies from the hopping pattern, increasing the gain of the Remote's antenna, relocating the Remote's antenna, or installing a repeater station.

Blocking Zones with Interference (iNET)

The transceiver uses channels in the 902–928 MHz spectrum, with selectable hopping of up to 80 channels. You may block up to three zones within the frequency channel map to avoid interference. This selection is available on units that have been properly provisioned using the **Channel Config(uration)** submenu. See *Usage Key for the Channel Configuration Menu* below.

Selecting Channels (iNET-II)

The iNET-II operates only in the **CHANNELS** mode, with selectable hopping from 1 to 75 channels. This selection is available on units that have been properly provisioned using the **Channel Config(uration)** submenu.

Usage key for the Channel Configuration Menu

blank = Radio channel is not used
y (yes) = Radio channel is used
NA (not available) = Radio channel is not available

Other selections on the Channel Configuration Menu:

- **Clear All**—Clears all entries in the Channel Configuration Menu, resetting the available channels to **no usage**. Channels that are not available will appear with a notation of **NA**. These channels are not available because of pre-existing conditions, and are not user-configurable.
- **Enter Channels**—Allows selection of the channels used for frequency hopping operation. The selection of particular channels will result in an indication of **y**. Be aware that these channels do not become active until the **Commit Changes** selection is invoked. Channels can be entered by numbers (1, 2, 3, etc.), ranges (1-3, or the text **all**, **odd**, or **even**.
- **Commit Changes**—Loads active channels into the freq. list.

7.0 TECHNICAL ASSISTANCE

Troubleshooting should begin at the Access Point, as the rest of the system depends on it for synchronization & configuration.

When difficulty is experienced, check that all units in the network meet these basic requirements:

- Adequate and stable primary power
- An efficient and properly aligned antenna system
- Secure connections (RF, data & power)
- Proper configuration of the unit's operating parameters, especially Device Mode selection (Access Point/Remote), Network Name, and IP Address
- The correct interface between the radio and the connected data equipment (proper cable wiring, data format and timing)

Refer to the *Reference Manual* for additional troubleshooting information, including a chart of common difficulties. If a problem persists, factory technical assistance is available by contacting GE MDS during business hours (8:30 AM to 6:00 PM Eastern Time). Use one of the following methods to contact Tech Services:

Telephone: (585) 241-5510 FAX: (585) 242-9620
E-mail: gemds.techsupport@ge.com
Web: www.gemds.com

Document revision date: October 2014