MDS iNET 900™

Wireless IP/Ethernet Transceiver

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MDS
Microwave Data Systems Inc.

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Operational Safety Notices

RF Exposure

The radio equipment described in this guide emits radio frequency energy. Although the power level is low, the concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come closer than two meters (6 feet) to the antenna when the transmitter is operating.

This manual is intended to guide a professional installer in installing, operating and performing basic system maintenance on the described equipment.

FM/UL/CSA Notice
MDS iNet 900 When Approved

This product is available for use in Class I, Division 2, Groups A, B, C & D Hazardous Locations. Such locations are defined in Article 500 of the National Fire Protection Association (NFPA) publication NFPA 70, otherwise known as the National Electrical Code.

The transceiver has been recognized for use in these hazardous locations by three independent agencies —Underwriters Laboratories (UL), Factory Mutual Research Corporation (FMRC) and the Canadian Standards Association (CSA). The UL certification for the transceiver is as a Recognized Component for use in these hazardous locations, in accordance with UL Standard 1604. The FMRC Approval is in accordance with FMRC Standard 3611. The CSA Certification is in accordance with CSA STD C22.2 No. 213-M1987.

FM/UL/CSA Conditions of Approval
MDS iNet 900 When Approved

The transceiver is not acceptable as a stand-alone unit for use in the hazardous locations described above. It must either be mounted within another piece of equipment which is certified for hazardous locations, or installed within guidelines, or conditions of approval, as set forth by the approving agencies. These conditions of approval are as follows:

1. The transceiver must be mounted within a separate enclosure which is suitable for the intended application.

2. The antenna feedline, DC power cable and interface cable must be routed through conduit in accordance with the National Electrical Code.

3. Installation, operation and maintenance of the transceiver should be in accordance with the transceiver's installation manual, and the National Electrical Code.

4. Tampering or replacement with non-factory components may adversely affect the safe use of the transceiver in hazardous locations, and may void the approval.

⚠ WARNING

**EXPLOSION
HAZARD!**

Do not disconnect equipment unless power has been switched off or the area is know to be non-hazardous.

Refer to Articles 500 through 502 of the National Electrical Code (NFPA 70) for further information on hazardous locations and approved Division 2 wiring methods. [1]z?

FCC Notice, U.S.A.
MDS i Net 900 When Approved

The MDS iNet 900 transceivers comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device is specifically designed to be used under Section 15.247 of the FCC Rules and Regulations. Any unauthorized modification or changes to this device without the express approval of Microwave Data Systems may void the user's authority to operate this device.

Furthermore, this device is indented to be used only when installed in accordance with the instructions outlined in this manual. Failure to comply with these instructions may also void the user's authority to operate this device.

FCC Information

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

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1. This seem like this note should be a DANGER classification if there is a potential for an explosion. Please verify.

ABOUT THIS MANUAL

This guide presents installation and initial operating instructions for the MDS *iNET* 900™ transceiver. Following installation, we suggest keeping this guide near the equipment for future reference.

The scope of this manual is limited to the safe and effective installation of the unit in typical office or non-hazardous industrial settings. Users who require optimization of the equipment's capabilities and operating range should read the *MDS iNET 900 Network Administrator's Manual*, P/N 05-xxxxA01. This manual provides more in-depth information on antenna selection and optimization, and extensive coverage on user-controllable parameters and diagnostic tools.

Many of the essential installation information is contained on the *Installation Reference Chart* found at the center of this manual.

PRODUCT DESCRIPTION

The MDS *iNET* 900 transceiver (shown on the cover) is a data radio transceiver designed for to support wireless data networks.

The MDS *iNET* 900 transceiver is designed to provide network managers with a easy-to-install wireless local area network (LAN) services with plug-and-play hardware. The unit can be reconfigured for any one of three standard operating arrangements; some require the use of electronic keys (alphanumeric code) purchased from MDS. The model descriptions reflect their operating mode capabilities. The core data interface services are 1. Ethernet, 2. Serial, and 3. Serial and Ethernet. (See Table 1 on page 5 for a summary of core interface services.)

Three model configurations are available; they are:

1. Ethernet Bridge—Supports Ethernet traffic only

2. Serial gateway—Supports serial traffic only
    (Encrypted over IP protocol)

3. Access Point/Dual Gateway—Supports Ethernet and serial data
    simultaneously

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Table 1. *i*NET 900 Models and Data Interface Services

Model	Oper. Mode	LAN Data (IP/Ethernet)	COM1 Data	COM1 MGT Sys. Access	COM2 Data
Ethernet Bridge[1]	Remote Gateway	Yes	No	Yes	No
Serial[1]	Remote Gateway	No	Yes	Yes	Yes
Dual Gateway[2]	Remote Gateway & Access Point	Yes	Yes	Yes	Yes

NOTES
1. Firmware key required to convert to alternate operating modes: Remote Serial/LAN Gateway, Ethernet Bridge, or Access Point Operation.
2. Default: Remote Serial/LAN Gateway. Able to be converted to Access Point without firmware key

The MDS *iNET* 900 transceivers serve as either an "Access Point" or "Remote Gateway". An Access Point is a wireless hub that provides connectivity into a wired Ethernet LAN/WAN. From a radio perspective, an Access Point also serves as the radio network's "master station" providing synchronization signaling for associated *iNET* 900 Remote Gateway radios.

INSTALLATION PLANNING

This section provides tips for selecting an appropriate site, choosing an antenna system, and reducing the chance of harmful interference.

General Requirements

There are three main requirements for installing the radio—adequate and stable primary power, a good antenna system, and the correct interface between the transceiver and the data device. The center *Installation Reference Chart* shows a typical Remote Gateway installation.

Access Point stations are similar, but typically they use an omni-directional antenna and a Local-Area Network (LAN) or a Wide-Area Network connected to the LAN port. The Access Point iNET radio provides a connection to the wired network for devices attached to the Remote Gateways.

Antennas are a vital link in the system; they must be chosen and installed correctly. The *MDS iNET 900 Network Manager's Manual* provides details on choosing a site and making antenna selections

INSTALLATION

A typical transceiver product shipment consists of an iNET 900 transceiver and a manual. Check the contents against the packing list attached to the outside of the shipping box.

Below are the basic steps for installing a *i*NET 900 transceiver. Should further information be required, see "IN CASE OF DIFFICULTY..." on page 14 of this manual for information on contacting the factory. You will also find support information at the Microwave Data System Web site at www.MicrowaveData.com on the Internet.

NOTE: It is recommended that the Access Point station be installed *first.* In this way, it will be possible to quickly check the operation of each associated Remote Gateway unit as it is placed on the air.

> **MDS *iNET* 900 transceivers are shipped from the factory set to the "Remote Gateway" mode unless they are marked differently.**

Step 1—Mount the Transceiver

Mount the transceiver to a stable surface. (Fasteners/anchors/screws are not supplied unless specified when the order.) Four threaded holes are located on the bottom of the radio that are suitable for connecting mounting hardware. Use 6-32 x 1/4 inch screws to attach mounting hardware to the bottom of the radio.

Screws used to hold the mounting brackets to the radio should be 5⁄16 inch (8 mm) long or shorter to prevent damage to the radio's internal PC board. If these screws are replaced for any reason, the new screws must not exceed this length. The radio's case is made of a durable cast-aluminum, however, the use of the wrong sized screws can damage the screw sockets on the cover.

CAUTION
POSSIBLE
EQUIPMENT
DAMAGE

Step 2—Install the Antenna

The antenna and *i*NET 900 unit should be mounted with the antenna a minimum of six inches (15 cm) from other equipment, especially metallic objects.

NOTE: Radio frequency energy generated by the *i*NET 900 can interfere with the operation of nearby low-level RTU circuits and change the reported values of the data being monitored. For this reason, the antenna should be mounted at least 10 feet (>3 meters) from the RTU, sensors and other components of the system.

General information on the selection and installation of antenna systems is provided in the *MDS iNET 900 Network Manager's Manual*.

Step 3—Measure & Install Primary Power

The primary power at the transceiver's power connector must be within 10.5–30 Vdc and be capable of continuously furnishing up to 500 mA. The optimum voltage is 13.8 Vdc. Be sure to observe proper polarity as shown in Figure 1. A power connector is provided with each radio suitable for use with pigtail leads.
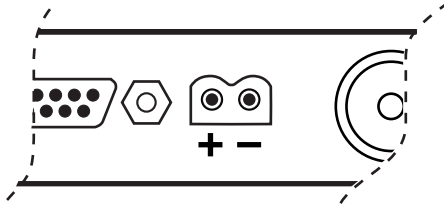

Figure 1. Primary Power (DC) Polarity

The radio is designed to be used only in negative-ground systems. Make sure the polarity of the power source is correct. Reverse polarity will damage the *iNET* 900's circuitry and will result in permanent damage to the unit.

CAUTION
POSSIBLE
EQUIPMENT
DAMAGE

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 transceiver power connector.

Step 4—Review the Radio's Configuration

There are two essential settings for *i*NET 900 transceivers that should be known before placing the radio into service. They are:

Radio Operating Mode—Access Point or Remote Gateway

Network Name—Unique name of the radio network that is used to generate the hopping pattern.

NOTE: Transceivers are normally shipped from the factory configured as a Remote Gateway.

Unit IP Address—Must be a unique number to allow for IP access through the Ethernet Port.

Transmitter Power Output Level—Default is 1 Watt. Adjust as necessary for compliance with FCC guidelines.

NOTE: A unique IP address is important if the radio's LAN (Ethernet) port will be used for IP-based data communications or for unit configuration.

NOTE: The COM1 port's only function is to provide access to the iNET 900's management system. COM2 is not functional at this time.

The following is a summary of the installation procedure. For more detailed instructions on using the menu-based COM1 and the HTTP/Bowser interfaces, please read the *MDS iNET 900 Network Administrator's Handbook*.

Procedure

a. Connect a personal computer's serial communications port (COM1 or COM2) to the COM1 Port connector on the radio transceiver. (See the I*nstallation Reference Chart* for location. Data defaults: 19,200 kbs/8N1.)

b. Launch a terminal emulator program, such as HyperTerminal, on the computer.

c. Depress the **ENTER** key. The radio will respond with the start-up screen of a text-based Management System.

d. A login with password will be required to make any changes to the radio. (Default = **admin**)

e. Select the desired options to review existing settings and to initiate necessary changes such as the IP address and other network parameters. Changes are saved in the unit's flash memory.

f. Repeat the above steps for each transceiver in the network.

Basic *i*NET Unit Parameter Defaults

The table on the center *Installation Reference Chart* provides a summary of basic operating parameter's range of and default values. All of these are available through the *i*NET's Management System accessible through a terminal emulator connected to the COM1 port.

Step 5—Connect the Data Equipment

Connect Ethernet/IP-compatible equipment data equipment to the transceiver's LAN port. The port supports only 10BaseT.

Use only the required pins for the application—do not connect anything to unused pins. Use a straight-through Ethernet cable to connect to a hub or a crossover cable to connect directly to an Ethernet station or RTU. See the *Installation Reference Chart* in the middle of this guide for pinout information.

Remote Gateway—If the radio network seems to be operating properly based on observation of the unit's LEDs, connect the user data equipment to the LAN port. Use the IP **PING** command to verify the communications link integrity with the Access Point unit.

Access Point—Connect the WAN/LAN to the LAN port of the radio.

LED Indicators

A table of LED functions can be found on the center *Installation Reference Chart*.

Step 6—Check for Normal Operation

    a.   Observe the transceiver LED status panel (See the *Installation Reference Chart*) for the proper indications. In a normally operating system, the following LED indications will be seen within 30 seconds of start-up:

- PWR**—**Lit continuously
- LINK—Blinks intermittently at Remote Gateways and continuously on Access Point stations.
- LAN—On indicates it connected to a good Ethernet cable. Blinks (flickers) with data activity.

    b.   Check the received signal strength indicator (RSSI) for an adequate signal level from the radio network's Access Point station. (RSSI available through the iNET Management System) It may be necessary to reposition the gateway radio's antenna for better reception/signal strength, or if a directional antenna is used, rotate it until the signal is optimized.

See the *Installation Reference Chart* for details on the LED functions and chart of Management System menus.

If all checks out OK, you are done with the installation. Congratulations!

Performance Optimization

After the basic operation of the radio has been checked, you may wish to optimize its performance using some of the suggestions given here. The effectiveness of these techniques will vary with the design of your system and the format of the data being sent.

Complete instructions on using the unit's configuration options referenced within this section are can be found in the *MDS iNET 900 Network Manager's Manual*.

TROUBLESHOOTING

It is best to begin troubleshooting at the Access Point station, as the rest of the system depends on the Access Point for polling instructions and synchronization data. If the Access Point station has problems, the operation of the entire network will be affected.

All radios in the network must meet these basic requirements:
- Adequate and stable primary power
- An efficient and properly aligned antenna system
- Secure connections (RF, data & power)
- Proper programming of the radio's operating parameters, especially Mode selection (Access Point/Remote), Network Name, and IP Network Address
- The correct interface between the radio and the connected data equipment (proper cable wiring, data format and timing).

Table 2 on page 12 provides suggestions for resolving system difficulties that may be experienced in the radio system. If problems persist, contact the factory for further assistance. Refer to the inside back cover of this guide for contact information.

Table 2. Troubleshooting Techniques

Difficulty	Recommended System Checks
The PWR LED does not turn on.	a. Check for the proper supply voltage at the power connector.
	b. Cycle the power and wait for the unit to reboot. ($\approx$ 30 seconds)
Interference is suspected.	a. Verify that the system has a unique network name. A nearby systems (Access Point station) with the same network name will cause interference.
	b. If omnidirectional antennas are used on, consider changing to directional antennas. This will often limit interference to and from other stations.
	c. The installation of a filter in the antenna line may be necessary. Consult the factory for further assistance.
The LINK LED does not turn on.	a. Check for secure interface connections at the radio and the connected device.
	b. Check the antenna, feedline and connectors. Reflected power should be less than 10% of the forward power reading (SWR $\approx$2:1 or lower).
	c. No synchronization with Access Point, or poor overall performance. Check RSSI level.
Cannot pass IP data to WAN.	a. Use the PING command to test communication with iNET units in the local radio system.
	b. If successful with local PING, attempt to PING an IP unit attached to an iNET radio.
	c. If successful with the LAN PINGs, try connecting to a known unit in the WAN.

*I*NET **SPECIFICATIONS**

GENERAL

Temperature Range:	–30°C to +70°C (–22° F to 158° F)
Humidity:	95% at +40°C (104° F); non-condensing
Primary Power:	10.5–30 Vdc(13.8 Vdc Nominal)
External Power Supply Options:	48 Vdc; 110–120/210–220 Vac
Supply Current (typical):	(@1 Watt RF Output)
Transmit:	500 mA @ 13.8 Vdc
Size (Excluding mtg. hardware):	1.5" x 6" x 4" (H x W x D)
	3.8 x 15.2 x 10.2 cm
Weight:	0.9 kg / 2 lb
Case:	Cast Aluminum
Shock and Vibration:	Meets MIL STD 202F, 810E, 202D

RADIO CHARACTERISTICS
GENERAL:

Frequency Range:	902–928 MHz ISM Band
Mode:	Freq. Hopping Spread-Spectrum (FHSS)

TRANSMITTER:

Power Output	
(at antenna connector):	0.1 to 1.0 watt (+20 dBm to +30 dBm)
	Increments of1.0 dB, set *by user*
Duty Cycle:	Continuous
Output Impedance:	50 Ohms

RECEIVER:

Type:	Double conversion superheterodyne
Sensitivity:	–92 dBm @ 512 kbps < 1×10^{-6} BER
	–100 dBm @ 256 kbps < 1×10^{-6} BER
Time Required to Synchronize with Access Point Radio:	Less than 13 seconds (typical)

IN CASE OF DIFFICULTY...

MDS products are designed for long life and trouble-free operation. However, this equipment, as with all electronic equipment may have an occasional component failure. The following information will assist you in the event that servicing becomes necessary.

TECHNICAL ASSISTANCE

Technical assistance for MDS products is available from our Customer Support Team during business hours (8:00 A.M.–5:30 P.M. Eastern Time). When calling, please give the complete model number of the radio, along with a description of the trouble symptom(s) that you are experiencing. In many cases, problems can be resolved over the telephone, without the need for returning the unit to the factory.

Telephone 1+ 585-242-8510 for product assistance or visit the technical support area of the Microwave Data Systems' Web site at www.MicrowaveData.com.

FACTORY SERVICE

If return of the equipment is necessary, please contact the MDS Customer Support Team. You will be issued a Returned Material Authorization (RMA) number. The RMA number will help expedite the repair so that the equipment can be repaired and returned to you as quickly as possible. Please be sure to include the RMA number on the outside of the shipping box, and on any correspondence relating to the repair. *No equipment will be accepted for repair without an RMA number.*

A statement should accompany the radio describing, in detail, the trouble symptom(s), and a description of any associated equipment normally connected to the radio. It is also important to include the name and telephone number of a person in your organization who can be contacted if additional information is required.

The radio must be properly packed for return to the factory. The original shipping container and packaging materials should be used whenever possible. All factory returns should be addressed to:

> Microwave Data Systems Inc.
> Customer Service Department
> (RMA No. XXXX)
> 175 Science Parkway
> Rochester, NY 14620 USA

When repairs have been completed, the equipment will be returned to you by the same shipping method used to send it to the factory. Please specify if you wish to make different shipping arrangements.

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