Microwave Data Systems Inc.

MDS *i*NET Series™

Wireless IP/Ethernet Transceiver
iNET-II Firmware Release 1
iNET Firmware Release 6

MDS 05-2873A01, Rev. E

MAY 2006

i n d u s t r i a l / w i r e l e s s / p e r f o r m a n c e

MDS

Refer to the *Installation Reference Chart* at the middle of this manual for essential installation and configuration details.

MDS

Contents

Copyright Notice

MDS

Manual Revision and Accuracy

While every reasonable effort has been made to ensure the accuracy of this manual, product improvements may result in minor differences between the manual and the product shipped to you. If you have questions or need an exact specification for a product, please contact our Technical Services Team using the information at the back of this guide. Microwave Data Systems reserves its right to correct any errors or omissions. Updated information may also be available on our Web site at www.micro-wavedata.com. This manual is for the use of professionals to guide them in the installation, operation and basic system maintenance of the equipment described.

OPERATIONAL & SAFETY NOTICES

RF Exposure

Professional installation required. 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 23 cm (9 inches) to the antenna when the transmitter is operating in indoor or outdoor environments. More information on RF exposure is on the Internet at www.fcc.gov/oet/info/documents/bulletins.

UL/CSA Notice

This product is available for use in Class 1, 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 two independent agencies —Underwriters Laboratories (UL) 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 CSA Certification is in accordance with CSA STD C22.2 No. 213-M1987.

UL/CSA Conditions of Approval

UL/CSA Conditions of Approval: 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.
5. A power connector with screw-type retaining screws as supplied by MDS must be used.

When installed in a Class I, Div. 2, Groups A, B, C or D hazardous location, observe the following notice: WARNING EXPLOSION HAZARD   Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

6. 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.

> ⚠ **WARNING**
>
> **EXPLOSION HAZARD!**

Do not disconnect equipment unless power has been switched off or the area is known 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.

FCC Part 15 Notice, U.S.A.

The transceiver described herein complies 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 intended 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.

Environmental Information

The manufacture of this equipment has required the extraction and use of natural resources. Improper disposal may contaminate the environment and present a health risk due to hazardous substances contained within. To avoid dissemination of these substances into our environment, and to limit the demand on natural resources, we encourage you to use the appropriate recycling systems for disposal. These systems will reuse or recycle most of the materials found in this equipment in a sound way. Please contact MDS or your supplier for more information on the proper disposal of this equipment.

About This Guide

This guide presents installation and initial operating instructions for the MDS iNET-II™ or the MDS *i*NET 900™ Wireless IP/Ethernet 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 Series User's Guide*, P/N 05-2806A01. This manual provides more in-depth information on antenna selection and optimization, and extensive coverage on user-controllable parameters and diagnostic tools.

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

MDS

PRODUCT DESCRIPTION

The MDS iNET-II and iNET transceivers are designed to provide wireless local area network (LAN) service with plug-and-play hardware. The transceivers come in two primary models—Access Point and Remote.

Three types of Remote Gateways are available—the Ethernet Bridge, the Serial Gateway, and the Dual Gateway supporting both IP/Ethernet and serial services. Table 1 summaries the different interface abilities for each type of radio.

A transceiver can be configured by the owner to operate as an Access Point or as a Remote with some restrictions. Only the Dual Gateway Remote units can be reconfigured as an Access Point. Ethernet Bridge and a Serial Gateway Remotes cannot be reconfigured as Access Point unless they are first upgraded to Dual Gateway type. This is accomplished with an "Authorization Key" purchased from the factory. Each one of these individual software keys is associated with the serial number of the corresponding unit.

Table 1. Transceiver Models and Data Interface Services

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

NOTES
1. Provides access to the embedded Menu System on all units.
2. Can be upgraded to Dual Gateway with an Authorization Key.
3. Can be configured as an Access Point or Dual Gateway through the embedded Menu System.

Transceivers serve as either an "Access Point" or "Remote." An Access Point (AP) is a wireless hub that usually provides connectivity into a wired Ethernet LAN/WAN. From a radio perspective, an Access Point serves as the network's "master station" providing synchronization data to all associated Remotes (RMT) within its network.

Differences Between iNET and iNET-II

The iNET and iNET-II Transceivers, while similar in many respects, do have some important differences. The main differences are summarized in Table 2:

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

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

NOTE: The MDS iNET and MDS iNET-II transceivers are *not* over-the-air compatible.

MDS CYBER SECURITY SUITE

The operation and management of an enterprise is becoming increasing dependent on electronic information flow. An accompanying concern is the cyber security of the communication infrastructure and the security of the data itself.

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. Please refer to the *User's Guide* (05-2806A01) for complete information.

MDS

Table 3. Cyber Security Highlights

Security Level	Specification
• MDS Cyber Security Suite, Level 1:	• AES-128 encryption (iNET-II only) • Includes Level 2 features below
• MDS Cyber Security Suite, Level 2:	• RC4-128 encryption (iNET only) • Automatic rotating key algorithm • Authentication: 802.1x, RADIUS, EAP/TLS, PKI, PAP, CHAP • Management: SSL, SSH, HTTPS • Approved AP/Remotes list (local authentication) • Failed login lockdown • 900 MHz operation and proprietary data framing

INSTALLATION PLANNING

This section provides tips for installation and start-up of the equipment.

General Requirements

There are three main requirements for installing the transceiver — adequate and stable primary power, a good antenna system, and the correct interface between the transceiver and the data device. The Installation Reference Chart (center of this guide) shows a typical Remote installation. Access Point stations typically use omnidirectional antennas whereas Remotes typically use directional antennas such as a Yagi. Otherwise, the installations are similar.

INSTALLATION STEPS

A typical product shipment consists of a transceiver, a power connector and this start-up guide.

Below are the basic steps for installing a transceiver. Should further information be needed, see "TECHNICAL ASSISTANCE" on Page 20 of this manual for information on contacting the MDS Technical Services Group. You will also find support information at the Microwave Data Systems Web site: www.microwavedata.com.

It is highly recommended that the Access Point unit be installed *first*. With this plan, you can quickly check the operation of each associated Remote as it is placed on the air.

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

Step 1—Mount the Transceiver

Mount the radio to a stable surface. (Fasteners/anchors or screws are not normally supplied.) 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 (6 mm) screws to attach mounting hardware to the bottom of the radio. Figure 1 shows the mounting dimensions.
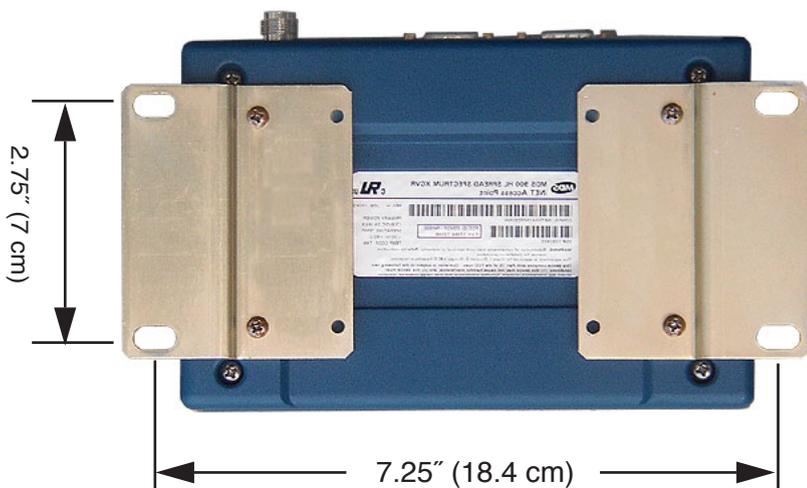
Figure 1. Transceiver mounting dimensions

CAUTION	Screws used to hold the mounting brackets to the radio
POSSIBLE EQUIPMENT DAMAGE	case should be SAE 6-32 and should not extend farther than 1/4 inch (6 mm) into case. This will prevent damage to the transceiver's internal PC board.

MDS

Step 2—Install the Antenna

To minimize radio frequency interference, the antenna should be mounted at least nine inches (> 23 cm) from the connected device(s), sensors and other components of the system. Additional information on antenna selection and installation is provided in the *MDS iNET Series User's Guide*.

Step 3—Measure & Connect Primary Power

The primary power at the transceiver's power connector must be within 10.5–30 Vdc and be capable of continuously providing up to 580 mA. A power connector with screw-terminals is provided with each unit. Strip the wire leads to 6 mm (0.25"). Be sure to observe proper polarity as shown in Figure 1 with the positive lead (**+**) on the left. If the transceiver is to be powered at voltages of 28 Vdc or higher, please review the *User's Guide* for important recommendations.

Lead Binding Screws (2)

Wire Ports
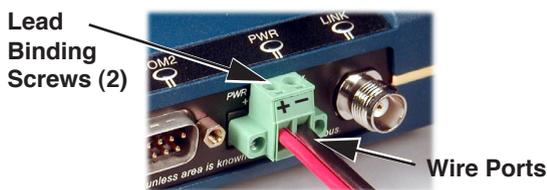
Figure 2. Power Connector Polarity: Left +, Right –

CAUTION **POSSIBLE** **EQUIPMENT** **DAMAGE**	The transceiver must be used only with negative-ground systems. Make sure the polarity of the power source is correct. *Review complete power requirements in the User's Guide, Part No. 05-2806A01.*

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.

NOTE: It typically takes about 30 seconds for the transceiver to power up, and about 20 to associate with another unit.

Step 4—Review the Transceiver's Configuration

Two essential settings for the transceiver should be known before placing the unit into service. They are:

- **Device Mode**—Access Point, or Remote (default).
- **Network Name—**Common identifier used by all of the units, which are part of the same network (required).

The Network Name must be programmed to enable Remote units to associate with the Access Point unit.

Other parameters that commonly need review or adjustment are:

- **IP Address**—Must be a unique address to allow for IP access through the LAN port or over-the-air. (Default = 192.168.1.1)
- **RF Output Power Level**—Check and adjust as necessary for compliance with regulatory guidelines. (Defaults: iNET=+30 dBm, iNET-II=+28 dBm.)
- **Data Rate**—**AUTO** selection (default) allows 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 and Menu System features.

NOTE: The default 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.

A summary of selected operating parameters' range and default values is included in the Reference Chart at the center of this booklet.

How to Review the Transceiver's Configuration

The following is an overview of the configuration procedure. For detailed instructions on using the HTTP (LAN Port) and text-based (COM1) Menu System, please refer to the *User's Guide*. Key menu selections are shown at the center of this guide.

a. Connect a computer's serial communications port to the COM1 Port. (Defaults: 19,200 bps/8N1/No Handshaking)

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

MDS

c.   Press the **ENTER** key. A login screen will be displayed that requires a password (default = **admin**) to access the Menu System. A password is required to make changes to all parameters.

d.   Program the radio's Network Name.

e.   Review other settings and make changes if necessary, such as the unit password, IP address and security.

Repeat the above steps for each unit in the network.

NOTE: The Menu System's "configuration files" will aid in uniformly configuring multiple units. The use of these files is described in the *User's Guide*.

Step 5—Connect the Data Equipment

Ethernet Example: Connect Ethernet-compatible data equipment to the unit's LAN port (10BaseT), or one of the serial ports, depending on the capability of your transceiver. (See Table 1 on Page 4.)

Use a straight-through Ethernet cable to connect the LAN port to a hub, and a crossover cable to connect it directly to an Ethernet station. See the Reference Chart at the middle of this guide for more information.

IP-to-Serial Example: From the PC, establish a TCP connection to the IP address of the Remote transceiver and to the IP port. 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 Location	Menu Item	Setting
Access Point	None is required	None is required
Remote Unit	IP Address	192.168.0.2
	Status	Enabled
	IP Protocol	TCP
	Baud Rate	9,600 (Example)
	Flow Control	None
	Local IP Port	30011

Step 6—Check for Normal Operation

In this step you will verify the proper operation of wireless communications between an Access Point and the associated Remotes.

At All Units...

Observe the transceiver's LED panel (See Reference Chart) for the proper indications. In a normally operating system, the radio will usually become associated in less than one minute from start-up.

At the Access Point Unit...

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.

b. If you have already installed a Remote unit, try sending a **PING** to that unit through the Menu System PING utility.

At Remote Units...

a. Look for the LINK LED to turn on and remain on. This indicates the unit has successfully associated with the network's Access Point. (The association process may take up to 30 seconds.)

b. Check the **Starting Information** screen for the **Device Status** (also known as Connection Status). It will show one of the following:

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 has changed its frequency hopping pattern to match that of the Access Point.

Connected —The unit has a radio (RF) connection 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 is has detected one or more alarms that have not been cleared.

MDS

c. When the network is operating properly based on observation of the unit's 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 at this site.

Resetting to Factory Defaults (Use with Care)

This procedure may be useful when several parameters have been modified, and there is no track of changes. It causes the transceiver to return to a known-operational state.

To reset all transceiver parameters back to the factory defaults, including the password (default = **admin**), you must enter a special code (authorization key) provided by the factory in place of the user name at the time of login. Contact the factory for more information.

Performance Optimization

After the basic operation of the network has been verified, you may wish to optimize its performance using the suggestions given below. The effectiveness of these techniques will vary with the amount of data being handled.

Optimize Received Signal Strength

Check the received signal strength indicator (RSSI) for an adequate signal level from the radio network's Access Point. (RSSI is available through the Menu System.) In the absence of interference, signal levels that are sufficient to provide reliable operation (with a 15 dB fade margin) are: ≥ –84 dBm @ 256 kbps, ≥ –75 dBm @ 512 kbps ≥ –65 dBm @ 1 Mbps.

If the signal levels are lower, it may be necessary to reposition the station's antenna for better reception/signal strength.

Minimize Packet Retries

If the Wireless Packet Statistics' retry packet counter is unacceptably high, several techniques can be used to improve it.

These include identifying interference and taking corrective steps such as skipping some radio frequencies from the hopping pattern, increasing the gain of the Remote unit's antenna system, relocating the Remote's antenna, or installing a repeater system.

Blocking Out Zones

The transceiver uses channels in the 902–928 MHz spectrum, with selectable hopping from 1 to 80 channels. This selection is available only on iNET-II or specially provisioned iNET units using the **Channel Config(uration)** Submenu.

NOTE: When using **CHANNELS** mode, all radios (AP and Remotes) must be set to use the same channels in order to establish a link. If this is not done, the radios will not connect.

NOTE: The iNET-II operates only in the **CHANNELS** mode, with selectable hopping from 1 to 75 channels.

Usage key for Channel Configuration Menu:

n (no) = Radio channel is not used
y (yes) = Radio channel is used
NA (not available) = Radio channel is not available

Other selections on Channel Configuration Menu:

- **Clear All**—This command clears all entries in the Channel Config Menu, resetting the available channels to "no usage." Channels that are not available for use will appear with a notation of or **NA**. These channels are not available because of pre-existing conditions, and are not user-configurable.

- **Enter Channels**—This 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.*

- **Commit Changes**—This re-boots the radio and loads the active channels into the frequency list for frequency hopping operation.

MDS

AIMING DIRECTIONAL ANTENNAS

In general, signal levels stronger than –80 dBm will provide reliable communication in the network. Directional antennas usually require some fine-tuning of their bearing to optimize the received signal strength. The unit has a built-in received signal strength indicator (RSSI) that can be used as an aid to optimizing the received signal level. The measurement and antenna alignment process usually takes less than 10 minutes at each unit.

RSSI measurements and Wireless Packet Statistics are based on multiple samples over a period of several seconds. The average of these measurements is displayed by the Menu System.

In the steps below, the path to the Menu System item is shown in bold text.

Procedure

1. Verify the Remote is associated with an Access Point unit by observing the LINK LED. It should be on or blinking.

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 direction of antenna. Watch the RSSI indication for several seconds after making each adjustment so that the RSSI accurately reflects any change in the link signal strength. The less negative the number, the stronger the 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.

TRANSMITTER POWER AND ANTENNA SWR TEST

The following procedure may be used to measure the transmitter's RF power output and SWR "match" of the antenna system. A directional wattmeter is required for the test, such as a Bird Model 43, with an appropriate element installed.

Before you start, keep in mind that using the Test Mode will disrupt network operation.

Procedure

1. Connect a directional wattmeter between the ANTENNA port and the antenna system.

2. Place the transceiver into the Radio Test Mode.

   Main Menu>Maintenance/Tools Menu>Radio Test>Test Mode>Y>ON

   NOTE: The Test Mode has a 10-minute timer, after which it will return the transceiver to normal operation. The Test Mode can also be terminated manually, via the menu.

3. Set the transmitter RF output power to 30 dBm.

   Main Menu>Maintenance/Tools Menu>Radio Test>Test Mode> Tx Power Output

   NOTE: The Test Mode RF power setting will not affect the output level during normal operation.

4. Turn on (key) the transmitter.

   Main Menu>Maintenance/Tools Menu>Radio Test>Test Mode> TxKey> Enable

   User the spacebar to key and unkey the transmitter ON and OFF. (Enable/Disable)

5. Measure the forward and reflected power into the antenna system and calculate the SWR. The ratio should be less than 2:1. The power output level should agree with the programmed value set in Step 3.

   Main Menu>Radio Configuration>RF Power Output

6. Turn off Test Mode at the Access Point and Remote radio.

   Main Menu>Maintenance/Tools Menu>Radio Test>Test Mode>Disable

---

MDS

TROUBLESHOOTING

It is best to begin troubleshooting at the Access Point, because the rest of the system depends on it for network synchronization and configuration. If the Access Point 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 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)

Table 5 provides suggestions for resolving common system difficulties using the front panel LEDs as a guide. Table 6 on Page 17 provides guidance using the Menu System as a tool.

If problems persist, review the MDS Web site's technical support area for general troubleshooting help, service information, and recent software/firmware updates at www.microwavedata.com/service/technical/support/. Additional help is available from the MDS Technical Services Department. See "TECHNICAL ASSISTANCE" on Page 20 for contact information.

Table 5. Troubleshooting Using LEDs

Symptom	Problem/Recommended Checks
PWR LED does not light.	a. Voltage too low—Check for proper supply voltage at the power connector (10.5–30 Vdc).
	b. Indefinite Problem—Cycle the power and wait (≈ 30 seconds) for the unit to reboot. Then, recheck for normal operation.
PWR LED is blinking.	a. Blinking indicates the presence of an alarm condition.
	b. View Current Alarm List and Error Log and correct the problem if possible.
	c. Blinking continues until the fault is corrected, for example, a valid IP address is entered, etc.

Table 5. Troubleshooting Using LEDs *(Continued)*

Symptom	Problem/Recommended Checks
LINK LED does not light.	a. Network Name of Remote not identical to desired Access Point—Verify that the system has a unique Network Name.
	b. Not yet associated with an Access Point with the same Network Name. Check the "Status" of the unit's process of associating with the Access Point. Use the Menu System.
	c. Poor Antenna System—Check the antenna, feedline and connectors. Reflected power should be less than 10% of the forward power reading (SWR 2:1 or lower).
LAN LED does not turn on.	a. Verify the Ethernet cable is connect at both ends.
	b. Verify that the appropriate type of Ethernet cable is used: straight-through, or crossover as required.

Table 6. Troubleshooting with the Menu System

Symptom	Problem/Recommended System Checks
Remote does not associate; stays in HOPSYNC	a. Verify the AP has sufficiently large number in the "Max Remotes" parameter of the Network Configuration Menu.
	b. Verify the correct MAC address is listed in the "Approved Remotes List" or "Approved Access Points List" of the Security Configuration menu.
Serial data is slow with UDP multicast traffic	a. Change Beacon Period to FAST. (Radio Configuration Menu)
Display on terminal/Telnet screen garbled	a. Verify the terminal/terminal emulator or Telnet application is set to VT100

MDS

Table 6. Troubleshooting with the Menu System

Symptom	Problem/Recommended System Checks
Cannot access the MS through COM1	a. Connect to unit via Telnet or Web browser
	b. Disable the serial mode for COM1 (Serial Gateway Configuration>Com1 Serial Data Port>Status>Disabled)
	or, if you know the unit's data configuration...
	c. Connect to COM 1 via a terminal set to VT100 and the port's data baud rate.
	d. Type "+++ [ENTER]"
	e. Change the terminal's baud rate to match the transceiver's Console Baud Rate.
	f. Type "+++ [ENTER]"
Cannot pass IP data to WAN.	a. Verify your IP settings.
	b. Use the PING command to test communication with units in the local radio system.
	c. If successful with local PING, attempt to PING an IP unit attached to another radio.
	d. If successful with the LAN PINGs, try connecting to a known unit in the WAN.
Wireless Retries too high.	Possible Radio Frequency Interference—
	a. If omnidirectional antennas are used, consider changing to directional antennas. This will often limit interference to and from other stations.
	b. Try skipping zones where persistent interference is known or suspected.
	c. The installation of a filter in the antenna feedline may be necessary. Consult the factory for further assistance.
Password forgotten.	a. Connect to the unit using a terminal through the COM1 Port.
	b. Consult the factory. Get a password-resetting Authorization Key.
	c. Enter the Authorization Key at the login prompt as a password.

SPECIFICATIONS

GENERAL

Temperature Range:	–30° C to +60° C (–22° F to 140° 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:	8 Watts (580 mA @ 13.8 Vdc)
Receive:	2.8 Watts (203 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

RADIO CHARACTERISTICS

GENERAL:

Frequency Range:	902–928 MHz Industrial, Scientific & Medical (ISM) Band
Mode:	Freq. Hopping Spread-Spectrum (FHSS)
Boot Time:	≈ 30 sec
Time Required to Associate with Access Point:	≈ 20 sec

TRANSMITTER:

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

RECEIVER:

Type:	Double conversion superheterodyne
Sensitivity (< 1×10^{-6} BER):	iNET: –92 dBm @ 512 kbps
	iNET: –99 dBm @ 256 kbps
	iNET-II: -92 dBm @ 1 Mbps
	iNET-II: -97 dBm @ 512 kbps

MDS

TECHNICAL ASSISTANCE

Technical assistance for MDS products is available from our Technical Support Department 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.

Phone: 585 241-5510   E-Mail: TechSupport@microwavedata.com

FAX: 585 242-8369   Web: www.microwavedata.com

FACTORY SERVICE

If return of the equipment is necessary, please contact the MDS Technical Support Team. You will be issued a Service Request Order (SRO) number. The SRO 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 SRO 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 SRO 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
> (SRO 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. To inquire about an in-process repair, you may contact our Product Services Group at 585-241-5540 (FAX: 585-242-8400), or via e-mail at ProductServices@microwavedata.com.