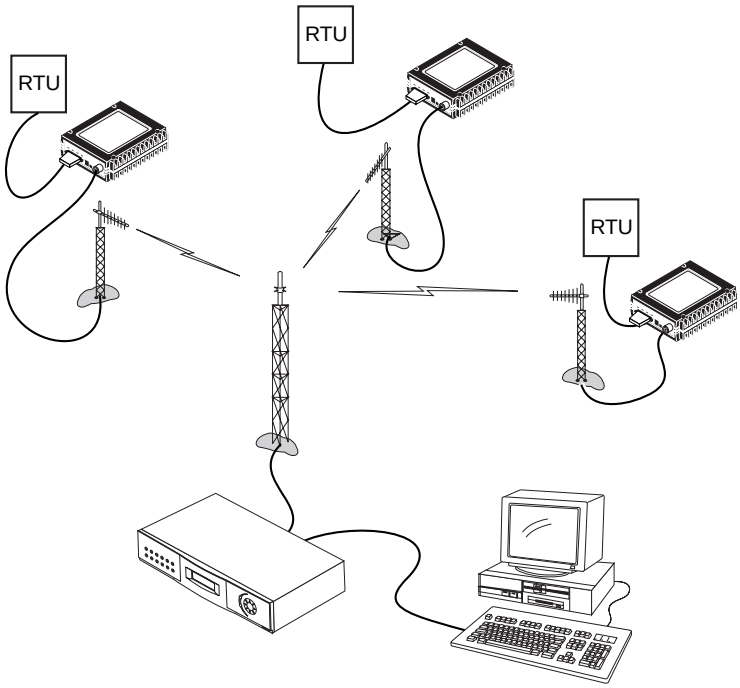
Network-wide Diagnostics



Systems Handbook

MDS 05-3467A01, Rev. B
OCTOBER 2000

Microwave Data Systems Inc.

Installation and Operation Guide

QUICK START GUIDE

Below are the basic steps for setting up network-wide diagnostics. This manual is intended to be used with the appropriate Installation and Operation Guide for the radios being used. In addition, the InSite Installation and Operation Guide is required to set up network-wide diagnostics. (A PDF copy of this manual is included on the InSite disk.)

1. Ensure your radios are capable of network-wide diagnostics (page 3)

- Do you have the appropriate radio model, firmware revision level and the radio software option?

2. Determine diagnostics cabling needs (page 5)

- The diagnostics host computer connects to the transceiver with an RJ-11 to DB-9 cable.
- The diagnostics host computer connects to the master station with a DB-9 to DB-9 cable.
- Chained (co-located) radios must have both diagnostics and data ports connected with a null modem cable.

3. Set DTYPE and DLINK at radios (page 4)

- The default **DTYPE** setting is **NODE**.
- Select the one radio in the system where polling originates and configure it as **DTYPE ROOT**.

4. Set up and configure InSite 5 (Insite 5 I&O Guide, PDF Format, on Insite 5 CD)

- Install the InSite program on your diagnostics host computer.
- Create an equipment list.
- Use the network-wide diagnostics selections to collect alarms and gather detailed information from any radio in the network.

TABLE OF CONTENTS

Copyright Notice

This Installation and Operation Guide and all software described herein are protected by **copyright: 2000 Microwave Data Systems Inc.** All rights reserved.

Microwave Data Systems reserves its right to correct any errors and omissions in this publication.

ISO 9001 Registration

Microwave Data Systems' adheres to this internationally accepted quality system standard.

MDS Quality Policy Statement

We, the employees of Microwave Data Systems, are committed to achieving total customer satisfaction in everything we do.

Total Customer Satisfaction in:

- Conception, design, manufacture and marketing of our products.
- Services and support we provide to our internal and external customers.

Total Customer Satisfaction Achieved Through:

- Processes that are well documented and minimize variations.
- Partnering with suppliers who are committed to providing quality and service.
- Measuring our performance against customer expectations and industry leaders.
- Commitment to continuous improvement and employee involvement.

Notice

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 additional questions or need an exact specification for a product, please contact our Customer Service Team using the information at the back of this guide. In addition, manual updates can often be found on the MDS Web site at www.microwavedata.com.

1.0 WHO NEEDS THIS MANUAL?

This manual is intended to guide a radio network systems planner or administrator to use advanced network-wide diagnostics in an MDS radio network. This manual is intended to tie other documentation together that is important to understanding and implementing network-wide diagnostics functions.

Other network-wide diagnostics documentation:

- InSite Online Help
- InSite Installation and Operation Guide (Paper, or PDF version on InSite disk)
- Transceiver and master station radio manuals

2.0 INTRODUCTION

2.1 Network-wide Diagnostics

Network-wide diagnostics is an advanced radio diagnostics option that allows the radio system operators to obtain radio diagnostics information without disrupting system data throughout the network.

Network-wide diagnostics uses packetized data methods that allows diagnostics information to pass throughout the system in a non-intrusive manner, without affecting the system data (payload) transmission.

Each radio in a network must have a unique unit address in order for network-wide diagnostics to identify each unit individually. As shipped from the factory, each MDS radio is set with a default unit address that is the same as the last four digits of the radio serial number.

To change or determine the unit address of the radio, use the **UNIT** command.

2.2 DTMF Diagnostics

Formerly, MDS provided a diagnostics system that used DTMF tones to communicate diagnostics information across the radio network. In a DTMF diagnostics system, the tones would interfere with the radio system traffic, and the throughput of information was limited.

The network-wide diagnostics system is incompatible with a DTMF diagnostics system.

3.0 THEORY OF OPERATION

3.1 Operational Modes

Network-wide diagnostics operates in the following modes:

- Intrusive (Fast response; may disrupt user data)
- Non-intrusive (Slower response; does not disrupt user data)

The Intrusive Mode

Intrusive diagnostics can be used from any radio connected to a computer with InSite software running.

This mode of operation is inherently intrusive to system payload data. This mode can be operated from any radio node in the system. All diagnostics information regarding any radio in the system can be accessed. Information is retrieved at a faster rate than when using the non-intrusive mode.

The Non-intrusive Mode

Non-intrusive diagnostics can only be used from an InSite computer connected to the root radio.

This network-wide diagnostics methodology intersperses short packets of diagnostic data with system data as part of routine system SCADA polling. As normal system polling occurs, the radio system attaches radio diagnostics information to the resultant poll information, and the diagnostics computer retrieves the diagnostics information. *The non-intrusive mode can only be operated from the root radio.*

4.0 SYSTEM REQUIREMENTS

There are several basic requirements to use network-wide diagnostics:

- MDS InSite 5 or later
- Compatible MDS radio equipment with appropriate firmware installed
- Network-wide feature authorization (this is an option in DSP radios)
- Planning and connections to use network-wide diagnostics functions.

Refer to the following appropriate section for more information on diagnostic system requirements.

4.1 InSite User Interface Software

Specialized computer software is required to use the network-wide diagnostics features of MDS radio products. MDS InSite software is available as a tool to meet the user interface software requirements. Using the NetworkView function of InSite, a graphically representation of the radio system is displayed. NetworkView gives the ability to query and configure radios throughout the network by pointing and clicking on a computer screen.

4.2 Compatible MDS Radio Equipment

All MDS DSP-based transceivers and master stations (except "B" versions) are compatible or can be upgraded for compatibility with network-wide diagnostics.

The following MDS radios (with the noted firmware) are compatible:

MDS 9810 & MDS 24810	Version 3.0 or later
MDS x710 *	Version 2.0 or later
MDS x790	All versions

* The "x" denotes any number

Refer to the **SREV** command to determine the radio's firmware revision level.

5.0 CONNECTION & CONFIGURATION

Software configuration of the radio, and proper DIAG port connections, are required to use network-wide diagnostics functions.

5.1 Radio Configuration

When configuring a radio for use with network-wide diagnostics, there are two basic software configurations that must be made. The commands are:

- **DTYPE**
- **DLINK**

Use the **DTYPE** command locally, at the radio, to set the radio's *diagnostics type*. **DTYPE NODE** sets the radio as a node. **DYPE ROOT** sets the radio as the root radio. **DTYPE** entered by itself will return the current setting. (See *Section 5.2, Diagnostics-Link (DLINK)*.)

Use the **DLINK** command locally, at the radio, to configure the diagnostics link operation on the DIAG port. **DLINK ON** enables the diagnostics link operation; **DLINK OFF** disables the capability.

5.2 Diagnostics-Link (DLINK)

DLINK followed by the baud rate sets the baud rate (bps) of the diagnostics link. The following **DLINK** baud rates selections are allowed:

- 1200
- 2400
- 4800
- 9600
- 19200 (default setting)

Example: **DLINK 4800** sets the RJ-11 DIAG port to operate at 4800 bps. The default is **DLINK 19200** and **DLINK ON**.

NOTE: The same baud rate must be entered into the InSite Equipment List's **BAUD** field.

5.3 Diagnostics-Types (DTYPE)

The **DTYPE** command specifies the radio's operational characteristics for network-wide diagnostics. There are four possible types of nodes in a network-wide diagnostics system.

The common types are:

- **ROOT** (always one, and only one, per network)
- **NODE** (the most common setting, and the default)

The less common types, but useful for some configurations, are:

- **GATE**
- **PEER**)

Refer to *Section 8.0, SPECIAL DTYPE SETTINGS*, for additional information.

Root

The root is the focal point of network-wide diagnostics information. Only one root can be defined in any network. Intrusive diagnostics can originate from any radio, including the root. However, the root is the only radio through which non-intrusive diagnostics can be obtained.

Node

This is the basic system radio device type. Typically, the radio network is comprised of nodes and one root (See Figure 2). Intrusive diagnostics can originate from any node. However, non-intrusive diagnostics cannot be done through a node.

The default radio device type is **NODE**.

5.4 Diagnostics Cables

Generally, when connecting MDS radios for use with network-wide diagnostics, always connect the DIAG ports of radios that are at the same site. When connecting DIAG ports together between radios (see Figure 4), it is important to use null-modem cables, which have the TX and RX connections swapped as shown in Figure 1).

5.5 Diagnostics Cable Assemblies

Transceiver to Transceiver

When two transceivers, such as MDS 9810s, are co-located, the diagnostics connectors must be connected with an RJ-11 to RJ-11 null-modem cable (MDS P/N 03-2198A12). This cable is supplied with the network diagnostics package. The cable is *white*, and 7 feet (2.1 meters) long. Figure 1 shows the cable pinouts.

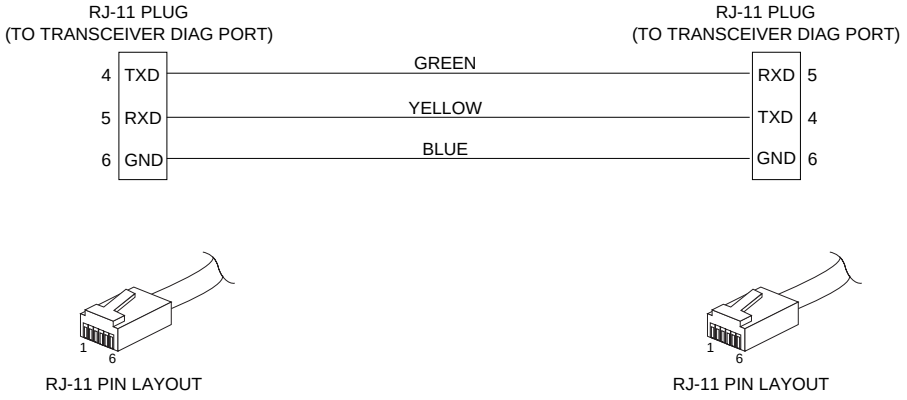


Figure 1. RJ-11 null-modem cable

Transceiver to Master Station

If a transceiver, such as MDS 9710A, is co-located with an MDS 9790A master station, the diagnostics connectors must be connected with a RJ-11 to DB-9 male null-modem cable. This cable can be created by connecting the MDS RJ-11 to DB-9 adapter cable (03-3246A01) and the MDS DB-9 to DB-9 null-modem cable (P/N 03-2198A12).

6.0 EXAMPLE SYSTEMS

Figure 2, Figure 3 and Figure 4 show the most basic network types and the **DTYPE** settings for each.

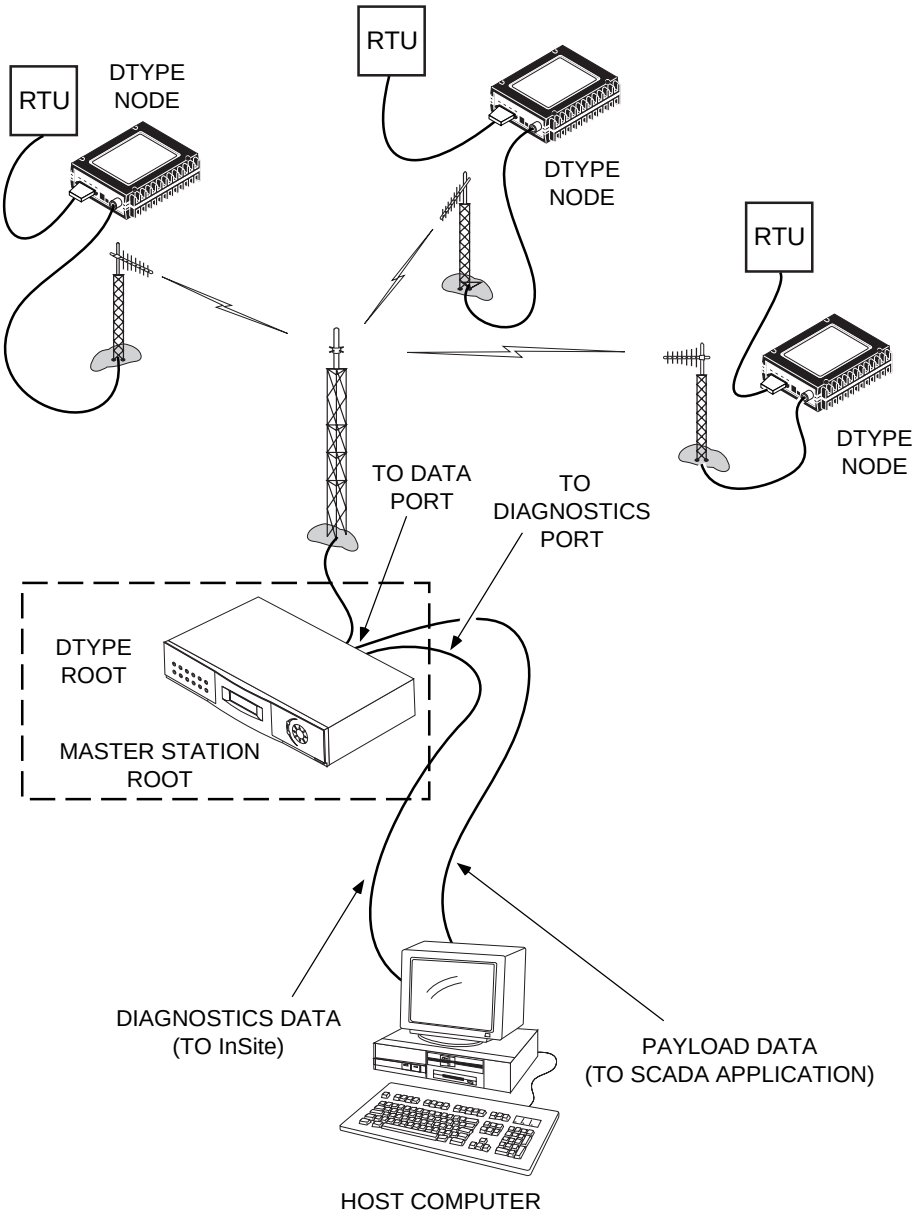


Figure 2. Basic point-to-multipoint system

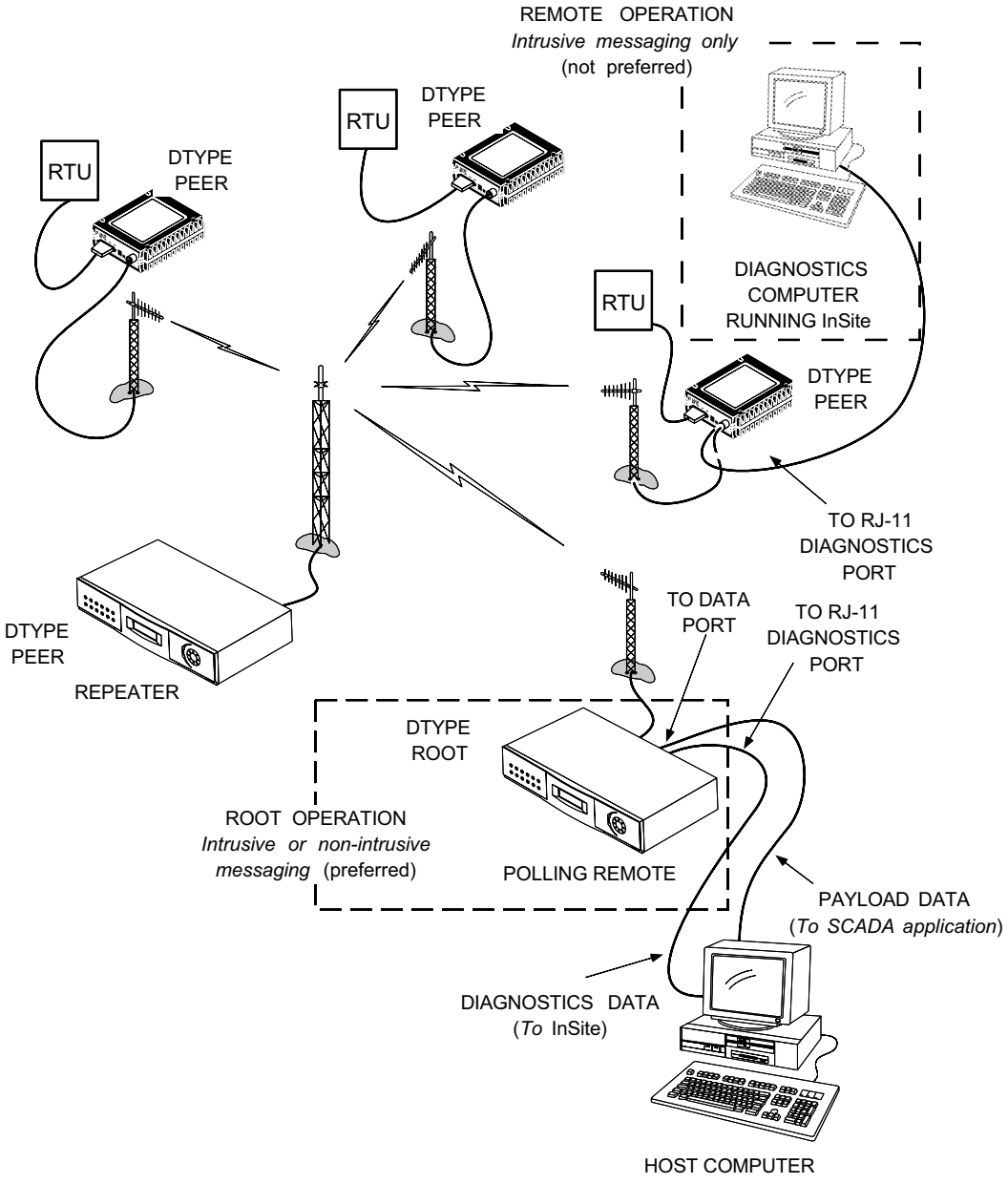


Figure 3. Point-to-multipoint repeater system

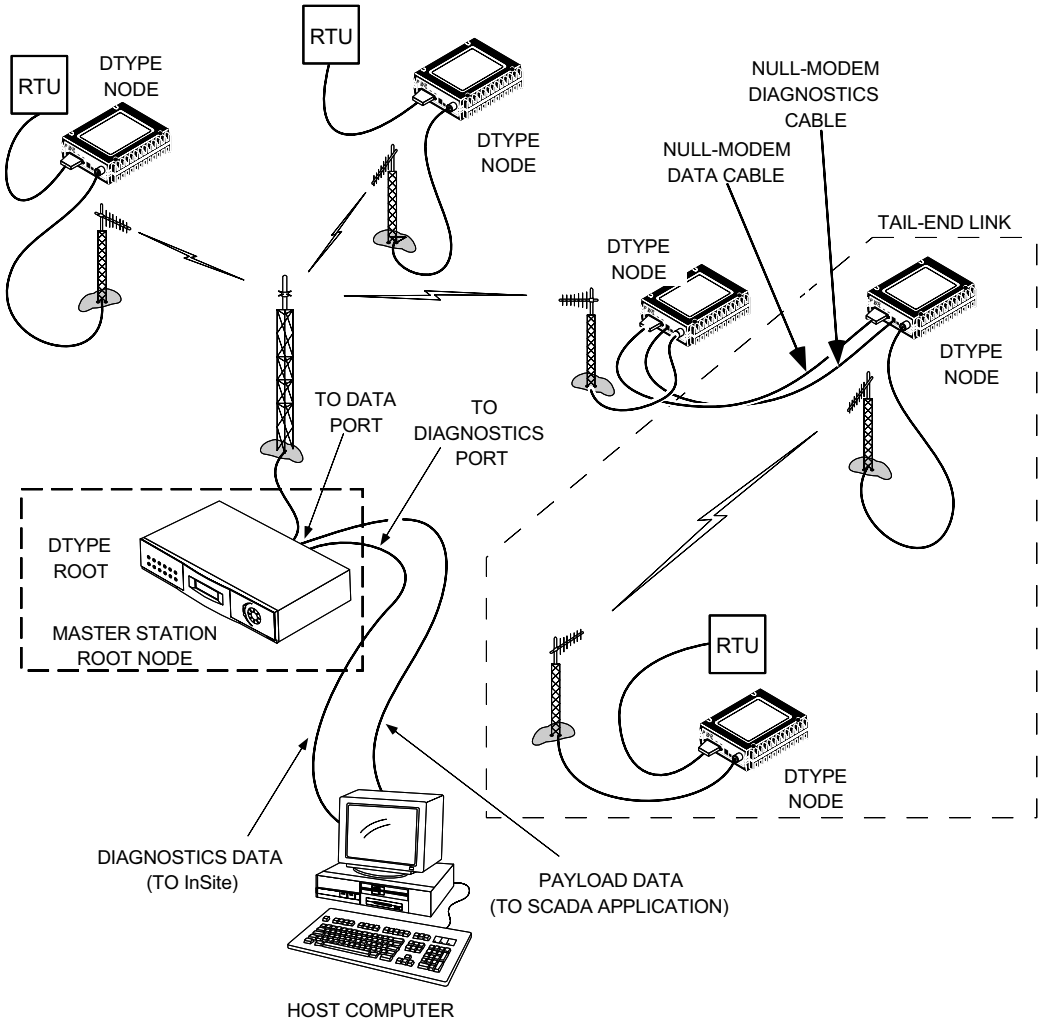


Figure 4. Point-to-multipoint system with a tail-end link

7.0 GLOSSARY OF TERMS

The following glossary explains many of the terms associated with radio diagnostics, and should prove helpful in understanding network-wide diagnostics operation.

DTMF Diagnostics—This is a form of remote diagnostics used by early MDS radios such as the MDS 2310 and 4310. Tones communicate diagnostics information between radios in a network. It disables *SCADA* data flow during diagnostic polling. DTMF radios are *not* compatible with network-wide diagnostics.

Host Computer—The computer or *PLC* installed at the master station site which controls the collection of data from one or more remote sites.

Intrusive Diagnostics— A mode of remote diagnostics that queries and commands radios in a network which has an impact on the delivery of the system *payload data*. This mode of diagnostics is much faster than the *Non-Intrusive Diagnostics* mode. It is the opposite of *Non-Intrusive Diagnostics*.

MAS—Multiple Address System. A radio system where a central master station communicates with several remote stations for the purpose of gathering telemetry data.

Network-wide Diagnostics—An advanced method of controlling and interrogating MDS radios in a radio network.

Non-Intrusive Diagnostics—This is a mode of network-wide diagnostics that queries and commands radios in a network without halting system *payload data*. Diagnostic data is collected non-intrusively over a period of time by being interspersed with *SCADA* system data. It is the opposite of *Intrusive Diagnostics*.

Passive Messaging—See *Non-Intrusive Diagnostics*.

Payload Data—This is the application's user communication data which is sent over the radio network. It is the primary purpose for the radio communications.

Poll—A request for data issued from the host computer (or master *PLC*) to a remote radio.

Polling Remote— In point-to-multipoint point radio networks, the polling remote is the radio that connects to the *SCADA* host and makes direct radio contact the repeater.

PLC—Programmable Logic Controller. A dedicated microprocessor configured for a specific application, with discrete inputs and outputs. It can serve as a host or as an *RTU*.

Radio Network—The complete set of radios through which a single polling scheme can operate. The radio network defines the scope of units that can be addressed through a single *Remote Diagnostics* connection.

Radio Sub-Network— A set of radios that communicate using the same frequency plan (either fixed frequency or frequency hopping). The radio network is composed of one or more radio sub-networks.

Remote (Station)—A radio in a spread spectrum network that communicates with an associated master station. A radio may be programmed for either Master or Remote mode using software commands.

Remote Diagnostics—A diagnostics system that allows the interrogation and configuration of a radio at a distant site.

Remote Terminal Unit—See *RTU*.

Repeater— In point-to-multipoint point radio networks, the repeater is the radio that makes direct radio contact with the remote radios.

RTU—Remote Terminal Unit. A data collection device installed at a remote radio site.

SCADA—Supervisory Control And Data Acquisition. An overall term for the functions commonly provided through an *MAS* radio system.

Unit Address—A value used to identify a specific radio in a radio network. The unit address can range from 0 to 65000, and can be changed to a five-digit number ranging from 10000 to 65000 using the **UNIT** command. Radios are shipped from the factory with a unit address matching the last four digits of the radio's serial number.

8.0 SPECIAL DTYPE SETTINGS

8.1 Repeater System Sub-Network

Repeater sub-networks require special **DTYPE** settings because remotes in these configurations will always hear each other. For repeater sub-networks where the polling remote is the root, all other radios in the sub-network must be **DTYPE PEER**.

For repeater systems which do not contain the root within their sub-network, the radio that interfaces with the SCADA host must be set to **DTYPE GATE.**

8.2 Simplex Sub-Networks

In sub-networks where simplex frequencies (same TX and RX frequencies) are used, special **DTYPE** settings are required because remotes in the configurations may hear each other.

For simplex sub-networks which do not contain the root, the radio that interfaces with the SCADA host must be set to **DTYPE GATE**

Diagnostics Message Filtering for Other Complex Networks

Table 1 shows how the **DTYPE** setting affects diagnostics communications. In some point-to-multipoint radio network configurations, radios transmit on frequencies that other radios in the system can hear, but do not relay SCADA data back to the host. Since network-wide diagnostics uses packetized information addressed to the host, it is possible that the diagnostics information will be attached to irrelevant SCADA data and retransmitted around the network, causing incoherent diagnostics communication.

Figure 5 shows a network which requires **DTYPE GATE** in a radio sub-network.

DTYPE GATE and **DTYPE PEER** are provided to filter out diagnostics information in these cases. Table 1 shows the cases in which the diagnostics message is filtered from the SCADA data.

Example: If a Gate can hear a Node, and you need to determine if the diagnostics information is filtered, follow the **Gate** row over to the **Node** column. There is a YES in the table intersection. The YES indicates the diagnostics information is not filtered, and that network-wide diagnostics communication is allowed to pass through the Node.

Table 1. Diagnostics Communication and Device-Types

	Root	**Gate**	**Node**	**Peer**
Root	Invalid	No	Yes	Yes
Gate	No	No	Yes	Yes
Node	Yes	Yes	Yes, in non-simplex systems No, in simplex systems	No
Peer	Yes	Yes	No	No

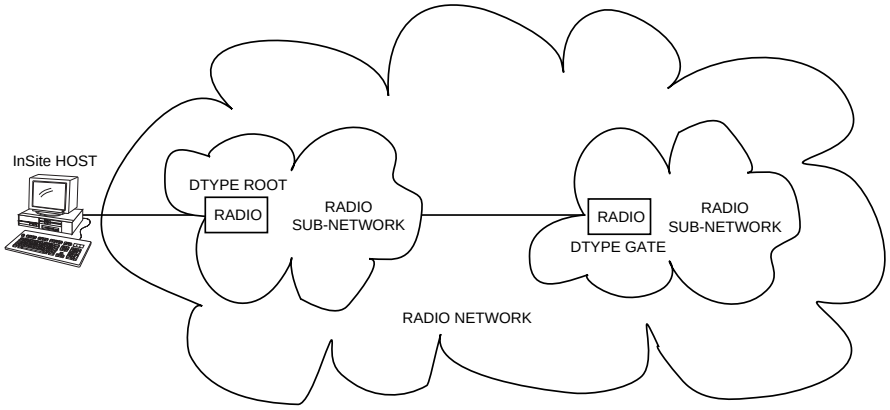


Figure 5. DTYPE GATE in a radio network

NOTES

NOTES

INDEX

B

C

D

E

F

G

H

I

M

N

P

R

S

T

U

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.

FACTORY 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.

Please use the following telephone numbers for product assistance:

716-242-9600 (Phone)

716-242-9620 (FAX)

FACTORY REPAIRS

Component-level repair of radio equipment is *not* recommended in the field. Many components are installed using surface mount technology, which requires specialized training and equipment for proper servicing. For this reason, the equipment should be returned to the factory for any PC board repairs. The factory is best equipped to diagnose, repair and align your radio to its proper operating specifications.

If return of the equipment is necessary, 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
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.

Microwave Data Systems Inc.

175 Science Parkway, Rochester, New York 14620
General Business: +1 (716) 242-9600
FAX: +1 (716) 242-9620
Web: www.microwavedata.com