About This Manual

NAVIGATING BY BOOKMARKS

A “bookmark” is the principal navigation tool in our PDF files. All of a file’s bookmarks are available when the “View Bookmarks and Page” is selected in your PDF viewer. Bookmarks in MDS’ PDF publications will usually list all primary and secondary headings found in the manual. In addition, there are bookmarks for the covers and other relevant information.

NAVIGATING BY THUMBNAILS

A second navigation tool is the “thumbnails” provided when “Thumbnails and Page” is selected in your PDF viewer. This is suitable for casual scanning of the book as if you were thumbing through the paper version. Clicking on the page thumbnail will take your view screen directly to that page. You can also resize the view box on the thumbnail to change the magnification level and the area being viewed.

NAVIGATING BY HOTLINKS

Many PDF versions of our manuals are equipped with hotlinks between portions of the document. Links in the body are displayed as magenta colored strings of text. When your cursor is positioned over a hotlink, the open hand will change into a pointing finger. Clicking on the link location will move you to the associated section of the manual. In some manuals, the hotlinks are only found in the Table of Contents—one link for each major section. These links are indicated by magenta boxes with dashed lines.

PRINTING

This file contains all of the pages of the paper manual including the covers and is ready for printing. The file will image each page exactly as it appears in the paper version if you have a 1200 dpi printer. Lower resolution printers are supported, but highly detailed illustrations such as schematics may not be as readable.

Some manuals will have 11 x 17 inch foldout pages. These pages will print on the default size of 8-1/2 x 11 inches in the “portrait” orientation scaled to fit on the page. To print the foldouts as they appear in the paper manual, select 11 x 17 inch (“Tabloid”) paper stock and the “landscape” orientation in the page set-up window and print the foldouts separately. (This assumes you have a large format printer on-line.)

MDS ON THE INTERNET

For information on MDS products, technical support and publication updates, connect to our Internet Web site at http://www.microwavedata.com/. Click on the address to launch your browser.

CALIFORNIA MICROWAVE
MICROWAVE DATA SYSTEMS

175 Science Parkway, Rochester, N.Y. 14620, U.S.A.
Sales & Customer Support: +1 (716) 242-9600
FAX–All Services: +1 (716) 242-9620
World Wide Web: http://www.microwavedata.com/

MDS 450D/950D

400 MHz & 900 MHz Digital Radios

MDS 05-2815A01, REV. C
JUNE 1998

Installation & Operation Guide

CALIFORNIA MICROWAVE
MICROWAVE DATA SYSTEMS

QUICK START GUIDE

Below are the steps to install either the MDS 450D or MDS 950D digital point-to-point radio.

1. Install and connect the antenna system to the radio (page 7)

2. Install and connect the related data equipment (page 7)

3. Configure the Transmit Clock if Required (page 13)

EIA-530 Interface (V.35 and EIA 449/V.36)

- Set Digital Interface S1-1 for internal or external clock timing. OFF = Internal, ON = External)
- Set Digital Interface S1-2 for looped or non-looped clock timing. (OFF = Non-looped, ON = Looped)

G.703 Interface (set at factory)

4. Transmitter Keying (page 16)

- EIA 530 interface radios will key from external digital equipment's RTS signal. To key radio continuously, set Front Panel Logic Board switch SW1-1 to ON.

5. Connect and apply power to the radio (page 10)

- Ensure an antenna or dummy load is connected to the ANTENNA connector before applying primary power.
- Observe correct polarity and provide appropriate fuses.

6. Connect alarm/monitoring equipment, if required (page 8)

7. Measure Received Signal Strength and align antenna (page 15)

- Use a DC voltmeter on the Front Panel Logic Board RSS Test Point 1 or rear panel MONITOR connector and align the antenna for maximum DC voltage (i.e., maximum received signal strength).

8. Verify radio communications by observing Front Panel Indicators (page 18)

TABLE OF CONTENTS

Copyright Notice

MDS Quality Policy Statement

ISO 9001 Registered Quality System

At MDS, we are committed to achieving Total Customer Satisfaction in everything we do. This includes:

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

If you are not completely satisfied with the quality of an MDS product or service, please let us know as soon as possible; we will endeavor to make sure you are satisfied with your purchase. Thank you for your patronage.

1.0 INTRODUCTION

The MDS 450D/950D are full-duplex digital radios generally used for point-to-point voice and data networks. They transmit and receive simultaneously. The MDS 450D is intended for use in the 400 MHz band and the MDS 950D is used in the 900 MHz band.

Please consider leaving this document near the equipment so it is available for general information and for contacting MDS for additional assistance. This guide contains only basic information concerning the MDS 950D and 450D. Refer to one of the following technical manuals for comprehensive service and installation information.

MDS 450D Technical Manual	MDS P/N 05-2419A01
MDS 950D Technical Manual	MDS P/N 05-2796A01

The radio is tuned for use at specific frequencies at the factory. The radio rear panel has a label showing the permanently configured frequency range and data rate. (See Figure 1 and Figure 2).

1.1 Advantages of a Digital System

In digital systems, information is regenerated at each radio link. This eliminates the passing of any noise typically found in analog multi-link systems. In addition, if the radio link is to be used for several independent data channels, a digital multiplexer is used with no need for additional modems.

1.2 Applications

The radio has been designed for high speed, high performance digital point-to-point communications and is used for sending and receiving data. The digital information can be composed of digitized voice, video, telemetry, remote terminal traffic or a combination of these. In most cases, the radio is connected to a digital multiplexer which digitizes and combines the multiple inputs into one serial synchronous data stream.

Some typical applications are:

- Partial T1/E1 data links
- Ethernet/Token Ring LAN extensions
- Off-premises extensions (OPX) for voice, data, and FAX
- Utility data telecommunications

1.3 MDS 950D Licensing

The MDS digital point-to-point radios must be licensed for use in the USA. The Federal Communications Commission rules Part 101 must be followed when the 950D is used in the USA. When the 950D is used outside the USA, appropriate regulations should be followed.

1.4 MDS 450D Licensing

There are no FCC allocated frequencies applicable to the MDS 450D. However, some USA government agencies have 400 MHz frequency allocations. Outside the USA, appropriate regulations should be followed.

1.5 Model Numbers

The model number on the rear panel of the radio can be interpreted using Figure 1 or Figure 2.

DO NOT USE THIS INFORMATION FOR PRODUCT ORDERING

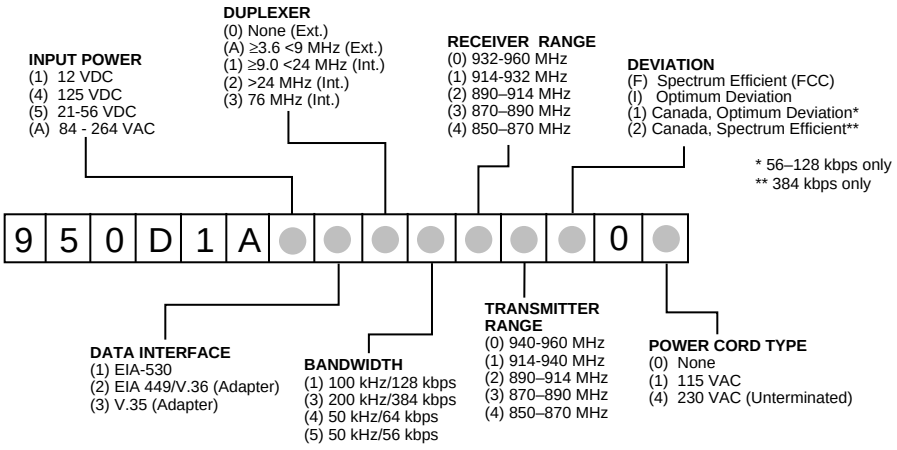

Figure 1. MDS 950D Model Numbers

DO NOT USE THIS INFORMATION FOR PRODUCT ORDERING

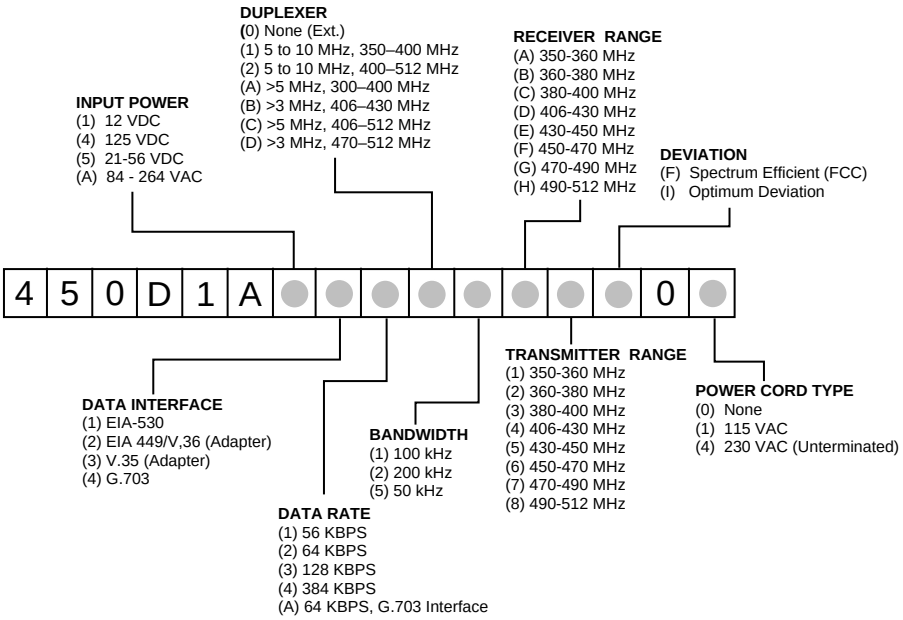

Figure 2. MDS 450D Model Numbers

1.6 Operation

There are no external user controls on the radio except for the power switch on AC powered models. If required, use the front panel indicators to isolate and determine faults with the radio link.

The radio is sensitive to devices that generate radio frequencies. Do not place radio frequency generating devices close to the radio or antenna system. The antenna should always be mounted at least 10 feet (3 meters) away from the radio and any associated equipment.

DANGER

PERSONAL INJURY HAZARD

Strong fields near the antenna may present a health hazard to humans who are continually exposed to the RF field. The fields can seriously interfere with the operation of low level electronic circuits. Also, objects near the antenna can result in poor radio performance.

2.0 UNPACKING AND INSPECTION

Check the contents against the packing list secured to the outside of the shipping container. Accessories and spare parts kits (if any) are wrapped separately. Inspect all items for signs of damage. All packing materials should be saved for possible re-shipment. Figure 3 shows the typical complement of shipped items.

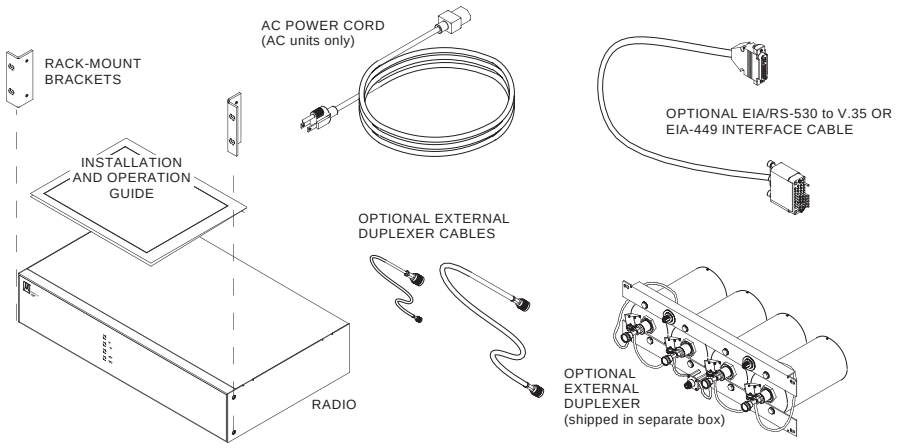

Figure 3. Typical Shipment

3.0 INSTALLATION

The following installation instructions are condensed. Refer to the applicable Technical Manual for detailed system planning and installation information.

3.1 Mounting

The radio can be set on a sturdy surface or it may be installed in an equipment rack with the supplied brackets. If the radio is supplied with an external duplexer, or multiplexer they should be mounted together in an equipment rack. Figure 4 shows the important mounting dimensions for the radio and external duplexer.

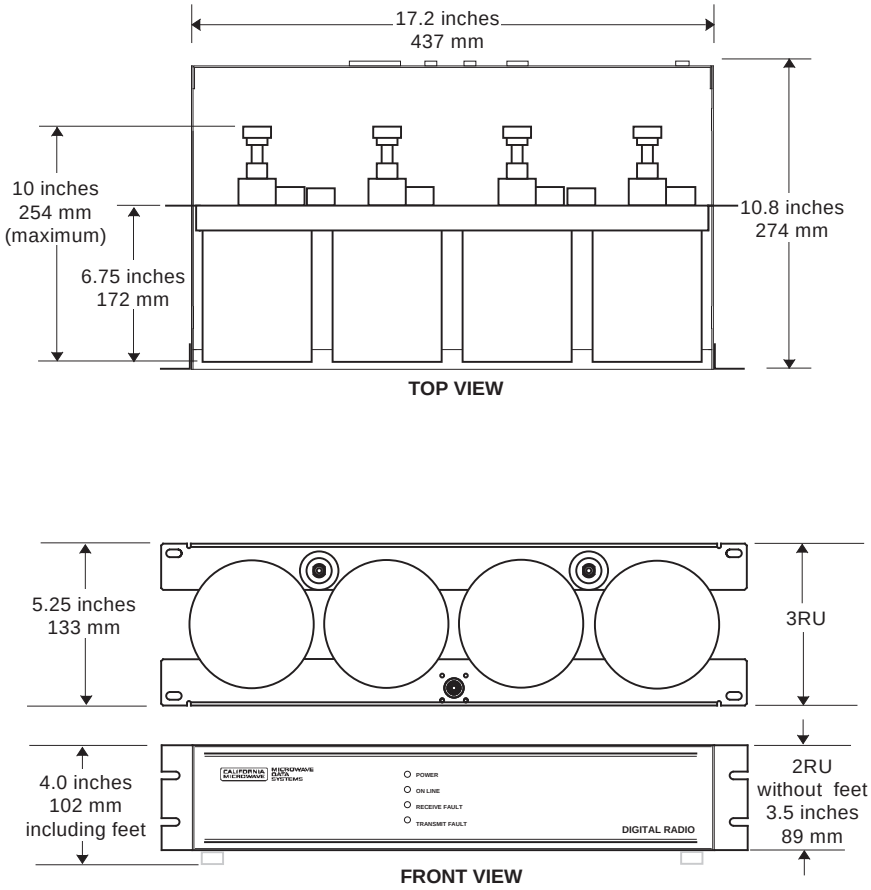

Figure 4. Mounting Dimensions with External Duplexer

3.2 Clearance

In any installation, access to the rear of the radio is required to allow cable connection and possible maintenance access in the future. If possible, mount the duplexer so the RF connectors face toward the rear of the rack. Having the duplexer facing backwards allows the coaxial cables to connect to the radio with a minimum of adapters and connectors.

In general, allow at least four inches of clearance in back of the chassis for connectors and cable bends, and at least one inch of clearance on the top, bottom, and sides for air circulation.

3.3 Ventilation

When selecting a mounting location, keep in mind the need for ventilation. If the equipment is installed in an enclosed cabinet containing other heat generating equipment, provide additional air circulation through the cabinet to keep the equipment as cool as practical. The equipment should also be located in a relatively clean, dust free area.

The MDS 950D and 450D each have a small fan mounted on the inside of the rear panel. The cabinet vent holes may have to be cleaned periodically of dust build-up.

NOTE: Although the maximum temperature environment for the radio is +50°C (+122°F), lower temperatures are more conducive to trouble free operation, as is true with all electronic equipment.

3.4 Antennas and Feedline

To minimize interference to and from nearby systems, and to meet FCC specifications (USA only) for antenna performance, a directional antenna must be used for point-to-point radio installations.

Choice of the correct antenna feedline is important because high-loss coaxial cable results in poor radio performance. Coaxial cable commonly used for frequencies below 100 MHz, such as RG-8 and RG-58, are not suitable for use at 400 or 900 MHz.

Refer to the technical manual for detailed information on antenna systems.

4.0 REAR PANEL CONNECTIONS

Figure 5 shows the location of the rear panel connections on a typical MDS 450D or 950D radio.

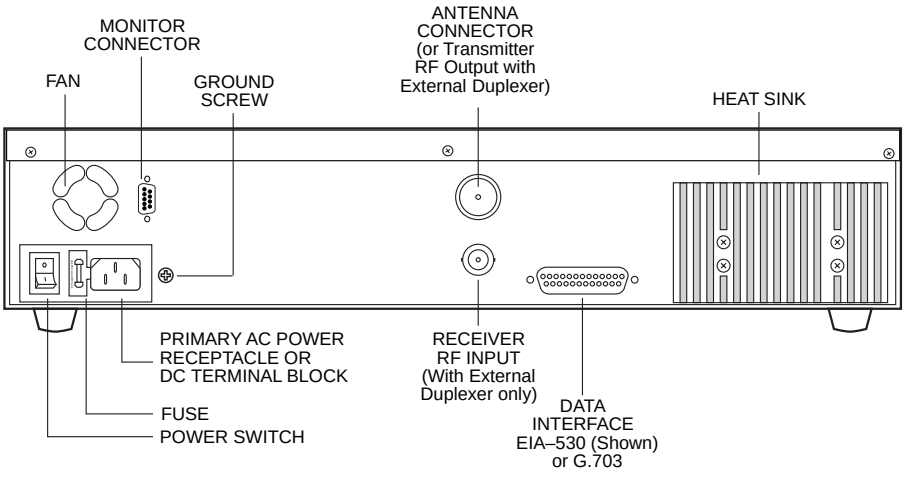

Figure 5. Rear Panel—Typical Chassis

4.1 Antenna and Duplexer Connections

The radio may have one or two coaxial connectors on the rear panel. If the radio is equipped for use with an external duplexer, two coaxial connectors are mounted on the rear panel. A smaller BNC type (not threaded) is connected to the receiver assembly and the N type (externally threaded) is connected to the transmitter. The operating frequencies are labeled on the rear panel. Connect the duplexer ports as indicated.

If the radio is equipped with an internal duplexer, a single N type connector is mounted on the rear panel which serves as the antenna connector.

If large diameter semi-rigid coaxial cable is used for the feedline, insert a short length of Superflex Cable with N connectors (MDS P/N 97-1677A28) or other low-loss flexible cable between the radio and the feedline. The flexible cable eliminates the need for tight bends in the feedline and reduces stress on the feedline and connectors.

4.2 Data Interface Connection

The radio may be equipped with either an EIA-530 or G.703 interface. Regardless of the interface type, the MDS radio is configured as Data Circuit-terminating Equipment (DCE) and cannot be reconfigured. The connecting equipment must be Data Terminal Equipment (DTE) unless an appropriate crossover (null modem) cable is used.

EIA-530 Interface (V.35 and EIA 449/V.36)

This interface option adheres to the EIA-530 (Electronic Industries Association) synchronous data interface (serial) standards. The electrical signals are compatible with V.35 and EIA 449/V.36 standards. However, an adapter cable must be used for compatibility with the V.35 or EIA 449/V.36 connector standards.

The following adapter cables with the corresponding part numbers are available.

EIA-530 to V.35 Adapter Cable	**MDS P/N 03-2174A01**
EIA-530 to EIA 449/V.36 Adapter Cable	**MDS P/N 97-2197A40**

Refer to Figure 6 for EIA-530 connector information.

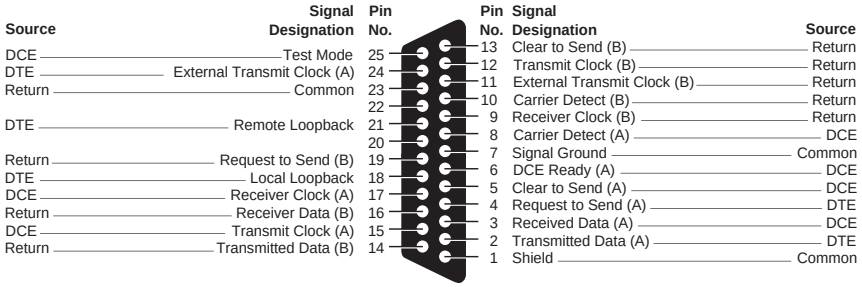

Figure 6. EIA-530 Interface

If the EIA-530 interface is being connected to a MDS MX-2000 multiplexer use one of the following cables.

EIA-530 to EIA-530 6 foot (1.83 meters)	**MDS P/N 97-1971A05**
EIA-530 to EIA-530 12 foot (3.65 meters)	**MDS P/N 97-1971A06**

G.703 Interface

This interface adheres to the criteria set by the CCITT G.703 guidelines. It is a co-directional interface. The only data rate available with a G.703 interface is 64 kbps.

Refer to Figure 7 for G.703 interface connector pinout information.

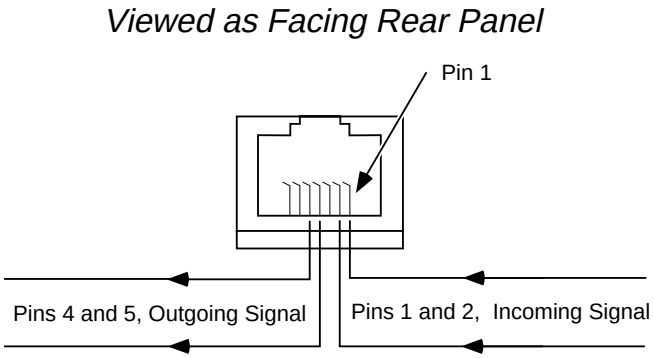

Figure 7. G.703—RJ-45 Interface Pinouts

4.3 Monitor Connections

A Male DB-9 connector is mounted on the rear panel to provide remote monitoring of alarms and receive signal strength indication (RSSI) from the 03-3074A01 Logic Board. An isolated, form-C, dry contact, relay provides a summary alarm. Three open collector optocouplers with an

isolated common provide individual alarms. A positive voltage (relative to chassis) is provided for relative RSSI. The sense of all alarms is such that an alarm condition will be indicated when there is no power supplied to the radio.

The pin functions for the DB-9 Monitor connector are as follows:

- Pin 1 - Summary alarm, normally open (NO)
- Pin 2 - Summary alarm, common
- Pin 3 - Summary alarm, normally closed (NC)
- Pin 4 - Receive signal strength
- Pin 5 - Receive signal strength common (chassis)
- Pin 6 - Receive alarm, NPN open collector
- Pin 7 - 1E-3 BER alarm, NPN open collector
- Pin 8 - RF power alarm, NPN open collector
- Pin 9 - Common for pins 6, 7 and 8

Monitor operation

Summary Alarm—The Summary Alarm relay remotes the operation of the front panel ON LINE LED. The form-C, dry contact, relay will be in the normally open position (Pin 2 connected to 1) when the system is functioning properly (ON LINE LED illuminated). The alarm relay contacts will be in the normally closed position (Pin 2 connected to 3) when the system has a fault - including no DC input power - (ON LINE LED off). Connections to these terminals must be limited to 30 Vdc and 0.4 ampere.

Receiver Signal Alarm - An open collector, NPN, opto-coupled transistor connected to pin 6 (C) and pin 9 (E), will conduct when a signal is received, (RSS voltage greater than 0.7 Vdc, indicating a received RF level of greater than -110 to -100 dBm, depending on data rate). An external pull-up resistor (typically 1 K–4.7 K) from pin 6 to a positive voltage of 5–30 Vdc is required; common is on pin 9.

1E-3 BER Alarm - An open collector, NPN, opto-coupled transistor connected to pin 7 (C) and pin 9 (E), will conduct when the Bit Error Rate is better than about 1E-3. An external pull-up resistor (typically 1 K–4.7 K) from pin 7 to a positive voltage of 5–30 Vdc is required; common is on pin 9.

RF Power Alarm - An open collector, NPN, opto-coupled transistor connected to pin 8 (C) and pin 9 (E), will conduct when the RF output of the transmitter module is greater than about 1 watt. An external pull-up resistor (typically 1 K–4.7 K) from pin 8 to a positive voltage of 5–30 Vdc is required; common is on pin 9.

CAUTION
POSSIBLE EQUIPMENT DAMAGE

Absolute maximum (breakdown) voltage of the optocoupler transistor is 40 Vdc. Absolute maximum collector current is 50 ma. Typically, collector current should be limited to about 5 ma., which will keep saturation voltage below about 0.5 volt. This implies a 1 K resistor to a 5 volt source or a 4.7 K resistor to a 24 volt source.

RSSI Output - A DC voltage of +0.3 to +3 Vdc is provided on pin 4 of the connector that is proportional to the received RF signal strength. This voltage is the same as TP1 RSS on the logic board. Output impedance is about 5000 ohms, so it must be measured with a high impedance voltmeter. Common is on pin 5 which also connects to the radio chassis.

5.0 POWER REQUIREMENTS

All MDS 950D and 450D radios, whether DC or AC-powered, are shipped ready to operate at the customer-specified voltage. The following information provides details on input voltage range and power consumption for typical units.

CAUTION
POSSIBLE EQUIPMENT DAMAGE

When making the primary power connections, make sure the voltage and its polarity is correct for the internal power supplies. Application of improper voltage can damage the power supplies.

5.1 Power Input on AC and 125 Vdc Units

AC Operation

The AC powered models have an on-off switch as part of the power connection and fuse holder as shown in Figure 8. There is also a spare fuse inside the fuse holder.

AC-powered radios use a wide range power supply that can operate at any input source between 85–264 Vac (RMS) at 47–440 Hz. The maximum input power consumption is 60 VA while transmitting.

DC Operation

The AC power supply has an input full-wave rectifier, so it can also be used with 125 Vdc power sources with positive or negative ground.

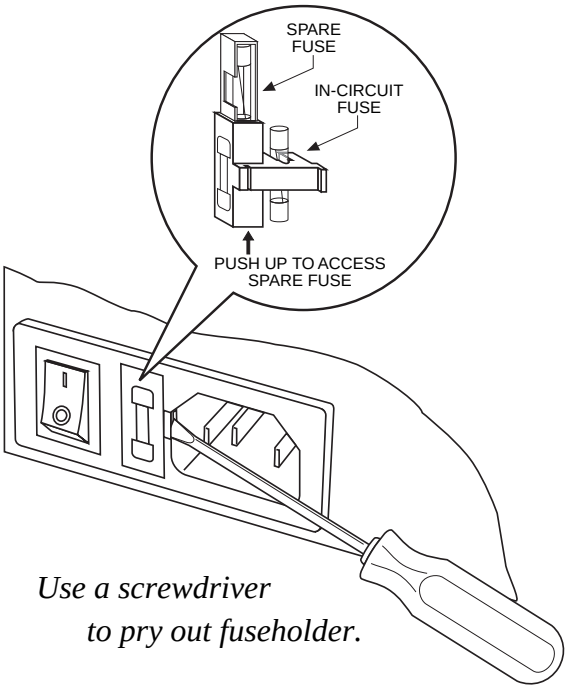

Figure 8. Fuse Replacement on Power Entry Assembly (AC Models)

5.2 Power Input on 12–56 Vdc Units

The DC powered models consist of a three terminal barrier strip labeled for polarity and voltage as shown in Figure 9. **Models configured for 14 Vdc must be negative ground.** All other DC models can be connected to positive or negative ground.

On these DC powered radios, inputs can be 12–14 or 21–56, depending on the power supply assembly that has been installed (Refer to power entry label). It is necessary to replace the power supply assembly to change the input voltage range.

On the units configured for 14 Vdc operation, there is no internal supply. The rear panel terminals connect directly to the internal assemblies. Since there is no internal regulated supply, RF power output may vary with input voltage.

14 and 21–56 Vdc powered units have no power switch. The unit operates as soon as power is applied at the rear panel.

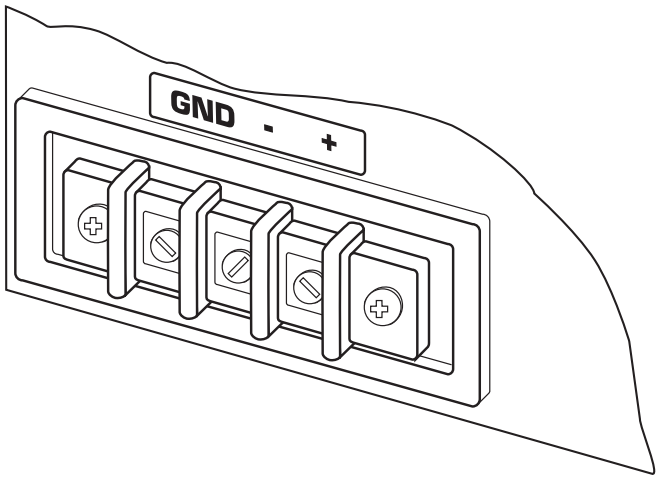

Figure 9. DC Power Entry Terminal Block (DC Models)

Ensure there is a fuse in the primary DC supply line, as close to the power source as practical. Refer to Table 1 for appropriate fuse sizes and types.

Table 1. Recommended Power Line Fuses

NOMINAL SUPPLY VOLTAGE	FUSE SIZE AND TYPE
14 Vdc	External 5 Amp, fast-blow
24 Vdc	External 4 Amp, fast-blow
48 Vdc	External 2 Amp, fast-blow
85–264 Vac 125 Vdc	Internal 3.0 Amp, GMA

Although it is best to maintain the input voltage at the nominal level, the DC power supplies are capable of operating over a wide range of voltages. Table 2 lists the safe operating range for each power supply.

Table 2. DC Operating Voltages

NOMINAL SUPPLY VOLTAGE	OPERATING RANGE
14 Vdc	12.0–14.6 Vdc
24/48 Vdc	21–56 Vdc
125 Vdc	120–200 Vdc

5.3 Safety (Chassis) Ground Screw

Use this screw to connect the chassis to a station safety ground (earth). It is located at the rear panel below the power input assembly.

This ground must be part of a grounding and bonding system that includes the equipment rack, antenna, tower and primary power electrical systems. Review local electrical code or company safety standards for methods of providing an adequate ground system.

6.0 CONFIGURATION AND CHECKS

When the MDS 450D or 950D is shipped, the unit has been completely set up and tested. No user configuration is needed to put it into service except for verification of the transmit clock (TXC) settings and verification of received signal strength.

CAUTION
POSSIBLE EQUIPMENT DAMAGE

Radios equipped with a G.703 interface are continuously keyed by having SW1-1 on the Front Panel Logic Board set to ON. Therefore, ensure there is an antenna or dummy load attached to the ANTENNA connector before applying primary power.

6.1 Primary Power

Measure the primary power that will be applied to the radio. The voltage should match the voltage range the radio is configured for.

6.2 Transmit Clock

Because the system is synchronous (dependent on a common timing signal), a Timing Clock must be used by the radio and other connected digital equipment. The equipment must be configured so that only one unit supplies the Transmit Clock and all others synchronize to this clock.

The radio has a transmit clock that can operate from its own crystal or can synchronize to another signal such as the External Transmit Clock (ETC) of the multiplexer (or terminal) or recover the clock signal from the received data.

Radios with the G.703 interface are always externally clocked.

On the Digital Interface Board, switches S1-1 and S1-2 control the Transmit Clock operation. S1-1 selects either the radio's internal clock or an external clock. S1-2 allows the Receive Clock (RC), which comes from the receive data, to be looped back as its Transmit Clock. When S1-2 is ON, S1-1 must be OFF.

NOTE: All radios with a G.703 interface must have S1-1 set to ON and S1-2 set to OFF under all circumstances.

To gain access to the Digital Interface Board, loosen the three screws along the top of the rear panel and carefully lift off the cover as much as the cabling allows. Locate the Digital Interface Board and, if required, set configuration switches, S1-1 and S1-2, for the required clock configuration. See Figure 10 for the location of S1.

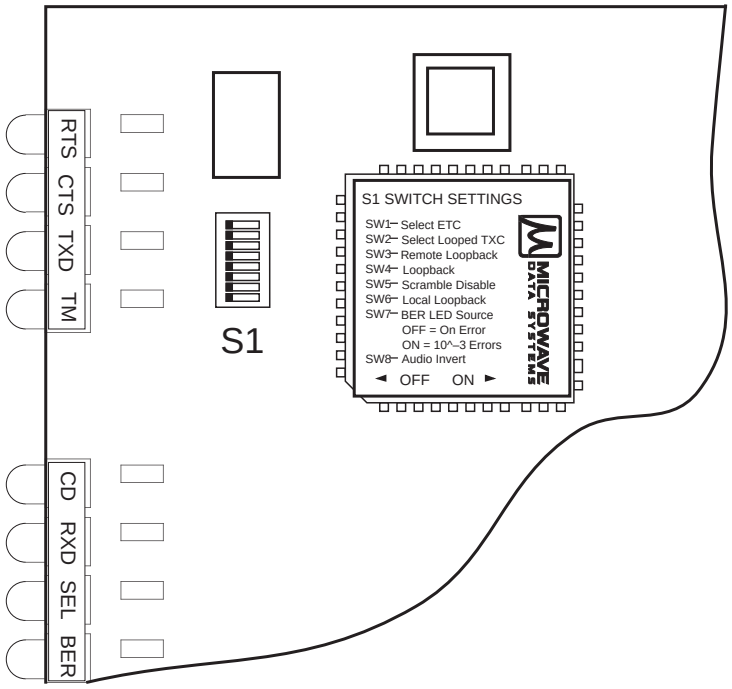

Figure 10. Location of S1 on the Digital Interface Board

Refer to Figure 11, Figure 12 and Figure 13 for Transmit Clock configurations and S1-1 and S1-2 settings for radios configured with an EIA-530 interface.

Figure 11 shows a typical system with the digital multiplexer (or terminal) generating the Transmit Clock. Figure 12 shows a typical system with one radio generating the Transmit Clock.

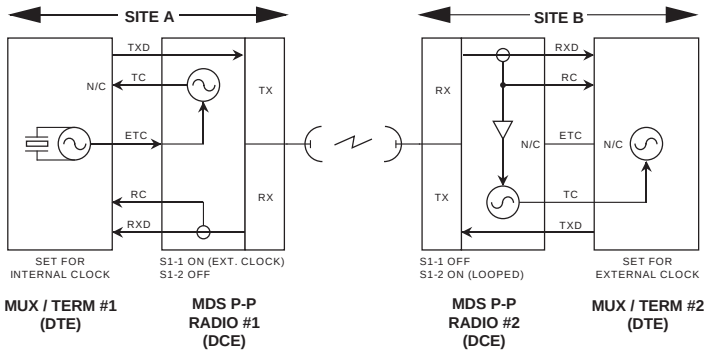

Figure 11. Clock Generated by DTE at Site A

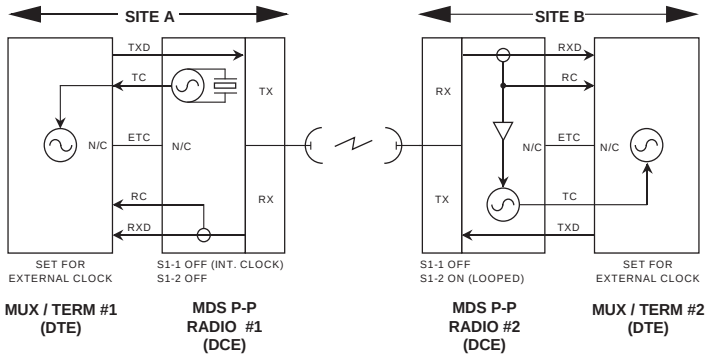

Figure 12. Clock Generated by MDS Radio at Site A

6.3 Repeater Configuration

To extend a radio circuit, two radios can be connected together at one site to make a full-duplex repeater. To connect two radios together as a repeater, without any multiplex equipment, a EIA-530 null-modem cable is required (MDS P/N 97-1870A11). The cable connects to the DATA ports of the two co-located radios. Figure 13 shows this configuration.

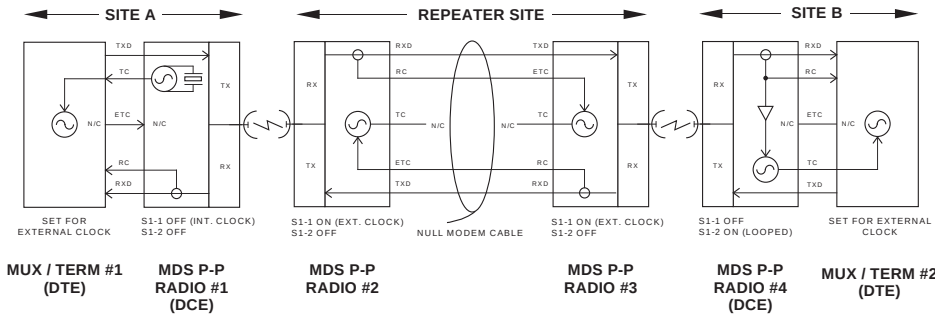

Figure 13. MDS 950D/450D Repeater System

6.4 Received Signal Strength

During installation, the received signal strength (RSS) should be monitored while the station antenna is oriented for best reception of the distant radio. To do this, connect a DC voltmeter to the MONITOR connector on the rear panel—Pin 4(+) and Pin 5(-), or, with the top cover lifted off as much as the cabling allows, monitor Test Point 1 (RSS) on the Front Panel Logic Board with a DC voltmeter (see Figure 14). As the received signal strength increases so does the RSS DC voltage. The nominal RSS voltage range is between 0.8 Vdc and 3.0 Vdc.

6.5 Transmitter Keying

On radios equipped with an EIA–530 Interface, the transmitter will be keyed by the RTS signal from the external digital equipment. To continuously key the radio independently of external digital equipment, set Front Panel Logic Board switch SW1-1 to ON.

On radios with a G.703 interface, SW1-1 on the Front Panel Logic Board (Figure 14) is set to ON at the factory to key the radio continuously.

During test and adjustment, the external digital equipment may be removed from the Interface DATA connector. An EIA-530 transmitter can be keyed by one of the following methods:

- Switching SW1-1 on the Front Panel Logic Board to ON (see Figure 14).
- Providing an RTS signal by jumpering Pin 4 to Pin 6 on the rear panel EIA-530 interface connector.

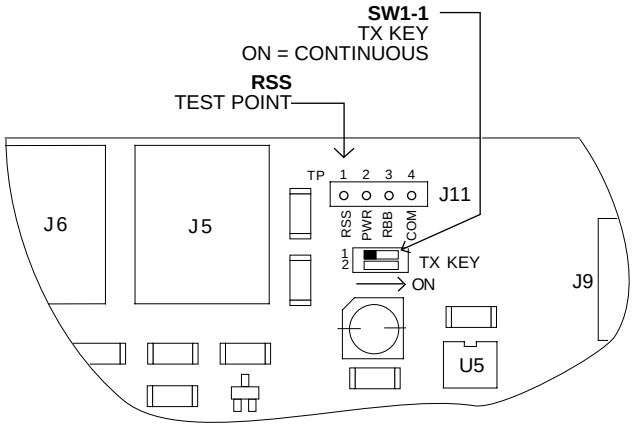

Figure 14. Front Panel Logic Board
(Showing RSS test point and SW1-1 location)

7.0 OPERATING FREQUENCY

Frequency changes without realignment can be accomplished if the operating frequency is to be changed less than 200 kHz. *If the operating frequency is to be changed by more than 200 kHz refer to the Technical Manual for complete realignment instructions.*

The operating frequencies are programmed using an MDS Hand-Held Terminal (HHT) Kit (MDS P/N 02-1501A01).

7.1 Frequency Review Procedure

1. Loosen the three screws along the top of the rear panel and carefully lift the cover off as much as cabling allows.

2. Connect the HHT cable into either J5 (Transmitter) or J6 (Receiver) on the Front Panel Logic Board depending on which frequency is to be reviewed. See Figure 15 for reference.

3. Read the currently set frequency by typing **FRQ** + **ENTER** on the HHT. The HHT displays the currently programmed operating frequency.

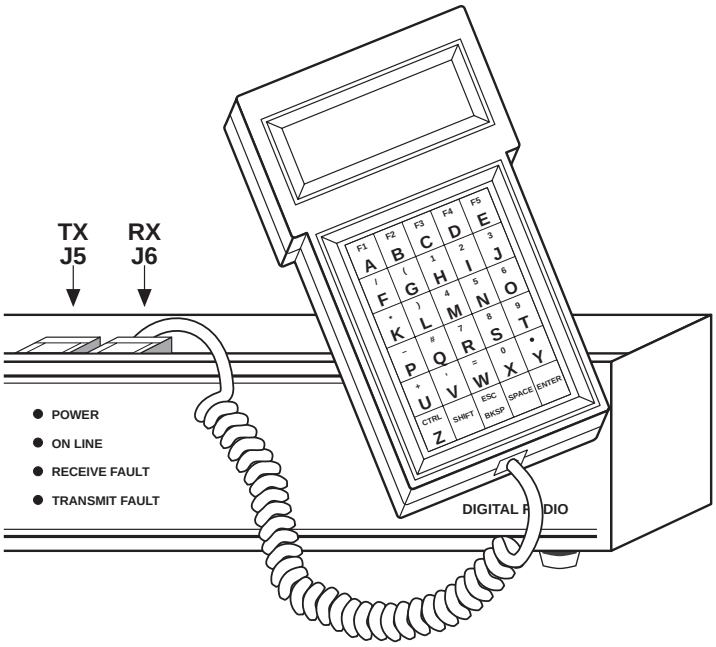

Figure 15. Hand-Held Terminal Connections

7.2 Frequency Change Procedure

CAUTION
POSSIBLE EQUIPMENT DAMAGE

Changing the radio operating frequencies should be done by a qualified radio technician with appropriate test equipment and technical manual.

1. Loosen the three screws along the top of the rear panel and carefully lift the cover off as much as cabling allows.

2. Apply primary power to the radio and if the unit has a power switch, switch it ON.

3. Connect the HHT cable into either J5 (Transmitter) or J6 (Receiver) on the Front Panel Logic Assembly depending on which frequency is to be changed. See Figure 15 for reference.

4. Enter the command to change the currently set frequency by typing **PRX +** [SPACE] **+** [SHIFT] **+ xxx.xxxx** on the HHT if connected to the receiver (J6). Type **PTX +** [SPACE] **+** [SHIFT] **+ xxx.xxxx** if the HHT is connected to the transmitter (J5). Enter the actual operating frequency in MHz. Trailing zeros are not required.

8.0 FRONT PANEL INDICATORS

Table 3 lists the normal indications that should be seen at the front panel. If the normal indications are not obtained, refer to the troubleshooting chart in Figure 16.

Table 3. Normal Conditions of Front Panel Indicators

	NORMAL INDICATION	
INDICATOR	**NO ANTENNA OR DATA CONNECTION**	**RADIO CONNECTED TO DIGITAL EQUIPMENT & RECEIVING DATA SIGNAL OVER RF PATH**
POWER	ON	ON
ON LINE	OFF	ON
RECEIVER FAULT	ON	OFF
TRANSMITTER FAULT	OFF	OFF

POWER—*Green*

This indicator lights when primary power is supplied to the radio and the power is switched on.

ON LINE—*Green*

This indicator lights when the unit is operating normally and data is being passed. The ON LINE indicator will be off under the following conditions:

- High data error rate
- Weak received signal
- Low (or no) transmit power
- Unkeyed transmitter

If ON LINE is out, data transmission is weak or not possible in one or both directions.

RECEIVE FAULT—*Red*

This indicator lights if the received signal gets weak, *or* if the received error rate is greater than one in a thousand. When this indicator is on, ON LINE is off.

TRANSMIT FAULT—*Red*

This indicator lights if transmitter power drops. When the transmitter is not commanded to transmit, this indicator *and* ON LINE are off. If this indicator is on, ON LINE is off.

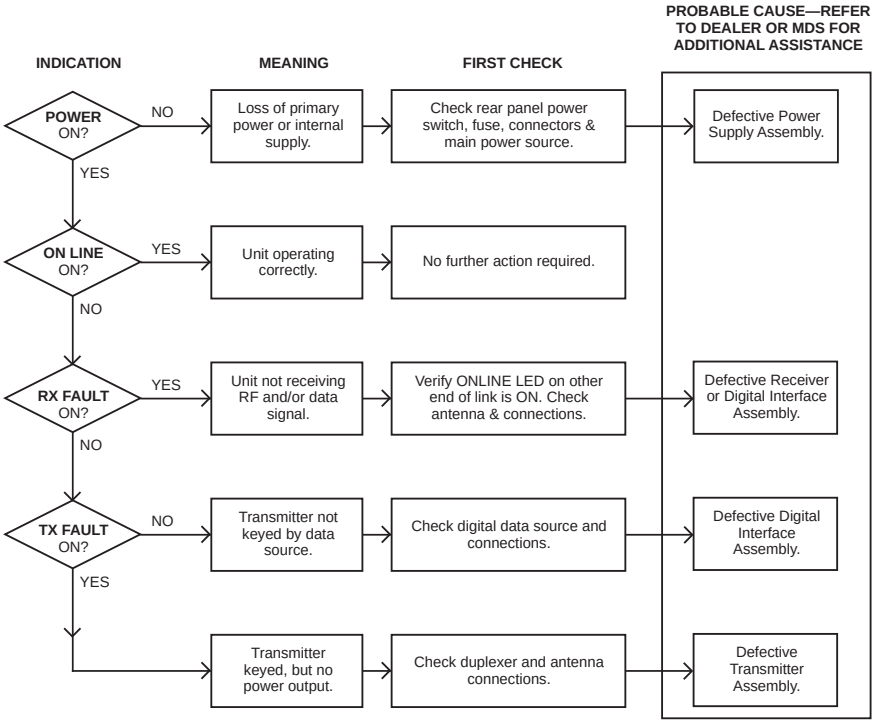

Figure 16. Troubleshooting Chart

9.0 LOOPBACK TESTING

Loopback operation can be helpful in testing radio performance in an installed system. There are three loopback possibilities. If additional information regarding Loopback testing is required, refer to the appropriate Technical Manual.

9.1 Local Loopback

Local Loopback takes transmit data, just before it modulates the transmitter, and feeds it back through the receive path of the Digital Interface where it is decoded and fed back out as receive data. This checks out the local Digital Interface and the connection between it and the DTE or multiplexer.

Local Loopback mode can be enabled by setting switch S1-6 at the Digital Interface Board to **ON**.

On radios equipped with an EIA–530 interface, Local Loopback mode can also be enabled from the multiplexer (or other DTE) by asserting EIA-530 interface connector Pin 18.

9.2 Remote Loopback

Remote Loopback causes the remote radio to loopback all of the data it receives. This checks out the radios at both ends of the path, as well as the path between them.

When Remote Loopback is enabled, the remote radio Transmit Clock (TC) automatically switches to Looped Clock timing, while the local radio automatically turns Looped Clock timing off. Remote loopback does not key the remote transmitter. It must be keyed through normal methods (see *Section 6.5, Transmitter Keying*).

Remote Loopback can be enabled by setting switch S1-3 at the Digital Interface Board to **ON**.

On radios equipped with an EIA–530 interface, Remote Loopback mode can also be enabled from the multiplexer (or other DTE) by asserting the EIA-530 interface Pin 21.

9.3 Loopback

Loopback takes all of the received data and sends it back to the other end. It is similar to Remote Loopback, except it must be initiated at the remote end rather than from the local end.

When Loopback is enabled, the Transmit Clock automatically switches to Looped Clock timing.

Loopback is selected by turning S1-4 ON at the Digital Interface Board of the remote radio.

NOTES

Model and Serial Number:

Date unit installed:

NOTES

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 assemblies 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.

175 Science Parkway
Rochester, N.Y. 14620, USA
General Business: +1 (716) 242-9600
FAX: +1 (716) 242-9620
Internet: Sales@mdsroc.com
World Wide Web: http://www.mdsroc.com/