



1.0 INTRODUCTION

The MDS SD1 transceiver (Figure 1) is a software-configurable, industrial solution for use in wireless telemetry applications. The unit operates in the 150-174 MHz frequency band.

The radio interfaces with a variety of data control equipment such as remote terminal units (RTUs), programmable logic controllers (PLCs), flow computers, and similar devices. Data interface connections may be made by both serial (RS-232/485) and limited Ethernet protocols.

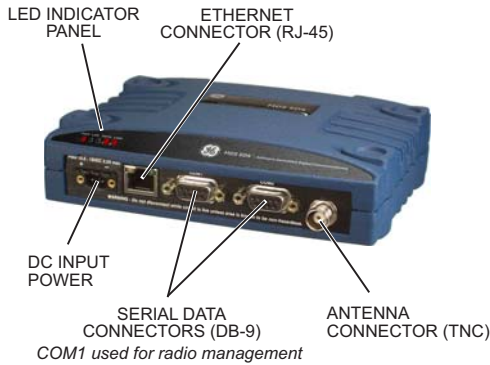


Figure 1. MDS SD1 Data Transceiver

2.0 INSTALLATION

There are three main requirements for installing the transceiver:

- Adequate and stable primary power
- An efficient and properly installed antenna system
- Correct interface connections between the transceiver and the data device.

Figure 2 shows a typical installation of the radio.

NOTE: Retrofit Kits are available to simplify installation at former MDS x710 digital and analog sites. Consult the *Reference Manual* for ordering details.

2.1 Installation Steps

In most cases, the steps given here are sufficient to install the transceiver. Refer to the *Reference Manual* for additional details, as required.

1. **Mount the transceiver** using the brackets supplied. Attach the brackets to the bottom of the transceiver case (if not already attached), using the four 6-32 x 1/4 inch (6 mm) screws supplied. Mounting bracket dimensions are shown in Figure 3. If DIN Rail mounting brackets are to be used, consult the *Reference Manual*.

NOTE: To prevent moisture from entering the radio, do not mount the case with the cable connectors pointing up. Also, dress all cables to prevent moisture from running along the cables and into the radio.

CAUTION: Using screws longer than 1/4 inch (6 mm) to attach the brackets to the radio may cause internal damage. Use only the screws supplied.

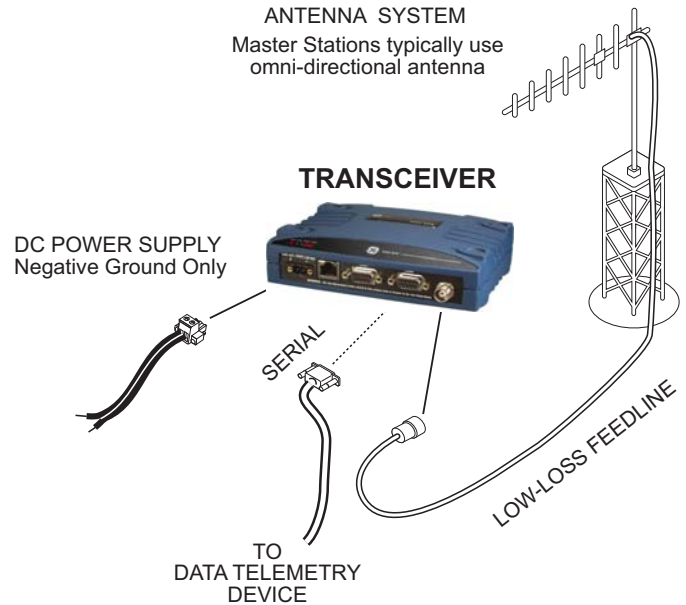


Figure 2. Typical Installation (Remote Site Shown)

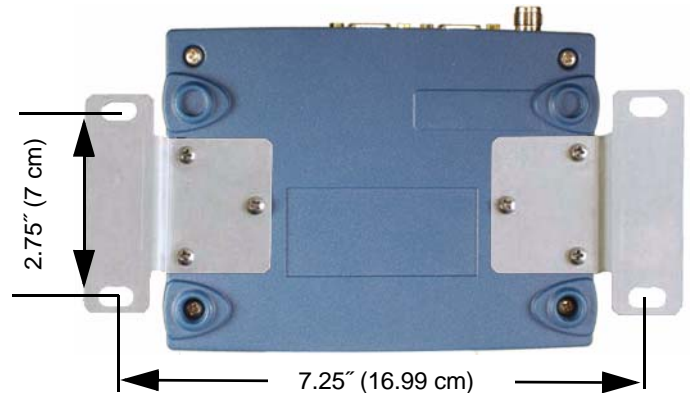


Figure 3. Mounting Bracket Dimensions

2. **Install the antenna and feedline.** The antenna used with the radio must be designed to operate in the radio's frequency band, and be mounted in a location providing a clear path to the associated station(s). At Remote sites, aim directional antennas toward the Master Station. Low loss coaxial feedline should be used and it should be kept as short as possible.
3. **Connect the data equipment.** Connection may be made to the COM port using Serial protocols (RS-232/RS-485).
 - Connect your data equipment to the appropriate serial port on the front panel. (Typically, COM2 is used for connecting data equipment, and COM1 is used for management of the radio. Other arrangements are possible. Refer to the *Reference Manual* for details.) In all cases, the radio is hardwired as a DCE device. A straight-thru cable may be used for most applications.
4. **Connect primary power.** Input power must be 10.0 to 30 Vdc and capable of providing at least 2.5 Amperes. A power connector with screw-terminals is provided with the unit (see

Figure 4). Strip the wire leads to 6 mm (1/4 inch) and insert them into the wire ports. Be sure to observe proper polarity as shown below. Tighten the binding screws securely.

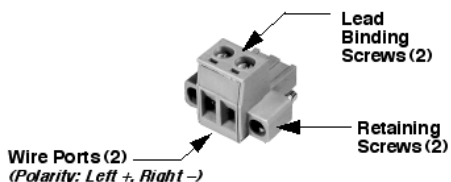


Figure 4. DC Power Connector

CAUTION: The unit is designed for use with *negative-ground* systems only. The power supply should be equipped with overload protection (NEC Class 2 rating), to protect against a short circuit between its output terminals and the radio's power connector.

5. **Set the radio's configuration.** Connect a PC to the radio's COM1 port as shown in Figure 5. A straight-thru cable may be used for this connection.

NOTE: Consult your System Administrator if you are unsure of the settings required for your network.

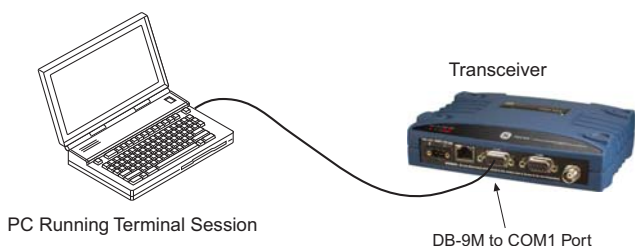


Figure 5. Setup for PC Configuration

2.1.1 Software Configuration

There are two methods for communicating with the radio for configuration and management: **Serial** (COM1 DB9 connector) and **Telnet** (ETHERNET RJ-45 connector). Both present identical functionality, but the method of access is different for each. The focus here is on Serial access, but Telnet may be used by following these additional points, which replace Steps 1 and 2 below:

- For Telnet, connect to the radio with a PC that is on the same IP network as the transceiver. Launch a Telnet program, and connect to the radio using its programmed IP address.
- The default IP address is 192.168.1.1. If you do not know the IP address of the radio, use the serial configuration steps below to view the address with the **IPCONFIG** command.

1. With a PC connected to the COM1 serial port, launch a terminal program, such as HyperTerminal (included with most pre-Vista Windows®-based PCs) and set the following parameters:

8 bits, no parity, one stop bit (8N1), flow control disabled, VT100 emulation. The radio's COM1 port automatically determines the connected baud rate (within the range of 1200–115200 bps).

2. Press the **ESCAPE** key followed by a series of **ENTER** keypresses (1/2 second intervals) until the > prompt appears. The radio is now ready to accept commands.
3. Set/verify the **RX** (receive) and **TX** (transmit) frequencies. To set the receive frequency, enter **RX** followed by the correct frequency in MHz (**xxx.xxxxx**). Press **ENTER**.

To set the transmit frequency, enter **TX** followed by the correct frequency in MHz (**xxx.xxxxx**). Press **ENTER**.

4. The factory default modem settings support operation for most systems. Other options are available using the proper software commands. The current setting may be viewed using the

MODEM command. Use **MODEM [xxxx]** if changes are required, where xxxx represents the modem speed in bps.

When finished with the steps above, review the other configuration options to determine if other settings are required for your system. Table 3 lists key software commands for the radio.

2.2 Initial Checkout

In-service operation of the transceiver is completely automatic. The only operator actions required are to apply DC power and observe the LEDs for proper indications. Table 1 summarizes the radio's LED functions.

2.2.1 LED Functions

NOTE: LED labeling may vary on early units. LED position and functionality remains as described below.



Figure 6. LED Status Indicators

Table 1: Description of LED Status Indicators

LED Name	Description
PWR	<ul style="list-style-type: none"> • Continuous—Power applied, no problems detected. • Rapid flash (5x-per-second)—Alarm indication.
LAN	<ul style="list-style-type: none"> • Flashing—Ethernet data activity is detected. • Off—Ethernet signals not detected, or excessive traffic is present at the port.
DATA1/DATA2	These LEDs show data activity on the DB-9 serial payload port(s).
LINK	When lit, indicates that a communication link exists with the master station.

NOTE: The Ethernet connector also has two embedded LEDs. A flashing green indicates Ethernet data activity, and a yellow indicates 100 Mbps operation has been achieved.

2.2.2 Antenna SWR Check

Before placing the unit in final operation, the antenna system's standing wave ratio (SWR) should be checked using a wattmeter suited to the frequency of operation. High SWR (above 2:1) may indicate an antenna or feedline problem, and should be corrected.

2.2.3 RSSI Check (for Remotes)

Using the **RSSI** command (received signal strength indication), check for adequate signal strength. The radio must be receiving a signal from the associated Master Station (LINK LED on or blinking). In general, signal levels stronger than -80 dBm will provide very reliable communication and allow for a degree of "fade margin."

Optimize the RSSI at Remotes by slowly adjusting the direction of the station antenna. Watch the RSSI indication for several seconds after making each adjustment so that the RSSI accurately reflects any change in the signal strength. With RSSI, the less negative the number, the stronger the incoming signal (*i.e.*, -70 dBm is stronger than -80 dBm).

3.0 TROUBLESHOOTING

All radios in the network must meet the following basic requirements for proper operation. Check these items first when troubleshooting a communication problem:

- Adequate and stable primary power
- Secure cable connections (RF, data and power)
- A clear transmission path between Master and each Remote

- An efficient and properly aligned antenna system providing adequate received signal strength.
- Proper programming of the transceiver's parameters
- The correct interface between the transceiver and the connected data equipment (correct cable wiring, proper data format, timing, etc.)

3.1 LEDs

The radio's LED indicator panel provides useful information when troubleshooting a system problem. Refer to [Table 1](#) for LED information.

3.2 Event Codes

When an alarm condition exists, the transceiver creates a message that can be read on a connected PC by using the **ALARM** command. Consult the *Reference Manual* for details.

3.2.1 Types of Alarms

Minor Alarms—report conditions that, under most circumstances will not prevent transceiver operation. This includes out-of-tolerance conditions, baud rate mismatches, etc. The cause of these alarms should be investigated and corrected to prevent system failure.

Major Alarms—report serious conditions that generally indicate a hardware failure, or other abnormal condition that will prevent (or seriously hamper) further operation of the transceiver. Major alarms may require factory repair. Contact your factory representative for assistance.

3.3 Built-In Spectrum Analyzer

A Spectrum Analyzer screen is available for viewing other radio signals near the SD's operating frequencies. Access to the analyzer is made with the **Spectrum** command.

Optionally, you can specify a frequency at the prompt to view the surrounding spectrum of that frequency. To do this, enter **Spectrum xxx.xx**, where **xxx.xx** is the frequency in MHz.

The display creates a received signal strength indication (RSSI) vs. frequency plot for the frequency and surrounding signals. Refer to the *Reference Manual* for more information.

4.0 COM1/COM2 REFERENCE

4.1 COM1 Connections for PC Control

The COM1 DB-9 connector is used for PC management of the radio. A straight-through cable is required that connects Pin 2 (RXD), Pin 3 (TXD), and Pin 5 (Ground). (See [Figure 7](#).)

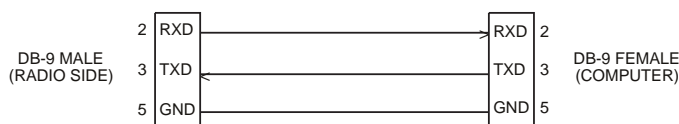


Figure 7. COM1 Wiring to Computer

4.2 COM2 Connections

The COM2 connector ([Figure 8](#)) is typically used to connect an external DTE telemetry device to the radio, supporting the RS-232 or RS-485 (balanced) format, depending on how the radio is configured. The radio supports data rates of 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps (asynchronous data only).

The COM2 connector mates with a standard DB-9 plug available from many electronics parts distributors.

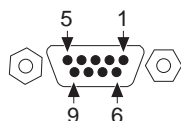


Figure 8. COM2 Connector (DB-9F)
As viewed from outside the radio

4.2.1 Pin Descriptions—RS-232 Mode

[Table 2](#) provides pin descriptions for the connector when operating in RS-232 mode. For RS-422/485, refer to the *Reference Manual*.

NOTE: The radio is hard-wired as a DCE device.

Table 2: COM2 Pin Descriptions—RS-232

Pin No.	Input/ Output	Pin Description
1	OUT	DCD (Data Carrier Detect/Link) —A low indicates signal received.
2	OUT	RXD (Received Data) —Supplies received data to the connected device.
3	IN	TXD (Transmitted Data) —Accepts TX data from the connected device.
4	IN	Sleep Mode Input —Grounding this pin places the radio in a low power consumption mode.
5	--	Signal Ground —Connects to ground (negative supply potential) on chassis.
6	OUT	Alarm Output (DSR) —Behavior is user-configurable. <i>Default behavior:</i> An RS-232 high/space (+5.0 Vdc) on this pin indicates an alarm condition. An RS-232 low/mark (–5.0 Vdc) indicates normal operation.
7	IN	RTS (Request-to-Send) —Keys the transmitter.
8	OUT	CTS (Clear-to-Send) —Goes “high” after the programmed CTS delay time has elapsed (DCE), or keys another connected radio when RF data arrives (CTS KEY).
9	--	Reserved—User I/O for special applications.

5.0 COMMAND OVERVIEW

[Table 3](#) on the following page lists key software commands for the SD transceiver. Many commands can be used in two ways:

1. The basic command (shown first) may be entered alone to issue a query or execute a simple command.
2. The basic command may be appended with additional arguments (shown in brackets, if applicable) to further define a setting.

A complete list of commands and detailed descriptions is provided in the *SD Reference Manual* (under development for SD1).



RF Exposure Notice

The concentrated energy from a directional antenna may pose a health hazard. Do not allow people to come closer than **1.80 meters** to the front of the antenna when the transmitter is operating with a 7 dBd (9.15 dBi) gain antenna. Use of higher gain antennas means increasing the distance accordingly. This guide is intended for use by a *professional installer*. More information about RF exposure can be accessed online at the following address:

www.fcc.gov/oet/info/documents/bulletins

L'énergie concentrée en provenance d'une antenne directionnelle peut présenter un danger pour la santé. Ne pas permettre aux gens de s'approcher à moins de 1,80 mètres à l'avant de l'antenne lorsque l'émetteur est en opération avec une antenne ayant un gain de 7 dBd (9,15 dBi). On doit augmenter la distance proportionnellement si on utilise des antennes ayant un gain plus élevé. Ce guide est destiné à être utilisé par un installateur professionnel. Plus d'informations sur l'exposition aux rayons RF peut être consulté en ligne à l'adresse suivante:

www.fcc.gov/oet/info/documents/bulletins

Industry Canada Notice

This Class A digital apparatus complies with Canadian ICES-003. Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

FCC Part 15 Notice

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.

Operation of this device 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. Any unauthorized modification or changes to this device without the express approval of the manufacturer 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 guide. Failure to comply with these instructions may void the user's authority to operate this device.



Table 3: Key Command Commands

Command	Function
ALARM	Read current operating condition of the radio.
BAUD [xxxxx abc]	Set/display the data rate and control bits.
BUFF [ON, OFF]	Enables or disables the internal radio data buffer.
CTS [0-255]	Set/display the Clear-to-Send delay in seconds.
DEV	Display modem control deviation.
DEVICE [DCE, CTS KEY]	Set/display device mode.
DKEY	Dekey the radio (transmitter OFF). This is generally a radio test command.
DUMP	Display all programmable settings.
HELP	Shows available commands.
KEY	Key the radio (transmitter ON). This is generally used as a radio test command.
MODEM [xxxx]	Set the modem characteristics of the radio.
PORT [RS232, RS485]	Set/display COM2 data port interface settings.
PTT [0-255]	Set/display the Push-to-Talk delay in milliseconds.
PWR [20-37]	Set/display the transmit power setting.
RSSI	Display the Received Signal Strength Indication.
RTU [ON/OFF/0-80]	Re-enables or disables the radio's internal RTU simulator and sets the RTU address.
RX [xxx.xxxx]	Set/display the receive frequency.
RXLEVEL [-20 to 0]	Set/display the receive audio input level.
SCD [0-255]	Set/display the Soft-Carrier Dekey delay in milliseconds.
SHOW [DC, PWR]	Display the DC voltages and transmit power level.
SNR	Signal-to-Noise Ratio, expressed in dB
SPECTRUM [xxx.xx]	Display the transceiver's built-in spectrum analyzer, where xxx.xx denotes center frequency.
STAT	Display radio status and alarms.
TEMP	Display the internal temperature of the radio in degrees C.
TOT [1-255, ON, OFF]	Set/display the Time-out Timer delay in seconds.
TX [xxx.xxxx]	Set/display the transmit frequency.
TXLEVEL [-20 to 0, AUTO]	Set/display the transmit audio input level.
UNIT [10000...65000]	Set/display the transceiver's unit address.