1 INTRODUCTION

The MDS SD transceiver (Figure 1) is a software-configurable, industrial radio for use in wireless telemetry applications. Models offered at the time of printing include: **MDS SD2** (215-235 MHz), **SD4** (350-512 MHz), and **SD9** (928-960 MHz). The term *SD* is used for information common to all models of the radio.

The radio supports both polled and report-by-exception data networks, and 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 support both Ethernet and serial (RS-232/485) protocols.

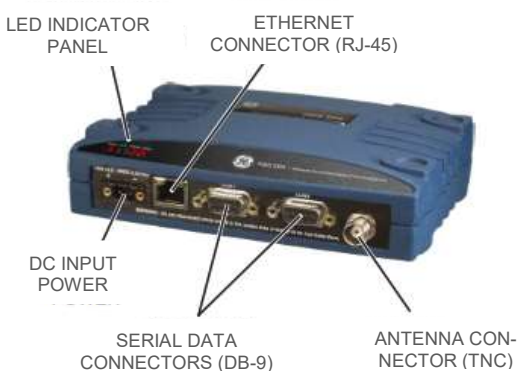


Figure 1. MDS SD Data Transceiver

1.1 Additional Information

This Setup Guide covers the essential installation and startup for all SD transceivers except those operating in x710 mode. Alternate information is available in English, (see 05-4846A01 Technical Manual). GE MDS manuals, Setup guides, Firmware, drivers and Application Notes are available free of charge at www.gemds.com.

GE MDS has produced a series of instructional videos for configuration and setup of the Orbit products on YouTube. These are available in English, free of charge at: http://tinyurl.com/pey2ull

1.1.1 x710 Mode—Different Manuals Required

The radio may be configured to emulate a corresponding MDS x710 transceiver. For x710 mode information, consult these manuals instead:

Setup Guide (05-4669A01)

Technical Manual (05-4670A01)

2 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 equipment.

Figure 2 shows a typical installation of the radio.

NOTE: Retrofit Kits are available to ease installation at former MDS x710 digital and analog sites. Consult your factory representative for ordering details.

2.1 Installation Steps

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

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

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.

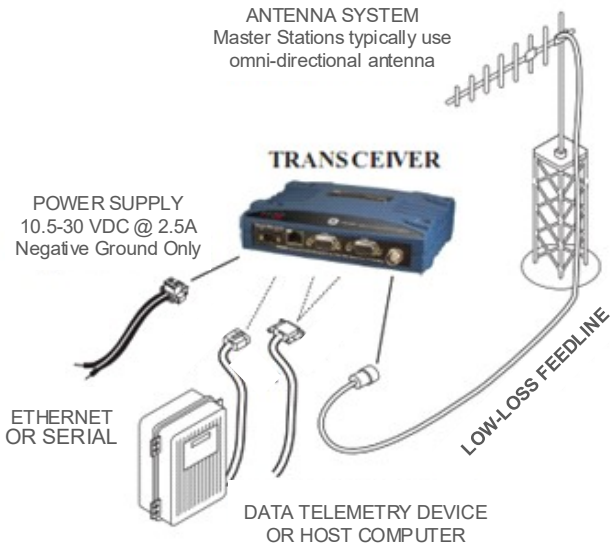


Figure 2. Typical Installation (Remote Site Shown)

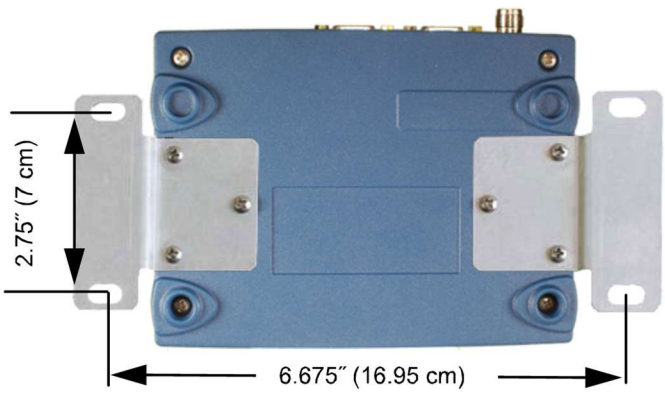


Figure 3. Mounting Bracket Dimensions

2. **Install the antenna and feedline.** The antenna must be designed to operate in the radio's frequency band, and be mounted in a location providing a clear path to 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 using Ethernet signaling, Serial protocols (RS-232/RS-485), or both.

   If Ethernet is to be used, connect your data equipment to the front panel Ethernet port next to the PWR connector.

   If serial is to be used, connect your data equipment to the COM1 or COM2 port on the front panel. (Typically, COM2 is used for connecting data equipment and COM1 is used for serial management of the radio. Other assignments are possible. (Refer to the *Technical Manual* for details.) In all cases, the radio is hardwired as a DCE device. A straight-thru cable may be used in most applications.

NOTE: Do not connect the Ethernet port to a LAN with high traffic levels. Excessive traffic will overload the port and Ethernet communications will be temporarily disabled.

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 (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.

NOTE: Some early models supported 10.5 to 16 Vdc power, not 10.0 to 30 Vdc. *Always check the labeling above the Power connector to verify the proper range for your unit.*

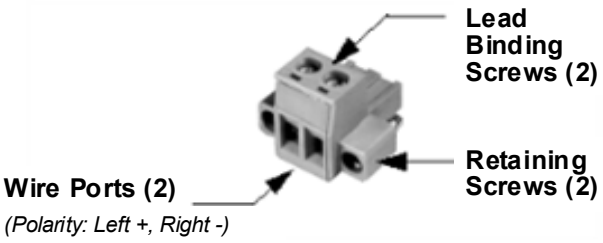


Figure 4. DC Power Connector

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.

2.1.1 Configuration Settings

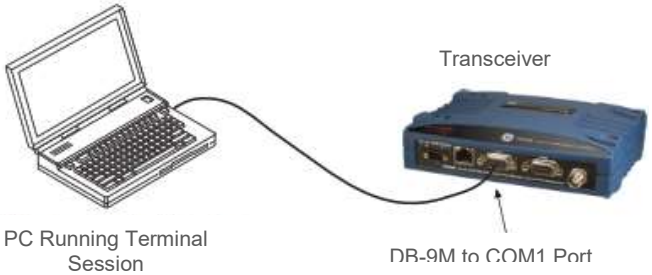


Figure 5. Setup for PC Configuration

The SD Radio contains a Setup Wizard for fast, easy configuration of key settings. On a new radio shipped from the factory, the wizard starts as soon as you are connected to the radio. Follow the steps below to connect and use the wizard.

1. Connect an Ethernet cable (straight-thru or crossover) between the radio and a PC as shown in Figure 5.
2. Configure your PC network settings to an IP address on the same subnet as the radio. The default IP address on a new factory shipped radio is 192.168.1.1. The default subnet mask is **255.255.255.0**.
3. Enter the radio's IP address in a web browser window, just as you would enter a website address. When the login screen appears (Figure 6), enter the User Name and Password for the radio. The default entries for a new radio are both **admin**. Click **OK**.

Figure 6. Login Screen

4. The Basic Setup Wizard (Figure 7) begins automatically upon connection to a new factory shipped radio. It displays a series of screens with key selections as follows:

   TX/RX Frequencies (entries must match station license)
   RF Power Output
   Operating Mode
   Modem Type
   Serial Port Configuration
   Ethernet Bridging
   Encryption Setting
   AP or Remote Service

   Continue through each wizard screen until all selections have been made. (You may back up to previous screens if required, to review or change settings.) Contact your network administrator if you are unsure about a setting.

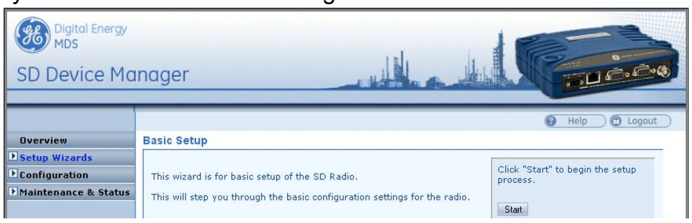


Figure 7. Basic Setup Wizard

5. At the conclusion of the wizard, click **Done.** Configuration is now complete for this radio. Run Remote Management Wizard, if required, for other installed radios in the network.

   A summary of all SD settings (Figure 8) may be viewed, by clicking **Overview.** The Overview screen may be formatted for printing, by clicking **Printer friendly configuration** (at the bottom of the screen.

6. When finished, log out of the Device Manager by clicking **Logout** in the upper right hand side of the screen.

Figure 8. Overview Summary Screen

NOTE: The radio may also be programmed using serial or Telnet management methods. Refer to the *Technical Manual* for details.

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 9. LED Status Indicators

Table 1: Description of LED Status Indicators

LED Name	Description
PWR	POWER: • Continuous—Power applied, no problems detected. • Rapid flash (5 times-per-second)—Alarm indication.
LAN	ETHERNET: • Flashing—Ethernet data activity is detected. • Off—Ethernet signals not detected, or excessive traffic is present.
DATA 1/2	DATA1 / DATA2: The DATA LEDs show data activity on the DB-9 serial payload port(s).
LINK	LINK: When lit, indicates that a communication link exists with the another station.

NOTE: In addition to the LEDs above, the Ethernet connector also has two embedded LEDs. A flashing green indicates Ethernet data activity. A yellow indicates 100 Mbps operation.

2.2.2 Antenna SWR Check

The antenna system's standing wave ratio (SWR) should be checked on new installations using a wattmeter suited to the frequency of operation. High SWR (above 2:1) may indicate an antenna or feedline problem.

2.2.3 RSSI Check (for Remotes)

Using the Maintenance & Status>>Performance screen, check the received signal strength indication (RSSI). 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 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 the new heading. With RSSI readings, the less negative the number, the stronger the incoming signal.

NOTE: The radio's RSSI facility limits the maximum displayed signal strength to -60 dBm. A receive signal attenuator is available in the **Configuration>>Radio>>Advanced Settings** screen.

3 Troubleshooting

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

- Adequate and stable primary power
- Secure 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 radio settings
- 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 indications.

3.2 Event Codes

When an alarm condition exists, the transceiver creates a message readable on the **Maintenance & Status** Screen. From this screen, select **Event Log** to view the current alarm(s). Consult the *Technical Manual* for details.

3.2.1 Types of Alarms

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

Major Alarms—These 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/Graph

A Spectrum Analyzer/Graph is available to display other radio signals near the SD radio's operating frequencies. This can be a helpful tool in cases of interference. The graph may be accessed from the **Maintenance & Status>>Radio Test** screen.

To use the graph, simply enter the frequency you wish to use as the center point of the graph, and enter the frequency range you wish to cover. Select **Show Spectrum** to display the results.

The display creates a received signal strength indication (in dBm) vs. frequency plot for signals near the center frequency (see Figure 10).

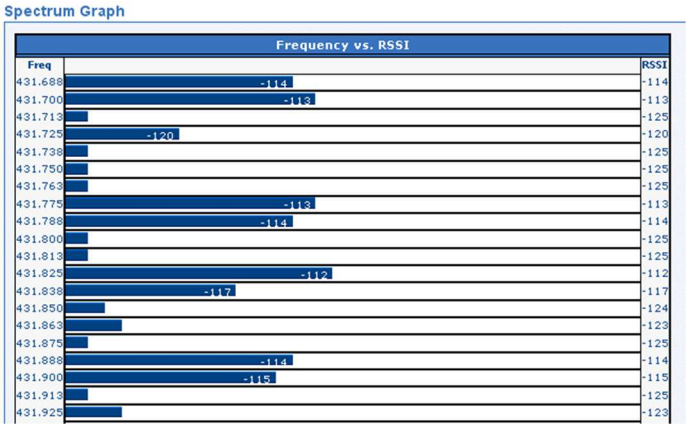


Figure 10. Spectrum Analyzer/Graph (Portion of Display)

4 COM1/COM2 REFERENCE

The COM1/COM2 connectors (Table 2) are 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) on these connectors.

These connectors mate with a standard DB-9 plug available from many electronics parts distributors.

Figure 11. COM1/COM2 Connector (DB-9F) As viewed from outside the radio

4.1 Pin Descriptions—RS-232 Mode

COM1/COM2 Pin Descriptions—RS-232 Table 2 provides pin descriptions for the connector when operating in RS-232 mode. For RS-422/485, refer to the *Technical Manual*.

Table 2: COM1/COM2 Pin Descriptions—RS-232

Pin	In/ Out	Pin Description
1	OUT	**DCD (Data Carrier Detect/Link)**—A low on this pin indicates signal received.
2	OUT	**RXD (Received Data)**—This pin supplies received data to the connected device.
3	IN	**TXD (Transmitted Data)**—This pin accepts TX data from the connected device.
4	IN	**Sleep Mode Input**—Grounding this pin turns off most circuits in a remote radio. This allows for greatly reduced power consumption, yet preserves the radio's ability to be quickly brought on line.
5	--	**Signal Ground—**This pin connects to ground (negative supply potential) on chassis.
6	OUT	**Alarm Output (DSR)—**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. This pin may be used as an alarm output.
7	IN	Reserved.
8	OUT	Reserved.
9	--	User I/O for special applications; not normally used.

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

5 REGULATORY AND PRODUCT INFORMATION

RF Exposure Notice

Concentrated energy from a directional antenna may pose a health hazard to humans. Do not allow people to come closer to the antenna than the distances listed in the table below when the transmitter is operating. More information on RF exposure can be found online at the following website: www.fcc.gov/oet/info/documents/bulletins.

Antenna Gain vs. Minimum RF Safety Distance

	Antenna Gain		
Safety Distance	**0–5 dBi**	**5–10 dBi**	**10–16.5 dBi**
SD4	0.79 meter	1.41 meters	3.05 meters
SD9	0.46 meter	.82 meters	1.74 meters
SD1	For SD1, maintain an RF safety distance of 1.80 meters for a 7 dBd (9.15 dBi) antenna. Use of higher gain antennas means increasing the distance accordingly.		
SD2	For SD2, maintain an RF safety distance of 1.50 meters for a 7 dBd (9.15 dBi) antenna. Use of higher gain antennas means increasing the distance accordingly.		
other models:	Consult factory prior to operation.		

FCC Part 15 Notice

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. 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 manual. Failure to comply with these instructions may void the user's authority to operate this device.

Industry Canada Notice

This Class A digital apparatus complies with Canadian ICES-003.

Modifications:

Any modifications made to this device that are not approved by GE MDS LLC, Inc. may void the authority granted to the user to operate this equipment.

Servicing Precautions

When servicing energized equipment, be sure to wear appropriate Personal Protective Equipment (PPE). During internal service, situations could arise where objects accidentally contact or short circuit components and the appropriate PPE would alleviate or decrease the severity of potential injury. When servicing radios, all workplace regulations and other applicable standards for live electrical work should be followed to ensure personal safety.

Manual Revision and Accuracy

This manual was prepared to cover a specific version of firmware code. Accordingly, some screens and features may differ from the actual unit you are working with. While every reasonable effort has been made to ensure the accuracy of this publication, product improvements may also 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 GE MDS using the information at the back of this guide. In addition, manual updates can be found on our web site at www.gemds.com

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 GE MDS or your supplier for more information on the proper disposal of this equipment.

Battery Disposal —This product may contain a battery. Batteries must be disposed of properly, and may not be disposed of as unsorted municipal waste in the European Union. See the product documentation for specific battery information. Batteries are marked with a symbol, which may include lettering to indicate cadmium (Cd), lead (Pb), or mercury (Hg). For proper recycling return the battery to your supplier or to a designated collection point. For more information see: www.weeerohsinfo.com.

Product Test Data Sheets

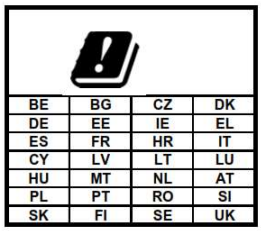
Test Data Sheets showing the original factory test results for this unit are available upon request from the GE MDS Quality Leader. Contact the factory using the information at the back of this manual. Serial numbers must be provided for each product where a Test Data Sheet is required.

CSA/us Notice

This product is approved 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 the Canadian Standards Association (CSA) which also issues the US mark of approval (CSA/US). The CSA Certification is in accordance with CSA STD C22.2 No. 213-M1987.

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: The transceiver must be mounted within a separate enclosure which is suitable for the intended application. The antenna feed line, DC power cable and interface cable must be routed through conduit in accordance with the National Electrical Code. Installation, operation and maintenance of the transceiver should be in accordance with the transceiver's installation manual, and the National Electrical Code. Tampering or replacement with non-factory components may adversely affect the safe use of the transceiver in hazardous locations, and may void the approval. A power connector with screw-type retaining screws as supplied by GE MDS must be used.

CE Mark and Radio Equipment Directive (RED) Notice (applies to select bands of SD04 product only)



Product that is CE marked is compliant with European Union Radio Equipment Directive 2014/53/EU.

GEMDS products employ a variety of wireless technologies and frequencies. These can include, cellular M2M, WIFI, and licensed narrowband radio frequencies. The user is responsible to ensure that proper spectrum licenses are obtained for all licensed uses, carrier SIMs are authorized for M2M cellular, and proper antenna gain is used to maintain local regulatory compliance.

Hazardous Locations Notice

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.

NO USER SERVICEABLE PARTS INSIDE

1.