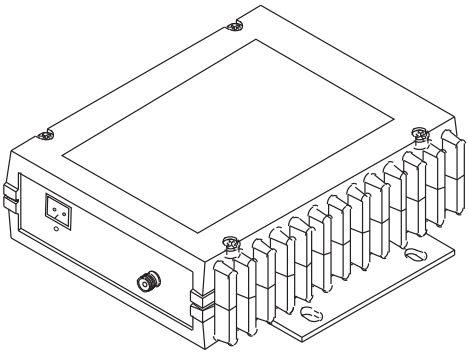
MDS LCT 450
Tri-Mode Data Transceiver



Firmware Release 1.x.x

MDS 05-4819A01, Rev. 01
MAY 2008

GE MDS
industrial wireless networks

Start-Up Guide

OPERATIONAL & SAFETY NOTICES

RF Exposure

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. Recommended Safety Distance

Device complies with Power Density requirements at 20 cm separation:	No
Required separation distance for 9 dBi antenna (in m):	2.53

Above data based on a 30-watt output level with a 100% duty cycle.

FCC Part 15 Notice

The transceiver is approved under Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation. Any unauthorized modification or changes to this device without the express approval of Microwave Data Systems may void the user's authority to operate this device. Furthermore, this device is intended to be used only when installed in accordance with the instructions outlined in this manual. Failure to comply with these instructions may void the user's authority to operate this device.

INTRODUCTION

This guide presents basic installation and operating instructions for the MDS LCT 450 Series wireless transceiver.

The transceiver (Figure 1) is designed to operate in the Railroad Distributed Power application. It is software-configurable to provide flexible operation in a variety of applications using one hardware platform. It employs microprocessor control and Digital Signal Processing (DSP) technology to provide robust communications even under adverse conditions.

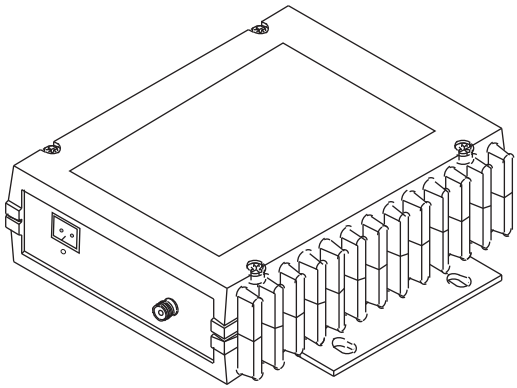


Figure 1. Data Transceiver

NOTE: Some features may not be available on all units, based on the options purchased and the applicable regulatory constraints for the region in which the radio will operate.

Front Panel Connectors

Figure 2 and Figure 3 show the interface connectors and indicators on the transceiver's front an d rear panels. These items are referenced in the installation steps given later in this guide.

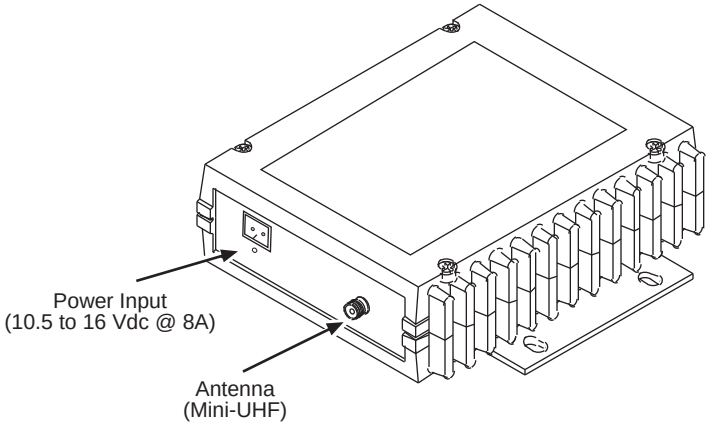


Figure 2. Antenna & DC Power Connectors

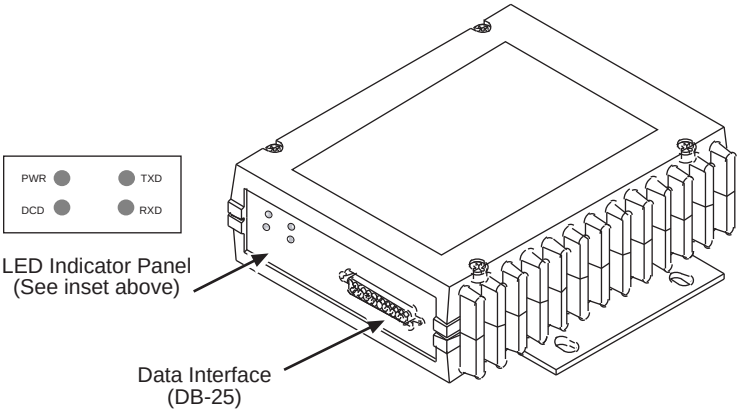


Figure 3. Data Interface Connector & LED Status Panel

INSTALLATION

There are three main requirements for installing the transceiver:

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

Figure 4 shows a typical station arrangement. This is followed by step-by-step procedures for installing the transceiver and making front and rear panel connections.

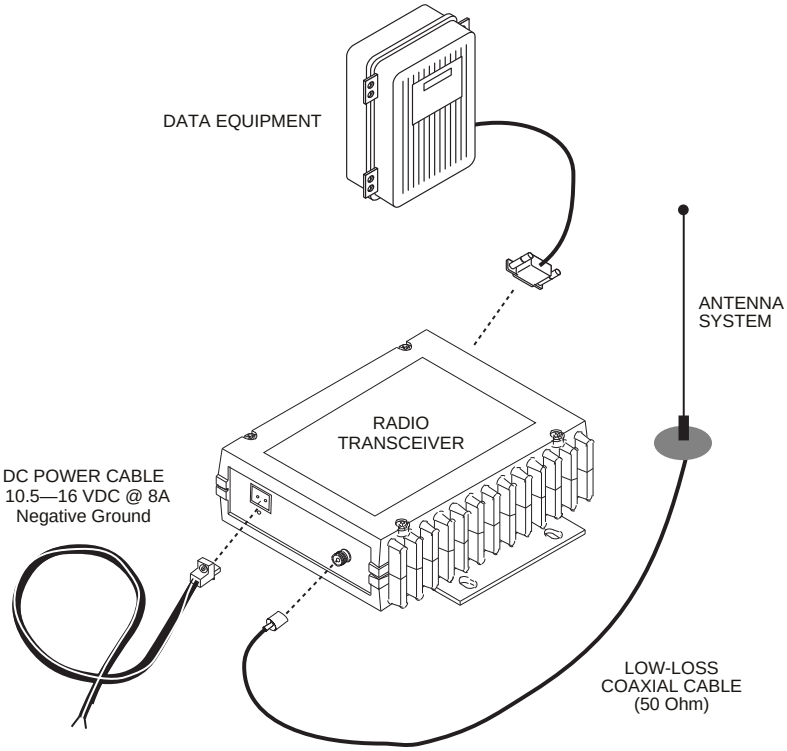


Figure 4. Typical Station Arrangement

Installation Steps

Below are the basic steps for installing the transceiver. Refer to Figure 4 as necessary to make the cable connections.

1. **Mount the transceiver to a stable surface** using the brackets supplied with the radio. Begin by attaching the radio's mounting 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. Figure 5 shows the mounting bracket dimensions.

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.

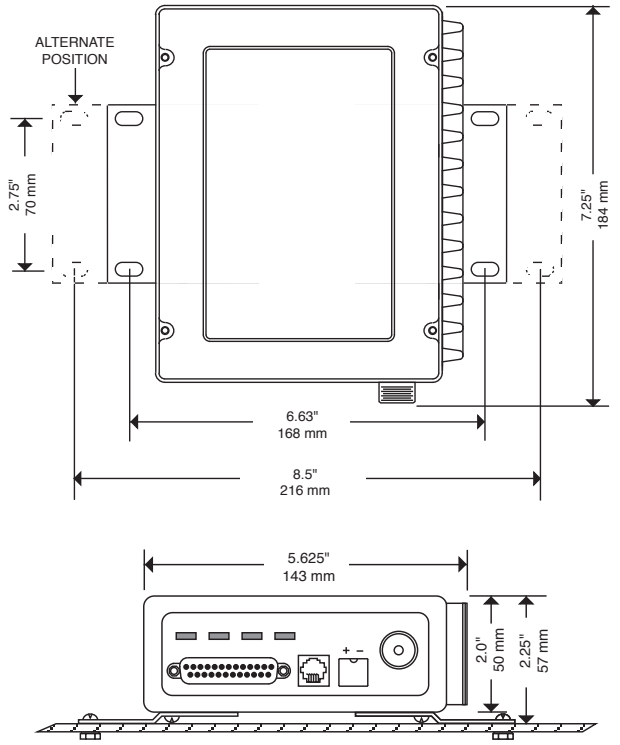


Figure 5. Transceiver Mounting Bracket Dimensions

CAUTION
POSSIBLE EQUIPMENT DAMAGE

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

2. **Install the antenna and feedline** for the station. The antenna used with the transceiver must be designed to operate in the radio's frequency band, and be mounted in a location that provides a clear, path to the other associated station(s). Use low loss coaxial feedline and keep the cable as short as possible.

3. **Connect the data equipment** to the DATA INTERFACE connector. Check DATA INTERFACE REFERENCE on Page 13 for pin wiring details.

   Note: The radio's DIAGNOSTICS port is used for reprogramming the radio's firmware.

4. **Connect primary power to the transceiver.** Power applied must be within 10.5–16 Vdc and capable of continuously providing at least 8 Amperes. A power connector with is provided with each unit (see Figure 4).

CAUTION
POSSIBLE EQUIPMENT DAMAGE

The transceiver 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.** The transceiver is designed for quick installation with a minimum of software configuration required.

   a. Connect a PC to the transceiver's DATA INTERFACE connector as shown in Figure 6. If desired, a cable may be built using the information shown on Page 13 of this guide.

   b. Launch a terminal communications program, such as HyperTerminal (included with most Windows™ systems). Press the ENTER key a few times (at half-second intervals) to receive the ready ">" prompt on the screen.

NOTE: To prevent unintended keying of the transmitter during management activities, set **PTTSIG** to **OFF**, or do not connect to Pin 6 of the COM1 port.

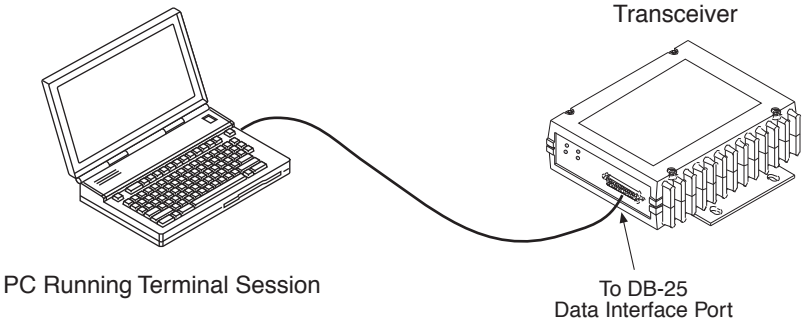


Figure 6. PC Configuration Setup

c. Set the transmit frequency by entering **TX xxx.xxxx**, where **xxx.xxxx** is the frequency in MHz. Press **ENTER**. The response **PROGRAMMED OK** indicates successful entry.

d. Set the receive frequency by entering **RX xxx.xxxx**, where **xxx.xxxx** is the frequency in MHz. Press **ENTER**. The response **PROGRAMMED OK** indicates successful entry.

e. Set the radio's modem type if necessary, using the **MODEM xxxx** command, where **xxxx** is the modem selection (typically **4800** or **9600**). The default setting is **9600**. Set the radio's serial data interface rate (typically **BAUD 9600 8N1**).

This completes the initial setup and configuration of the radio.

SOFTWARE COMMAND SUMMARY

Table 1 lists software commands commonly used during initial installation and setup of the transceiver.

Table 1. Command Summary

Command Name	Function
BAUD [xxxx xxx]	Sets radio's serial data interface rate/format. Default setting is BAUD 9600 8N1.
DKEY	Dekey the radio (transmitter OFF). This is generally a radio test command.
KEY	Key the radio (transmitter ON). This is generally a radio test command.
MODEM [xxxx]	Set the modem characteristics of the radio.
PWR [37–45]	Set or display the transmit power setting.
PTTSIG [ON, OFF]	Set/display push-to-talk configuration.
RSSI	Display the Received Signal Strength Indication.
RX [xxx.xxxx]	Set or display receiver frequency.
SER	Display the radio serial number.
SNR	Signal-to-Noise Ratio (in dB).
SPECTRUM [xxx.xx]	Display internal spectrum analyzer, where **xxx.xx** characters denote center frequency in MHz. The command **spectrum** may be entered alone to view current operating channel.
SREV	Display the Software Revision Level.
STAT	Display radio status and alarms.
TEMP	Display the internal temperature of the radio in degrees C.
TX [xxx.xxxx]	Set or display the transmit frequency.

Detailed Command Usage

(This section currently under revision)

chan [chan # [rxfreq # [txfreq # [pwr # [bw #]]]]]

chan - channel # {all,0-8]

rxfreq - receiver frequency

txfreq - transmitter frequency

pwr - power in watts (5, 20, 25, 30)

bw - bandwidth (12.5, 25)

>chan

Channel 1 RX 452.92500 MHz TX 452.92500 MHz PWR 30 Watts BW 25.000 KHz

>chan all

Selected LCT Channel is 0

Channel 0 RX 450.00000 MHz TX 453.00000 MHz PWR 5 Watts BW 25.000 KHz

Channel 1 RX 452.92500 MHz TX 452.92500 MHz PWR 30 Watts BW 25.000 KHz

Channel 2 RX 452.95000 MHz TX 452.95000 MHz PWR 30 Watts BW 25.000 KHz

Channel 3 RX 457.92500 MHz TX 457.92500 MHz PWR 30 Watts BW 25.000 KHz

Channel 4 RX 457.95000 MHz TX 457.95000 MHz PWR 30 Watts BW 25.000 KHz

Channel 5 RX 452.92500 MHz TX 452.92500 MHz PWR 30 Watts BW 25.000 KHz

Channel 6 RX 452.95000 MHz TX 452.95000 MHz PWR 30 Watts BW 25.000 KHz

Channel 7 RX 457.92500 MHz TX 457.92500 MHz PWR 30 Watts BW 25.000 KHz

Channel 8 RX 457.95000 MHz TX 457.95000 MHz PWR 30 Watts BW 25.000 KHz

>chan 8 rxfreq 453

rxfreq 453

Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 30 Watts BW 25.000 KHz

>chan 8 pwr 20

pwr 20

Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 20 Watts BW 25.000 KHz

>chan 8 bw 12.5

bw 12.5

Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 20 Watts BW 12.500 KHz

>mode test

>selchan help

Usage:

selchan [0-8]

>selchan 8

Channel Number 8

>chan

Channel 8 RX 453.00000 MHz TX 457.95000 MHz PWR 20 Watts BW 12.500 KHz

>key

TRANSMITTER ENABLED

>dkey

TRANSMITTER DISABLED

>mode normal

TROUBLESHOOTING

For proper operation, all radios in the network must meet these basic requirements:

- Adequate and stable primary power
- Secure connections (RF, data and power)
- A clear transmission path between stations
- An efficient antenna system providing adequate received signal strength.
- Proper programming of the transceiver's operating parameters
- The correct interface between the transceiver and the connected data equipment (correct cable wiring, proper data format, timing, etc.)

LED Indicators

The LED status indicators (Figure 7) are an important troubleshooting aid and should be checked whenever a problem is suspected. Table 2 describes the function of each status LED on the front panel of the radio.

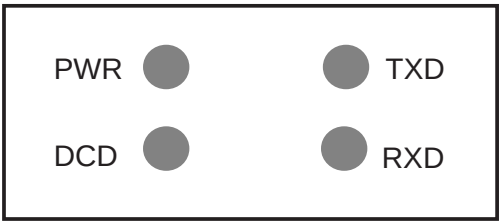


Figure 7. LED Indicators

Table 2. LED Status Indicators

LED Name	Description
PWR	• Continuous—Power applied, no problems detected. • Rapid flash (5 times-per-second)—Alarm indication.
TXD	Data being transmitted over the air.
RXD	Data being received over the air.
DCD	When lit, indicates that a communication link is established with the other station(s).

Event Codes

When an alarm condition exists, the transceiver creates a code that can be read on a connected terminal. These codes can be helpful in resolving many system difficulties. Refer to Table 3 (Page 11) for a definition of the event codes.

Checking for Alarms—*STAT command*

To check for alarms, connect a terminal to the radio's DIAGNOSTICS port. See DATA INTERFACE REFERENCE on Page 13 for pinout information.

Enter **STAT** on the connected terminal. If no alarms exist, the message **NO ALARMS PRESENT** appears on the display.

If an alarm does exist, a two-digit alarm code (00–31) is displayed and the event is identified as a Major or Minor Alarm. A brief description of the alarm is also given.

If more than one alarm exists, the word **MORE** appears on the screen. To view additional alarms, press **ENTER**.

Major Alarms vs. Minor Alarms

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 generally indicate the need for factory repair. Contact your factory representative for assistance.

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.

Event Code Definitions

Table 3 contains a listing of event codes that may be reported by the transceiver. The codes shown are a subset of a larger pool of codes used for various GE MDS products. *For this reason, the table does not show a sequential listing of all code numbers*. Only the codes applicable to this product are shown.

Table 3. Event Codes

Event Code	Event Class	Description
01	Major	Improper software detected for this radio model.
04	Major	The RF synthesizer is reporting an out-of-lock condition.
08	Major	The system is reporting that it has not been calibrated. Factory calibration is required for proper radio operation.
12	Major	Receiver time-out. No data received within the specified receiver time-out time.
13	Minor	A Transmitter timeout was detected. The radio stayed keyed longer than the duration specified by the TOT command.
17	Minor	A data parity fault has been detected on the PAYLOAD port. This usually indicates a parity setting mismatch between the radio and the customer equipment.
18	Minor	A data framing error has been detected on the PAYLOAD port. This may indicate a baud rate mismatch between the radio and the customer equipment.

Table 3. Event Codes *(Cont'd)*

Event Code	Event Class	Description
26	Minor	The DC input voltage is out-of-tolerance. If the voltage is too far out of tolerance, operation may fail.
31	Minor	The transceiver's internal temperature is approaching an out-of-tolerance condition. If the temperature drifts outside of the recommended operating range, system operation may fail.

Internal Spectrum Analyzer

The radio contains a built-in spectrum analyzer tool (Figure 8) that can be displayed on a connected PC. The tool is helpful in diagnosing interference problems on or near your channel frequency.

Access the spectrum analyzer by entering **spectrum** at the command prompt. A display appears showing detected signals on your *current channel*.

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

As shown in Figure 8, the display creates a received signal strength indication (RSSI) vs. frequency plot for the frequency and surrounding signals. By analyzing the display, you can determine the presence of other signals near the transceiver's operating frequency. This information can be helpful in troubleshooting interference problems.

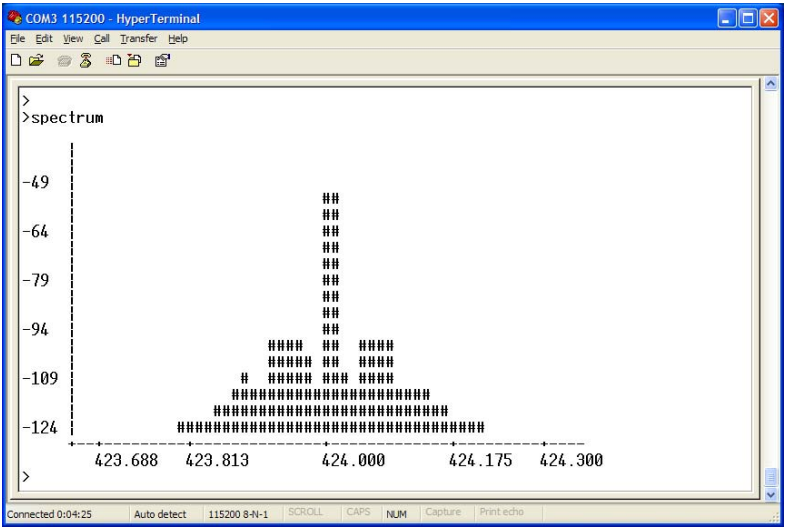


Figure 8. Internal Spectrum Analyzer Display

DATA INTERFACE REFERENCE

(This section currently under revision)

Table 4 lists the pin functions on the DB-25 DATA INTERFACE connector.

Table 4. LED Status Indicators

Pin No.	Description
1	No connection.
2	**Ground**—Connects to ground (negative supply potential) on the radio's PC board.
3	No connection.
4	**Detected Audio.**
5	**Channel 3 Select** (see Note 1).
6	**RX(A)** RS-485 digital.
7	**Data PTT** (Keying Signal).
8	**RX(B)** (RS-485 digital

Table 4. LED Status Indicators

9	**+5 Vdc** to programming device
10	Programming data (bi-directional [SRI] or TD [ARIA])
11	**Ground**—Connects to ground (negative supply potential) on the radio's PC board.
12	**Power Switch Contact** (momentary ground changes state) (Unique to SRI)
13	**Return (Ground)** to programming interface.
14	**Channel 2 select** (See Note 1)
15	**Programming data**, RD (unique to ARIA)
16	**NCData Interface Control** (High = analog input, Low= digital input)
17	**TX Audio**
18	**Ground**—Connects to ground (negative supply potential) on the radio's PC board.
19	**Channel 0 select** (Note 1)
20	**+13.6 VDC**
21	**Ground**—Connects to ground (negative supply potential) on the radio's PC board.
22	**+13.6 VDC**
23	**Channel 1 select** (Note 1)
24	**NCTBD – TX(A)** (RS485 digital)
25	**NCTBD – TX(B)** (RS485 digital)

Notes:

Note 1: Channel select decoding: (High = no connection, Low= Gnd)

Chan 3 Chan 2 Chan 1 Chan 0 Selected

High (future use) High High High 1

High (future use) High High Low 2

High (future use) High Low High 3

High (future use) High Low Low 4

High (future use) Low High High 5

High (future use) Low High Low 6

High (future use) Low Low High 7

High (future use) Low Low Low 8

SPECIFICATIONS

GENERAL

Frequency Range*:	450–512 MHz

RECEIVER

Maximum Usable Sensitivity:	–110 dBm at $1x10^{-6}$ BER (Preliminary)
Bandwidth:	12.5 kHz

TRANSMITTER

RF Carrier Power:	5 Watts to 30 Watts
Duty Cycle:	25%
Output Impedance:	50 Ω
Channel Spacing:	6.25, 12.5, 25 kHz
FCC Emission Designators:	
12.5 kHz B/W:	9K25F1D, 9K25F2D, 9K25F3D
25.0 kHz B/W:	16K5F1D. 16K5F2D, 16K5F3D

DATA CHARACTERISTICS

Payload Signaling Type:	EIA/RS-485
Connector Type:	DB-25 Female
Payload Data Rates:	300–115200 bps, asynchronous
Payload Data Latency:	10 ms maximum

DIAGNOSTICS INTERFACE

Signaling Standard:	RS-232

PRIMARY POWER

Voltage:	13.8 Vdc Nominal (10.5 to 16 Vdc) Negative-Ground Systems Only
TX Supply Current:	8 Amperes (Typical) @ 30 Watts Output
RX Supply Current:	*Operational*—125 mA, Nominal
Fuse:	8-Ampere, internal

ENVIRONMENTAL

Humidity:	95% at 40 degrees C (104°F), non-condensing
Temperature Range:	–40 to 70 degrees C (–40°F to +158°F)
Weight:	1.0 kilograms

GE MDS

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