Evaluation Board

A key part of the Evaluation Development Kit is the Evaluation Board shown in Figure 7. It contains a 16-pin header connector (J2) that mates with female connector J3 the OEM transceiver board. It carries all signals (except RF) onto the Evaluation Board. Table 2 lists the basic pin functions of J2. For more detailed pinout information, including the differences between TTL and RS-232/485 configured radios, refer to Section 13.1 on Page 60.

The Evaluation Board provides convenient connection points for diagnostics, payload data, and DC power. Each of these connectors are discussed in this section. The board also includes a series of test probe points to the left of J2. These may be used for monitoring logic signal activity with a multimeter or oscilloscope. The probe points are identified by printed markings on the board.

The transceiver board's RF/Antenna connection is *not* brought onto the Evaluation Board by the 16-pin header. The antenna connection is always made at J200 on the transceiver module using a male MMCX-type connector.

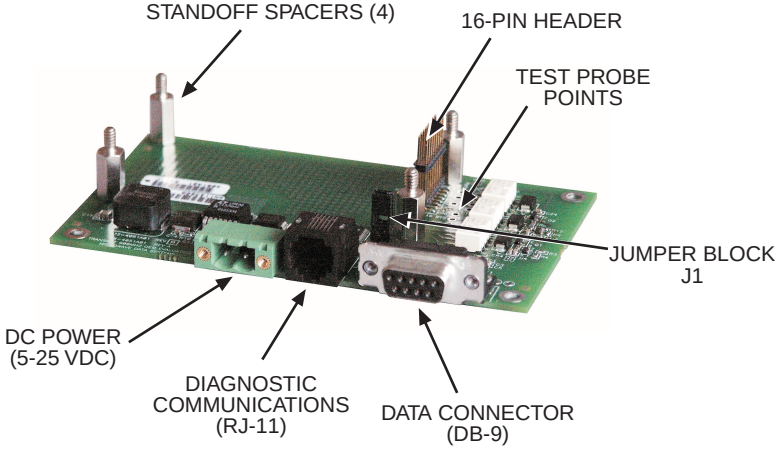

Figure 7. OEM Evaluation Board (P/N 03-4051A01)

Table 2. Basic Pin Functions of J2 (16-Pin Header Connector)

Pin No.	Pin Function
1	Ground
2	Diagnostic TXD
3	Alarm Condition
4	Diagnostic RXD

Table 2. Basic Pin Functions of J2 (16-Pin Header Connector)

5	DC Input
6	Sleep Mode Input
7	Data Carrier Detect (DCD)
8	Power Supply Shutdown Control
9	Reserved—Do not connect.
10	Transmitted Payload Data (TXD)
11	DC Input
12	Request to Send (RTS)
13	Reserved—Do not connect.
14	Received Payload Data (RXD)
15	Ground
16	Clear to Send (CTS)

Connecting the Evaluation Board & Transceiver (Figure 8)

To connect the Evaluation Board to the radio, carefully align the pins of the 16-pin header with J3 on the transceiver module and press down firmly. The radio PC board should seat solidly on the four standoff spacers. Use nuts to secure the board to the standoffs.

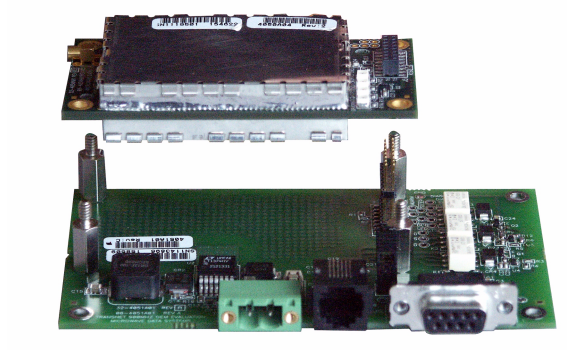

Figure 8. Connecting the Evaluation Board and Transceiver Together

CAUTION: Take care to avoid short-circuiting the underside of the Evaluation PC board. The bottom of the board is *not* insulated, and contact with metallic objects on the work surface could cause damage to the board or connected equipment.

3.2 Cable Connections for Benchtop Testing

There are four basic requirements for operating the transceiver and evaluation board in a benchtop test environment. They are:

- Adequate and stable primary power
- A proper antenna system or RF load (50 Ohms)
- The correct interface wiring between the transceiver and the connected DTE device (RTU, PLC, etc.)
- A connected PC terminal to read/set transceiver parameters.

Figure 9 shows a typical setup for bench testing an OEM Transceiver. Two such setups will be required if you intend to establish over-the-air communications with another OEM transceiver.

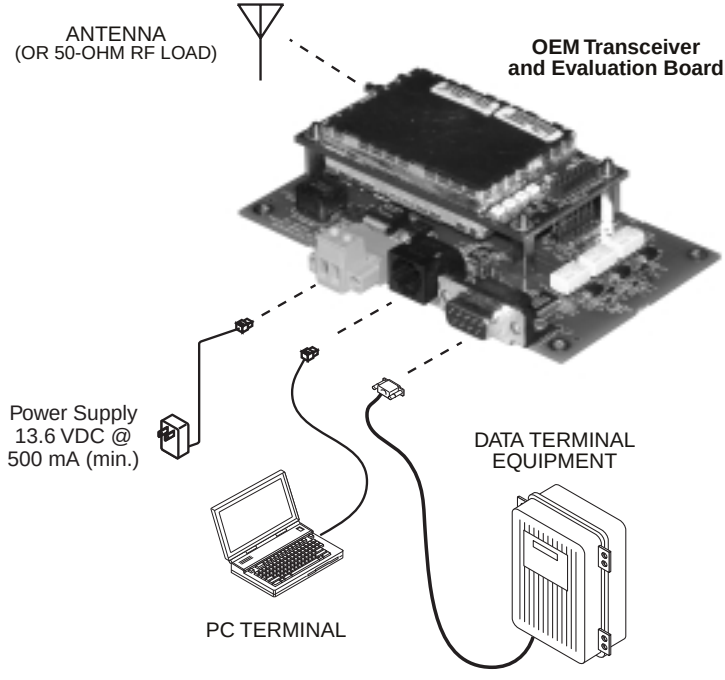

Figure 9. Typical Test Setup

Antenna Connection (J200 on the transceiver module)

The Antenna connector is located at the upper left corner of the transceiver module and is a female MMCX-type coaxial connector. Connect an antenna or other suitable RF load to this connector. Only approved antenna/cable assemblies may be used with the radio

CAUTION
POSSIBLE EQUIPMENT DAMAGE

Do not apply DC power to the transceiver without first attaching a proper RF load, or the transceiver may be damaged.

Diagnostic Connection (J4)

J4 is an RJ-11-6 modular connector used to connect the evaluation board/transceiver to a PC terminal for programming and interrogation. An RJ-11 to DB-9 Adapter Cable (Part No. 03-3246A01) is required for this connection. If desired, an cable may be constructed for this purpose as shown in Figure 10. Only Pins 4, 5, and 6 of the RJ-11 connector should be used. Pins 1, 2, and 3 are reserved for factory test purposes.)

The data parameters of the diagnostics port are as follows: 8 data bits, 1 stop bit, and no parity. It automatically configures itself to function at 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps, as required.

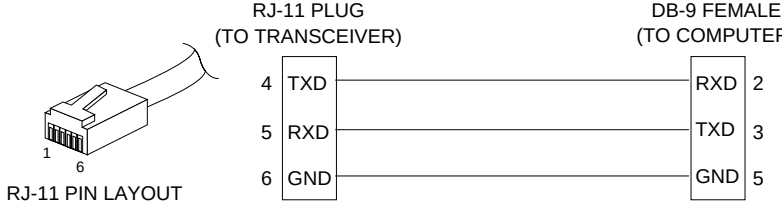

Figure 10. RJ-11 to DB-9 Diagnostic Cable—Wiring Details
(A pre-constructed cable is also available, Part No. 03-3246A01)

Diagnostic Communication Modes

Two methods may be used to communicate with the radio's diagnostic port:

- **Terminal Interface**—The PC is used in its basic terminal emulation mode, (i.e., HyperTerminal session) and commands are issued as simple text strings.
- **Radio Configuration Software**—Proprietary software from MDS that runs under the Windows operating system. It provides a graphical user interface with "point and click" functionality. The program is included on the *TransNET Support Package* CD shipped with every radio order.

Both of these control methods are described in more detail in the section titled "PROGRAMMING REFERENCE" on Page 34. This section also includes a chart listing all commands for the OEM transceiver.

Data Connector (J5)

J5 on the Evaluation Board (Figure 11) is the data interface for the transceiver. It is used to connect the transceiver to an external DTE terminal that supports the EIA/RS-232 or EIA/RS-485 format, depending on how the radio hardware was configured at the factory. The data connector supports interface data rates of 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200 bps (asynchronous only). The connector mates with a standard DB-9 plug available from many electronics parts suppliers.

Data Wiring Connections

The connections made to J5 will depend on the requirements of the DTE device being used with the transceiver, and the operating functions that you require. Only the required pins for the application should be used. Do not use a straight through "computer" type cable that is wired pin-for-pin.

Typical RS/EIA-232 applications require the use of Pin 2 (receive data—RXD) and Pin 3 (transmit data—TXD). Additionally, some systems may require the use of Pin 7 (Request-to-send—RTS). If hardware flow control is desired, Pin 7 (RTS) and Pin 8 (CTS) may also need connection.

Table 3 gives pin details for radios configured for RS/EIA-232 service. Table 4 gives details for radios configured for RS/EIA-485 service.

NOTE: *Radios equipped with a payload TTL interface are presented as RS-232 mode from the Evaluation Board.*

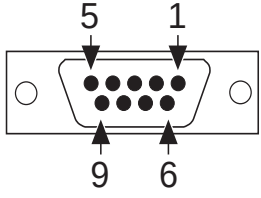

Figure 11. DATA Connector (DB-9F)
As viewed from outside the device

Pin Descriptions—RS/EIA-232 Mode

Table 3 lists the DATA connector pin functions for radios configured to operate in RS/EIA-232 mode.

Table 3. J5 DATA Connector Pinouts—RS/EIA-232

Pin Number	Input/ Output	Pin Description
1	OUT	**Data Carrier Detect (DCD)—**A low indicates hopping synchronization has been achieved.
2	OUT	**Received Data (RXD)—**Supplies received payload data to the connected device.
3	IN	**Transmitted Data (TXD)—**Accepts payload data from the connected device.
4	IN	**Sleep Mode Input—**A ground on 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 brought quickly back on line. See "Sleep Mode Operation (Remote units only)" on Page 31 for details.
5	IN	**Ground—**Connects to ground (negative supply potential).
6	OUT	**Alarm condition—**A low indicates normal operation. A high indicates an alarm. (See ASENSE [HI/LO] command for more information.)
7	IN	**Request to Send (RTS)—**A high causes CTS to follow after the programmed CTS delay time has elapsed (DCE).
8	OUT	**Clear to Send (CTS)—**Goes high after the programmed CTS delay time has elapsed (DCE), or keys an attached radio when RF data arrives (CTS KEY).
9	--	Reserved—Do not connect.

Pin Descriptions—RS/EIA-422/485 Mode

Table 4 on the following page lists the DATA connector pin functions for radios configured to operate in RS/EIA-422/485 mode. See Figure 12 for wiring schemes.

NOTE: *Radios equipped with a payload RS-232/485 interface can select **PORT RS485** for RS/EIA-485 mode.*

Table 4. DATA connector pin descriptions—RS/EIA-485 Mode

Pin Number	Input/ Output	Pin Description
1	—	Reserved — Do not connect.
2	OUT	**TXD+/TXA —** Non-inverting driver output. Supplies data to the connected device.
3	IN	**RXD+/RXA —** Non-inverting receiver input. Accepts data from the connected device.
4	IN	**Sleep Mode Input —** A ground on 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 brought quickly back on line. See "Sleep Mode Operation (Remote units only)" on Page 31 for details.
5	IN	**Ground —** Connects to ground (negative supply potential).
6	--	Reserved — Do not connect.
7	IN	**RXD–/RXB —** Inverting receiver input.
8	OUT	**TXD–/TXB —** Inverting driver output.
9	--	Reserved — Do not connect.

Table 4 Notes:

- RXD+/RXA and RXD–/RXB are data sent into the radio to be transmitted out
- RXD+/RXA is positive with respect to RXD–/RXB when the line input is a "0"
- TXD+/TXA and TXD–/TXB are data received by the radio and sent to the connected device
- TXD+/TXA is positive with respect to TXD–/TXB when the line output is a "0"

Figure 12. EIA-422/485 Wiring Schemes
(Consult external device manual for its detailed pin information)

DC Power Connector (J3)

This connector accepts operating power for the transceiver. A wall-style AC adapter (Part No. 01-3862A02) is recommended for this service.

DC connection is made with a 2-pin polarized plug, MDS Part No. 73-1194A39. Be sure to observe proper polarity. **The left terminal is positive (+) and the right is negative (-)**. (See Figure 13).

CAUTION
POSSIBLE EQUIPMENT DAMAGE

The transceiver must be used only with negative-ground systems. Make certain that the polarity of the power source is correct.

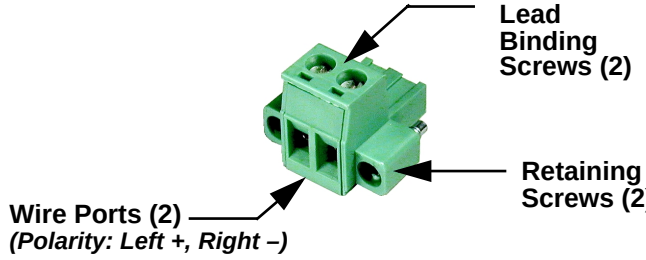

Figure 13. DC Power Connector (P/N 73-1194A39)

NOTE: Although the power connector used on the OEM Evaluation Board resembles those used by some earlier MDS transceivers, such as the MDS 9810 and x710 family, the connectors are *not* equal and the use of the wrong plug will provide unreliable connections. Only the power connector shown in Figure 13 with screw terminals and two retainer screws should be used with the OEM Evaluation Board.

Jumper Block J1 (DC Power Configuration)

Jumper J1 does not normally require any change by the user. The jumper is used to configure the board for the proper voltage level applied to the transceiver module.

Both jumper plugs are normally installed on J1. The plug connecting Pins 3 and 4 may be temporarily removed to insert an ammeter in series with the DC power line going to the transceiver. This provides a convenient way to measure the transceiver's current draw during bench testing.

3.3 Initial Power-Up & Configuration

When all of the cable connections described in Section 3.2 have been made, the transceiver is ready for initial power-up. Operation begins as soon as power is applied, and there are no manual adjustments or settings required.

To place the transceiver into operation:

1. Ensure that all cable connections are properly wired and secure. Verify that no metallic objects are touching the underside of the evaluation board which might cause a short-circuit.
2. Apply DC power. The GP indicator (CR6) on the transceiver board should light continuously.

3. Using a connected PC terminal, configure the unit with the proper mode (master or remote), network address and data parameters. See *Configuration Settings* below for programming details.
4. Observe the transceiver's LED indicators for proper operation. Table 5 on Page 17 shows the functions and normal indications of the LEDs.
5. Verify that the transceiver is transmitting and receiving data (TXD, RXD) in response to the master station and/or connected terminal device.

Configuration Settings

This section explains how to set the essential operating parameters of the transceiver. For more information on connecting a PC terminal and preparing it for use, refer to Section see "PROGRAMMING REFERENCE" on Page 34.

The three essential settings for the transceiver are as follows:

Mode—Master, Remote, or Extension
Network Address—a unique number from 1–65000
Data Interface Parameters—bps, data bits, parity, stop bits
Band—set transceiver to one of its three operating bands (A, B or C)

Follow these steps to program the transceiver:

1. Set the Mode using the **MODE M** (Master), **MODE R** (Remote), or **MODE X** (Extension) command. (Note: There can be only *one* master radio in a system.)

   For Extension (SAF) radios only: If *any* **MODE X** radios are used in the network, SAF must be turned on at the Master station. The **MODE X** radio must be programmed with an Extended Address (**XADDR**). Units that need to hear the **MODE X** radio must be programmed with an appropriate **XPRI** and/or **XMAP** value. (See "Simple Extended SAF Network" on Page 26 for more information.)
2. Set a unique Network Address (1–65000) using **ADDR** command. Each radio in the system *must* have the same network address. *Tip: Use the last four digits of the master station's serial number to help avoid conflicts with other users.*
3. Set the baud rate/data interface parameters. Default setting is 9600 bps, 8 data bits, no parity, 1 stop bit. If changes are required, use the **BAUD xxxxx abc** command where **xxxxx** equals the data speed (1200–115200 bps) and **abc** equals the communication parameters as follows:

   a = Data bits (7 or 8)
   b = Parity (N for None, O for Odd, E for Even)
   c = Stop bits (1 or 2)

NOTE: 7N1, 8E2 and 8O2 are invalid interface parameters.

Configuring Multiple Remote Units

In most installations, the Remote radios will be programmed with virtually the same set of parameters. This process can be streamlined by testing key pieces of equipment—such as the Master, Remote, and any Extensions—on a benchtop setup prior to installation. This allows you to test various configurations in a controlled environment.

Once the evaluation network is working satisfactorily, you can save the configuration of each unit in a data file on your PC's hard drive through the use of *TransNET Configuration Software*. You can then open the Remote configuration file and install it in the next Remote radio. The software prevents you from overwriting unit or other mode-specific parameters.

LED Indicators

The LED indicators are located to the right of the transceiver's shield cover (near J3) and show important information about status of the module. The functions of LEDs are explained in Table 5 below.

NOTE: For the LEDs to function, they must be enabled using the **LEDS ON** command.

Within 16 seconds of power-up, the following indications will be seen if the unit has been properly configured and is communicating with another transceiver:

- GP lamp lit continuously
- DCD lamp lit continuously (if unit is synchronized with another station)
- Remote radio(s) transmitting data (TXD) and receiving data (RXD) with another station.

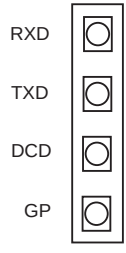

Table 5. LED indicator descriptions

LED Name	Description
RXD (CR3) Receive Data	Serial receive data activity. Payload data from connected device.
TXD (CR4) Transmit Data	Serial transmit data activity. Payload data to connected device.
DCD (CR5) Data Carrier Detect	Continuous—Radio is receiving/sending synchronization frames On within 10 seconds of power-up under normal conditions
GP (CR6) General Purpose	• Continuous—Power is applied to the radio; no problems detected • Flashing (5 times-per-second)—Fault indication. See "TROUBLESHOOTING" on Page 52 • Off—Radio is unpowered or in Sleep mode