RAYMAR INFORMATION TECHNOLOGY

DDS/MR64
Installation and Operation
User Guide

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FCC REQUIREMENTS

This equipment complies with FCC Rules Part 68. Please note the following:

- When you order service, the telephone company needs to know the Facility Interface Code.

Type of Service	Facility Interface Code
2.4 kbps-DDS	04DU5-24
4.8 kbps-DDS	04DU5-48
9.6 kbps-DDS	04DU5-96
19.2 kbps-DDS	04DU5-19.2
56 kbps-DDS	04DU5-56
64 kbps-DDS	04DU5-64

- The Service Order Code: 6.0F

- The USOC jack required: RJ48S

In addition, if requested, please inform the telephone company of the make, model number, and FCC registration number, which are on the equipment label.

The telephone company may change technical operations or procedures affecting your equipment. You will be notified of changes in advance to give you ample time to maintain uninterrupted telephone service.

If you experience trouble with this telephone equipment, please contact

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for information on obtaining service or repairs. The telephone company may ask that you disconnect this equipment from the network until the problem has been resolved. If your equipment continues to disrupt the network the telephone company may temporarily disconnect service. If this occurs you will be informed of your right to file a complaint with the FCC.

PREFACE

This manual is written for users of the DDS/MR64. Please read the appropriate chapters before you change any option on the printed circuit board, change dip switches, or operate the unit. The manual includes the following:

Chapter 1, Introduction - Contains introductory information and equipment description.

Chapter 2, Installation - Contains installation and start-up instructions.

Chapter 3, Operation - Describes operation of the DDS/MR64.

Chapter 4, Configuration - Describes selectable options and how to apply them.

Chapter 5, Diagnostics - Describes test data loops and features.

Chapter 6, Troubleshooting - Describes tests and indications used to locate or isolate malfunctions.

Chapter 7, Non-DDS applications - Describes the use of the DDS/MR64 as a limited distance modem.

Chapter 8, Rate Adaption Option - Describes operating characteristics and options that are specific to rate adaption.

Chapter 9, Maintenance - contains maintenance information.

Appendix A, Specifications.

Appendix B, Abbreviations and Acronyms.

STATEMENT OF APPLICATION

This manual supports both the standalone and shelf mount units. Operation and function of either unit is identical. Where necessary, this manual provides detailed information in support of the standalone unit. Detailed information in support of the shelf mount unit can be found in the shelf installation and operation manual.

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Chapter 1
Introduction

GENERAL

The Telenetics DDS/MR64 is a digital data unit that allows you to connect your computer or other DTE unit directly to the digital network without any other network access device. The unit pumps data at up to 64 kbps in point-to-point or multipoint applications. It combines the functions of a data service unit and a channel service unit (DSU/CSU) into a single compact unit.

In addition to offering Digital Data Service (DDS) operation, the DDS/MR64 can operate as a short haul modem providing full-duplex, serial data communications with either synchronous data from 2.4 to 64 kbps or asynchronous data from 2.4 to 19.2 kbps over a privately owned 4-wire, unloaded, twisted-pair cable system.

The DDS/MR64 is also capable of running asynchronous DTE rates of 38.4 kbps or 57.6 kbps over 56 kbps or 64 kbps lines, synchronous DTE rates of 19.2 kbps or 9600 bps over 56 kbps or 64 kbps lines, and a synchronous or asynchronous DTE rate of 1200 bps over a 2400 bps line.

PHYSICAL DESCRIPTION

The DDS/MR64 is a standalone desktop unit. The front panel (Figure 1-1) contains six Light Emitting Diodes (LED's), three push buttons, and an LCD screen. The rear panel (Figure 1-2) contains a power cord, power switch, fuse, DTE connector, and a standard 8-pin DDS jack. The DTE interface connects to the Data Terminal Equipment and the 8-pin jack connects to the DDS line. Internally the unit contains one printed circuit board.

FUNCTIONAL

The DDS/MR64 processes serial synchronous or asynchronous digital data from the DTE for transmission over the DDS network or other limited distance 4-wire, unloaded, twisted-pair cable systems. The receiver contains an automatic equalizer which compensates for the distortion and attenuation caused by the length of the line without any adjustments by the user.
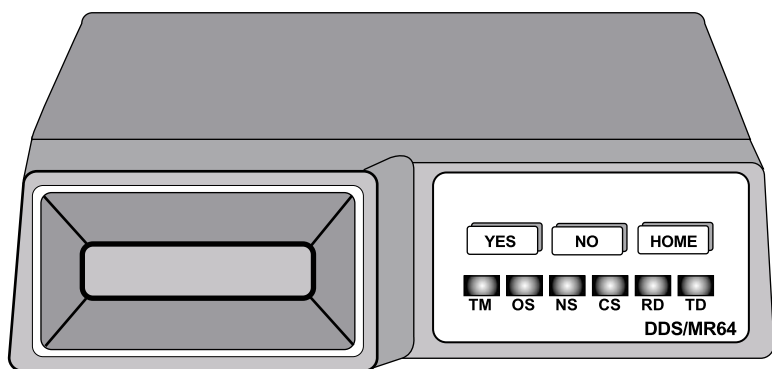
Figure 1-1
Front Panel
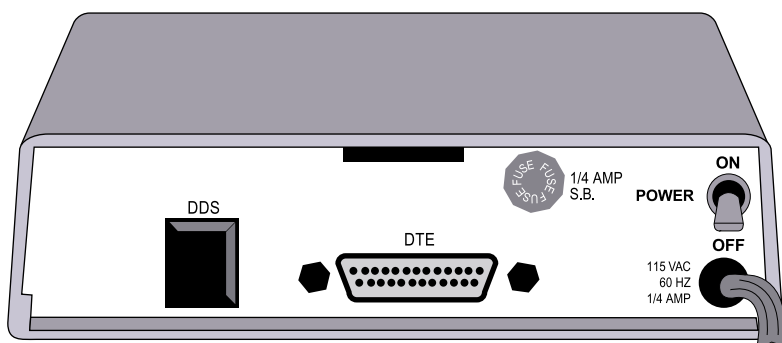
Figure 1-2
Rear Panel

FEATURES

- Data rates from 2.4 kbps to 64 kbps synchronous and 2.4 kbps to 19.2 kbps asynchronous

- Direct connection to the DDS network

- Point-to-point or multipoint transmission

- Bipolar return to zero signaling

- LED indication

- Short haul modem capability up to 150,000 feet providing full-duplex operation on 4-wire private telephone lines.

- Full feature diagnostics

- Liquid Crystal Display (LCD) allow the operator to review or change settings

- Front panel pushbutton configuration and operation

- Nonvolatile memory for configuration storage

- RS232 or CCITT V.35 DTE interface can be selected by switches on the circuit board

- Asynchronous 38.4 kbps or 57.6 kbps DTE rates over 56 kbps or 64 kbps DDS lines.

- Synchronous 19.2 kbps or 9600 bps over 56 kbps or 64 kbps lines.

- Synchronous or asynchronous 1200 bps over 2400 bps lines.

COMPATIBILITY

Compatible with the Telenetics and Motorola DDS/MR series of products with the exception of running the DDS/MR1 or the DDS/MR56 at 64 kbps.

Compatible with Bell 500 Series DSU and CSU equipment.

COMPLIANCE

Compliant with specifications listed in Bell publications 62310 and 41450.

RECEIPT INSPECTION

After unpacking the equipment, check the contents against the packing list. Inspect the equipment carefully for damage that may have occurred in shipment. If there is damage or material shortage, contact the shipping agent and Telenetics for advice and assistance. You should keep the shipping container and packing material for future shipment.

SITE PREPARATION

Install the unit within 6 feet of a 115 or 230 Vac grounded outlet as required for the specific model and no further than 50 feet from the terminal equipment.

The installation area should be clean, well lighted, and free from extremes of temperature, humidity, appreciable shock, and vibration. Allow sufficient space at the rear of the unit for signal line and interface cable clearance.

HARD OPTIONS

The PC card has two strap options that should be verified or changed prior to installation. These options are factory set for standard installations. The factory options are described in *Chapter 4, Configuration*. If a hard option requires changing, follow the instructions in Chapter 4 before continuing installation.

INSTALLATION

Figures 2-1 and 2-2 illustrate typical installation.

• Connect the DTE cable to the 25-pin DTE connector. Secure the two screws to complete the connection.

• Connect the opposite end to the DTE port.

• Insert the 8-pin plug into the rear panel DDS jack labeled DDS.

- Insert the opposite end into the TELCO DDS system.

- Plug in the AC power cord.

- Place the power switch ON.

The DDS/MR64 will now perform all functions as determined by option configuration (Chapter 4).
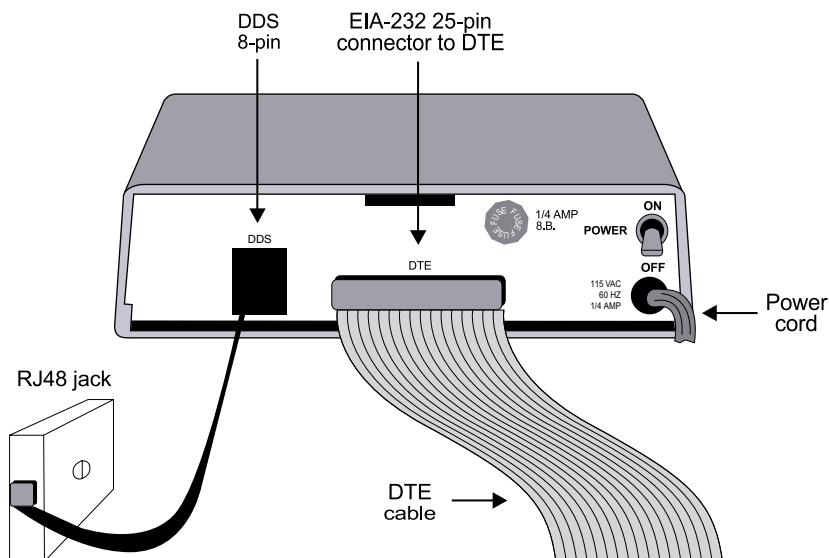
Figure 2-1
Connection Using the RJ48 Jack
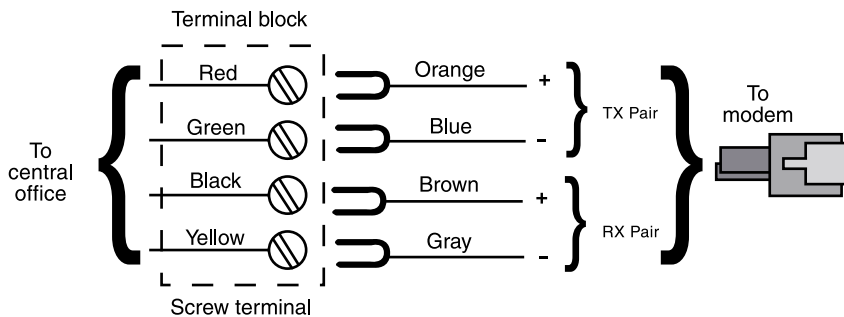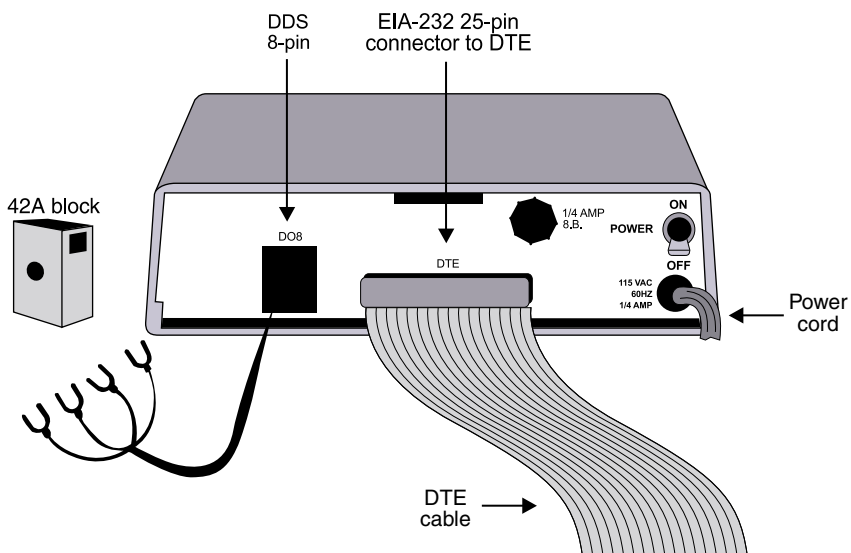
Figure 2-2
Connection Using the 42A Block

GENERAL

After completing installation, the unit is ready for operation and configuration. Most configuration options are soft options and are selected by the LCD and push buttons. Therefore, operation of the unit should be understood prior to option selection. Hard options are described at the end of Chapter 4.

The DDS/MR64 requires no start up procedure. After installation and configuration, the DDS/MR64 will perform all configured functions.

DATA TERMINAL EQUIPMENT (DTE)

The DTE interface to the DDS/MR64 is through a 25-pin, D-type connector. The sense levels and impedances conform to either EIA-232 or CCITT V.35 INTERFACE depending on the option switch selected. The type of DTE interface selected in the unit is displayed on power-up.

DTE INTERFACE CONNECTORS

Pin functions of the DTE interface connector are listed in Table 3-1 and 3-2.

Table 3-1
CCITT/EIA-232 Connector

CIRCUIT FUNCTION	PIN	CCITT/RS-232
Protective ground	1	101/AA
Signal ground	7	102/AB
Request to Send (RTS)	4	105/CA
Clear to Send (CTS)	5	106/CB
Data Set Ready (DSR)	6	107/CC
Received Line Signal Detector (RLSD)	8	109/CF
Test mode	25	142
No signal	12	110/CG
Rx data	3	104/BB
Rx clock	17	115/DD
Tx clock	15	114/DB
Tx data	2	103/BA
External clock	24	113/DA
Remote loopback *	21	140
LL loopback *	18	141
RT loopback *	11	
Test Pattern *	22	
+12 V	9	
- 12 V	10	

*Can be disabled by front panel push buttons
Selected by DTE interface dip switches

Table 3-2

V.35 Connector

CIRCUIT FUNCTION	"D" CONNECTOR PIN	V.35 CONNECTOR PIN
Protective ground	1	A
Signal ground	7	B
Request to Send (RTS)	4	C
Clear to Send (CTS)	5	D
Data Set Ready (DSR)	6	E
Received Line Signal Detector (RLSD)	8	F
Test mode **	25	K and NN
No signal **	12	M
Rx data A	3	R
Rx data B	16	T
Rx clock A	17	V
Rx clock B	19	X
Tx clock A	15	Y
Tx clock B	13	AA
Tx data A	2	P
Tx data B	14	S
External clock A	24	U
External clock B	23	W
Remote loopback *	21	BB and N
LL loopback *	18	J
RT loopback *	11	EE
Test Pattern *	22	L
+12 V **	9	JJ
−12 V **	10	KK

* *Can be disabled by front panel push buttons*
** *Selected by DTE interface dip switches*

Request to Send RTS

This signal goes on when the DTE wants to send data. When RTS is on, the DDS/MR64 is in transmit mode and responds by turning on Clear to Send (CTS).

Clear to Send CTS

This signal goes on when the DDS/MR64 is ready to transmit data and is in response to RTS going on. The normal RTS on to CTS on delay depends on the data rate (refer to Table 3-3). When CTS is off the DDS/MR64 ignores input data.

Note: Once RTS is raised by the DTE, the behavior of CTS may depend on the status of the Circuit Assurance OPTion (CA OPT). Refer to Circuit Assurance in Chapter 4.

Table 3-3
Normal CTS On Delay (Typical Values)

Data Rate	RTS-CTS Delay (ms)
2400 bps	7.4
4800 bps	3.2
9600 bps	1.7
19.2 kbps	1.0
56 kbps	0.6
64 kbps	0.6

Transmitter Clock TC

This signal goes on when the DDS/MR64 sends transmit timing information to the DTE. The DDS/MR64 samples the transmit data during the transition from space to mark of the transmitter clock. The time between transition of the transmitter data line and the sampling transition of the transmitter clock must not be less than 25% of the nominal bit time.

Transmit Data TD

This signal goes on when the DTE transmits data to the DDS/MR64.

External Clock

This signal goes on when the DTE sends transmit timing information to the DDS/MR64. This option may be used in non-DDS applications or to clock data into the buffer when the buffer option is enabled. When external clock is used it must be within $\pm$ 0.1% of required frequency.

Received Line Signal Detector   RLSD

Also known as Carrier Detect (CD). This signal goes on when the DDS/MR64 is receiving a line signal that meets the requirements for data transfer. RSLD is on when data is being received and can be forced on regardless of line signals. RLSD goes off under any of these conditions:

• Reception of 3 consecutive "IDLE" characters

• Reception of 7 consecutive "Out-of-Service" characters

• Loss of signal.

When RLSD is off, Receive Data is held to a mark state.

Receive Clock   RC

This signal goes on when the DDS/MR64 provides the DTE with continuous timing information for clocking received data. The DTE samples received data during the transition from space to mark of the receive clock.

Receive Data   RD

This signal goes on when the DDS/MR64 provides the DTE with data received from the communications line. Transitions of this lead occur within $\pm$ 25% of the nominal bit time. This signal is held in a mark state when RLSD is off.

Data Set Ready   DSR

This signal goes on when line and equipment conditions are all set for data transfer. DSR must be on to transmit data and can be forced on regardless of conditions.

Note: The behavior of DSR may depend on the status of the System Status OPTion (SS OPT). Refer to System Status in Chapter 4.

This signal goes on when the DDS/MR64 cannot identify a signal from the DDS line.

GROUNDING

Protective Ground

Protective/chassis ground is provided on the DTE interface connector.

Signal Ground

Signal ground provides a common reference for the interface signals. An optional strap connection provides chassis ground.

In addition to front panel initiation, tests can also be initiated by the DTE. The DTE pin numbers used to initialize these tests depend on the type of DTE interface used and are listed in Tables 3-1 and 3-2. This section describes sequential signal generation that activates these tests. Test signals are looped between the DTE, DCE, and the DDS network. When lit, the TM LED indicates test mode is selected and the LCD shows the status of the selected test.

Local Line Loopback   LL

When the DTE turns LL on, the DDS/MR64 logic transmitter and receiver connect internally to loop signals back to the DTE. The communications transmitter and receiver are also connected to loop signals back to the DDS communication line.

Remote Terminal Loopback   RT

When the DTE turns RT on, the DDS/MR64 loops data to and from the DDS line through the DTE interface. A bilateral loopback also provides a loopback path for connecting the DTE transmit and receive data.

Remote Loopback   RL

When the DTE turns RL on, the DDS/MR64 sends a command to the remote DDS/MR64 causing it to go into RT loopback. When RL is turned off, the DDS/MR64 sends a command to the remote DDS/MR64 canceling the RT loopback command.

Test Pattern   TP

When the DTE turns TP on, a 511 bit test pattern is sent to the DDS line. The data received is scanned for the same test pattern. Any error in the receive pattern causes the appropriate message to be displayed. If the DDS/MR64 is in LL when TP is on, the test pattern is transmitted through the DDS/MR64 transmit logic and looped back through the DDS/MR64 receive logic. This results in a self test.

Test Mode   TM

When the DDS/MR64 is in either remote or local test mode, TM lights.

Connection between the DDS/MR64 and the DDS system consists of four leads divided to form a receive data pair and a transmit data pair. The leads are on a miniature 8-position jack (RJ48) without a shorting bar as shown in *FCC Rules and Regulations Part 68, Subpart F, Figures 68.500(d)(1) and (d)(2)*. The remaining pins are not used. A mating connector is mounted on the DDS/MR64.

The sense levels, voltage levels, and impedances of these interface lines conform to *AT&T Technical Reference Pub 62310*. Pin assignments are listed in Table 3-4.

Table 3-4
Pin Assignments

Function	Direction	Line Pin Number	UDS Wire Color
Transmit Tip (T1)	DDS/MR64 to line	2 and 5	Orange
Transmit Ring (R1)	DDS/MR64 to line	1 and 4	Blue
Receive Ring (R)	Line to DDS/MR64	8 and 6	Slate
Receive Tip (T)	Line to DDS/MR64	7 and 3	Brown

The receiver incorporates an automatic line equalizer to compensate for any length DDS line.

SEALING CURRENT

When the DDS/MR64 is used as a Limited Distance Modem, the DDS/MR64 has the ability to source sealing current. A dip switch (Figure 3-1) on the stand alone unit PC board or the auxiliary jack along with the dip switch on the shelf mount unit provides this service. Do not use this switch or connect this jack if the unit is operating over the DDS network. This option should only be used at one end of an LDM-type circuit.

Dip Switch				Mode
1	2	3	4	
OFF	OFF	ON	ON	Normal DDS operation
ON	ON	OFF	OFF	Source sealing current
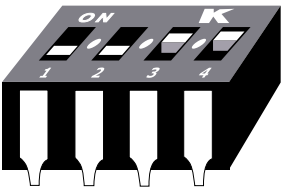
Figure 3-1
Typical DIP Switch

To source sealing current on the stand alone unit, set the dip switch for Source sealing current. The 48 volts needed to source sealing current is provided internally. (On the shelf mount unit, the installer must supply 48 volts to the unit through the AUX jack. Pin 1 of the AUX Telco should be ground and pin 8 should be -48 volts. If a positive voltage is used, pin 8 should be ground and pin 1 should be +48 volts. Voltages lower than 48 volts may be used, causing a proportional decrease in sealing current.) The sealing current will be between 4 and 20 mA, depending on line length.

FRONT PANEL INDICATORS

Push Buttons

Configuration control is through the three push buttons on the front panel. The push buttons allow the user to configure the DDS/MR64 or select a test mode. The three push buttons are:

YES   Selects the displayed menu option

NO   Advances the displayed menu option

HOME Switches between Data mode and Set mode

LCD

Configuration control through the front panel is known as soft strapping. The front panel 10-character LCD displays the status or option changes resulting from push-button manipulation.

LEDs

The six front panel LEDs reflect status of the data interface signals from modem operations or tests. The LED's are described as follows:

TM   ON when the DDS/MR64 is in a Test Mode.

Blinks at one-half-second rate when the DDS/MR64 is placed in RT loopback by the Telco.

Blinks at one second rate when placed in RL by the remote DSU.

Blinks at two second rate when placed in CSU local loopback (CSULL) by the Telco.

NS   ON indicates that there is No Signal from the DDS line.

OS   ON means that a Telco Out-Of-Service code is received.

CS   ON indicates that Clear to Send (CTS) is ON.

TD   Indicates Transmit Data from the DTE. ON for a SPACE.

RD   Indicates Received Data is going to the DTE. ON for a SPACE.

Power Switch

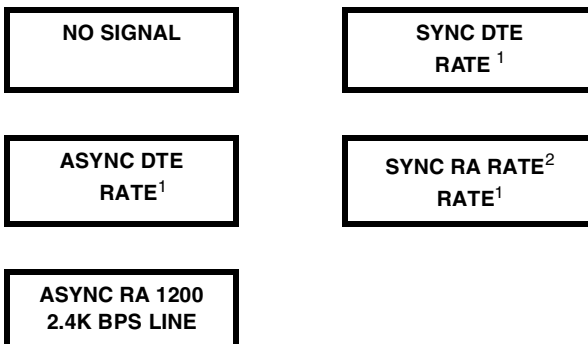A rear panel power switch controls power ON/OFF.

GENERAL

The configuration options allow you to select various operating features that program the DDS/MR64 to your network conditions.

Most configuration options are selected by front panel push buttons. Option descriptions state if an option is not available. For instance, if synchronous is selected, bits per word does not appear. Hard straps and a dip switch on the PC board configure signal ground and the DTE interface.

CONFIGURATION ON POWER-UP

After installation, turn the power on. The DDS/MR64 will perform a self test. If the test fails, the LCD displays ERROR. If an error occurs ensure it is consistent and then refer to Maintenance.

If no error occurs the LCD advances to one of three displays:

NO SIGNAL	**SYNC DTE** **RATE** [1]
ASYNC DTE **RATE**[1]	**SYNC RA RATE**[2] **RATE**[1]
ASYNC RA 1200 **2.4K BPS LINE**	

1 *The word "RATE" does not actually display on the LCD. What displays is the programmed bits per second (bps) rate of the connection.*

2 *The word "RATE" does not actually display on the LCD. What displays is the programmed rate adapted rate.*

In the DDS mode, NO SIGNAL means there is no connection to the DDS network. When used as a limited distance modem, NO SIGNAL means

there is no data connection to another modem. Press HOME. The LCD
advances to the first option selection.

CONFIGURATION OPTION DESCRIPTIONS

Configuration options available through the front panel are as follows:

Timing

Transmitter timing may be slaved to

• INTERNAL timing provided by the DDS/MR64 for LDM
  applications.

• DDS received data timing

• EXTERNAL timing provided by DTE

Normal operation uses DDS received data timing.

Rate

The rate option is selectable to 2.4, 4.8, 9.6, 19.2, 56 kbps, or 64 kbps
clear channel.

Synchronous/Asynchronous   SYNC/ASYNC

The sync/async option is used to configure the DDS/MR64 to operate
either synchronously or asynchronously.

Bits Per Word   BITS/WORD

The bits/word option is used to select the asynchronous word size. The
word size is computed by adding the number of data bits, the number of
stop bits, the number of parity bits (0 to 1), and one start bit. The bits/
word option can be 8, 9, 10, or 11. The previous option SYNC/ASYNC
must be selected to ASYNC for this option. If SYNC is selected, this
option does not apply and is not displayed.

*Note: If the async data rate is 38.4 or 57.6 kbps, the 8 BITS PER WORD
and 9 BITS PER WORD options will not be displayed.*

The RTS control options are as follows:

- Normal - Normal DTE controlled RTS.

- Permanent - Provides a permanent RTS and CTS.

- 35 sec AS - 35 second anti-streaming terminal disconnect. In this mode, if RTS is on from the DTE for 35 continuous seconds, the DDS/MR64 turns CTS OFF.

- SIM SW CR - Simulated switched carrier. Provides a permanent RTS to the DSU/CSU. CTS to the DTE is controlled by and follows RTS from the DTE.

- SIM SW CR A-STRM - Enables both the SIM SW CR option and the 35 sec AS option.

Note: The behavior of CTS once RTS is raised by the DTE may depend on the status of the Circuit Assurance OPTion (CA OPT). Refer to Chapter 4, Circuit Assurance.

Buffer   **BUFF OPT**

This option is used to buffer externally clocked transmitted data and can be enabled or disabled. The option is used mainly with a crossover cable in tail circuit applications. When enabled, transmit data from the DTE is clocked into the buffer using the external clock from the DTE. Data is clocked from the buffer to the DDS line using the clock from the DDS/MR64 (usually in DDS timing). The RTS CONT option should be set for normal. This option is intended for use in a polled system (RTS is toggled). If the TIMING option is selected for EXTERNAL, this option does not apply and is not displayed.

Loopback   **LB OPT**

The remote loopback (RMT LB) feature may be enabled or disabled to avoid accidental activation.

DSR   **DSR OPT**

DSR can be on or off during loopback modes.

With this option on, RLSD must be on for DSR to be on. This means that DSR will turn off while receiving Idle or Out-of-Service codes.

With this option off, DSR does not depend on the state of the DDS/MR64 receiver. This option can be used when the remote DDS/MR64 maintains a permanent RTS to verify a complete link.

Circuit Assurance   CA OPT

When on, RLSD must be on for CTS to be on. This means that CTS will turn off while receiving Idle or Out-of-Service codes. When this option is off, CTS does not depend on the state of the DDS/MR64 receiver. This option can be used when the remote DDS/MR64 maintains a permanent RTS to verify a complete link before sending data.

Note: When using DDS/MR64 units for multi-point links, the master unit must have both the CA and SS options disabled

RTS/CTS Delay   RS-CS DLY

Certain applications and DTE devices require longer RTS-CTS delay times than others. The approximate RTS on to CTS on delay time selections are:

- 25 ms
- 30 ms
- 60 ms
- Normal - The delay is dependent on the rate. Refer to Table 3-3.

64 k Scrambler

In 64 k clear channel operation, certain specific long patterns of data may be interfered with by the DDS network. Should this occur, the 64 k Scrambler option should be enabled. When the 64 k Scrambler option is enabled, the remote DSU/CSU must be a Telenetics or Motorola DDS/MR64 product with the 64 k Scrambler option enabled.

OPTION SELECTION

Front Panel Option Selection

The DDS/MR64 operates in either DATA or SET mode. DATA mode is
for normal operation. SET mode allows the user to initiate tests or select
soft strap configuration options. DATA mode displays one of the
following:

Data line characteristics:

```
┌─────────────────┐          ┌─────────────────┐
│   SYNC DTE      │          │   ASYNC DTE     │
│   Data Rate     │          │   Data Rate     │
└─────────────────┘          └─────────────────┘
```

```
┌─────────────────┐          ┌─────────────────┐
│  ASYNC DTE 57.6 │          │  SYNC RA 19200  │
│ (ASYNC DTE 38.4)│          │  (SYNC RA 9600) │
│   Data Rate     │          │  (SYNC RA 1200) │
└─────────────────┘          │   Data Rate     │
                             └─────────────────┘
```

```
┌─────────────────┐
│  ASYNC RA 1200  │
│  2.4K BPS LINE  │
└─────────────────┘
```

Where Data Rate is equal to 2.4, 4.8, 9.6, 19.2, 56, or 64 kbps LINE.

DTE Tests:

```
┌─────────────────┐          ┌─────────────────┐
│  TEST PATTERN   │          │ REMOTE LOOBACK  │
│      OK         │          │   UNRECEIVED    │
└─────────────────┘          └─────────────────┘
```

```
┌─────────────────┐          ┌─────────────────┐
│  TEST PATTERN   │          │    REMOTE       │
│     ERRORS      │          │   TERMINAL      │
└─────────────────┘          └─────────────────┘
```

```
┌─────────────────┐          ┌─────────────────┐
│     LOCAL       │          │ REMOTE LOOPBACK │
│   LOOPBACK      │          │   RECEIVED      │
└─────────────────┘          └─────────────────┘
```

Remote Test:

```
┌─────────────────────────┐        ┌─────────────────────────┐
│   TELCO INITIATED       │        │   TELCO INITIATED       │
│   REMOTE TERMINAL       │        │   LOCAL LOOPBACK        │
└─────────────────────────┘        └─────────────────────────┘

┌─────────────────────────┐
│   REMOTE INITIATED      │
│   REMOTE TERMINAL       │
└─────────────────────────┘
```

To change from DATA mode to SET mode, press HOME. SET mode is divided into two sections:

- Front panel tests

- Configuration options

Front Panel-Initiated Tests

"SELECT TEST?" is the first question of SET mode. If NO is pressed the DDS/MR64 proceeds to the configuration options menu. If YES is pressed the DDS/MR64 enters the test menu. Test choices are displayed with a question mark. To enter a desired test press YES. The DDS/MR64 performs the selected test and the appropriate message is displayed. Press NO to bypass a test and HOME to return to data mode . Once a test is selected, YES or NO attempts to clear ERRORS, and HOME exits the test. The following is a list of the available tests:

RL/TP   Remote Loopback with Test Pattern

LL/TP   Local Loopback with Test Pattern

TP   End-to-End Test Pattern Test

RT   Remote Terminal Loopback

LL   Local Loopback

RL   Remote Loopback

Chapter 5, Diagnostics provides further information.

Configuration Option Menu

To scroll through the option menu, answer the displayed questions with YES or NO.

When an option question is answered YES, that option becomes active. A list of option questions and option settings are shown in Table 4-1.

Table 4-1
Option Menu

MAIN MENU	LCD MESSAGES		
1	NO SIGNAL	(Press HOME to advance to MAIN 2)	
	SYNC DTE RATE *	Shows programmed SYNC DTE and line rate	
	ASYNC DTE RATE *	Shows programmed ASYNC DTE and line rate	
	SYNC RA RATE§ RATE*	Shows rate adapted sync DTE and line rate	
	ASYNC RA 1200 2.4K BPS LINE	Shows rate adapted async 1200 bps DTE over 2400 bps line	

MAIN MENU	SUBMENU	SUBMENU ITEM	PUSH-BUTTON(S)
2 SELECT TEST?	REMOTE LOOPBACK WITH PATTERN?	TEST PATTERN OK	HOME
		TEST PATTERN ERRORS	YES,NO, HOME
		REMOTE LOOPBACK UNRECEIVED	NO,HOME
	LOCAL LOOPBACK WITH PATTERN?	TEST PATTERN OK	HOME
		TEST PATTERN ERRORS	YES,NO,HOME
	TEST PATTERN?	TEST PATTERN OK	HOME
		TEST PATTERN ERRORS	YES,NO,HOME
	REMOTE TERMINAL?	REMOTE TERMINAL	HOME
	LOCAL LOOPBACK?	LOCAL LOOPBACK	HOME
	REMOTE LOOPBACK?	REMOTE LOOPBACK RECEIVED	HOME
		REMOTE LOOPBACK UNRECEIVED	NO,HOME
3 SYNC DTE CHANGE?			YES,NO,HOME
ASYNC DTE CHANGE?			YES,NO,HOME
4 RATE ADAPTER ENABLED CHANGE?			YES,NO,HOME
RATE ADAPTER DISABLED CHANGE?			YES,NO,HOME
5 CHANGE LINE RATE? (programmed rate)	CHANGE TO 64K? (programmed rate)		YES,NO,HOME
	CHANGE TO 56K? (programmed rate)		YES,NO,HOME
	CHANGE TO 19.2K? (programmed rate)		YES,NO,HOME

*   *The word RATE does not actually appear on the LCD. The rate of the line that the DDS/MR64 is connected to is shown on the LCD.*

§   *The word RATE does not actually appear on the LCD. The programmed rate adapted rate is shown on the LCD*

Table 4-1, continued
Option Menu

MAIN MENU		SUBMENU	SUBMENU ITEM	PUSH BUTTON(S)
5	CHANGE LINE RATE? (programmed rate) (continued)	CHANGE TO 9.6K? (programmed rate)		YES,NO,HOME
		CHANGE TO 4.8K? (programmed rate)		YES,NO,HOME
		CHANGE TO 2.4K? (programmed rate)		YES,NO,HOME
6	RATE ADAPTER 19.2K BPS CHANGE?			YES,NO,HOME
	RATE ADAPTER 9.6K BPS CHANGE?			YES,NO,HOME
7	CHANGE TIMING? (programmed timing)	CHANGE TO INT? (programmed timing)		YES,NO,HOME
		CHANGE TO DDS? (programmed timing)		YES,NO,HOME
		CHANGE TO EXT? (programmed timing)		YES,NO,HOME
8	CHANGE DATA TIMING?	CHANGE TO INT? (programmed timing)		YES,NO,HOME
		CHANGE TO EXT? (programmed timing)		YES,NO,HOME
9	CHANGE NETWORK TIMING?	CHANGE TO INT? (programmed timing)		YES,NO,HOME
		CHANGE TO DDS? (programmed timing)		YES,NO,HOME
10	ASYNC DTE = 57.6K CHANGE?			YES,NO,HOME
	ASYNC DTE = 38.4K CHANGE?			YES,NO,HOME
11	BITS PER WORD = 8 CHANGE? *			YES,NO,HOME
	BITS PER WORD = 9 CHANGE? *			YES,NO,HOME
	BITS PER WORD = 10 CHANGE?			YES,NO,HOME
	BITS PER WORD = 11 CHANGE?			YES,NO,HOME

Note: Submenu 5 displays only 64 k, 56 k, and 2.4 k when the rate adapter option is enabled. If async is selected, Main Menu 5 cannot be accessed and line rate is automatically set to 2.4 kbps.
Note: Main Menu 6 can only be accessed if the rate adapter option is enabled and 56 k or 64 k line rate is selected.
Note: Main Menu 7 cannot be accessed if the rate adapter option is enabled
Note: Main Menus 8 an 9 can only accessed if the rate adapter option is enabled.
Note: Main Menu 10 and 11 can only be accessed if in Async
* 8 and 9 Bits Per Word Menu cannot be accessed if 38.4 kbps or 57.6 kbps is selected

Table 4-1, continued
Option Menu

MAIN MENU		SUBMENU	SUBMENU ITEM	PUSHBUTTON (S)
12	CHANGE CONTROL OPTIONS?	CHANGE RTS CONTROL?	NORMAL RTS CHANGE?	YES,NO,HOME
			PERMANENT RTS CHANGE?	YES,NO,HOME
			35 SEC ANTI-STRM CHANGE?	YES,NO,HOME
			SIM SW CR CHANGE?	YES,NO,HOME
			SIM SW CR A-STRM CHANGE?	YES,NO,HOME
		CHANGE SYNC BUFFER OPT?	SYNC BUFFER DIS CHANGE?	YES,NO,HOME
			SYNC BUFFER EN CHANGE?	YES,NO,HOME
		CHANGE REMOTE LB OPT?	RMT LB ENABLED CHANGE?	YES,NO,HOME
			RMT LB DISABLED CHANGE?	YES,NO,HOME
		CHANGE DSR OPT?	DSR OPT ENABLED CHANGE?	YES,NO,HOME
			DSR OPT DISABLED CHANGE?	YES,NO,HOME
		CHANGE SYS STATUS OPT?	SS OPTION ENABLED CHANGE?	YES,NO,HOME
			SS OPTION DISABLED CHANGE?	YES,NO,HOME
		CHANGE CA OPTION?	CA OPTION ENABLED CHANGE?	YES,NO,HOME
			CA OPTION DISABLED CHANGE?	YES,NO,HOME
		CHANGE RTS-CTS DELAY?	RTS-CTS NORMAL CHANGE?	YES,NO,HOME
			DLY CTS 25 mSEC CHANGE?	YES,NO,HOME
			DLY CTS 30 mSEC CHANGE?	YES,NO,HOME
			DLY CTS 60 mSEC CHANGE?	YES,NO,HOME
		CHANGE DTE RL OPT?	DTE RL ENABLED CHANGE?	YES,NO,HOME
			DTE RL DISABLED CHANGE?	YES,NO,HOME
		CHANGE DTE LL OPT?	DTE LL ENABLED CHANGE?	YES,NO,HOME
			DTE LL DISABLED CHANGE?	YES,NO,HOME

Table 4-1, continued
Option Menu

MAIN MENU	SUBMENU	SUBMENU ITEM	PUSHBUTTON (S)
12 CHANGE CONTROL OPTIONS? (continued)	CHANGE DTE TP OPT?	DTE TO ENABLED CHANGE?	YES,NO,HOME
		DTE TP DISABLED CHANGE?	YES,NO,HOME
	CHANGE DTE RT OPT?	DTE RT ENABLED CHANGE?	YES,NO,HOME
		DTE RT DISABLED CHANGE?	YES,NO,HOME
	CHANGE 64K SCRAM OPT?	SCRAMBLER EN CHANGE?	YES,NO,HOME
		SCRAMBLER DIS CHANGE?	YES,NO,HOME
	LOAD FACTORY OPTION SET?		YES,NO,HOME
	SAVE NEW CONFIGURATION?		YES,NO,HOME

Press HOME to exit set mode. If the current settings are different from the previously saved settings, "SAVE CURRENT CONFIGURATION?" is displayed. To save the current settings into nonvolatile memory, press YES. If NO is pressed the current settings are used but not saved. The DDS/MR64 then returns to DATA mode.

STRAP/SWITCH CONFIGURATION

Options are available through hard straps and dip switches located on the DDS/MR64 main board.

Warning: Turn the power OFF and unplug the power cord before removing the cover.

Cover Removal

- Place the unit on its side on a flat surface. Insert a screwdriver blade in one of the rear latch slots (Figure 4-1).

- Gently push the screwdriver while twisting lightly back and forth.

- Assist removal by prying the cover from the chassis with your fingers on the units rear edges.

- Repeat this procedure on the remaining three latch slots.
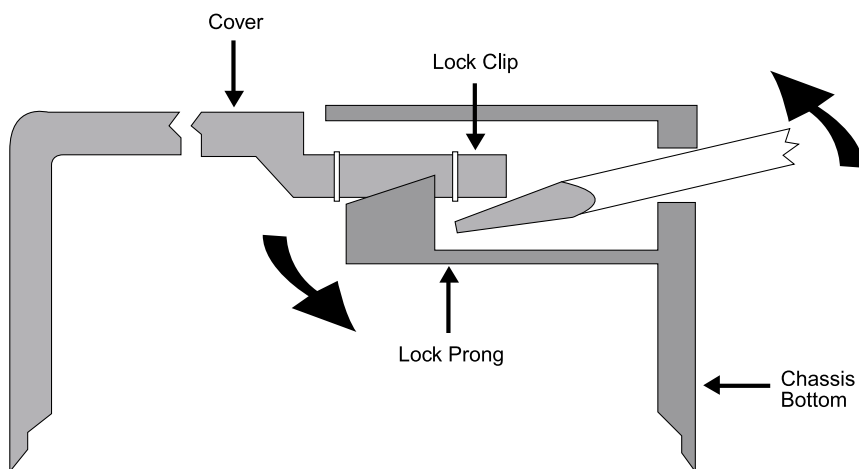
Figure 4-1
Cover Removal

•   Align the rear panel slide guides and the front panel lock tabs.

•   Press the cover to the chassis until the lock prongs engage the lock clips.

Option straps and switches are illustrated in Figure 4-2.
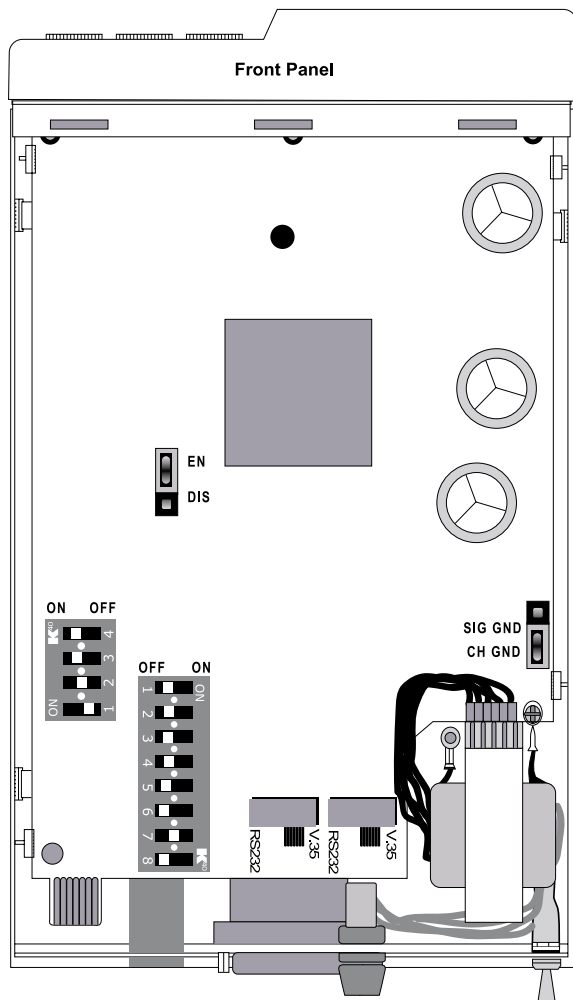
Figure 4-2
Option Straps and Switches (Factory defaults shown)

Front Panel Option

EN enables control of all soft strap options via the front panel push buttons.

DIS disables the front panel push buttons to prevent changing the options currently selected. The operator is limited to scrolling through and viewing those options.

EN

DIS
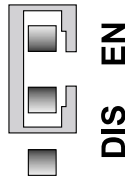
* Factory default

Chassis Signal Ground

CH GND connects signal ground to chassis ground. This option helps eliminate some interference problems.

SIG GND separates signal ground from chassis ground.

CH GND

SIG GND
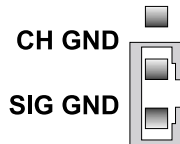
* Factory default

The DTE interface options are selected by an eight position dip switch mounted on the pc board near the DTE connector (see Figure 4-2 and Figure 4-3). Positions 5 and 8 are not used and should be kept off.

Switch 1 TM	ON connects and OFF disconnects Test Mode output to the DTE connector.
Switch 2 NS V.35	ON connects and OFF disconnects the No Signal output to the DTE connector in V.35 mode.
Switch 3 12 V	ON connects and OFF disconnects the 12 V from the DTE connector.
Switch 4 - 12 V	ON connects and OFF disconnects the -12 V from the DTE connector.
Switch 6 NS EIA-RS232	ON connects and OFF disconnects the No Signal output to the DTE connector in EIA-RS232 mode.
Switch 7 ISO-2593	Affects the pins used for TP and LL DTE test inputs on the V.35 connector. ON - the V.35 interface is compatible with ISO-2593. OFF - the V.35 interface is the same as previous Telenetics/Motorola products. To be compatible with ISO-2593, the pins used for the TP and LL DTE test inputs are "swapped."
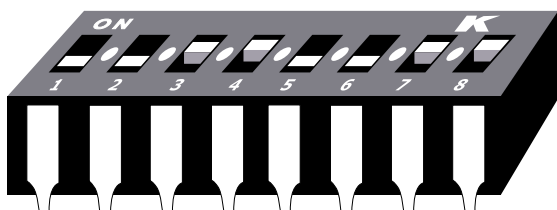
Figure 4-3
DTE Interface Options DIP Switch

TEST FEATURES

By selecting various tests available through the front panel options, you can send test signals or patterns to check the operation of components in the network. During any test, TM is on constant for locally initiated tests and blinks for remotely initiated tests.

Note: To attempt to clear TEST PATTERN ERRORS message from the LCD, press YES or NO. If the error message is not replaced with TEST PATTERN OK, then errors are still being received.

To stop the test, press HOME, then respond to the question EXIT TEST? by pressing YES.

Remote Terminal Loopback   RT

This test causes the local DDS/MR64 to loop back a remotely generated test signal to check the remote unit (Figure 5-1). If the signal returns unchanged, the remote unit and the DDS network are OK.

A bilateral loopback test lets the local DTE loop a signal through the DTE interface. This tests the DTE transmit and receive circuits.

Local Line Loopback   LL

This test checks the transmit and receive logic components in one loop circuit and the transmit and receive line components in another loop circuit (Figure 5-2). The DDS/MR64 loops a signal from the DTE through the logic components and back to the DTE. If the signal does not change, the logic components are OK.

At the same time, the DDS/MR64 loops a signal through the transmit and receive line components. If the signal does not change, the line components are OK.
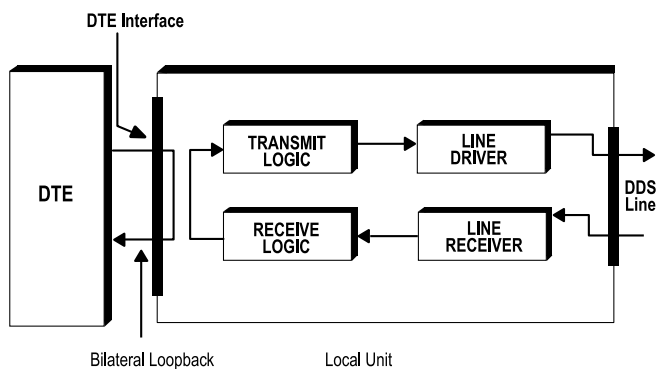
Figure 5-1
Remote Terminal Loopback (RT)
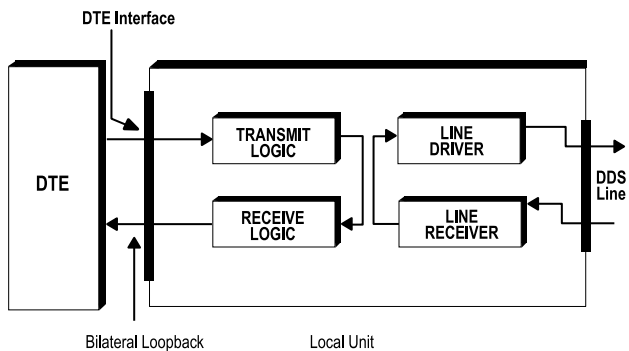
Figure 5-2
Local Line Loopback (LL)

This test is similar to the LL test except that the data sent through the local logic circuits is a test pattern originated by the DDS/MR64 (Figure 5-3). The LL/TP returned signal is scanned in a similar way to the LL test.
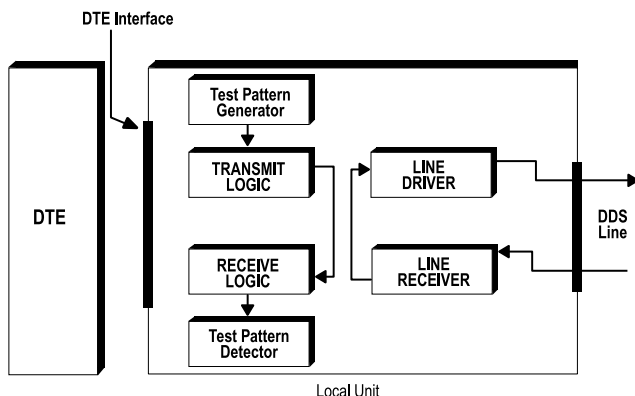
Figure 5-3
Local Line Loopback with Test Patter (LL/TP)

Remote Loopback   RL

This test checks the local DDS/MR64, DDS network, and remote unit (Figure 5-4). The local DDS/MR64 sends a signal to the remote unit causing it to go to the RT configuration. The local DTE can then transmit data which will be looped back at the remote unit and received by the local DTE. If the signal returns unchanged, the local DDS/MR64, DDS network, and remote unit is functional.

The remote unit must be a Telenetics or Motorola CSU/DSU or any CSU/DSU that complies with CCITT V.54 for remote loopback or is compatible with U.S. Sprint-AT&T procedure to function.
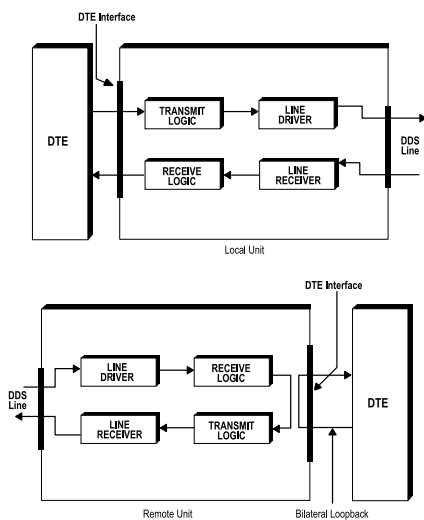
Figure 5-4
Remote Loopback (RL)

This test is similar to the RL test except that the data sent across the line is a test pattern sent from the local DDS/MR64 and looped back through the remote DDS/MR64 (Figure 5-5).
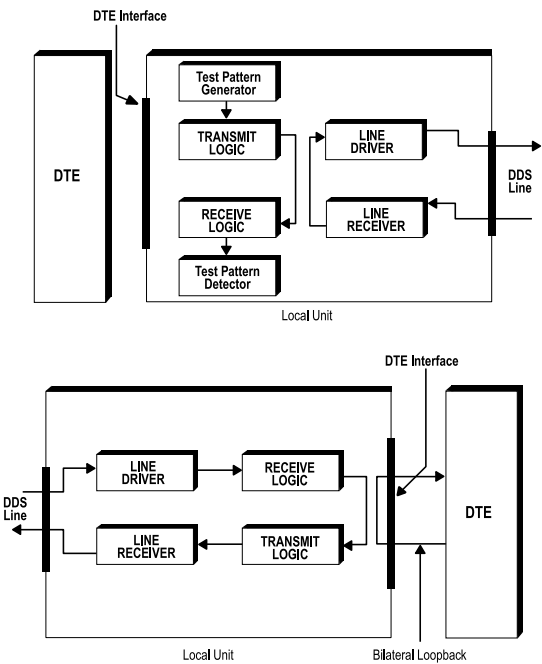
Figure 5-5
Remote Loopback with Test Pattern (RL/TP)

Note: Pressing NO when REMOTE LOOPBACK UNRECEIVED is showing on the LCD causes the EXIT TEST? question to display.

TP tests the local and remote units plus the DDS network (Figure 5-6). TP causes the DDS/MR64 to generate and transmit a 511 bit test pattern over the DDS network to the remote unit.

The remote unit must either loop back the test pattern or generate its own test pattern to the local DDS/MR64 for error checking.
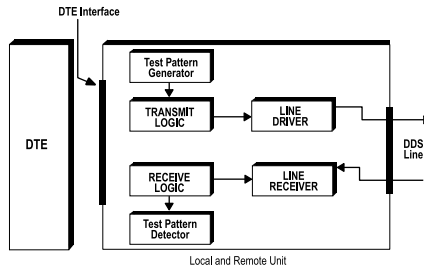
Figure 5-6
Test Pattern (TP)

GENERAL

If the unit appears to malfunction, verify the following before further troubleshooting:

- Telco and DTE connectors are correctly inserted and attached

- DDS/MR64 is plugged into power socket and jack

- Power is available at the plug

- Timing is selected to DDS (and only DDS)

NS LED ON

The NS LED being on indicates a line disorder. Recheck for proper Telco line connection

OS LED ON

If the OS LED is on, check the power and Telco line connections on the remote unit.

If remote unit is set up properly, report the problem of "out-of-service" code on the DDS circuit to the telephone company.

TM LED ON

If the TM LED is on perform the following steps:

- Ensure unit is in DATA mode and disable all DTE test functions

- Disconnect the DTE and Telco cables

- Toggle power on, off, on.

- If TM light remains on, refer to *Chapter 9, Maintenance*.

TM LED FLASHING

If TELCO INITIATED LOCAL LOOPBACK or TELCO INITIATED REMOTE TERMINAL appears on the LCD, remove the Telco cable. If the TM LED stops flashing, report to the telephone company that the DDS circuit is in a test configuration. If the TM LED continues flashing, refer to *Chapter 9, Maintenance*.

If REMOTE INITIATED REMOTE TERMINAL appears on the LCD, remove the Telco cable. If TM LED stops flashing, the remote unit is in a test configuration. If the TM LED continues flashing, refer to *Chapter 9, Maintenance*.

If troubleshooting procedures performed so far have not resolved the problem, continue.

Note: To use the diagnostic and test features built into the modem, the Front Panel Option must be strapped EN.

SELF TEST LL/TP

Using the front panel push buttons, place the unit in LL/TP. The TEST PATTERN OK should be displayed. If the TEST PATTERN ERRORS is continuously displayed, refer to *Chapter 9, Maintenance*.

END-TO-END TEST   TP

Using the front panel push buttons, place both local and remote units into TP. NS and OS LED's should be off. TEST PATTERN OK should be displayed. If TEST PATTERN ERRORS is displayed, refer to *Chapter 9, Maintenance*.

LOCAL LOOPBACK TEST   LL

Using the front panel push buttons, place the unit in LL. All data sent from the local DTE is looped back to itself. This will test the DTE equipment, cable, interface, and local DDS/MR64. If data is not the same, refer to *Chapter 9, Maintenance*. This test is not applicable for DTE devices without display terminals.

Ensure power is plugged in for both units, timing is set for DDS, and the remote unit is in DATA mode. Using the front panel push buttons, place the unit in RL. REMOTE LOOPBACK RECEIVED is displayed on the local unit and REMOTE INITIATED REMOTE TERMINAL is displayed on the remote unit. The TM LED should be flashing on the local modem and on the remote modem. All data sent by local DTE equipment will be looped back through the remote modem. This tests the DTE, cables, interface, the local DDS/MR64, DDS circuit, and the remote unit. If REMOTE LOOPBACK UNRECEIVED or data is not the same, refer to *Chapter 9, Maintenance*.

REMOTE LOOPBACK WITH TEST PATTERN   RL/TP

Using the front panel push buttons, place the unit in RL/TP. SENDING PATTERN is displayed on the local unit until the remote unit is placed into RT. If the remote unit does not respond, the local DDS/MR64 displays REMOTE LOOPBACK UNRECEIVED. Otherwise, TEST PATTERN OK or TEST PATTERN ERRORS is displayed on the local unit and REMOTE INITIATED REMOTE TERMINAL is displayed on the remote unit. This tests local DDS/MR64, DDS circuit, and the remote unit. If TEST PATTERN ERRORS or REMOTE LOOPBACK UNRECEIVED is displayed, refer to *Chapter 9, Maintenance*.

Chapter 7
Non-DDS Applications

GENERAL

In addition to offering DDS operation, the DDS/MR64 can operate as a limited distance modem providing full-duplex serial synchronous data communications at rates of 2.4 to 64 kbps and asynchronous data at 2.4 to 57.6 kbps over privately owned cables. The cable system must consist of ordinary unloaded 4-wire twisted pair.

The maximum distance between units is a function of data rate and wire size (refer to Table 7-1).

Table 7-1

Maximum Operating Distance

Data Rate (bps)	19 Gauge Wire Distance	26 Gauge Wire Distance	dB
64000	57 kft	16 kft	43
56000	61 kft	18 kft	43
19200	77 kft	27 kft	43
9600	90 kft	33 kft	40
4800	116 kft	43 kft	40
2400	150 kft	57 kft	40

INSTALLATION

To install the units, connect the receive pair (T - gray, R - brown) of unit A to the transmit pair (T1 - blue, R1 - orange) of unit B. Likewise, connect the transmit pair of unit A to the receive pair of unit B (Figure 7-1). Refer to Table 3-4 for pin assignments of the modular jack. The T and R designations stand for Tip and Ring, which is simply Telephone Company terminology to distinguish between the two leads of a single pair. For the DDS/MR64, it is important to distinguish between the receive pair and the transmit pair.

Set the timing option of one unit to INTERNAL or EXTERNAL and the second unit to DDS. The unit set to INTERNAL or EXTERNAL provides the master timing for the circuit. The timing should be set to EXTERNAL only if it is desired for the DTE connected to that unit to provide the timing using pin 24 of the DTE connector.
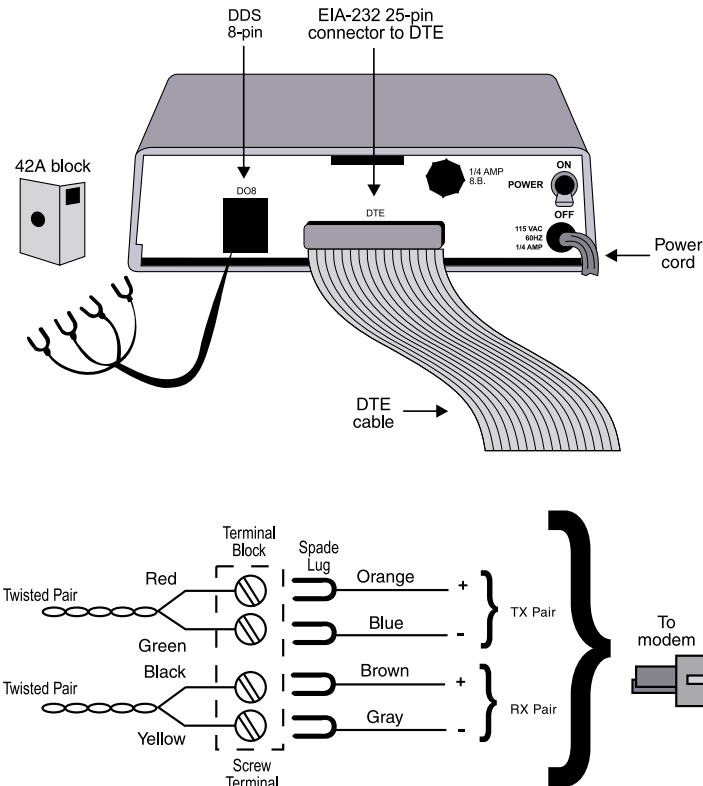
Figure 7-1
Connection as Limited Distance Modem

OPTIONS

Set the remaining options as described in Chapter 4 of this manual.

TESTS

The master unit should not be put into RT, LL, or in a loopback using RL from the remote unit. To do so will cause the circuit to lose its timing reference and errors will be created. To test the circuit, put the unit with DDS timing into any desired loopback mode and send test patterns from the master unit.

Chapter 8
Rate Adapter Option

GENERAL

With the internal rate adapter option, the DDS/MR64 can also be configured to transmit 19.2 kbps or 9.6 kbps synchronous or asynchronous data over a 56 kbps or 64 kbps DDS or LDM link, or 1.2 kbps synchronous or asynchronous data over a 2.4 kbps DDS or LDM link. This mode of operation is called rate adapted 19200 bps, rate adapted 9600 bps, or rate adapted 1200 bps. Several operating characteristics and options are different from the standard format.

Rate adapted 19200 bps, 9600 bps, or 1200 bps can be run by the DDS/MR64 when the rate adapter option and the appropriate rate is selected.

FRONT PANEL DISPLAY

During data mode, the LCD displays the same messages as for the non-rate adapting option with the following exceptions:

Data Rate:	SYNC RA 1200 2.4K BPS LINE	DDS/MR64 is operating at rate adapted synchronous 1200 bps.
	ASYNC RA 1200 2.4K BPS LINE	DDS/MR64 is operating at rate adapted asynchronous 1200 bps.
	SYNC RA 9600 56K BPS LINE (64K BPS LINE)	DDS/MR64 is operating at rate adapted synchronous 9600 bps.
	SYNC RA 19200 56K BPS LINE (64K BPS LINE)	DDS/MR64 is operating at rate adapted synchronous 19200 bps.

Operating Distance

When the unit is running rate adapted 19200 bps, 9600 bps, or 1200 bps, the maximum distance between units is determined by the line rate. Refer to Table 7-1 for the maximum operating distances.

RATE ADAPTER CONFIGURATION OPTIONS

Most options available for the non-rate adapter option are available for the rate adapter option. Configuration options which are different for the rate adapter option include the following:

Timing

If the rate adapter option is running rate adapted 19200 bps or 9600 bps, the standard timing options are not used. Timing options are as follows:

NET TIME - Network transmitter timing can be slaved to either:

• DDS - Received data timing for normal operation.

• INTERNAL - Timing for limited distance modem operation.

DATA TIME - The rate adapter circuitry can be slaved to either:

• INTERNAL - Timing for normal operation.

• EXTERNAL - DTE provided timing.

Rate

This option is the same as for the non-rate adapter option except that while the rate adapter is enabled, the only options available are 64 kbps, 56 kbps, and 2.4 kbps. If the asynchronous and rate adapter options are enabled, this menu is skipped and the line rate is set for 2400 bps (rate adapted asynchronous 1200 bps).

Warning: Disconnect power before performing maintenance. Although dangerous voltage levels are not exposed, disconnecting power will ensure no electric shock hazard is present.

GENERAL

The unit contains no internal electronic components that can be serviced or replaced by the user. Repairs should not be attempted by the user.

FUSE

If a fuse fails, replace it with one of equal rating. Repeated failure indicates a more serious problem. If this happens, refer to the section on maintenance.

MAINTENANCE

The unit provides maintenance free service. Periodically, it is necessary to remove dust that has collected on internal components. Remove dust with a soft bristle brush and low pressure air or vacuum.

Before attempting diagnostic tests, check that all connectors and plugs are firmly inserted. The test procedures will identify the faulty component in a bad communications link.

If the unit appears faulty, contact Telenetics for service and assistance. Do not return the unit without prior instructions.

POWER REQUIREMENTS

The DDS/MR64 contains an internal power supply with the following characteristics:

Volts (rms)	117 ±10%
Hertz	60 ±5%
Cooling	5 maximum

Fuse protection is provided for AC input.

The DDS/MR64 is equipped with a 6-foot captive power cord.

INTERFACE TECHNICAL CHARACTERISTICS

Transmit Pair

Output Impedance:	135 Ohm ±10%
Output Pulse:	50 ±5% duty cycle
Output Amplitude:	1.4 ±0.1V across 135 Ohms (0.785 ±0.05 V at 9600 bps)
Output Power:	+6 dBm with 135 Ohm load (0.0 dBm at 9600 bps)

Receive Pair

Impedance:	135 Ohm ±10%
Input Levels:	+6 to -40 dBm

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Raymar Information Technology, Inc.
Limited Warranty

One Year Limited Hardware Warranty
Raymar Information Technology, Inc., dba Raymar-Telenetics, warrants their products against defects in hardware, material and workmanship under normal use for one (1) year from the date of purchase. Raymar will, at no charge, either repair the product (with new or reconditioned parts), or replace it (with a new or reconditioned product). Repaired replacement products are warranted for either 90 days or the remainder of the original warranty period, whichever is longer. This warranty extends to the original end-user only.

What This Warranty Does Not Cover
This warranty does not cover: (a) software; (b) installation or service of the product; (c) conditions resulting from consumer damage such as improper maintenance or misuse, abuse, accident or alteration; (d) all plastic surfaces (including display screens) and all other exposed parts that are scratched or damaged due to normal use; (e) operation of our products with equipment not supplied by Raymar (f) products which have had the serial number removed or made illegible; or (g) products rented to others. This warranty applies only to hardware products manufactured by or for Raymar Information Technology, Inc. and identified by the Raymar-Telenetics trademark, trade name or product identification logo affixed to them. Refer to the Service and Support section of the User's Guide for service after the warranty expires. No warranty is made as to coverage availability or grade of service provided by the carrier.

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How To Use Raymar's Limited Warranty Service
To take advantage of this warranty, you must do the following:
• If you are having trouble with your product, contact Raymar service using the appropriate number from the Service and Support section of the User's Guide. If it is determined that your product requires service, you will be issued a Return Materials Authorization (RMA) form.
• Pack the defective product securely for shipping. Include only the units pre-approved by service on your RMA form.
• This warranty is void if the product is damaged in transit, you must insure your shipment.
• Ship the defective product, proof of date of purchase, and the RMA form to the address specified.
• Display your RMA number prominently on the outside of the shipping box. Customer is responsible for freight in, door to door. Raymar is responsible for return shipping costs.
• To ensure prompt service, please write on the RMA form a brief description of the problem you are experiencing with the product.
  Raymar Information Technology, Inc.
  7325 Roseville Road
  Sacramento, CA 95842
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  http://support.telenetics.com or e-mail to techsupport@raymarinc.com

Raymar Information Technology, Inc.
Return Merchandise Authorization (RMA) Procedure

Before returning any Raymar-Telenetics product, an RMA number must be obtained.

The most convenient way to obtain an RMA number for a product purchased from Raymar-Telenetics is to call **1-800-747-1522 (+1-916-783-1951)**. When doing so, please have the following information ready:

- Company name
- Full billing address, as well as the address for the location where the product should be returned once repaired or replaced
- Telephone & Fax numbers
- Email address
- Product model number and serial number

For each item being returned, please include the product model number, the serial number, a description of the problem being encountered, and the cause of the problem (if known).

Please note that prior to authorizing a return, a product support specialist may call to verify that the product is properly installed or may ask you to perform tests to insure that the product has actually failed.

The product must be properly packed and returned to:

Raymar-Telenetics
7325 Roseville Road
Sacramento, CA 95842

The RMA number must be legibly displayed on the shipping carton. Raymar-Telenetics will not be responsible for any product returned without an RMA number.

If the product is out of warranty, estimates for repair rates and any applicable shipping costs will be communicated by a customer service representative. Currently, Raymar-Telenetics accepts purchase orders or credit cards as payment methods.

Repairs currently require 5 – 10 business days and are returned via UPS Ground.