

# **DDS/MRI Manual**

**For Sales or Service Contact:**

**Data Connect Enterprise**  
301-924-7400

[http://www.data-connect.com/  
sales@data-connect.com](http://www.data-connect.com/sales@data-connect.com)



# DDS/MR1

## Installation and Operation

Motorola UDS  
5000 Bradford Drive  
Huntsville, AL 35805-1993  
(205) 430-8000

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Motorola UDS  
5000 Bradford Drive  
Huntsville, Alabama 35805-1993  
(205) 430-8000

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Updates to the products and the manual are obtainable at participating UDS dealers and distributors, or directly from UDS on the same terms and conditions as those offered by UDS to its registered customers as verified by the completion and return of the registration form to UDS.

## 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
2.4KB-DDS	04DU5-24
4.8KB-DDS	04DU5-48
9.6KB-DDS	04DU5-96
56KB-DDS	04DU5-56

- The Service Order Code: 6.0 Y
- 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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5000 Bradford Drive  
Huntsville, Alabama 35805-1993  
Telephone: (205) 430-8000

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.

## WARNING

This equipment uses, generates, and can radiate radio frequency energy interfering with radio communications if not installed and used in accordance with the instruction manual. It has been tested and complies with the limits for a Class A computing device according to FCC Rules, Part 15. Operation of this equipment in a residential area may cause interference. If it does, you must correct the cause of the interference. Shielded cables may be necessary with this unit to ensure compliance with the Class A limits.

Changes or modifications to this unit, not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

## CANADIAN EMISSION REQUIREMENTS

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numérique n'émet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class A prescrites dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

## PREFACE

This manual is written for users of the UDS DDS/MR1. Please read it before you change any option on the printed circuit boards or operate the unit. This manual includes the following:

- Chapter 1 Introduction - Contains introductory information and equipment description;
- Chapter 2 Installation - Contains instructions for mechanical and electrical installation of the DDS/MR1;
- Chapter 3 Operation - Describes operational procedures and processes;
- Chapter 4 Configuration - Describes front panel and hardware 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/MR1 as a limited distance modem;
- Chapter 8 Maintenance - Contains maintenance information;
- Appendix A Rate Adapter Card - Describes the use of the DDS/MR1 with the rate adapter piggyback card installed;
- Appendix B Specifications;
- Appendix C Abbreviations and Acronyms.
- Index
- Warranty
- Registration Card

## 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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### GENERAL

The UDS DDS/MR1 is a digital data unit that connects a data terminal to the digital network. The unit operates at all data rates from 1.2 to 64 kbps for error free communication in either point-to-point or multipoint applications. The DDS/MR1 combines the functions of a Data Service Unit (DSU) and a Channel Service Unit (CSU) into a single compact device. It is directly compatible with Bell 500 Series DSU and CSU equipment and complies with the requirements specified in Bell publications 62310 and 41450.

In addition to offering DDS operation on the Digital Data Service Network, the DDS/MR1 can operate as a limited distance modem providing full-duplex, serial communications with either synchronous or asynchronous data from 1.2 to 19.2 kbps, or synchronous data at 56 and 64 kbps over privately owned 4-wire, unloaded, twisted-pair cable systems.

When equipped with a rate adapter interface card, the DDS/MR1 is also capable of transmitting data at two rate adapted speeds: either 19.2 kbps data over a 56 kbps link or 1.2 kbps data over a 2.4 kbps link. The data can be either synchronous or asynchronous while the link can be either DDS or LDM. For more information on this mode of operation refer to Appendix A.

### FUNCTIONAL DESCRIPTION

The DDS/MR1 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 DDS/MR1 uses a bipolar return-to-zero signal. This system encodes data as pulses on the communications line rather than

## Chapter 1 Introduction

modulating a carrier frequency as in standard analog modems.

The DDS/MR1 can be configured entirely through the front panel pushbuttons. Prompts on the Liquid Crystal Display (LCD) allow the operator to review or change settings. The DDS/MR1 uses nonvolatile memory to store selected settings.

The DDS/MR1 DTE interface can be changed to support 64 kbps or slower speeds. The DTE interfaces available for the DDS/MR1 include EIA-232, CCITT V.35, and EIA-530/EIA-449.

The receiver contains an automatic equalizer to compensate for distortion and attenuation caused by line length without user adjustment.

### PHYSICAL DESCRIPTION

The DDS/MR1 is a standalone desktop unit. (Consult your dealer for information on the UDS shelf mount unit.) The front panel (figure 1-1) contains six Light Emitting Diodes (LEDs), three pushbuttons, and an LCD screen. The rear panel contains a power cord, power switch, fuse, DTE connector, and a standard 8-pin DDS line jack (Figure 1-2). The DTE interface connects to the Data Terminal Equipment and the 8-pin jack connects to the DDS line. The unit contains a main printed circuit (pc) board and one of four available piggyback DTE interface pc boards.

### RELIABILITY

Reliability is ensured by a conservative electrical design that uses customized LSI circuitry to reduce the number of components. It is further ensured by extensive tests and environmental conditioning of parts and assemblies. This is followed by an acceptance test of the finished product.

The UDS Reliability Program is under continuous review and update in order to provide our customers with the best products possible.

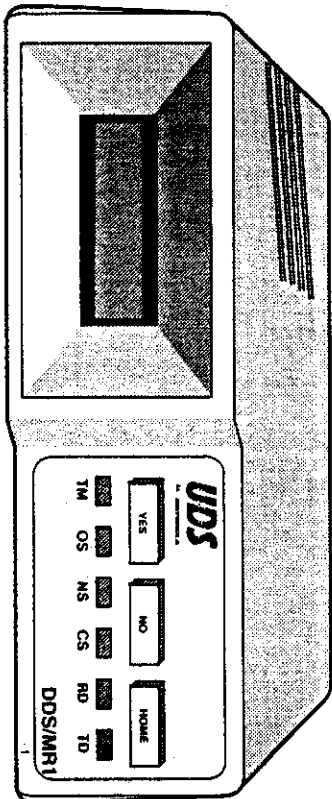


Figure 1-1  
DDS/MR1

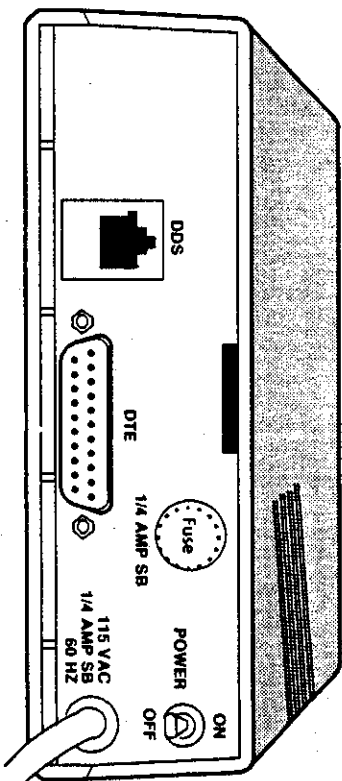


Figure 1-2  
Rear Panel

## Chapter 2 Installation

### 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 UDS 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

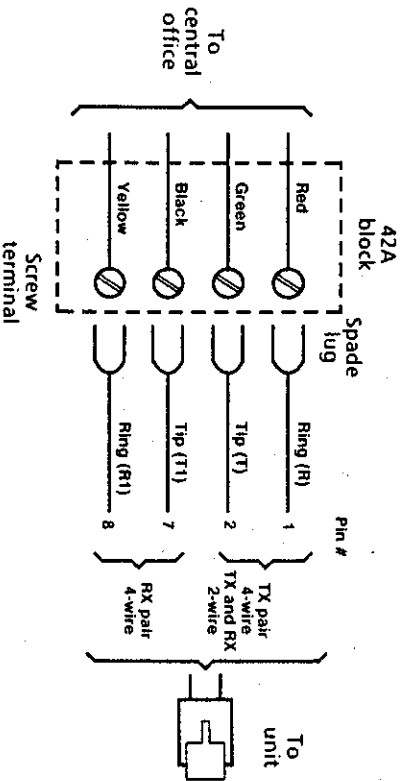
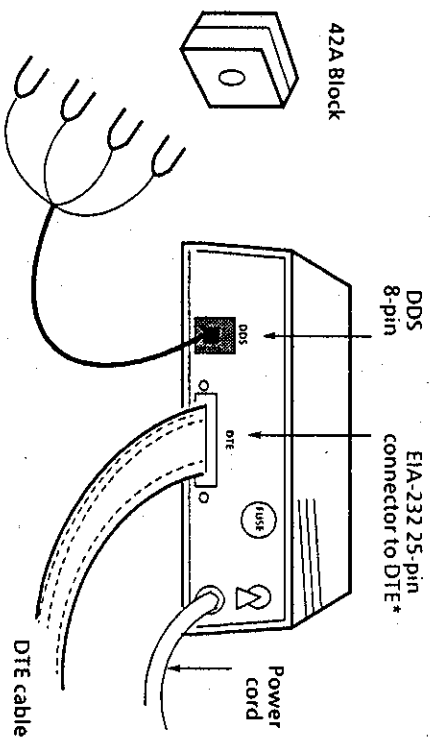
The pc card has two strap options that should be verified or changed prior to installation. Also, the piggyback board has a dip switch that must be set to the correct DTE interface prior to operation. These options are factory set for standard installations. The factory options are described in Chapter 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 installations.

- Connect the DTE connector to the 25-pin receptacle. Secure the two screws to complete the connection.
- Connect the opposite end to the DTE port.
- Connect the 8-pin connector to the TELCO style DDS receptacle.
- Connect the opposite end to the TELCO DDS system.
- Plug in the ac power cord.
- Place the power switch on.

The DDS/MR1 will now perform all functions as determined by option configuration (Chapter 4).



\* The DTE piggyback board selected at time of purchase is equipped with the appropriate DTE interface.

Figure 2-1  
Connection Using 42A Block

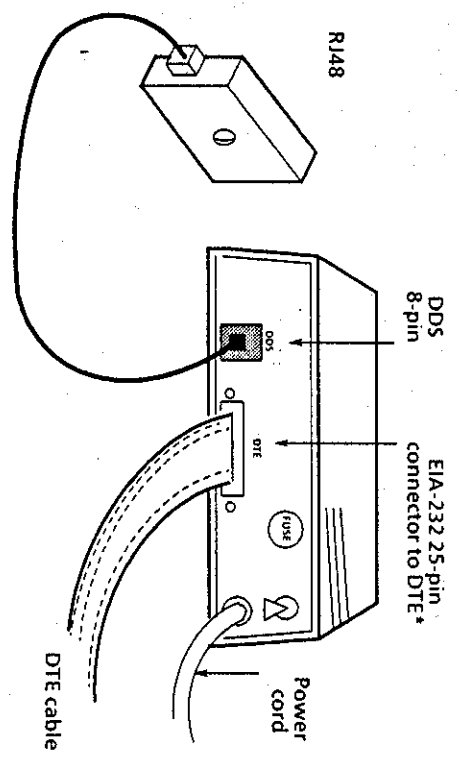


Figure 2-2  
Connection Using RJ48 Jack

V.35 Adapter Module

An adapter module field change kit is provided for EIA-232 DDS/MR1 units that are field changed to the V.35 pc board. The following instructions apply for the standalone or shelf configuration.

- Remove the two EIA-232 hex lug nuts with a 3/16 inch nut driver.
- Open the supplied hardware bag.
- Using the same 3/16 inch nut driver, insert the screws and washers as shown in Figure 2-3.
- Insert the module over the DB-25 connector. If the module does not insert, check to see that the locking bar is in the open/load position.

- The module can be locked in place by sliding the bar to the right (close/lock).

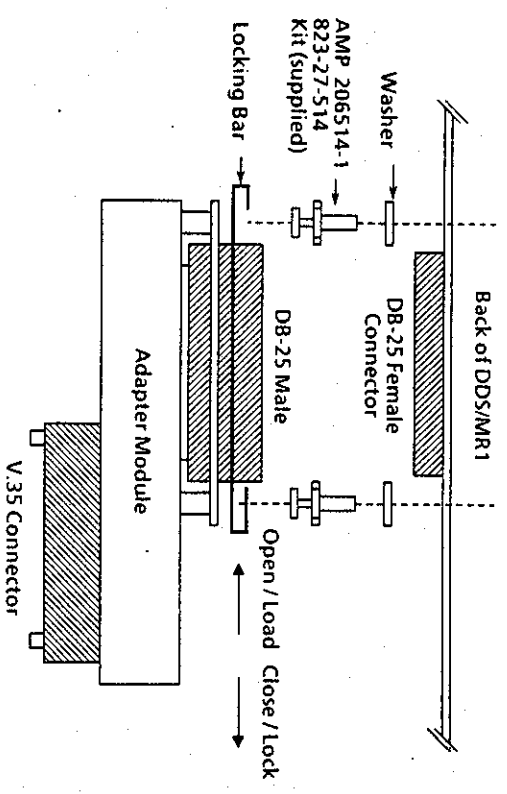


Figure 2-3  
Adapter Module Installation

## Chapter 3 Operation

### GENERAL

After completing installation the unit is ready for operation and configuration. All but two configuration options are soft options and are selected by the LCD and pushbuttons. Therefore, operation of the unit should be understood prior to option selection. Hard options are described at the end of Chapter 4. The DDS/MR1 requires no start-up procedure. After installation and configuration, turn the power on; the DDS/MR1 will perform all functions as optioned.

### DATA TERMINAL EQUIPMENT (DTE) INTERFACE

The DTE interface to the DDS/MR1 is through a 25-pin D-type connector. The sense levels and impedances conform to either EIA-232, EIA-530/EIA-449, or CCITT V.35, depending on the DTE piggyback board provided. The type of DTE interface installed in the unit is displayed on powerup.

#### NOTE

Although the EIA-232 interface card allows the DDS/MR1 unit to be configured for all rates up to 64 kbps, the EIA-232 standard specifies rates of 19.2 kbps or less. Therefore, DDS/MR1 units equipped with an EIA-232 interface card may not always operate properly at 56 or 64 kbps data rates.

### DTE INTERFACE CONNECTORS

Pin functions of the DTE interface connector are listed in Tables 3-1, 3-2, and 3-3. A DDS/MR1 equipped with the EIA-530 interface can be easily interconnected with terminal equipment using the EIA-449 interface. This can be done

with an external crossover cable or other connecting device. The pin functions for both EIA-530 and EIA-449 are listed in Table 3-3.

There are 12 signals specified in the EIA-449 standard which are not supported by the DDS/MR1. These signals and pin numbers are listed in Table 3-4.

Circuit Function	Pin	CCITT/RS-232
Protective ground	1	101/AA
Signal ground	7	102/AB
Request to send	4	105/CA
Clear to send	5	106/CB
Data set ready	6	107/CC
Received line signal detector	8	109/CF
**Test mode	25	142/
**No signal	13	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	
** +12V	9	
** -12V	10	

Table 3-1  
CCITT/EIA-232 Connector

\* Can be disabled by front panel pushbuttons.  
\*\* Selected by DTE interface dip switches.

Circuit Function	"D" Connector Pin	V.35 Connector Pin
Protective ground	1	A
Signal ground	7	B
Request to send	4	C
Clear to send	5	D
Data set ready	6	E
Received line signal detector	8	F
**Test mode	25	K
**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/A
Tx data A	2	P
Tx data B	14	S
External clock A	24	U
External clock B	23	W
*Remote loopback	21	BB/b
*LL loopback	18	J
*RT loopback	11	EE/f
*Test pattern	22	L
** +12V	9	J/J
** -12V	10	LL/l

Table 3-2  
V.35 Connector

\* Can be disabled by front panel pushbuttons.  
\*\* Selected by DTE interface dip switches.

Circuit Function	Pin	CCITT/ RS-530	Pin	RS-449
Protective ground	1	101/	1	---
Signal ground	7	102/AB	19	SG
Request to send A	4	105/CA (A)	7	RS (A)
Request to send B	19	105/CA (B)	25	RS (B)
Clear to send A	5	106/CB (A)	9	CS (A)
Clear to send B	13	106/CB (B)	27	CS (B)
Data set ready A	6	107/CC (A)	11	DM (A)
Data set ready B	22	107/CC (B)	29	DM (B)
Received line signal detector A	8	109/CF (A)	13	RR (A)
Received line signal detector B	10	109/CF (B)	31	RR (B)
**Test mode / no signal	25	142/Tm110/	18	TM
Rx data A	3	104/BB (A)	6	RD (A)
Rx data B	16	104/BB (B)	24	RD (B)
Rx clock A	17	115/DD (A)	8	RT (A)
Rx clock B	9	115/DD (B)	26	RT (B)
Tx clock A	15	114/DB (A)	5	ST (A)
Tx clock B	12	114/DB (B)	23	ST (B)
Tx data A	2	103/BA (A)	4	SD (A)
Tx data B	14	103/BA (B)	22	SD (B)
External clock A	24	113/DA (A)	17	TT (A)
External clock B	11	113/DA (B)	35	TT (B)
*LL loopback	18	141/LL	10	LL
*Remote loopback	21	140/RL	14	RL

Table 3-3  
CCITT/EIA-530 or EIA-449 Connector

\* Can be disabled by front panel pushbuttons.  
\*\* Selected by DTE interface dip switches.

Circuit Function	Pin	RS-449
Signaling rate indicator	2	SI
Terminal ready	12	TR
Incoming call (ring indicator)	15	IC
Select frequency / signal rate selector	16	SF/SR
Receive common	20	RC
Terminal in service	28	IS
Terminal ready	30	TR
Select standby	32	SS
Signal quality	33	SQ
New signal	34	NS
Send common	36	SC
Standby indicator	37	SB

Table 3-4  
EIA-449 Signals Not Supported By DDS/MR1

**Request to Send**  
Originated by DTE. When RTS is on, the DDS/MR1 is in transmit mode and responds by turning on Clear to Send.

**Clear to Send**  
Originated by the DDS/MR1 in response to RTS going on. When CTS is on, the DDS/MR1 is ready to transmit data. When RTS is turned off, CTS will turn off within 1 bit time. The normal RTS on to CTS on delay depends on the data rate (refer to Table 3-5). When the EIA-232 interface card is installed, longer RTS-to-CTS delay times can be selected. For more details refer to Configuration Option Descriptions in Chapter 4. When CTS is off the DDS/MR1 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.



Data Rate	RTS-CTS Delay
1200	16 ± 0.8 ms
2400	8 ± 0.4 ms
4800	4 ± 0.2 ms
9600	2 ± 0.1 ms
19.2k	1 ± 0.05 ms
56k	0.40 ± 0.02 ms
64k	0.35 ± 0.02 ms

Table 3-5  
CTS On Delay

**Transmitter Clock**  
TC

Originated by DDS/MR1. Provides the DTE with transmit timing information. The DDS/MR1 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

Originated by DTE. Provides the DDS/MR1 with data to be transmitted.

**External Clock**

Originated by DTE. Provides the DDS/MR1 with transmit timing information, an option that 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 ± 0.1% of required frequency.

**Received Line Signal Detector**  
RLSD

Originated by DDS/MR1. Indicates valid data has been received on the communication line. Also called carrier detect.

- 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

Originated by the DDS/MR1. 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

Originated by the DDS/MR1. Provides the DTE with data received from the communications line. Transitions of this lead occur within ± 25% of the nominal bit time. This signal is held in a mark state when RLSD is off.

**Data Set Ready**  
DSR

Originated by the DDS/MR1. Indicates to the DTE that the DDS/MR1 is powered on.

**NOTE**

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

**No Signal**  
NS

Originated by the DDS/MR1. Indicates no 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.

**DTE INITIATED TEST SIGNALS**

In addition to front panel initiation, tests can also be DTE initiated. The DTE pin numbers used to initialize these tests depend on the type of DTE interface used and are listed in Tables 3-1, 2, and 3. 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.

When the DTE turns LL on, the DDS/MR1 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.

When the DTE turns RT on, the DDS/MR1 loops data to and from the DDS line through the DTE interface. When bilateral loopback is enabled this mode also provides a loopback path for connecting the DTE transmit and receive data.

When the DTE turns RL on, the DDS/MR1 sends a command to the remote DDS/MR1 causing it to go into RT loopback. When RL is turned off, the DDS/MR1 sends a command to the remote DDS/MR1 canceling the RT loopback command.

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 received pattern causes the appropriate message to be displayed. If the DDS/MR1 is in LL when TP is on, the test pattern is transmitted through the DDS/MR1 transmit logic and looped back through the DDS/MR1 receive logic. This results in a self test.

When the DDS/MR1 is in either remote or local test mode, TM lights.

\* Not available with the EIA-530/EIA-449 DTE interface.

**DDS SYSTEM INTERFACE**

Connection between the DDS/MR1 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/MR1.

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 3-6.

Function	Direction	Pin Number	UDS Wire Color
Transmit tip (T1)	DDS/MR1 to line	2 and 5	Orange
Transmit ring (R1)	DDS/MR1 to line	1 and 4	Blue
Receive ring (R)	Line to DDS/MR1	8 and 6	Slate
Receive tip (T)	Line to DDS/MR1	7 and 3	Brown

Table 3-6  
Pin Assignments

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

**FRONT PANEL CONTROLS AND INDICATORS**  
Pushbuttons

Configuration control is through three pushbuttons on the front panel. They allow the user to configure the DDS/MR1 or select a test mode. The three pushbuttons are

- YES - Selects the displayed menu option
- NO - Advances the displayed menu option
- HOME - Switches between Data mode and Set mode

**Test Pattern TP\***  
**Test Mode TM**

**Remote Terminal Loopback RT\***

**Remote Loopback RL**

**Local Line Loopback LL**

When the DDS/MR1 is in either remote or local test mode, TM lights.

\* Not available with the EIA-530/EIA-449 DTE interface.



Configuration control through the front panel is known as soft strapping.

The front panel ten character LCD displays the status or option changes resulting from pushbutton manipulation.

The six front panel LEDs reflect status of the data interface signals resulting from modem operations or tests.

The LEDs are described as follows:

TM - On when the DDS/MR1 is in test mode.

Blinks at one half second rate when placed in DSU loopback by the TELCO.

Blinks at one second rate when placed in RL by the DSU unit at the opposite end.

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

OS - On when the Out-of-Service code is received. This code is sent by TELCO during testing.

NS - On when there is No Signal from the DDS line or no connection to the DDS line.

CS - On when the DTE CTS is on.

RD - Indicates that Received Data is going to the DTE. On for a space, off for a mark.

TD - Indicates that Transmitted Data from the DTE is being sent. On for a space, off for a mark.

A rear panel power switch controls power on / off.

**Power Switch**

**Chapter 4  
Configuration**

**GENERAL**

Three piggyback cards are available, each with a different DTE interface. A fourth rate adapter piggyback card allows 19.2 kbps synchronous or asynchronous data to be transmitted over the 56 kbps DDS link or 1.2 kbps synchronous or asynchronous data to be transmitted over the 2.4 kbps DDS link. The rate adapter card interface conforms to EIA-232. Not all configuration options are the same for the rate adapter card. For more details refer to Appendix A.

**NOTE**

The unit is purchased with the selected piggyback card preinstalled at the factory. However, changing cards on site is a relatively simple task when required.

Configuration options are selected by front panel pushbuttons. Option descriptions state if an option is not available. For instance, if synchronous is selected, bits per word does not appear.

**CONFIGURING  
THE DDS/MR1**

After installation, turn the power on. The DDS/MR1 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.