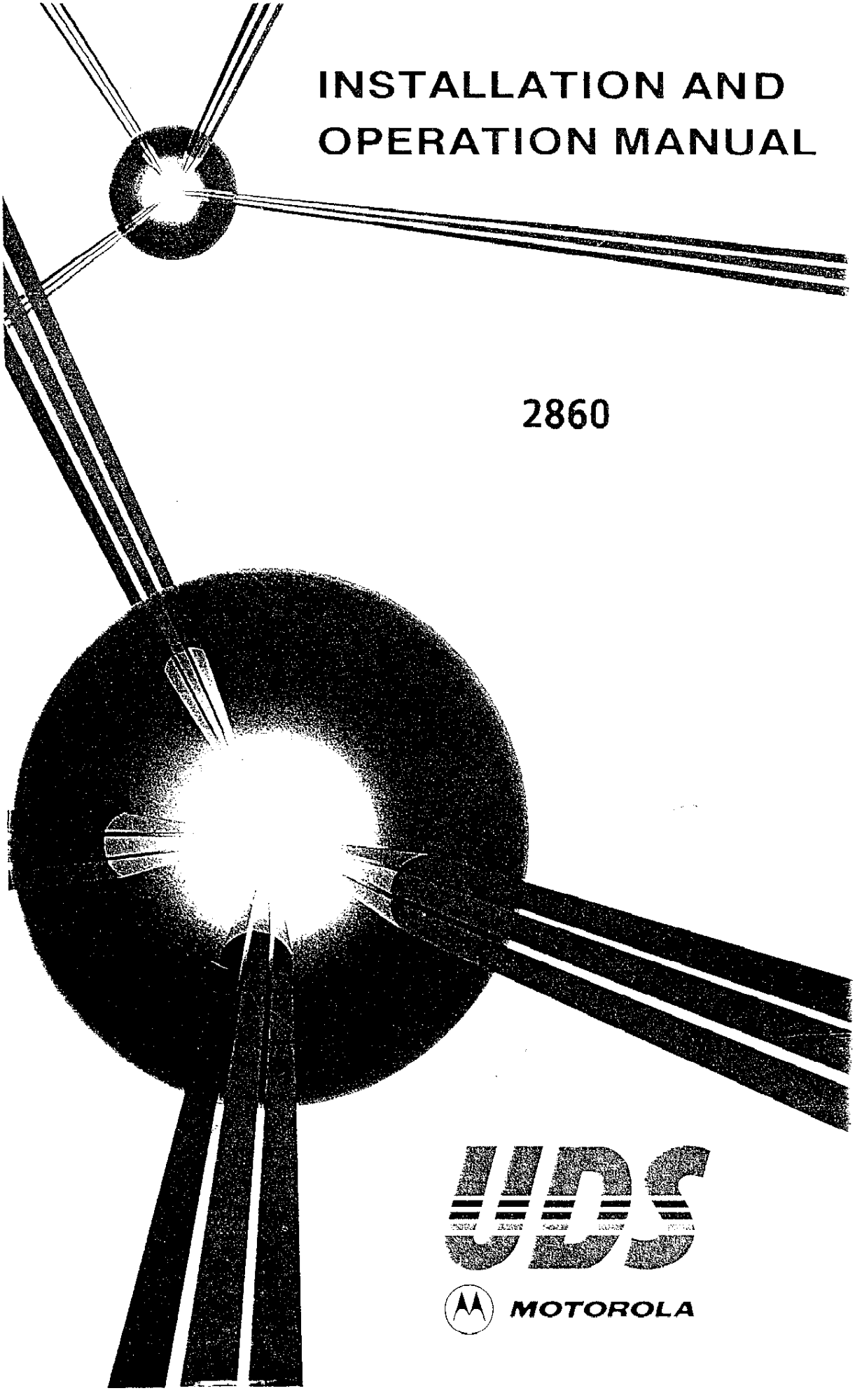
INSTALLATION AND OPERATION MANUAL

2860



UDS

MOTOROLA

2860

Installation and Operation

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NOTICE

UPDATES

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.

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'emet pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la class A prescriptes dans le Règlement sur le brouillage radioélectrique édicté par le ministère des Communications du Canada.

PREFACE

This manual is written for users of the 2860 modem. Please read it before you change any option or operate the modem. This manual includes the following:

Chapter 1	Introduction - Contains introductory information;
Chapter 2	Installation - Contains instructions for mechanical and electrical installation of the modem including a description of the TELCO line interface;
Chapter 3	Operation - Describes the operation of the front panel switches, lights, and liquid crystal display; outlines operating modes, and rapid configuration via the QUICK STRAP feature;
Chapter 4	Option Selection - Contains descriptions of all modem options;
Chapter 5	Diagnostics - Describes test modes available and their use in isolation of network problems;
Chapter 6	Autodialer - Describes synchronous BISYNC, SDLC/HDLC, and 801 autodialer function and operation;
Chapter 7	Maintenance - Provides maintenance information;
Appendix A	Specifications;
Appendix B	Data Interface;
Appendix C	LCD Menu.
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. When purchased, each unit meets the applicable FCC and UL specifications.

Table of Contents
2860

Chapter 3 continued

Chapter 4 Option Selection

Chapter 4 continued

Chapter 5 Diagnostics

ts

Illustrations
2860

Tables
2860

Chapter 1
Introduction

GENERAL

The UDS 2860 modem is a 4800/2400 bps synchronous/asynchronous communication device for use over leased lines or the dial-up public switched telephone network (PSTN). The modulation methods are compatible with Bell 208 and 201C. The modem circuitry is contained on one printed circuit board.

The 2860 provides automatic dialing using either BISYNC or SDLC synchronous protocols. Dialing in 801 mode is also available but requires a special cable. Telephone numbers can be up to 36 digits long. Either tone or pulse dialing is supported. Messages are provided to monitor the progress of the call.

Numerous options are available to tailor the 2860 to a particular application. All options except signal ground/chassis ground connection can be set via the front panel pushbuttons and liquid crystal display (LCD).

DESCRIPTION

The 2860 is contained within a plastic chassis. The cover is easily removed for access to the signal/chassis ground option strap. The front panel (Figure 1-1) contains six light emitting diodes (LEDs) that display modem status, and three pushbutton switches for controlling modem operation. The rear panel (Figure 1-2) contains the ON/OFF switch, fuse, DTE, TELCO, and TELSET connectors. AC power is supplied through a 6-foot 3-wire cord and plug.

SPECIFICATIONS

A list of the modem specifications is provided in Appendix A.

1
Introduction

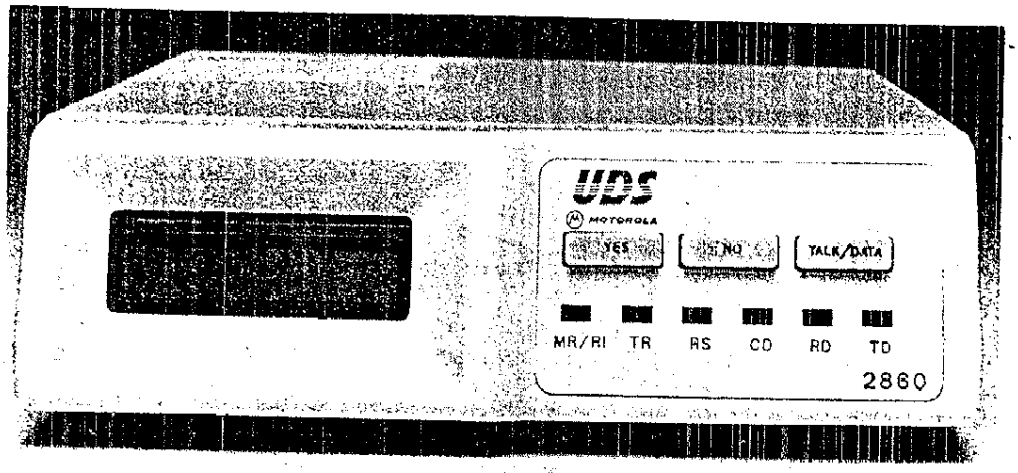


Figure 1-1
2860

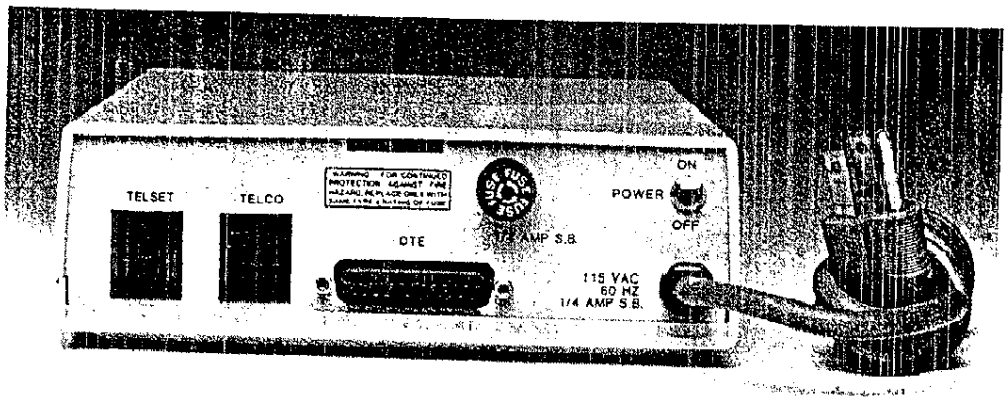


Figure 1-2
Rear Panel

Chapter 2
Installation

GENERAL

This chapter provides information for the mechanical and electrical installation of the modem.

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. UDS suggests that the shipping container and packing material be retained for future shipment.

SITE PREPARATION

Install the modem within 6 feet of a 115 Vac grounded outlet and no further than 50 feet from the data terminal equipment (DTE). The Telco wall jack must be within 5 feet of the modem for the supplied cables to reach.

The installation area should be clean, well lighted, and free from extremes of temperature, humidity, appreciable shock, and vibration. Allow at least a 4-inch space at the rear of the modem for cable clearance and air flow.

GROUNDING OPTION STRAP

Cover Removal

To select or inspect grounding options, remove the modem cover.

stallation

WARNING

Disconnect all cables prior to cover removal.

Stand the unit on its side on a flat surface. Use a medium size flat screwdriver blade to either push or lightly pry a rear lock tab off the latch lock (Figure 2-1). Assist removal by separating the top from the bottom with your fingers on the unit rear edges. Repeat this procedure with the remaining latch slots.

To replace the cover align the latch locks, rear guide grooves, and front panel retaining tabs. Press the cover in place until the latch locks engage the lock tabs.

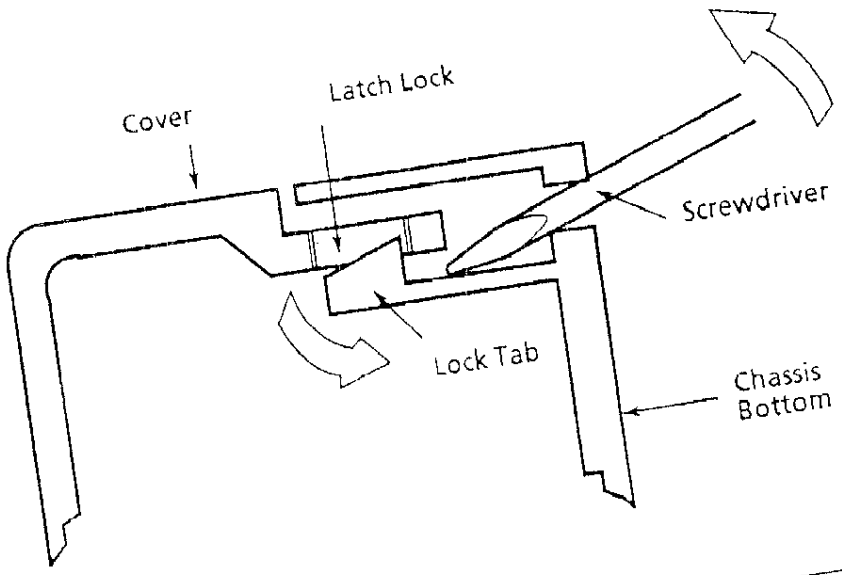


Figure 2-1
Cover Removal

Ground Strap

Signal ground is normally connected to chassis ground (factory). If interference exists, isolate signal ground from chassis ground.

The option strap is located at the rear of the printed circuit board between the DTE and TELCO connectors. Viewed from the front of the modem, when the strap is in position SIG, signal ground is isolated from chassis ground. When the strap is in position CHSS, signal ground is connected to chassis ground.

Changing the Strap Setting

To change the strap setting, lift the jumper connector off and reinsert it in the new position.

Figure 2-2 shows a typical strap application.

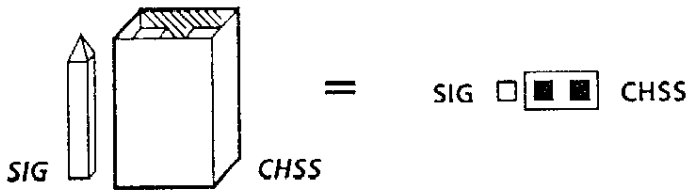


Figure 2-2
Option Strap Configuration

TELEPHONE LINE CONNECTION

There are two types of PSTN telephone jack connections for use with the dial-up lines:

- Permissive
- Programmable

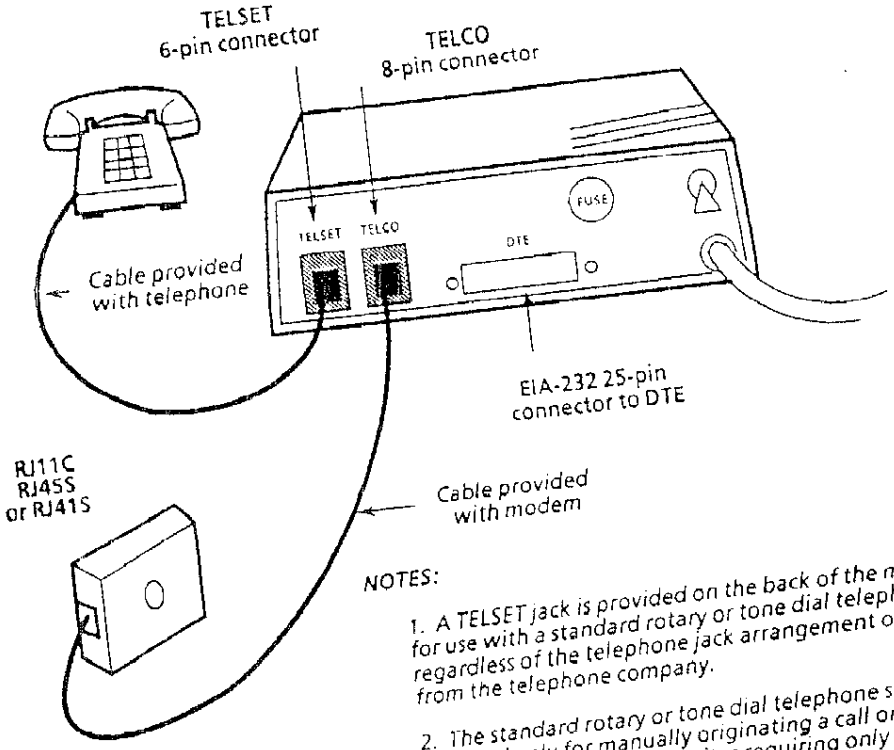
allation

missive

The permissive jack (RJ11C) is the most common type and was designed primarily for voice communications. Domestic phone service uses permissive connections. See Figure 2-3.

ogrammable

The programmable jacks (RJ41S, RJ45S) are designed for data communications and may provide a better data signal. If an RJ41S is used, its built-in switch must be set to programmable (PROG). See Figure 2-3.



NOTES:

1. A TELSET jack is provided on the back of the modem for use with a standard rotary or tone dial telephone regardless of the telephone jack arrangement ordered from the telephone company.

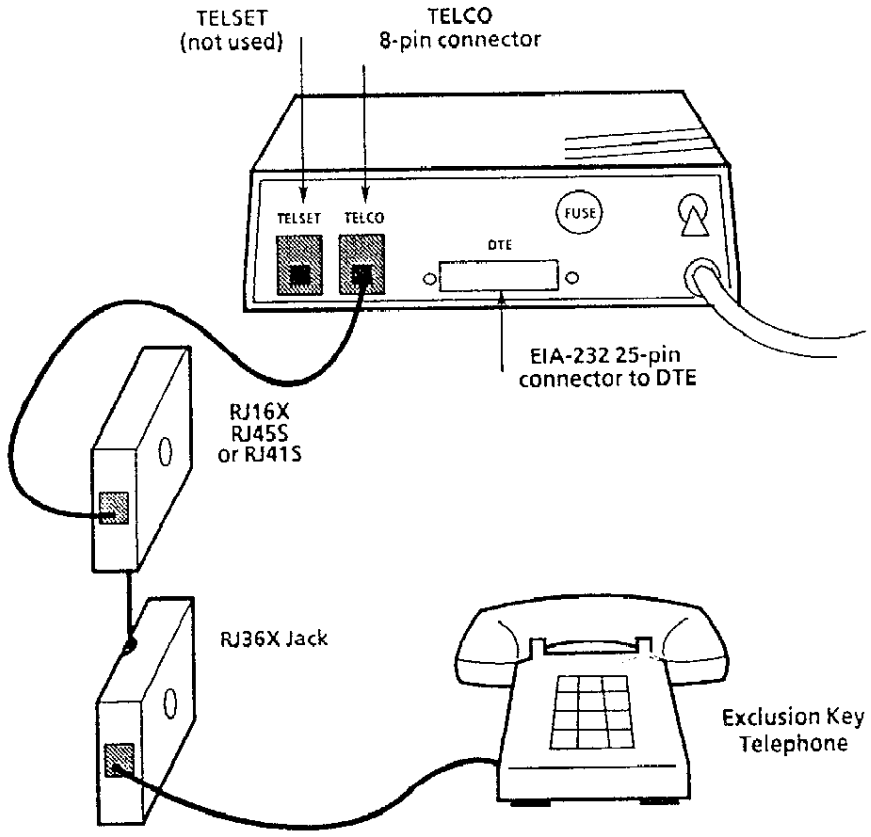
2. The standard rotary or tone dial telephone set is required only for manually originating a call or for voice communication. For sites requiring only autoanswer capability, a phone is not needed.

3. Direct connection offers two modes of operation -- either the permissive RJ11C or the programmable RJ41S/RJ45S jack arrangements.

Figure 2-3
Permissive or Programmable Connection

Exclusion Key Telephone

If ordering an exclusion key telephone (Figure 2-4), specify the options as given in Table 2-1.



NOTES:

1. *The two jacks are connected by the telephone company.*
2. *Use RJ16X jack for permissive mode connections; RJ45S or RJ41S jack for programmable mode connections.*

Figure 2-4
Exclusion Key Telephone Connection

Option	Description
A2	Modem controls the line
B4	Audio monitoring
C5	Pushbutton phone (customer preference)
C6	Rotary phone (customer preference)
D8	Voice mode indication

Table 2-1
Exclusion Key Telephone Options

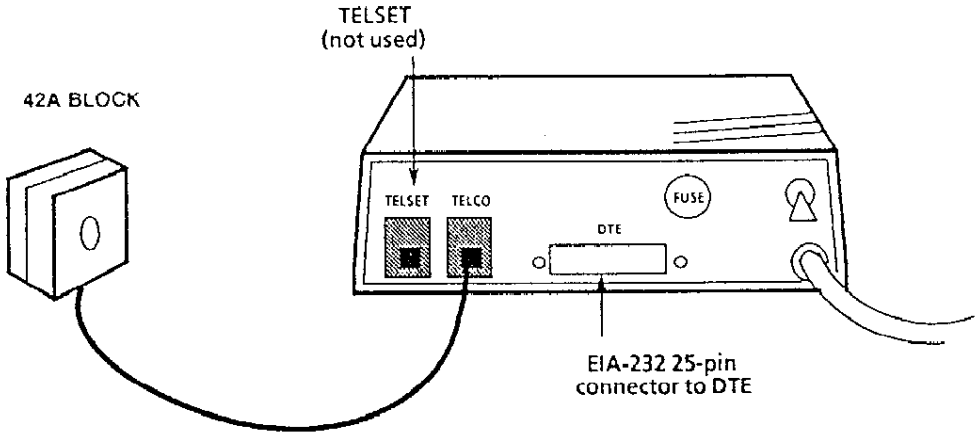
Leased Line

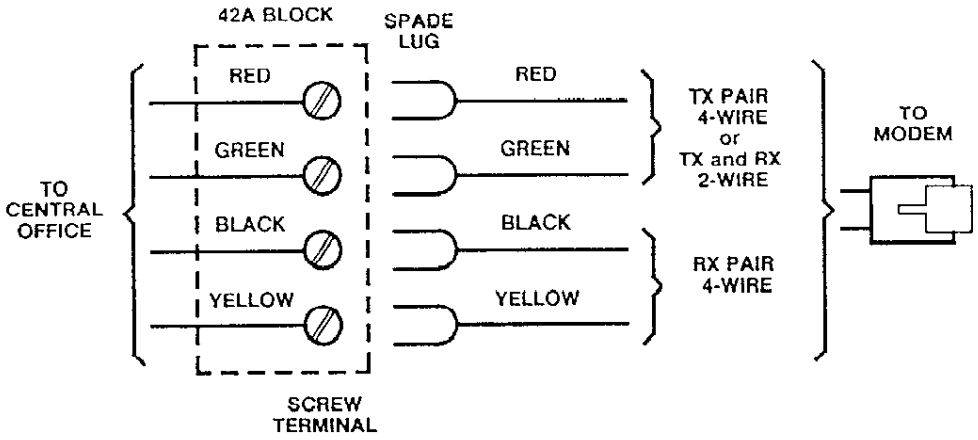
The 42A block is the preferred termination for leased line use. It requires the use of the 8-pin modular to spade lug cable. See Figure 2-5.

> NOTE
> Although preferred, some Bell operating companies have discontinued the use of the 42A block for private leased line terminations. Instead, the modular jack JM-8 is used. If this is the case in your area, you need a special cable (UDS PN 61020801). Contact your nearest UDS sales office or your distributor for further information.

TELEPHONE CABLES

The cables used for connection between the modem and the various Telco jacks are illustrated in Figure 2-6.





NOTE: Set the transmit output level to 0 dBm.

Figure 2-5
Leased Line Connection

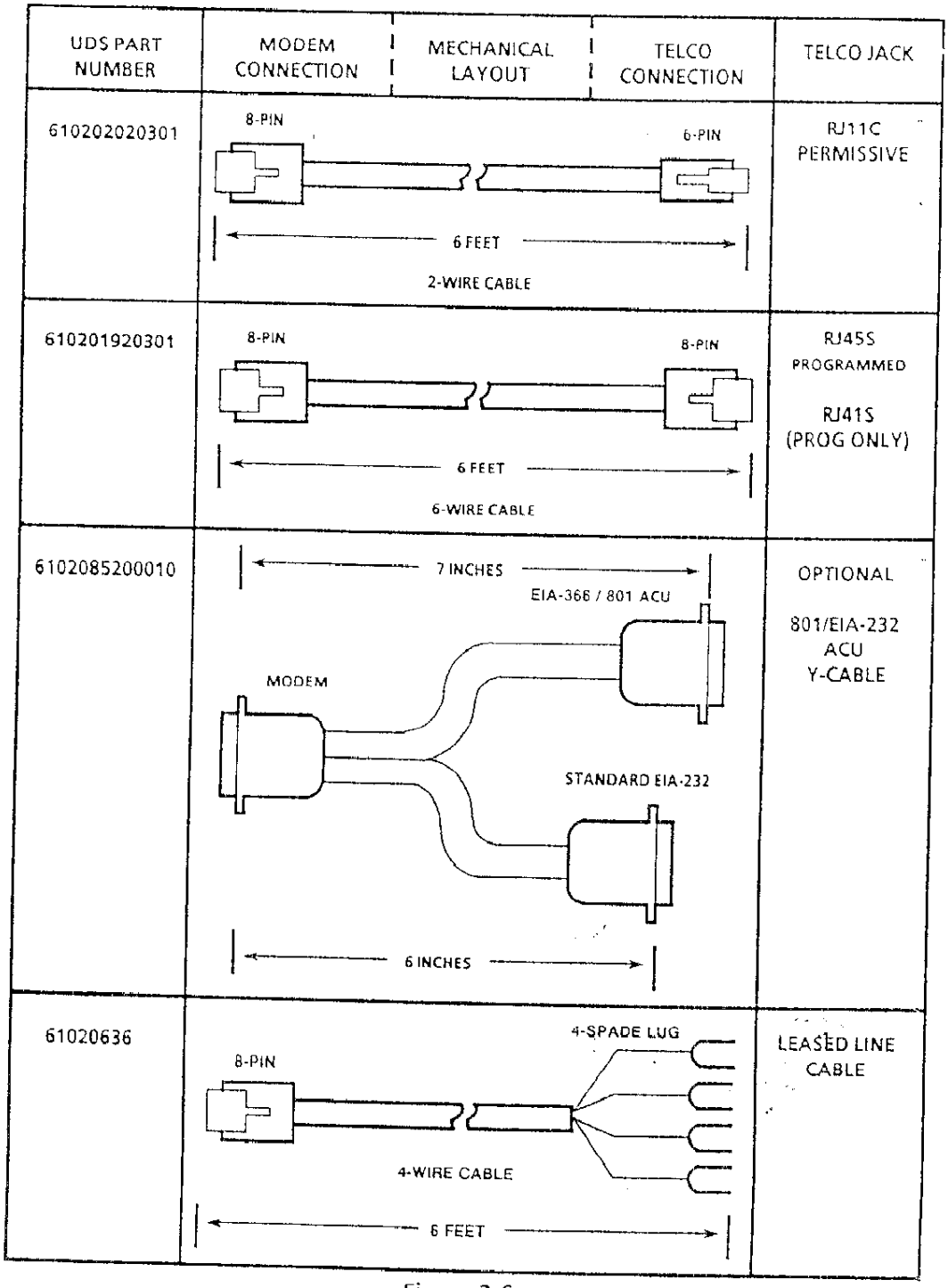


Figure 2-6
Telephone Cables

> **CAUTION**
> The 8-position modular plugs are visibly larger than the 6-position plugs. When using a cable with an 8-position plug on one end, always ensure the larger plug is inserted into the modem TELCO jack. Insertion of the smaller plug could cause an unreliable connection.

Dial-Up and Leased Line Interface

Dial-up PSTN telephone line connections are made with either the 6-wire or 2-wire permissive cable plugged into the modem 8-position TELCO jack on the rear of the modem. The modular plug pin assignments are described below and shown in Figure 2-7.

Leased line connections also use the TELCO jack on the rear of the modem.

DIAL-UP OPERATION

Pin	Function	
	Programmable	
1-2	Not used	
3	MI	Mode indicator connection of exclusion key handset
4	R	Ring side of telephone line
5	T	Tip side of telephone line
6	MIC	Mode indicator common
7	PR	Connection of transmit level programming resistor
8	PC	Programming resistor common
	Permissive	
1-3	Not used	
4	R	Ring side of telephone line
5	T	Tip side of telephone line
7-8	Not used	

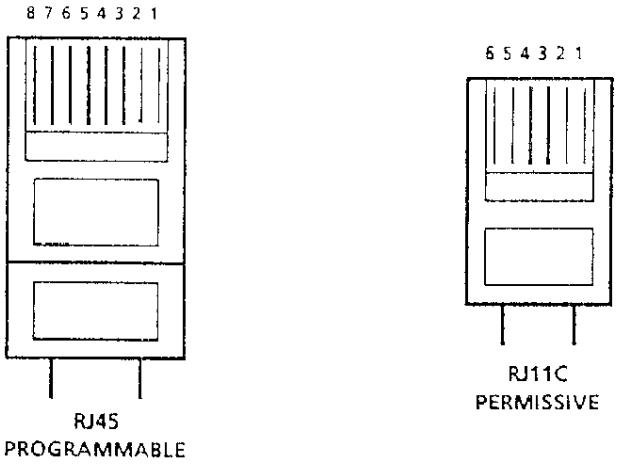


Figure 2-7
Programmable and Permissive Modular Plug Pin Assignments

LEASED LINE OPERATION

Pin	Function	
1-2	Not used	
3	R1	Ring side of 4-wire receive line
4*	R	Ring side of 2-wire/4-wire transmit line
5*	T	Tip side of 2-wire/4-wire transmit line
6	T1	Tip side of 4-wire receive line
7-8	Not used	

* Used for both transmit and receive in 2-wire leased line operation.

TELEPHONE HANDSET INTERFACE

To use a rotary dial or pushbutton telephone, plug the phone into the modem TELSET jack using a 6-position, 2-conductor modular cable. Telset ring and tip are connected to pins 3 and 4 of this cable.

DTE EIA-232D INTERFACE

The interface between the modem and DTE uses the 25-pin connector labeled DTE and conforms to EIA-232D for serial digital interface. Use a small blade screwdriver to fasten the cable in place. Pin functions are described in Appendix B Data Interface.

Connecting Modem Power

If you removed the modem cover to check or change the signal/chassis ground option, replace it. Verify the power switch is OFF, and insert the power plug into a standard 115 Vac grounded outlet. After modem connections are made, the modem is ready for normal operation.

Chapter 3
Operation

GENERAL

This chapter contains the basic details of operation for the 2860. Also included is a Quick Configuration procedure for the easiest setup via LCD using the QUICK STRAP menu.

LCD CONTROL

The three pushbuttons on the front panel are labeled YES, NO, and TALK/DATA. These pushbuttons in conjunction with the 32 character LCD control the operation and configuration of the modem. The LCD shows the currently selected option or operating state of the modem. The YES button allows the current display to be selected by the modem. The NO button changes the current display to the next available option or state. During selection of options the TALK/DATA button allows the user to exit the current option menu and store any new options selected. In either dial-up state, data mode or data idle mode, the TALK/DATA button allows transfer between talk and data modes during manual call origination using a telephone connected to the TELSET connector. After completing option selection, the modem configuration can be stored in nonvolatile memory by using the SAVE OPTIONS? LCD selection.

Option Menu

Appendix C describes the LCD Options Menu. The menu itself appears in Table C-1. For any option choice beyond what is described in this chapter, refer to Chapter 4 Option Selection and Appendix C LCD Menu.

LED INDICATORS

Modem operation is monitored by six LED indicators connected to the EIA-232D interface. For control lines MR/RI, TR, RS, and CD, the LED indicators light when the control line is on. For data lines RD and TD, the LED indicators light when space data is present.

- MR/RI Modem Ready (Data Set Ready)/ Ring Indicator
- TR Data Terminal Ready
- RS Request to Send
- CD Carrier Detect
- RD Received Data
- TD Transmitted Data

POWER ON DIAGNOSTICS

When power is applied to the modem, a series of diagnostic tests are performed which take approximately 18 seconds to complete. During this time the processor, RAM, program memory, and peripheral signal processing components are tested for proper operation. The LCD shows the pass or fail result of these self tests. If a failed self test message is displayed, please call the UDS Field Service Department at 1-800-221-4380 for further assistance.

OPERATING MODE SELECTION

After completing the powerup diagnostic tests, the modem configures itself according to information stored in its nonvolatile memory. The modem is configured at the factory for Bell 208 synchronous 4800 bps dial-up operation with the autodialer disabled. If the modem is configured for one of the dial-up modes, the LCD indicates DATA IDLE MODE on the top line of the display. If one of the leased line modes is selected, the display indicates DATA MODE on the top line and the selected bit rate on the bottom line.

There are two methods of changing the modem operating mode. The EDIT OPTIONS? menu allows each modem parameter to be edited individually to obtain maximum performance in unusual applications. Chapter 4 contains information on selecting these options.

In most applications, the QUICK STRAP menu can be used to configure the modem. To change the operating mode of the modem using the QUICK STRAP menu, press the NO button several times until the QUICK STRAP message is displayed. Press the YES button to enter the QUICK STRAP menu.

QUICK CONFIGURATION

The QUICK STRAP menu provides a simple and rapid method of configuring the modem for the desired mode of operation. Nine possible modes are available in the QUICK STRAP menu. They can be reviewed by pressing the NO pushbutton for each mode. Table 3-1 shows the nine modes and their applications. Table 3-2 shows how some of the more important options are set under each quick strap mode.

When the desired mode is displayed, press the YES button to select that mode. The modem sets its internal options to the normal states for the selected mode. The selected mode remains displayed without the question mark for approximately 1 second.

Then the LCD displays the SAVE OPTIONS? message. Press YES to store the selected mode in nonvolatile memory. This is necessary if the selected mode is to be restored to the modem after an interruption in AC power occurs. For testing or temporary use, press NO and the selected mode will be active only until changed or an interruption in AC power occurs. After the SAVE OPTIONS? selection has been made, the modem returns to the DATA/DATA IDLE state.

If the Quick Configuration does not satisfy option requirements, refer to Chapter 4 for individual option selection.

NOTE
Front panel initiated stored number dialing is available in all dial-up modes.

Mode	Description
PSTN	Dial-up with no DTE autodialing capability.
PSTN with sync dialer	Dial-up mode with synchronous dialer enabled. Bisync or SDLC protocols are supported via EIA-232D.
PSTN with 801 dialer	Dial-up mode with parallel 801 autodialer enabled. Requires use of the Y-cable connected to EIA-232D port of modem and the 801 and EIA-232D ports of the DTE.
Leased 4-wire point-to-point/ multipoint master	Leased 4-wire mode for point-to-point or master site of a 4-wire multipoint polling network. Transmit path is constant carrier with dummy CTS delays of 8.5 or 0 ms. For 208 or 201 operation.
Leased 4-wire multipoint slave	Leased 4-wire mode for remote sites of 4-wire multipoint polling network. Anti-stream option is enabled to prevent network tie-up if RTS stays up due to DTE malfunction. Signal quality retrain is enabled because the receive signal is constant carrier.
Leased 2-wire point-to-point/ multipoint master	Leased 2-wire mode for point-to-point or master site of a 2-wire multipoint polling network. Transmit path is controlled carrier 50/25 ms for 208/201 CTS delay.
Leased 2-wire multipoint slave	Leased 2-wire mode for remote sites of 2-wire multipoint networks. Anti-stream option is enabled to prevent network tie-ups if RTS stays on due to DTE malfunction.

Table 3-1
Quick Strap Application Description

208/201 Mode	CTS Delay	TX LVL	TX/RX EQL	Signal Quality Retrain	Line Current Disc.	Anti-stream
PSTN	150/150	-9 (per)	Out/Out	Out	8 ms	N/A
PSTN with sync dialer	150/150	-9 (per)	Out/Out	Out	8 ms	N/A
PSTN with 801 dialer	150/150	-9 (per)	Out/Out	Out	8 ms	N/A
Leased 4-wire point-to-point/ master	8.5/0	0	Out/Out	Out	N/A	Out
Leased 4-wire multipoint slave	50/25	0	Out/Out	In	N/A	In
Leased 2-wire point-to-point/ master	50/25	0	Out/Out	Out	N/A	Out
Leased 2-wire multipoint slave	50/25	0	Out/Out	Out	N/A	In

Table 3-2
Quick Strap Application Guide

SELECTING BIT RATE

From the DATA/DATA IDLE state, press the NO button several times until the LCD shows the SELECT BIT RATE? message. Press the YES button to display the currently selected bit rate. The modem can operate in Bell 208 compatible 4800 bps or Bell 201 compatible 2400 bps modes.

Press NO until the desired bit rate is displayed. Press YES to select the new bit rate. If the new bit rate is different from the current rate, the LCD shows the SAVE NEW BIT RATE? message. Press YES to store the selected bit rate in nonvolatile memory. Press NO for temporary operation at the selected bit rate. After the SAVE BIT RATE? selection has been made, the modem returns to the DATA/DATA IDLE state.

DIAL-UP CALL ORIGINATION

When one of the dial-up modes is selected, calls can be originated manually via the TALK/DATA button. Calls may be originated via the autodialer using one of nine stored numbers accessed through the front panel or via the EIA-232D interface using the BISYNC, SDLC, or parallel 801 protocols. Information on the autodialer can be found in Chapter 6.

Dial-Up Manual Calls

In dial-up modes, calls can be originated manually by pressing the TALK/DATA switch. A telephone connected to the rear panel TELSET jack can then be used to place a call in the usual manner. When the connection has been established, press the TALK/DATA switch again. If Data Terminal Ready (DTR) is on, the modem takes control of the line, switches to DATA MODE, and Data Set Ready (DSR) is turned on. The modem is ready to send and receive data. If DTR is off the modem hangs up, returns to the DATA IDLE MODE, and the connection is lost.

Dial-Up Stored Number Calls

In dial-up modes, calls can be originated by dialing one of nine telephone numbers stored in nonvolatile memory. Numbers can have a maximum of 36 characters. Numbers can be entered, edited, or dialed via the front panel buttons and LCD.

ENTERING PHONE NUMBERS

Enter the dial stored number mode by pressing the NO button until the message DIAL FROM FRONT PANEL? appears on the LCD. Then press the YES button. The LCD shows DIAL A STORED NUMBER? Press NO and the LCD will show EDIT/REVIEW STORED NUMBERS?

Press YES and the LCD will show STORED NUMBER 1 on the first line and the actual telephone number on the second line. If no number has been stored, the second line is blank. To proceed to stored numbers two through nine, continue to press NO until the desired number is displayed.

When the desired number to edit has been reached, press YES. A question mark appears on the first line of the LCD and the left most digit of the telephone number blinks. Press NO until the desired character or digit is shown at the blinking location. Press YES to retain the blinking character and move to the next digit location. Continue this process until the desired number is entered. Be sure to press the YES button after the last digit has been entered.

If the phone number exceeds 16 characters the right most space will show a > indicating more characters exist off screen. During the input or edit of a phone number, when proceeding to the seventeenth character, the display shifts to the left. At that time the far left space shows a < indicating previous characters exist off screen.

All or a part of a number can be erased by pressing the NO button until the X character appears and then pressing the YES button. All digits to the right of the X character will be erased.

Press the TALK/DATA button to terminate the editing process and save the edited number to nonvolatile memory. Press YES to start the editing process again at the left most digit or press TALK/DATA again to exit the editing portion of the menu.

Table 3-3 shows the available characters and their meanings.

Digit / Character	Definition
0 through 9	Dial digits
*	Dial character
#	Dial character
A	Dial character
B	Dial character
C	Dial character
D	Dial character
T	Force tone dialing command
P	Force pulse dialing command
:	5 second pause
,	Wait for dial tone
X	Erase characters to the right
( ) and -	Character inserted for clarity, not dialed

Table 3-3
Stored Number Dialing Character Set

DIALING A STORED NUMBER

Enter the dial stored number mode by pressing the NO button until the message DIAL FROM FRONT PANEL? appears on the LCD. Then press the YES button. The LCD shows DIAL A STORED NUMBER? Press the YES button again. The LCD shows DIAL NUMBER 1 on the first line of the display and the number to be dialed, if one has been entered, on the second line. To dial this number press YES. To select one of the other nine numbers, press NO until the desired number is displayed and then press YES. If DTR is not on, the LCD shows the DTR IS OFF message and the LCD then returns to the DIAL FROM FRONT PANEL message. DTR must be on for dialing to take place. If DTR is not available, an option is provided to force DTR internal to the modem. Refer to Chapter 4 Option Selection for information.

DIAL-UP MANUAL CALL TERMINATION

In PSTN dial-up modes when the modem is online in the data mode, the telephone connection can be terminated by pressing the NO button until the HANG UP LINE? message is displayed. Press the YES button to terminate the call and return to the DATA IDLE state.

DIAL-UP AUTO/ MANUAL ANSWER

In PSTN dial-up modes with the autodialer disabled, the modem autoanswers an incoming call when DTR is on. If DTR is off the modem indicates the presence of a ring signal on the front panel MR/RI LED and on pin 22 of the EIA-232D interface. In dial-up modes with the autodialer enabled, an option is provided to enable or disable autoanswer. Calls can be manually answered in talk mode by pressing the TALK/DATA button when a ring signal is detected. The modem takes control of the line provided DTR is on or the force DTR option is selected.

LEASED LINE MODE

When leased line modes are selected, the TALK/DATA button has no effect on normal data mode operation. It is active only during option selection. The DTR signal is not required in leased line modes.

DISPLAY RECEIVE LINE LEVEL

When the modem is in data mode, the receive line level can be measured by pressing the NO button until the DISPLAY RECEIVE LINE LEVEL? message is shown on the LCD. Press the YES button to select this function. The level of the receive line signal is displayed in dBm. The range is from 0 to −50 dBm. Normal data mode operation is not affected by selecting this function. Press the NO button to exit the line level display.

DISPLAY RECEIVE LINE QUALITY

When the modem is in data mode, the receive line quality can be measured by pressing the NO button until the DISPLAY LINE QUALITY? message is shown on the LCD. Press the YES button to select this function. The relative quality of the receive line signal is displayed on a scale ranging from poor to fair to good. Normal data mode operation is not affected by selection of this function. Press the NO button to exit the line quality display.

TEST MODES

Test modes can be selected in any modem state by pressing the NO button until the TEST MODE? message is shown on the LCD. In PSTN modes the following tests are available:

- Self Test
- Transmit Test Pattern
- Receive Test Pattern
- Local Analog Loopback
- Local Digital Loopback
- Central Office Test

In 4-wire leased line modes the following tests are available:

- Self Test
- End to End Test
- Local Analog and/or Line Loopback
- Local Digital Loopback

In 2-wire leased line modes the following tests are available:

- Self Test
- Transmit Test Pattern
- Receive Test Pattern
- Local Analog Loopback
- Local Digital Loopback

The desired test can be selected by pressing the NO button until the LCD shows the required test. Press the YES button to activate the test. Press the NO button to disable the test and display the next available test in the menu. Normal data mode operation is interrupted when the test modes are active. Analog and Digital Loopback tests can also be initiated via the EIA-232D interface. Options are provided to enable or disable this capability. Descriptions of each test mode can be found in Chapter 5.

Chapter 4
Option Selection

GENERAL

The 2860 can be tailored to the requirements of most applications by using the EDIT OPTIONS? menu. If the Quick Strap process in Chapter 3 fails to meet system requirements, this chapter provides information on selecting individual options.

Option Menu

Appendix C describes the Option Menu. The menu itself appears in Table C-1. For any option choice beyond what is described in this chapter, refer to Appendix C.

ENTERING THE EDIT OPTIONS? MENU

From the DATA/DATA IDLE MODE message, press the NO button until the EDIT OPTIONS? menu appears on the LCD.

Press the YES button to enter the EDIT OPTIONS? menu. Press the YES button again to display the first option. The options displayed depend on the current settings for dial-up PSTN or leased lines and 2- or 4-wire modes.

SELECTING AN OPTION

To select the desired option, press NO until the option is displayed on the LCD. Press YES. Terminate option selection by pressing the TALK/DATA button.

If an option is changed from its current value, the modem displays the question SAVE OPTIONS? Press YES to store the new configuration to nonvolatile memory.

The front panel buttons usually operate the LCD in the following manner:

PUSHBUTTON ACTION:
YES - Selects displayed option and proceeds to the next option
NO - Changes displayed option
TALK/DATA - Returns to EDIT OPTIONS? menu

Alternative pushbutton action is described where appropriate.

OPTION DESCRIPTIONS

The following sections describe each option by order of appearance on the LCD. Refer to Appendix C for more information on option descriptions.

PSTN/Leased

LEASED

Selects operation for leased lines or dial-up PSTN lines.

The next section describes leased line options. Refer to the appropriate following sections for Dial-Up PSTN Options and the Autodialer Options.

LEASED LINE OPTIONS

2-Wire/4-Wire

2-WIRE

Selects between 2-wire or 4-wire leased line operation.

Leased Line Options continued

Signal Quality Retrain

SIGNAL QUALITY
RTRN ENABLED

208 mode (4800 bps) only. This option is used in 4-wire leased line point-to-point and multipoint polling applications where the remote modem is receiving a constant carrier from the central site. The remote modem must be able to recover from line dropouts or impairments without a training sequence. When errors exceed approximately one per 1000 bits, the receiver automatic equalizer taps are initialized and the gain is increased to facilitate convergence. Received data is held to mark condition for approximately 10 ms while the retrain process is in progress.

Options - enabled/disabled

Anti-Stream

ANTI-STREAM
ENABLED

Anti-streaming in multipoint polling networks helps prevent a malfunctioning remote DTE from tying up the entire network because of a constant RTS on condition to the modem. If enabled, a timer is started in the modem when RTS turns on. If RTS remains on continuously for more than 40 seconds, the modem transmitter is forced off. This prevents the modem from "streaming" its carrier on the network. Normal transmitter operation resumes after RTS is toggled on to off and then to on again.

Options - enabled/disabled

Leased Line Options continued

Carrier Detect Level

CARRIER DETECT LEVEL IS – 34 DB

This option sets the receiver carrier detect range. It should be set to – 34 dBm for most applications. If the receive line level falls below – 26 dBm, select – 44 dBm. The – 34 dBm setting provides greater immunity to errors when communicating over lines with high noise levels.

Options are
– 34 dBm
– 44

Pre-Equalizer

TX PRE-EQUAL ENABLED

This option inserts an additional fixed statistical equalizer into the signal path to improve modem performance over telephone lines with severe amplitude or delay distortion. The pre-equalizer is inserted in the transmitter path in 208 mode; in 201 mode, the pre-equalizer is inserted in the receiver path. Enable this option only if extremely distorted lines are encountered.

Options are
enabled for TX in 208 mode
enabled for RX in 201 mode
disabled

Leased Line Options continued

CTS Delay

CTS HAS 50
MSEC. DELAY

This option selects the time delay between the on transition of RTS and the on transition of CTS during normal data transfer. For constant carrier applications, operation with dummy CTS delays of 8.5 or 0 ms are available for 208 or 201 modes respectively. Constant carrier with CTS always on is also available for both modes. For controlled carrier leased line operation, the CTS delay is typically set to 50 ms for 208 mode or 9 or 25 ms for 201 mode.

When CTS is in its normal operating state, these options are available for CTS delay:

208 Mode Only
50, 150, or 600 ms delay, constant carrier (CTS always on), or constant carrier with 8.5 ms delay

201 Mode Only
9, 25, or 150 ms delay, constant carrier (CTS always on), or constant carrier with 0 ms delay

Leased Line Options continued

Transmit Clock Source

TRANSMIT CLOCK SOURCE IS INT

This option selects the source of the transmit clock signal. Internal selects the transmit clock generated in the modem and is used in most applications. External permits the modem transmit (TX) clock to be synchronized to an external transmit clock provided by the DTE. The external transmit clock option is used when the DTE transmit data is synchronized to its own clock provided on pin 24 of the EIA-232D interface. If the external transmit clock option is enabled, a 4800 (2400) Hz ± 0.01% clock signal must be provided on pin 24 for proper 208 (201) mode operation. The receive clock source option is used at remote modems in networks where all timing must be synchronized to a single master clock.

Options - Internal/external/receive clock

Digital Loopback Clock Source

DL CLOCK SOURCE IS TX BAUD CLOCK

This option is active only in Digital Loopback test mode. It determines the clock signal source for the modem transmit clock output to the DTE. If no external transmit clock is provided by the DTE, the TX BAUD CLOCK source option should be selected to provide a 1600 (1200) Hz baud clock to the DTE on transmit clock pin 15 during digital loopback testing. In most applications, the TX baud clock is selected.

Options - transmit baud clock/external transmit clock

Leased Line Options continued

201 DTE Fallback

201 DTE FALLBACK ENABLED

208 mode only. Enabled, this option allows fallback to 201 (2400 bps) mode when pin 23 of the EIA-232 interface is off. This permits the DTE to control the modem bit rate. 201 DTE fallback is not available when the 801 autodialer is enabled.

Options - enabled/disabled

201 Scrambler

201 SCRAMBLER ENABLED

CAUTION
If enabled, the remote modem must also have the scrambler enabled.

201 mode only. Scrambling provides data transitions regardless of the actual data state. This mode helps the receiver synchronize to a remote transmitter during long periods with no data transitions.

Options - enabled/disabled

Leased Line Options continued

DTE Initiated Tests

DTE INITIATED
TESTS ENABLED

This option activates Local Analog and Local Digital Loopback tests from the DTE via EIA-232 pins 18 and 21 respectively. When active, these tests are reported to the front panel LCD and the front panel pushbuttons are disabled.

Options - enabled/disabled

Transmit Level

TRANSMIT LEVEL
IS – 6 DBM

Seven settings are provided for the transmit output level in leased line mode. The typical setting is 0 dBm.

Options - 0/ – 2/ – 4/ – 6/ – 8/ – 10/ – 12 dBm

Leased Line Options continued

Data Format

SELECT SYNC DATA FORMAT

This option determines the format of the data processed by the modem. The sync data format is the normal synchronous data format without start or stop bits. When one of the async formats is selected, the modem converts the asynchronous data stream to synchronous by adjusting the duration of the start and stop bits. This adjustment compensates for speed differences relative to the modem synchronous clock rate.

The async data options are

8 bit format	6 bit ASCII no parity
9 bit format	7 bit ASCII no parity
10 bit format	7 bit ASCII plus parity
11 bit format	8 bit ASCII plus parity

The 10 bit format is most commonly used.

The 8 bit format is used only for DTEs that employ Baudot codes.

Data Set Ready

DSR IN AL IS ENABLED

This option controls the state of DSR when the Local Analog Loopback mode is active. Some DTEs require DSR to remain on when Analog Loopback is active. DSR is forced on in Analog Loopback if this option is enabled. DSR is forced off in all other test modes.

Options - enabled/disabled

Leased Line Options continued

Saving Options

SAVE OPTIONS?

This is the end of the leased line options menu. If any options have been changed you can save them in nonvolatile memory. This allows the modem to restore the selected options after any interruption in AC power. If options are not stored, the modem returns to the previously stored options after the next power interruption.

DIAL-UP PSTN OPTIONS

These options are available when the 2860 is configured for one of the dial-up modes.

Busy Out With DTR Off

BUSY OUT WITH DTR OFF ENABLED

CAUTION
This option must not be enabled when the modem is connected directly to the PSTN. It is intended for use only behind a PBX.

When enabled, this option forces the modem off hook when DTR is off. This feature is typically used on modems connected to a rotary line selection switch which routes incoming calls to the next available modem/DTE. The switch skips over lines that are connected to off hook modems. The DTE can take the line out of service by turning DTR off.

Options - enabled/disabled

Dial-Up Options continued

Busy Out in AL

BUSY OUT IN AL ENABLED

CAUTION
This option must not be enabled when the modem is connected directly to the PSTN. It is intended for use only behind a PBX.

Enabled, this option forces the modem off hook when the Analog Loopback test mode is selected from the front panel or by the DTE via EIA-232D pin 18. This option is typically used to remove a modem/DTE from service in a rotary line selection system. Refer to the BUSY OUT WITH DTR OFF description above for more details.

Options - enabled/disabled

Idle Tone

IDLE TONE ON

208 mode only. This option controls the transmission of the 600 Hz idle tone which is used to disable telephone line echo suppressors on long distance dial-up connections. It is sometimes necessary to disable the idle tone when operating over satellite links using echo cancellors or when bridging several answering modems in dial-up multipoint polling networks. Certain applications of the auto-fallback feature may require idle tone to be disabled for proper operation.

Options - on/off

Dial-Up Options continued

Carrier Detect Level

CARRIER DETECT
LEVEL IS – 34 DB

This option sets the modem receiver carrier detection threshold. It is set to – 34 dBm for most applications. If the receive signal level falls below – 26 dBm, the – 44 dBm setting should be selected. The – 34 dBm setting provides greater immunity to errors when operating over lines with high noise levels.

Options - – 34/ – 44 dBm

Pre-Equalizer

TX PRE-EQUAL
ENABLED

This option allows an additional fixed statistical equalizer to be inserted into the signal path to improve performance over telephone lines which exhibit severe amplitude or delay distortion. The pre-equalizer is inserted in the transmitter path in 208 mode; in 201 mode, the pre-equalizer is inserted in the receiver path. The pre-equalizer should be enabled only if line conditions are extremely distorted.

Options -
enabled for TX in 208 mode
enabled for RX in 201 mode
disabled

Dial-Up Options continued

CTS Delay

CTS HAS 50
MSEC DELAY

The CTS delay option allows selection of the time delay between the on transition of RTS and the on transition of CTS during normal data transfer. These times are not used during the protocol operation in the autodialer. Refer to Chapter 7 for timing details of the autodialer.

Delay times of 9, 25, and 150 ms for 201 mode and 50, 150, and 600 ms for 208 mode are available in controlled carrier applications. For point-to-point dial-up operation, the CTS delay is typically set to 150 ms. The 208 mode 600 ms delay can be used over satellite links which exhibit excessive echo.

The constant carrier modes are not available in half duplex (2-wire) modes.

Options are
- 208 mode - 50, 150, 600 ms delay
- 201 mode - 9, 25, 150 ms delay

Dial-Up Options continued

Transmit Clock

TRANSMIT CLOCK
SOURCE IS INT

This option selects the source of the transmit clock signal. Internal selects the transmit clock generated in the modem and is used in most applications. External permits the modem transmit (TX) clock to be synchronized to an external transmit clock provided by the DTE. The external transmit clock option is used when the DTE transmit data is synchronized to its own clock provided on pin 24 of the EIA-232D interface.

Options - internal/external

Digital Loopback Clock Source

DL CLOCK SOURCE
IS TX BAUD CLOCK

DL clock source is active only in Digital Loopback test mode. It determines the clock signal source for the modem transmit clock output to the DTE. If no external transmit clock is provided by the DTE, the transmit baud clock source option should be selected to provide a 1600 (or 1200 for 201 mode) Hz baud clock to the DTE on transmit clock pin 15 during digital loopback testing.

Options -
transmit baud clock
external transmit clock

Dial-Up Options continued

201 DTE Fallback

201 DTE FALLBACK ENABLED

208 modes only. Enabled, this option allows fallback to 201 (2400 bps) mode when pin 23 of the EIA-232D interface is off. This permits the DTE to control the modem bit rate. 201 DTE fallback is not available when the 801 autodialer is enabled.

Options - enabled/disabled

201 Autofallback Mode 1

201 AUTOFALLBACK MODE 1 ENABLED

208 PSTN modes only. Enabled, the 2860 will fall back to 201 mode when the following situation occurs after a PSTN connection has been established.

MODE 1 - REMOTE DTE INITIATES POLLING PROTOCOL.
The remote DTE and modem transmits to the local modem first. The local modem receiver searches for frequency components unique to the 201 mark data training signal. If detected, the modem switches to 201 mode. The detection process takes approximately 10 ms from start of receive carrier. The modem returns to 208 mode when DTR is turned off or another line disconnect occurs. For reliable 201 detection, the remote modem should be configured for at least a 25 ms CTS delay. The usual CTS delay selection for the 201 modem is 150 ms.

Dial-Up Options continued

201 Autofallback Mode 2

201 AUTOFALLBACK MODE 2 ENABLED

208 PSTN modes only. Enabled, the 2860 will fall back to 201 mode when the following situation occurs after a PSTN connection has been established.

MODE 2 - LOCAL DTE INITIATES POLLING PROTOCOL.
The local DTE turns on RTS and the local modem transmits the first message in 208 mode and looks for a response from the remote modem after RTS turns off. If a receive carrier is detected, the local modem locks into 208 mode for all subsequent transmissions until DTR is turned off. If a receive carrier is not detected before the local DTE turns on RTS again, the local modem sends the next transmit message in 201 mode. If a receive carrier is detected after RTS is turned off, the modem locks into 201 mode until DTR is turned off. If a receive carrier is not detected before the local DTE turns on RTS again, the local modem sends the next transmit message in 208 mode. This alternation of modes continues until a receive carrier is detected. Mode 2 should be used only in cases where the remote DTE will respond only to valid polls.

Options - mode 1 enabled /mode 2 enabled/disabled

NOTE
In either mode if a remote 201 modem (other than a 2860) originates a call to the local modem, it may be necessary to disable the local modem idle tone for proper operation.

Dial-Up Options continued

DTE Initiated Tests

DTE INITIATED TESTS ENABLED

This option enables Local Analog and Digital Loopback tests from the DTE via EIA-232 pins 18 and 21 respectively. When active, these tests are reported to the front panel LCD and the front panel pushbuttons are disabled.

Options - enabled/disabled

201 Scrambler

201 SCRAMBLER ENABLED

CAUTION
If enabled, the remote modem must also have the scrambler enabled.

Scrambling provides data transitions regardless of the actual data state. This helps the receiver maintain synchronization with the remote modem transmitter during long periods with no data transitions.

Options - enabled/disabled

Transmit Level

TRANSMIT LEVEL IS PERMISSIVE

The permissive setting is used with RJ11C type Telco jacks and sets the transmitter output level to −9 dBm. The programmable setting is used with RJ41/45 type jacks and allows the jack to program the transmitter output level to a value

Dial-Up Options continued

between 0 and – 12 dBm as determined by a resistor installed inside the Telco jack. The resistor is selected by the telephone company at installation. This allows the transmit level to be set to the optimum value for a given installation. If no resistor is installed, the output level is – 12 dBm. Typical installation uses the permissive option.

Options - permissive/programmable

Data Format

SELECT SYNC
DATA FORMAT

This option determines the format of the data processed by the modem. The sync data format is the normal synchronous data format without start or stop bits. When one of the async formats is selected, the modem converts the asynchronous data stream to a synchronous data stream by adjusting the duration of the start and stop bits to compensate for speed differences relative to the modem's synchronous clock rate.

Options - Sync/async (below)

Async data options are

8 bit format	6 bit ASCII no parity
9 bit format	7 bit ASCII no parity
10 bit format	7 bit ASCII plus parity
11 bit format	8 bit ASCII plus parity

The 10 bit format is most commonly used. The 8 bit format is used only for DTEs that employ Baudot codes.

Dial-Up Options continued

Speaker Control

SPEAKER ALWAYS OFF

Control options are provided to turn the speaker on and off for various operating states of the modem.

Options -
- always off
- on until DSR comes on
- on for 30 seconds after DSR
- off while dialing
- on while dialing
- always on

Speaker Volume

SPEAKER VOLUME IS LOW

This option controls the sound level from the speaker when it is active.

Options - high/low

Data Set Ready

DSR IN AL IS ENABLED

The state of DSR can be controlled when the Local Analog Loopback mode is active. Some DTEs require DSR to remain on when Analog Loopback is active. DSR is forced on in Analog Loopback if this option is enabled. DSR is forced off in all other test modes.

Options - enabled/disabled

Dial-Up Options continued

Squelch

SQUELCH
ENABLED

CAUTION
If enabling squelch, ensure the remote modem has a clear to send delay of at least 100 ms.

201 mode only. In 2-wire modes, the receiver is forced off while the modem is transmitting. To allow time for signal echoes to dissipate on the telephone line after completing transmission, a delay of 100 ms can be selected to keep the receiver forced off for an extra 100 ms after the remote modem has stopped transmitting.

Options - 100 ms/disabled

Satellite Delay

SATELLITE DELAY

201 mode dial-up operation only. After autoanswering an incoming call, the modem requires a period of silence after answer back tone to enable echo suppressors. The length of the silence may vary for different phone systems, so four options are provided.

Options - 8 / 100 / 200 ms / disabled

Dial-Up Options continued

Force DTR

FORCE DTR IS DISABLED

NOTE
The front panel TR LED is not forced on when this option is enabled.

Force DTR allows the modem to operate without DTR from the EIA-232D interface being turned on. This is convenient for originating calls and testing when DTR is off and cannot be easily turned on.

Options - enabled/disabled

DIAL-UP DISCONNECT OPTIONS

To reach the DISCONNECT OPTIONS? submenu from the EDIT OPTIONS? display, continue to press YES working down the EDIT OPTIONS? items. When the end is reached press YES again to enter the DISCONNECT OPTIONS? submenu.

Disconnect/ Dialer/ Save Options

DISCONNECT OPTIONS?

Use the DISCONNECT OPTIONS? menu to access the various methods of forcing the modem to disconnect from the telephone line.

PUSHBUTTON ACTION:

YES -	Displays DISCONNECT OPTIONS? menu
NO -	Advances to DIALER OPTIONS? menu or exits
TALK/DATA -	Exits EDIT OPTIONS? menu

Dial-Up Disconnect Options continued

Line Current Disconnect

LINE CURRENT
DISC DISABLED

Line Current Disconnect allows the modem to disconnect from the line when the Telco central office interrupts the DC current on the telephone line for a minimum of 8, 90, or 200 ms as selected. This feature allows the modem to return to the idle state after a call has been completed and the modem at the other end of the connection has returned to the on hook (data idle) state. This feature is useful in applications where the DTE does not provide control of DTR. However, it is not as reliable as DTR disconnect control due to variations in central office signaling.

Options - 8/ 90/ 200 ms/ disabled

RTS/DCD Activity Disconnect

RTS/DCD ACTIVITY
DISC DISABLED

Enabled, this option forces the modem to disconnect from the line after 20 seconds of no activity on either the RTS or DCD EIA-232D control lines. This alternate disconnect method can be used when DTR control is not available.

Options - enabled/disabled

Dial-Up Disconnect Options continued

Signal Quality Disconnect

SIGNAL QUALITY
DISC DISABLED

Enabled, this option forces the modem to disconnect from the line when the estimated bit error rate exceeds approximately one error per 1000 bits.

Options - enabled/disabled

Disconnect/Dialer/ Save Options?

DISCONNECT
OPTIONS?

Reviews disconnect options, proceeds to the DIALER OPTIONS? menu, or saves and exits.

PUSHBUTTON ACTION:

YES -	Returns to the beginning of the DISCONNECT OPTIONS menu
NO -	Advances to DIALER OPTIONS? menu or exits
TALK/DATA -	Exits EDIT OPTIONS? menu

DIALER OPTIONS

DIALER OPTIONS?

This screen enters the DIALER OPTIONS? menus or exits from the EDIT OPTIONS? menus. SELECT SYNC DIALER OPTIONS? immediately follows. SELECT 801 DIALER OPTIONS? is the second menu available under DIALER OPTIONS?

PUSHBUTTON ACTION:

YES - Proceeds to the selected option menu

NO - Selects next EDIT OPTIONS? menu choice

TALK/DATA - Exits EDIT OPTIONS? menu

Options are

enter SYNC DIALER menu

enter 801 DIALER menu

Dialer Autoanswer

AUTOANSWER IN
DIALER DISABLED

NOTE

Autoanswer is always enabled in dial-up mode when the autodialer is disabled.

This option controls whether or not an incoming call is answered by the modem. Disabled, the call is not answered but the RI LED flashes on the front panel and pin 22 of the EIA-232D interface turns on. Enabled, the call is answered unless an autodialer protocol sequence is in progress or RTS is on. Also, the call is not answered if DTR is off.

Options - enabled/disabled

Dialer Options continued

Synchronous Dialer

SYNC DIALER DISABLED

Enabled, the sync dialer can operate in BISYNC or SDLC/HDLC protocols. The options described below apply to either protocol.

Options - enabled/disabled

DSR in Dialer Mode

DSR ON IN DIALER MODE DISABLED

Some DTEs require DSR to be turned on before the protocol sequence can be initiated. There are two options for controlling DSR as detailed below. This option enables or disables both.

Options - enabled/disabled

DSR Follows DTR/ RTS

DSR FOLLOWS DTR AFTER 160 MSEC.

This option is active if enabled by the DSR ON IN DIALER option described above. The DSR FOLLOWS DTR AFTER 160 MSEC option is independent of RTS. The DSR FOLLOWS RTS option turns on DSR when RTS turns on provided DTR is on.

Options are
DSR follows DTR after 160 ms
DSR follows RTS

Dialer Options continued

DTR Off Delay

DTR OFF DELAY
DISABLED

This option facilitates loading a second DTE application package after call setup is complete. Enabled, DTR is ignored for 60 seconds after the answer back tone from the remote modem has been detected. If DTR is still off after 60 seconds, the modem goes on hook and the call is aborted. The first message sent by the DTE after detecting answer back tone is not transmitted by the modem. This prevents any end of text or other termination sequence sent by the dialing application package from disconnecting the remote modem. When the second transition of RTS is received from the DTE, the abort timer is reset and the modem transfers to data mode provided DTR is on. If DTR is turned off during the loading of the second application package, an incoming carrier signal also transfers the modem to data mode.

Options - enabled/disabled

Blind Dial for Dialer

BLIND DIAL IN
DIALER ENABLED

This option allows the dialer to operate with nonstandard dial tone frequencies. Enabled, the dialer goes off hook and waits 5 seconds. The dialer then dials the telephone number whether dial tone is present or not.

Options - enabled/disabled

Dialer Options continued

801 Dialer

801 DIALER
DISABLED

This option controls the parallel EIA-366 801 dialer. The 801 and Sync dialers are mutually exclusive. When one is enabled the other is automatically disabled.

Options - enabled/disabled

Character Set

PULSE CHAR SET
ENABLED

The 801 dialer accepts 4 bit parallel binary coded decimal digits from the DTE EIA-366 interface. The DTMF character set allows the dialer to accept digits 0-9, *, and #. The pulse dial character set allows only the digits 0-9. Refer to Chapter 6 Autodialer for details. The DTMF option is normally used.

Options are
pulse character set
DTMF character set

DSC/COS

DSC/COS ON IF
EON CH RCVD DIS

This option causes Distant Station Connected/Call Origination Status (DSC/COS) to be turned on if an end of number (EON) character is received from the DTE.

Options - enabled/disabled

Dialer Options continued

ACR Time Delay

SELECT ACR TIME DELAY?

Press YES to advance to the ACR Delay display. Press NO to advance to the ACR for Invalid Dial Digits display.

ACR Delay

ACR DELAY IS 15 SECONDS

The ACR timer can be set to a selected delay. ACR turns on when answer back tone has not been detected within the selected time or when a busy signal has been detected.

Options - 15/ 30/ 45/ 60 seconds

ACR for Invalid Dial Digits

ACR ON FOR INVLD DIAL DIGIT DIS

Enabled, this option turns on ACR when an invalid dialer digit is received from the DTE.

Options - enabled/disabled

Chapter 5
Diagnostics

GENERAL

The 2860 has numerous diagnostic tests to determine the source of problems in the data communications network.

> **NOTE**
> Refer to Appendix C, Table C-1 for a summary of the Diagnostics menu.

Accessing Diagnostic Tests

From the DATA/DATA IDLE MODE display on the LCD, press the NO button until the TEST MODE? message is shown on the LCD. Press the YES button to enter the test mode menu and display the first test option. There are six tests available in dial-up modes and four tests in leased line modes. Press NO until the desired test mode is displayed. Select the desired test by pressing YES. The test is terminated when NO is pressed.

DESCRIPTION OF DIAL-UP TEST MODES

The following tests are available in dial-up operation. These tests are described in the order of appearance on the LCD.

Self Test

This test verifies the modem internal operation. The modem checks its internal circuits by generating a test pattern, transmitting it to the receiver, and checking the received pattern for errors. During this test, the modem is isolated from its DTE and telephone line. The RD indicator blinks when an error is detected in the received test pattern. The CD LED is lit to indicate the presence of the receive carrier signal. See Figure 5-1.

If errors are detected during this test, contact UDS Field Service Department at 1-800-221-4380 for further assistance.

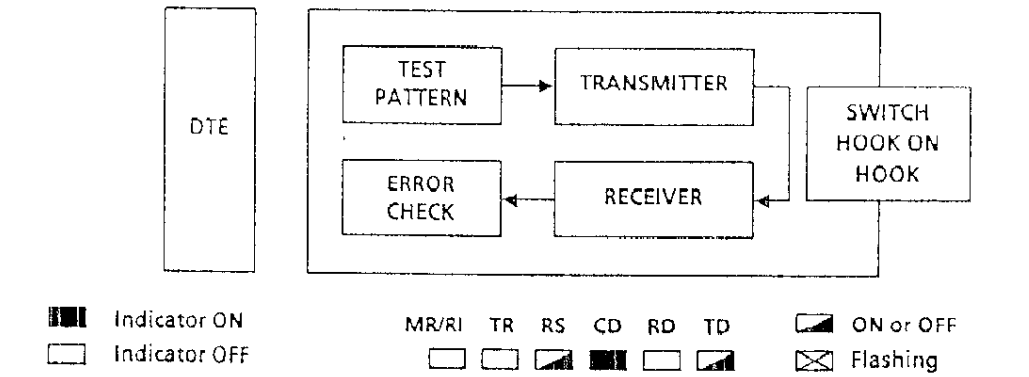


Figure 5-1
Self Test

Transmit/Receive Test Pattern

This test transmits a known data pattern down the telephone line to a receiving modem at the remote end. The test pattern is the same one used in self test mode. The local modem is configured for transmit test pattern and the remote modem is configured for receive test pattern mode. Call origination can be performed at either the local or remote modem using the TALK/DATA switch and a standard telephone connected to the TELSET jack on the rear of the modem. The dial stored number dialing feature may also be used for call origination if the DTR signal is on. DTR can be either on or off in this test mode. DSR is held off. In this mode the DTE has no control over the modem.

The receiving modem CD LED will be lit when the receive carrier is present and the RD LED blinks when receive errors are detected. If enabled, the answering modem will go on hook in response to a line current disconnect signal after the originating modem hangs up. The roles of local and remote modem can be reversed to test the line in the opposite direction. See Figure 5-2.

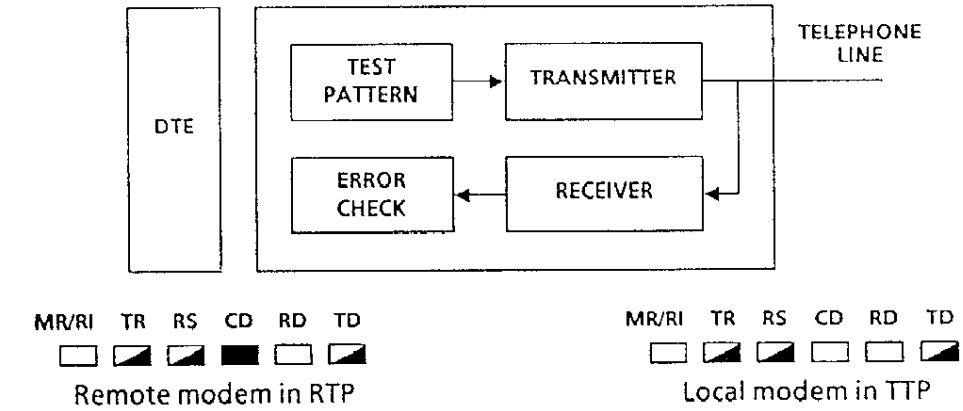


Figure 5-2
Transmit or Receive Test Pattern

Local Analog Loopback

This mode allows the DTE to test the modem via the EIA-232D interface. The modem transmitter is looped back to the receiver and the telephone line interface is forced on hook. An option is provided to control the state of DSR during Analog Loopback. Another option initiates Analog Loopback via pin 18 of the EIA-232D interface. See Figure 5-3. In this mode the DTE can generate test data that is looped back to itself for error analysis.

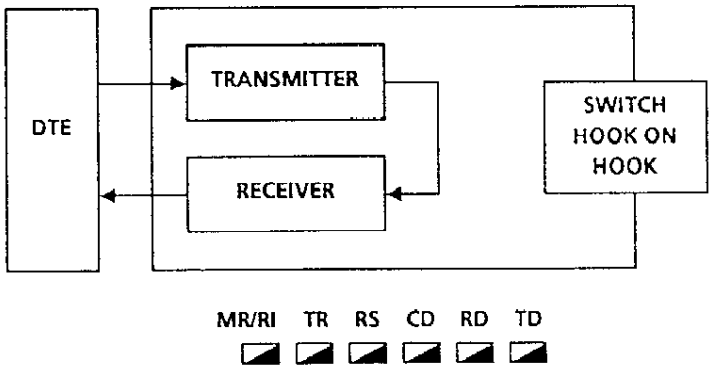


Figure 5-3
Local Analog Loopback Test (PSTN and 2-Wire Leased Line)

Local Digital Loopback

This test allows the DTE interface to be exercised without involving the modem internal functions. The telephone line interface is forced on hook and DSR is held off. DTE signals are looped back as follows:

- Transmit data is connected to receive data.
- RTS is connected to CTS and CD.
- An option is provided to select either external transmit clock or transmit baud clock to be looped to receive clock.

An option enables initiation of the Digital Loopback mode via pin 21 of the EIA-232D interface. See Figure 5-4.

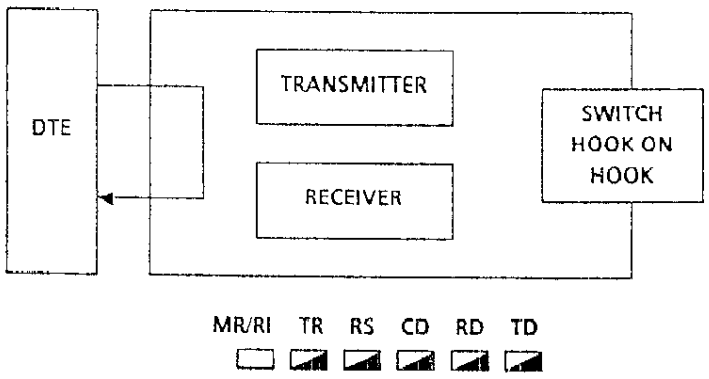


Figure 5-4
Local Digital Loopback Test (PSTN and 2-Wire Leased Line)

Central Office Test

This tests both transmit and receive functions of a remote modem from the local modem without further operator intervention at the remote site once the remote modem is placed in Central Office Test Modem Under Test mode.

The test setup is similar to that shown in Figure 5-2. DTR at either modem can be on or off. The local modem, simulating the Central Office,

originates a call to the remote modem. This can be done using stored number dialing or a telephone connected to the TELSET jack. Once the connection has been made, the local modem is placed in Central Office modem test mode.

A two second burst of scrambled marks is sent to the remote modem. If an error is received at the remote modem, it sends a scrambled space burst to the local modem. The local modem RD LED remains on during the burst and the LCD reports TEST FAILED. If the remote modem receives the burst with no errors, it sends a scrambled mark burst to the local modem. The local modem RD LED is off during the burst and the LCD reports TEST OK. The test can be repeated by pressing the YES button at the REPEAT TEST? message. Terminate the test by pressing the NO button at the REPEAT TEST? message.

The LCD then displays SEND HANGUP MESSAGE? Pressing NO returns the display to CENTRAL OFFICE TEST? and YES causes the local modem to send a disconnect sequence to the remote modem.

The local modem sends a four second burst of scrambled space to the remote modem. The remote modem goes on hook when receiving this burst. The local modem exits the test mode after the burst has been sent. The remote modem remains in modem under test mode until changed by operator intervention. This permits the remote modem to be called as many times as desired for repetitive testing.

DESCRIPTION OF LEASED LINE TEST MODES

In leased line modes four tests are available. They are described in order of appearance in the LCD menu. Tests available are determined by selecting 4- or 2-wire mode of operation.

Self Test

This test operates the same way it does in dial-up mode except the telephone line(s) is (are) terminated in 600 ohms. See Figure 5-1.

End to End Test

4-wire mode only. It operates in the same manner as the Transmit/Receive Test Pattern in 2-wire and dial-up modes except that the full duplex capability allows the test to be conducted in both directions simultaneously. The transmitter sends a scrambled mark pattern and the receiver expects to receive scrambled marks. Any errors received cause the RD LED to blink. Both local and remote modems should be set to End to End Test mode. DSR is held off and DTE interface is disabled. See Figure 5-5.

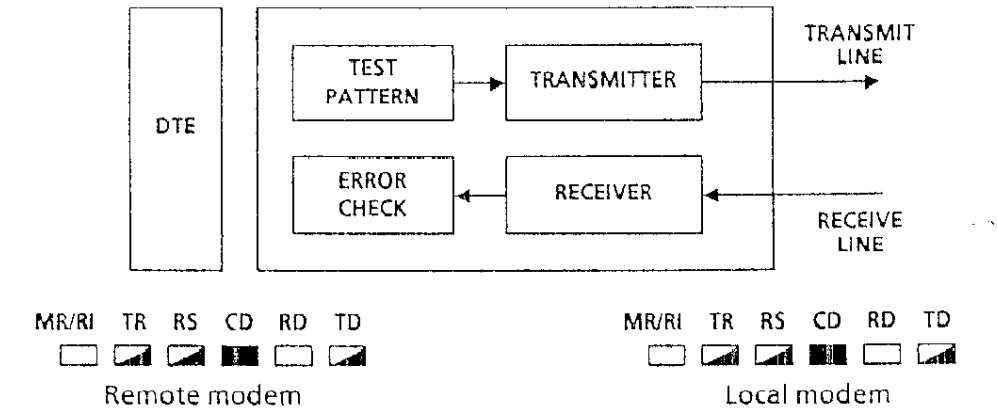


Figure 5-5
End to End Test

Transmit/Receive Test Pattern

2-wire mode only. It operates in the same manner as the dial-up PSTN Transmit/Receive Test Pattern mode. Since 2-wire mode is half duplex, the pattern can be sent in only one direction at a time. The local modem is set to transmit test pattern and the remote modem is set to receive test pattern. The transmitter sends a scrambled mark test pattern and the receiver expects to receive scrambled marks. Any errors

received cause the RD LED to blink. DSR is held off and the DTE interface is disabled. The roles of local and remote modem can be reversed to test the channel in the opposite direction. See Figure 5-2.

Local Analog Loopback Test

This test operates the same way it does in dial-up 2-wire mode. In 4-wire mode, the options for establishing line loopback and setting the line loopback gain at 0 or + 12 dB are also available. An option determines the state of DSR in Analog Loopback. Another option enables DTE initiation of this test via pin 18 of the EIA-232D interface. See Figures 5-6 and 5-7.

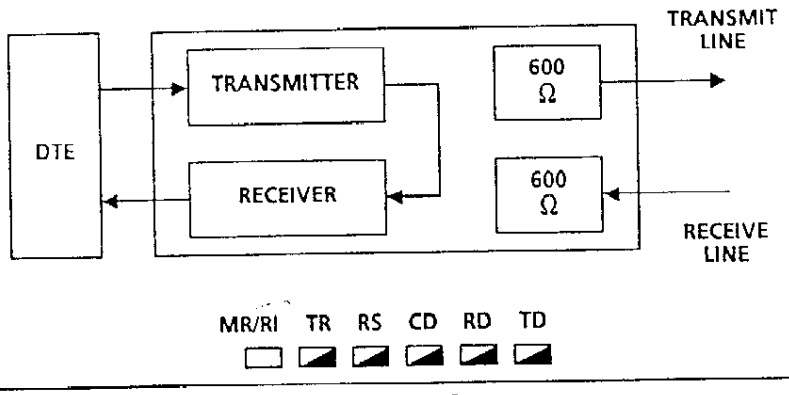


Figure 5-6
Local Analog Loopback Test

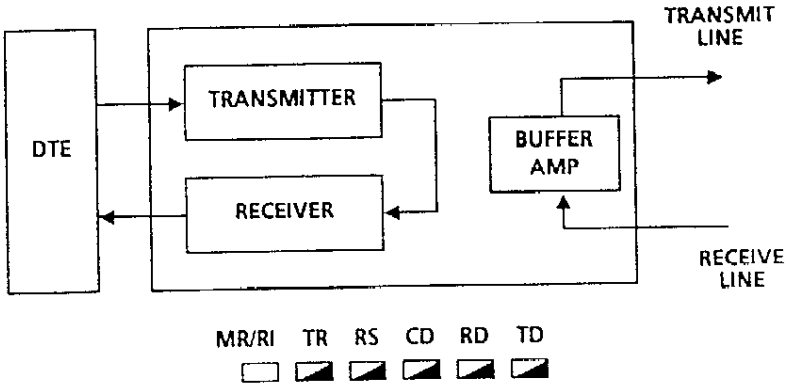


Figure 5-7
Local Analog and Line Loopback Test (4-Wire Only)

Local Line Loopback Test

4-wire mode only. This test mode loops the receive line back to the transmit line through an amplifier whose gain can be set to either 0 or + 12 dB. The test also allows the internal analog loopback path to be enabled or disabled at the same time. This test is useful for testing the telephone lines from the remote modem. DSR is held off during this test. See Figure 5-7.

Local Digital Loopback Test

In 2-wire mode this test operates the same way it does in dial-up mode except that the telephone line is terminated in 600 ohms (Figure 5-4). In 4-wire mode the DTE interface is looped back as described in the dial-up Digital Loopback test above. In addition, the receive clock and received data are looped from the receiver to the transmitter and Carrier Detect is looped to the transmitter as Request to Send. This allows the modem to act as a repeater and allows a remote modem to test the local modem and telephone lines. DSR is held off during this test. See Figure 5-8.

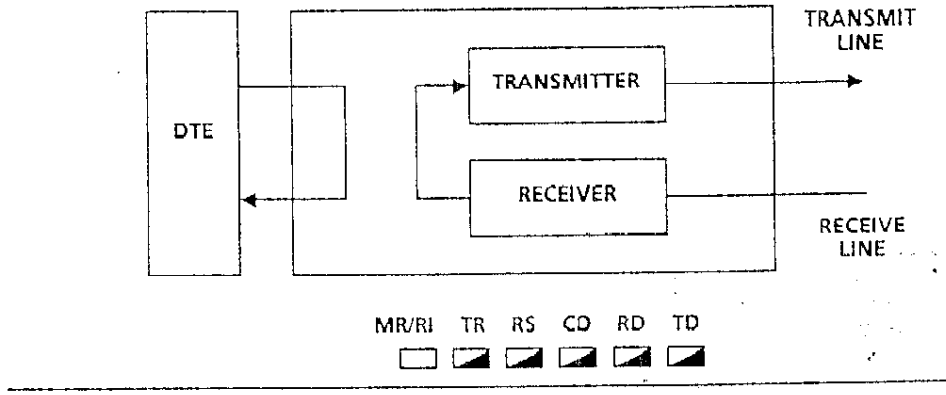


Figure 5-8
Local Digital Loopback Test (4-Wire Only)

NETWORK FAULT ISOLATION STRATEGIES

The following sections outline the procedures for isolating faults in a data communications network containing 2860 modems.

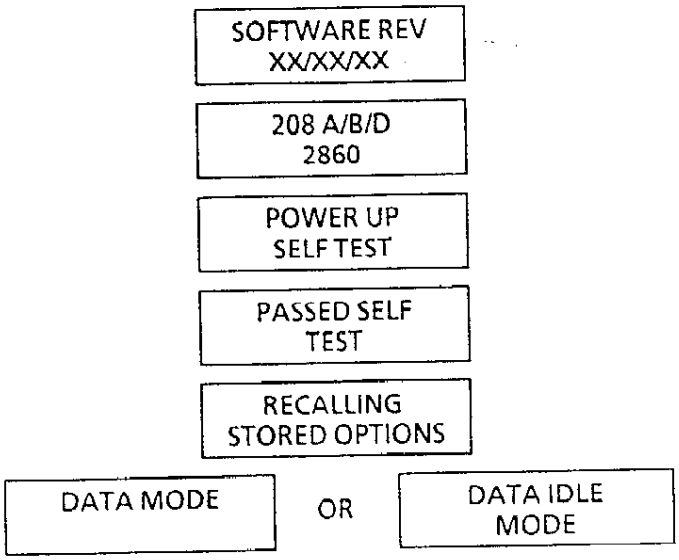
Modem Functional Test

The first step is to verify that the modems in the network are operating correctly. Perform the following steps for each modem in the faulty portion of the network:

1. Turn off the AC power to the modem. Disconnect all cables from the DTE, TELSET, and TELCO connectors.

2. Turn on the AC power. If the LCD is blank check the AC line fuse. Turn off the AC power to the unit. The fuse can be removed by pushing the fuse holder forward and turning counter-clockwise. Test the fuse for continuity. If the fuse is blown replace it with a 1/4 amp slow blow type only. Repeat step 2. If the new fuse blows, the unit is defective and should be returned for repairs.

3. If the modem is operating correctly, the following messages should be displayed on the LCD during the first 18 seconds after power is turned on:



4. If other messages are displayed during the start-up period the modem may be faulty. Contact UDS Field Service Department at 1-800-221-4380 for further assistance.

5. If the modem has passed the functional tests, proceed to the Analog Loopback test.

Local Analog Loopback Test

If the DTE has self test capability or a modem test set is available, connect the DTE cable to the modem and perform the following steps. If the DTE has no self test capability and if a modem test set is unavailable, proceed to the Modem Self Test section below.

1. From the DATA/DATA IDLE MODE display, press the NO button until the LCD shows the TEST MODE? display. Press the YES button to enter the TEST MODE menu. Press NO until the LOCAL ANALOG LOOPBACK? message is displayed and then press the YES button. If in 4-wire mode, press NO two more times to disable the line loop option.

2. Data may now be sent through the modem. If errors are detected, the DTE, DTE cable, or the modem may be faulty.

3. If data can be looped through the modem successfully, determine the type of network the modem is connected to and proceed to the modem configuration check.

Modem Self Test

1. From the DATA/DATA IDLE MODE display, press the NO button until the LCD shows the TEST MODE? display. Press the YES button to enter the TEST MODE menu. Press NO until the SELF TEST? message is displayed and then press YES.

2. Test pattern data is then sent through the modem. If errors are detected in the test pattern, the RD LED blinks for each error detected.

3. If errors are indicated, contact UDS Field Service Department at 1-800-221-4380 for further assistance. If no errors are indicated, determine the type of network the modem is connected to and proceed to the modem configuration check.

Modem Configuration Check

From the DATA/DATA IDLE MODE state, press the NO button until the LCD shows the QUICK STRAP? message. Press the YES button to enter the QUICK STRAP menu. The display now shows the currently selected network configuration of the modem. If this configuration does not match the intended application, press NO until the correct configuration is displayed.

Press YES to select the new configuration. Press YES again to save the new configuration to nonvolatile memory. If the initially displayed configuration is correct, press YES to exit the QUICK STRAP menu.

QUICK STRAP sets all modem options except bit rate to the normal settings for the selected configuration. Individual options may be changed by entering the EDIT OPTIONS? menu described in Chapter 4.

Press the NO button until the SELECT BIT RATE? message is shown on the LCD. Press the YES button to enter the SELECT BIT RATE menu. The currently selected bit rate is now shown on the LCD. If the bit rate is correct, press YES to exit the Bit Rate menu. Otherwise, press NO to display the other bit rate.

Press YES to select the new bit rate. Press YES again to store the new bit rate to nonvolatile memory and exit the bit rate menu. Press NO until DATA/DATA IDLE MODE is shown on the LCD. Reconnect the DTE, TELCO, and TELSET (if used) cables to the modem. Proceed to the test procedure description that is appropriate for the selected network configuration.

All PSTN Modes Test Procedure

This test determines if the modem/telephone connection and the telephone line are functioning correctly. For this test a second 2860 or compatible modem is needed. Perform the following steps:

1. Both the local and remote modems must be functioning correctly. If either has not been tested as outlined in the above sections, via Modem Functional test and Local Analog Loopback test or Modem Self Test, do so before proceeding.

2. The local modem originates the test. Connect a telephone to the TELSET jack of this modem.

3. Have the remote site operator place his modem in Transmit Test Pattern. DTR may be on or off.

4. Place the local modem in Receive Test Pattern. Enter TALK mode by pressing the TALK/DATA button. Dial the number of the remote modem. The remote modem answers the ring followed by approximately 2 seconds of silence, an answer back tone, then scrambled mark data.

5. Return the local modem to RECEIVE TEST. PATTERN mode by pressing the TALK/DATA button. The RD LED should be off unless errors are detected by the local modem. If the modem RD LED flashes, the telephone line or interconnecting cables may be at fault.

6. Remove and reconnect the TELCO cables at both modems. Repeat steps 1 through 5. If the local modem continues to indicate errors, the telephone line is most likely the source of the problem.

7. Press the local modem TALK/DATA button to disconnect the call. Press TALK/DATA again. Press the NO button several times until the test mode has been exited and the SELECT OPTIONS? message is shown on the LCD.

Press the YES button to enter the EDIT OPTIONS? menu. Press YES until the TX/RX EQUALIZER option is shown on the display. Enable the equalizer by pressing NO until the ENABLED message is displayed on the second line of the LCD.

Press YES to select this option. Press TALK/DATA to exit the EDIT OPTIONS? menu. Press YES to save the options to nonvolatile memory. The LCD should then display DATA IDLE MODE. Have the remote operator perform this step on his modem.

8. Repeat steps 1 through 6. If the local modem no longer indicates errors the telephone line may be marginal for reliable data communications. If the local modem still indicates errors the line is inadequate for data transmission. Contact your local phone company for assistance.

9. Repeat steps 1 through 8 with the roles of local and remote modems reversed.

2-Wire Leased Line Test Procedure

This test determines if the modem/telephone line connection is working properly. For this test a second 2860 modem is needed. Perform the following steps:

1. Both modems must be functioning correctly. If either has not been tested as outlined in the above sections, via Modem Functional Test and Local Analog Loopback Test or Modem Self Test, do so before proceeding.

2. Place the local modem in Receive Test Pattern.

3. Have the remote site operator place his modem in Transmit Test Pattern.

4. The RD LED on the local modem should be off unless errors are detected. If the RD LED flashes, the telephone line or interconnecting cables may be at fault.

5. Remove and reconnect the TELCO cables at both modems. Repeat steps 1 through 4. If the local modem continues to indicate errors, the telephone line may be the source of the problem.

6. Press the NO button several times until the test mode has been exited and the EDIT OPTIONS? message is shown on the LCD. Press the YES button to enter the EDIT OPTIONS? menu. Press YES until the TX/RX EQUALIZER option is shown on the display. Enable the equalizer by pressing NO until the ENABLED message is displayed on the second line of the LCD. Press YES to select this option. Press TALK/DATA to exit the EDIT OPTIONS? menu. Press YES to save the options to nonvolatile memory. The LCD then displays DATA IDLE MODE. Have the remote operator perform this step on his modem.

7. Repeat steps 1 through 5. If the local modem no longer indicates errors, the telephone line may be marginal for reliable data communications. If the local modem still indicates errors, the line is inadequate for data transmission. Contact your local phone company for assistance.

8. Repeat steps 1 through 7 with the roles of local and remote modems reversed.

4-Wire Leased Line Test Procedure

This test determines if the modem/telephone line connection is working properly. A second 2860 or compatible modem is needed for this test. Perform the following steps:

1. Both modems must be functioning correctly. If either has not been tested as outlined in the above sections, via Modem Functional Test and Local Analog Loopback Test or Modem Self Test, do so before proceeding.

2. Place the local modem in End to End test mode.

3. Have the remote site operator place his modem in End to End test mode.

4. Observe the local modem front panel RD LED. This LED should be off unless errors are detected by the local modem. If the RD LED flashes, the receive telephone line or interconnecting cables may be at fault. Since this is a full duplex operating mode, the remote site operator can observe that modem RD LED for errors at the same time. If the remote modem RD LED flashes, the transmit telephone line or connecting cables may be at fault.

5. Remove and reconnect the TELCO cables at the local modem and/or remote modem. Repeat steps 1 through 4. If either modem continues to indicate errors, the associated telephone line may be the source of the problem.

6. Press the NO button several times until the test mode has been exited and the SELECT OPTIONS? message is shown on the LCD. Press the YES button to enter the EDIT OPTIONS? menu. Press YES until the TX/RX EQUALIZER option is shown on the display. Enable the equalizer by pressing NO until the ENABLED message is displayed on the second line of the LCD. Press YES to select this option. Press TALK/DATA to exit the EDIT OPTIONS? menu. Press YES to save the options to nonvolatile memory. The LCD should then display DATA IDLE MODE. Have the remote operator perform this step on his modem.

7. Repeat steps 1 through 5. If the local modem and/or remote modem no longer indicates errors, the telephone line may be marginal for reliable data communications. If the local modem and/or remote modem still indicates errors, the associated line is inadequate for data transmission. Contact your local phone company for assistance.

Chapter 6
Autodialer

GENERAL

The autodialer places data calls via the DTE, indicates the status of placed calls, and communicates in a variety of popular protocols. This chapter describes the synchronous serial BISYNC/SDLC/HDLC and parallel EIA-366/801 autodialer protocols and the rules to follow during autodialer operation.

SYNCHRONOUS SERIAL DIALER

The following description of dial command syntax is common to all of the synchronous serial dialer protocols.

Dial Command

All characters in the dial command are ASCII or EBCDIC. The telephone number can have up to 36 digits including special characters. Characters inserted for clarity are not counted. Table 6-1 lists the autodialer dial characters and functions.

Valid Dial Characters	Function
0 thru 9	Dial digits
* and #	Valid tone digits
, (comma)	Dial tone detect
: (colon)	Blind dial if first character; otherwise, 5 sec pause
T	Force tone dialing
P	Force pulse dialing
F	Force online with no ABT
@	End of message
Space, dash, parenthesis	Clarity characters (not counted in 36 character total)

Table 6-1
Dial Characters

Example: D5551234

This example shows tone dialing. The T character is not needed since tone dialing is the default and the comma is not needed because the initial dial tone is automatically detected.

Example: D 9,555-1234

In this example the 9 is dialed, a second dial tone is detected, and the rest of the number is dialed. Tone dialing is used and the space and dash are ignored.

Example: DP 9:555-1234:T567#F

Here pulse dialing is used to dial 9. A 5 second pause is inserted and 5551234 is pulse dialed. After pausing 5 seconds, tone dialing is used to dial 567#. Then the modem goes online waiting for Answer Back Tone from the answering modem.

The end of message character @ is only necessary if a message of more than 36 characters is sent. If the DTE cannot vary its block length, an entire block of 256 characters, for example, can be sent as long as the first character is a D and the telephone number is followed by @.

Example:

D5551212 (@ not needed)
D5551212 @**********

Call Progress Response

The call progress messages signal the DTE of the outcome of call attempts. The message consists of one ASCII/EBCDIC byte. Refer to Table 6-2.

Message	Meaning
D	Dial tone detected
R	Ring back tone detected
B, T	Busy or reorder busy tone detected
A	Answer back tone detected
N, I	No tone detected, alien tone detected
E	Error detected in command
Q	Quit (60 sec abort) - no answer back tone detected

Table 6-2
Call Progress Responses

Synchronous Protocols

The 2860 works with two different synchronous protocols:

SDLC/HDLC
BLOCKED BISYNC

The modem automatically detects NRZ or NRZI in SDLC/HDLC protocol and transparent mode in BISYNC protocol.

The modem automatically detects ASCII or EBCDIC in all three protocols. The dialer uses eight bit characters with space parity, and parity is not checked. Figure 6-1 illustrates the protocol formats.

SDLC/HDLC format

	FL	ADD	CTRL	INFO FIELD	CRC	FL
EBCDIC	7E	FF	13	D9	8AF4	7E
ASCII	7E	FF	13	52	51CE	7E

Example of ringback detected message in each format.

BISYNC format

	SYN	SYN	STX	INFO FIELD	ETX	CRC16	PAD
EBCDIC	32	32	02	D9	03	1B91	FF
ASCII	16	16	02	52	03	7D61	FF

Figure 6-1
Protocol Formats

Figure 6-2 shows the EIA-232D control signals for sending commands and receiving responses. The option that allows DSR to follow RTS is enabled in this figure. Refer to Chapter 4 LCD synchronous dialer options menu for details of DSR options in autodialer operation.

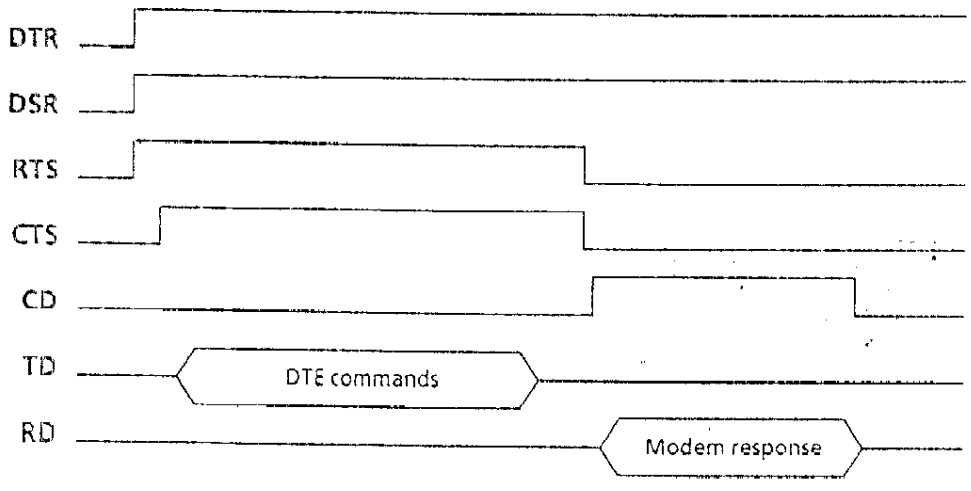


Figure 6-2
EIA-232D Synchronous Autodialer Control Signal Timing

Control Signals and Responses

The DTE signals work the same for BISYNC as they do for SDLC and HDLC. When the terminal drops DTR, the modem returns to idle mode. DTR must be held on during command/response interaction. If DTR is not on, the modem will not respond to an enquiry. RTS must be turned on and CTS must be detected before sending an enquiry. Turning DTR off forces the modem to go on hook and turn DSR off.

When DTR or RTS are turned off or on, they must be held for a minimum of 1.2 ms.

RTS must be turned on to send a message to the modem and turned off when the terminal has transmitted the message.

When RTS is off, the modem turns on CD and sends the response to the terminal, then turns off CD when finished sending the message. The time between turning RTS off and the modem turning on CD to send a response is between 12 and 25 ms. After CD is turned on the modem delays a minimum of 0.6 ms before sending a response.

After the modem has dialed the last number it starts the abort timer. If no answer back tone is received within 60 seconds the modem sends the no tone detected message Q to the terminal, places the modem on hook and looks for an ACK response message.

As long as the modem receives an enquiry from the terminal, the modem continues sending an acknowledgment to the terminal.

The modem repeats the same call progress or protocol message if it receives an E message or a NAK from the computer.

If the modem initiates a sequence and the terminal does not return the ACKs during the call progress message sequence, the modem retransmits the message up to 5 times with 1 second between each try; then it aborts back to looking for a dial message ENQ.

The modem waits for a response message from the terminal for up to 5 seconds after sending an ACK. If a response is not received after 5 seconds, the modem aborts the sequence and returns to looking for an enquiry.

The modem will not autoanswer an incoming ring during a protocol handshake or if the autoanswer option has been disabled.

SDLC/HDLC DIALER

Mode Definitions

FL is the opening and closing flag (7E hex).

ADD is the address field (FF hex).

CTRL is the control field (13 hex).

INFO FIELD contains the commands and responses between the terminal and the modem.

CRC is the CCITT compatible cyclic redundancy check. This is used to check for errors.

ENQ is the enquiry control character. This is a request to initialize a sequence.

ACK0 is an affirmative acknowledgment control character. This indicates that the previous transmission was accepted. The hex code for an ACK0 is 1070 in EBCDIC or 1030 in ASCII.

If a correct message is received by the modem, it responds with an ACK0. If either the message or the CRC that the modem receives is incorrect, the modem responds with an E.

Rules to Follow

For all commands and responses, the dialer uses the global address field of FF (hex) and an unnumbered information frame of 13 (hex) for the control field.

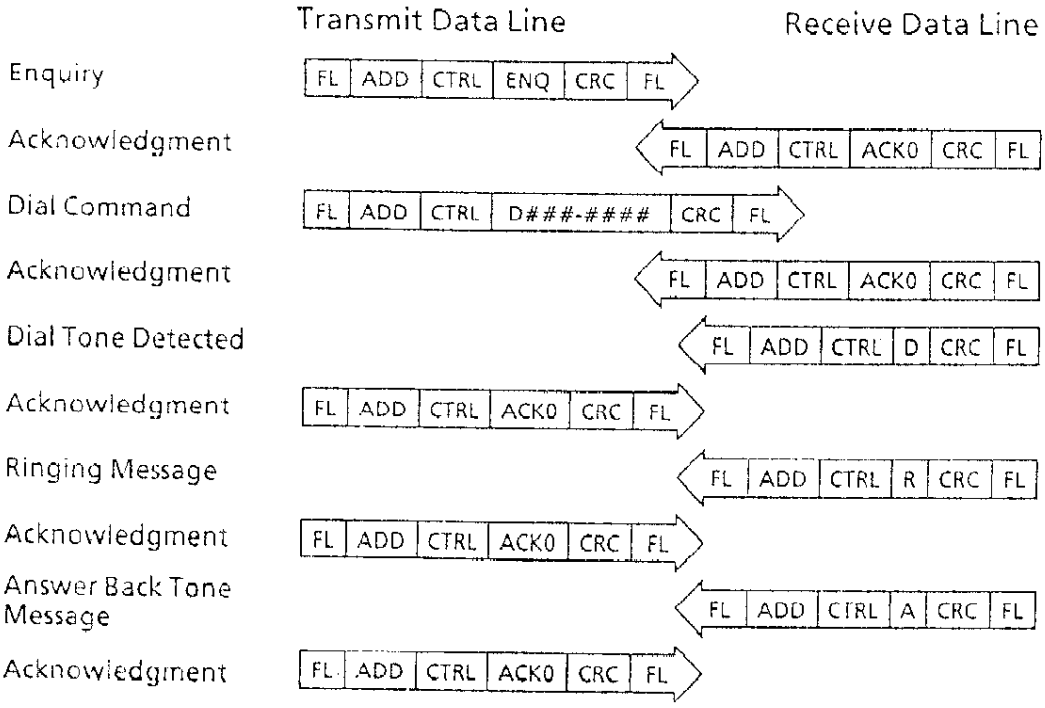
The modem will not dial the number in the dial command message until after it receives an ACK0 acknowledgment from the terminal.

If the terminal receives an invalid message or Frame Check, it sends an E message to the modem. The modem then retransmits the last message.

Refer to Figure 6-3 for an example of SDLC/HDLC protocol.

> **NOTE**
> Examples of messages are framed in blocked arrows to help illustrate the direction of flow. However, the message inside the blocked arrow is read or written from left to right regardless of the arrow direction.

SDLC/HDLC Autodial Sequence



The modem is now online and the data sent on the transmit data line will be sent across the telephone connection.

Figure 6-3
SDLC/HDLC Protocol Example

BISYNC DIALER MODE

The Bisync dialer operates in blocked mode.

Definitions

SYN is the sync control character. These special characters are used to establish character synchronization.

STX is the start-of-text control character. It indicates that a sequence of characters follows.

ETX is the end-of-text control character. It terminates the last block of a message sequence.

ETB is the end-of-block control character. It terminates the message blocks preceding the ETX.

INFO FIELD contains the commands and responses between the terminal and the modem.

DLE is the data link escape control character. It is used in transparent mode data transfer.

CRC16 is the cyclic mode redundancy check. It is used to check the data block for errors.

ENQ is the enquiry control character. It is used as a request to initialize a sequence.

ACK is the affirmative acknowledgment control character. It indicates that the previous transmission was accepted. The hex codes for ACK0 and ACK1 are 1070 and 1061 hex respectively in EBCDIC. The hex codes for ACK0 and ACK1 are 1030 and 1031 hex respectively in ASCII. ACK0 and ACK1 are used alternately to help detect missing blocks.

NAK is the negative acknowledgement control character. This character indicates that the previous transmission had a bad CRC16 frame check.

PAD characters are added to the end of message blocks to assure that trailing "garbage" characters are not received when a remote modem's carrier is turned off. The PAD character is a hex ff.

Blocked Mode

The dialer can receive more than two SYN characters but it must receive at least two. If the dialer receives an enquiry correctly, the modem turns on CD and sends an ACK0 with two pad characters on the end in response and then turns off CD. All messages have two pad characters on the end. If the enquiry is received incorrectly, the dialer will not respond and the enquiry should be sent again.

If the start of text is preceded by the control character DLE, indicating transparent mode, the dialer stores this, expects to see a DLE preceding the ETB or ETX, and excludes the DLE from the CRC16 calculation. When DLE SYN is idled, both the DLE and SYN are excluded from the CRC calculation. If a DLE DLE is received, the second DLE is included in the CRC calculation. If transparent mode is used in the message sequence (DLE preceding), the response has a DLE preceding the STX and ETX or ETB.

If the dialer receives the correct message, it sends an ACK1 back. When the message is incorrect, the modem responds with an E and the message should be sent again.

The dialer expects to see an EOT at the end of a message sequence.

If the dialer receives an ETB during the dial message sequence, an ETB will be used for the response message. The same is true for an ETX. Refer to Figure 6-4 for examples of Bisync Blocked Mode protocol.

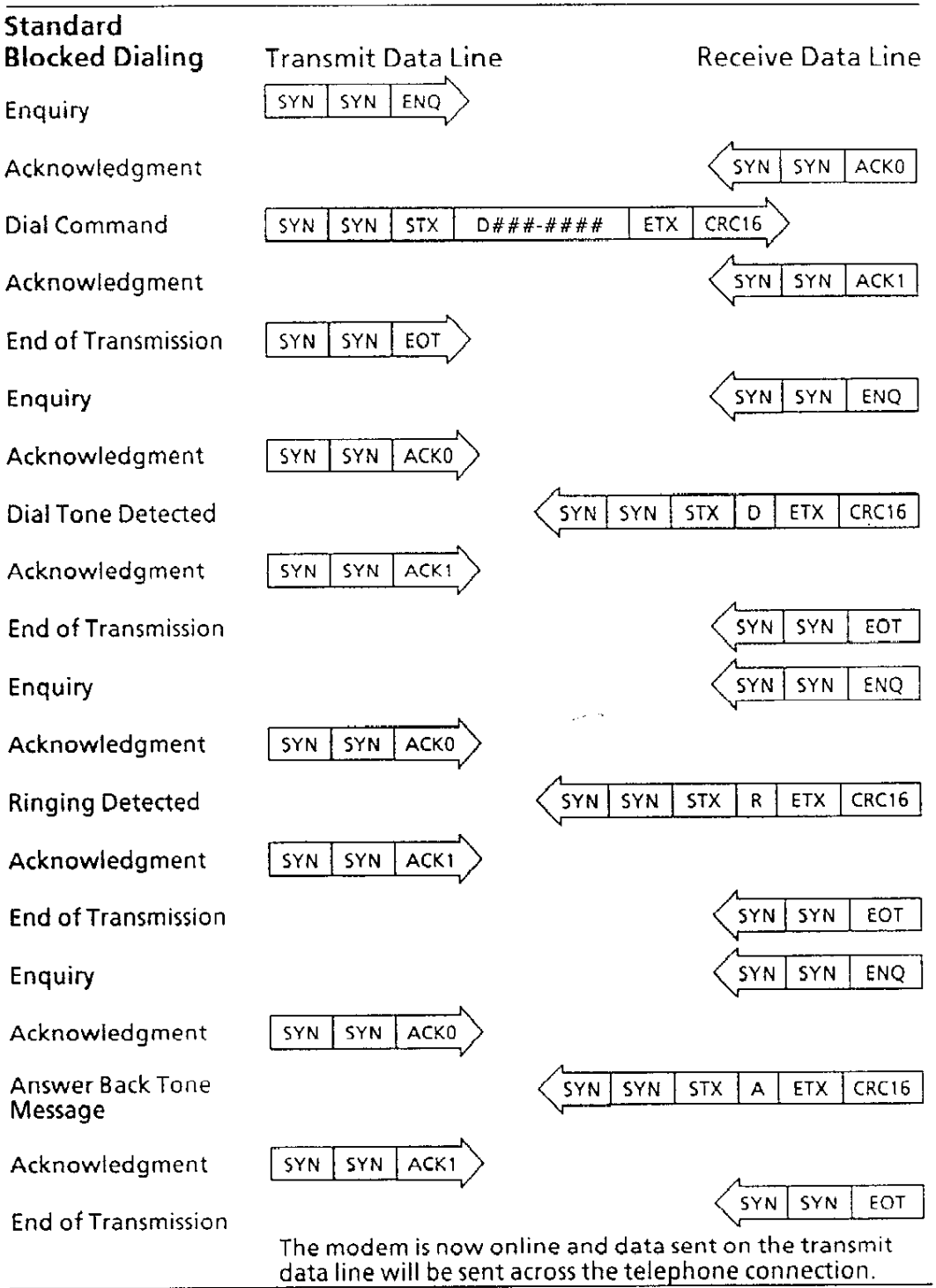


Figure 6-4
Bisync Blocked Mode Dialing Protocol Example

PARALLEL 801 AUTODIALER

This autodialer mode takes four parallel bits from the DTE 801 port via a special Y cable which connects between the modem DTE connector and the host EIA-232D and 801 (EIA-366) dialer ports.

EIA-366/801 CONTROL SIGNALS

The 801 dialing mode uses pins on the DTE connector which are not used by the EIA-232D interface. These pinouts are given in Appendix B.

Power Indication

PWI is supplied by the modem to indicate that the modem has power.

Digit Signal Circuits

The terminal presents parallel binary coded decimal data to the modem for dialing. Table 6-3 shows the two dial digit character sets for the 801. The character set can be selected via the LCD 801 dialer options menu. Refer to Chapter 4 Option Selection for details.

The telephone number can have up to 36 digits including special characters. If more than 36 digits are received the modem will go on hook, turn on Abandon Call Retry (ACR) and wait for Call Request (CRQ) to drop. The following special command characters are recognized by the 801 dialer.

Digit (Pulse)	Digit (DTMF)	NB8	NB4	NB2	NB1
0	0	0	0	0	0
1	1	0	0	0	1
2	2	0	0	1	0
3	3	0	0	1	1
4	4	0	1	0	0
5	5	0	1	0	1
6	6	0	1	1	0
7	7	0	1	1	1
8	8	1	0	0	0
9	9	1	0	0	1
Tandem digit	*	1	0	1	0
Pause	#	1	0	1	1
EON	EON	1	1	0	0
Unused	Tandem digit	1	1	0	1
Unused	Pause	1	1	1	0
Unused	Tone/pulse	1	1	1	1

Table 6-3
Parallel 801 Character Sets

EON

This character tells the dialer it has received the last dial character. It should look for dial tone and then dial the phone number.

Example 5551234(EON)

This shows tone dialing. The tandem character is not needed as the first character to check for dial tone since it is the default.

Tandem Digit

This character tells the dialer to stop dialing and look for another dial tone.

Example 9(Tandem)5551234

In this example the 9 is dialed, a second dial tone is detected, and the rest of the number is dialed. Tone dialing is used.

Pause

This character causes the dialer to wait 5 seconds and then continue to dial the number without looking for dial tone.

Tone/Pulse

This character forces either tone or pulse dialing. The default is tone dialing. If the tone/pulse character is sent once, the dialer switches to pulse dialing. If the character is sent a second time, the dialer switches back to tone dialing.

Example (Tone/Pulse)9(Pause)5551234
(Pause)(Tone/Pulse)567#

Here pulse dialing is used to dial 9. A pause is inserted and 5551234 is dialed. After another pause, tone dialing is used to dial 567#.

Digit Present

DPR is sent by the terminal to indicate to the modem that the code on the Digital Signal Circuits can be read. Circuit DPR must not be turned on before Present Next Digit (PND) comes on. When DPR is on, it must remain on until PND goes off. DPR may be turned off; when off, it must be held off until PND comes on again. If DPR is not turned on again within 5 seconds after PND is turned on, the dialer assumes it has received the last number and dials any numbers that have been received. If no numbers have been received, the modem goes on hook, turns on ACR and waits for CRQ to drop.

Data Line Occupied

DLO is sent by the modem to indicate when the communication channel is in use. Off indicates that the terminal may originate a call provided PWI is on.

Present Next Digit

PND is turned on by the modem to indicate that it is ready to accept the next digit on digit signal circuits NB1, NB2, NB4, and NB8. Off indicates that the terminal should turn off DPR and set the states of NB1, NB2, NB4, and NB8 for the next digit.

Call Origination Status

COS is supplied by the modem to indicate that a call has been completed and that the control of the data channel has been transferred from CRQ to DTR. Once the modem enters data mode, COS remains on until CRQ is turned off. An option is available to turn on COS immediately if an EON character is received. This option is located in the LCD 801 Dialer menu. Refer to Chapter 4 for details.

Abandon Call Retry

ACR indicates to the terminal that the call cannot be successfully established. When on, the terminal abandons the call and reinitiates it later. Call failure time delays of 15, 30, 45, and 60 seconds are available as options in the LCD 801 dialer menu. ACR can optionally be turned on if an invalid dial character is received. Refer to Chapter 4 for details.

Call Request

CRQ is supplied by the terminal to request the modem to originate a call when the modem is offline. CRQ must be on during call origination. If CRQ is turned off before call origination status (COS) is turned on, the call will be aborted. DTR can be off during call origination, but must be turned on before answer back tone is detected or the modem will abort the call.

Chapter 7
Maintenance

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

MAINTENANCE

The modem 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 modem appears faulty, contact the UDS Field Service Department at 1-800-221-4380 for service and assistance. Do not return the modem without prior instructions.

Appendix A
Specifications

GENERAL

Data Rate	4800 or 2400 bps, synchronous or asynchronous, half duplex (2-wire) or full duplex (4-wire)
Modulation	Differentially Phase Shift Keyed (DPSK) Modulation B used in 201 mode
Channel	Public switched telephone network (PSTN) or 2-wire/4-wire leased line
201 Scrambler	511 or disable
Originate	Manual or automatic dialing via DTE or front panel
Answer	Manual or automatic answering
Speaker	Enabled, disabled or timed. Choice of two volume levels provided.
Impedance	600 ohms off hook 10K ohms on hook
Power	+ 5 volts 400 mA + 12 volts 100 mA – 12 volts 100 mA 115 Vac ± 10%, 10 watts max

A
Specifications

TRANSMITTER

Carrier Frequency	1800 Hz	
Transmit Level	Permissive	– 9 dBm
	Programmable	0 to – 12 dBm
Answer Back Tone	Frequency	2025 Hz
	Duration	2.7 sec
	Level	– 9 dBm
Clear to Send Delay	208 mode	8.5, 50, 150, or 600 ms
	201 mode	0, 9, 25, or 150 ms

RECEIVER

Received Line Signal Detect	– 34 or – 44 dBm ± 2 dB 2 to 4 dB hysteresis
Carrier Attack/ Release Time	6 ± 2 ms
Equalization	208 mode Tx compromise in/out Rx automatic 201 mode Tx none Rx compromise in/out

AUTODIALER

Dialer Protocol

SDLC/HDLC, BISYNC, or parallel 801

Tone Dial Frequencies

Digit	Tone (Hz)
1	697/1209
2	697/1336
3	697/1477
4	770/1209
5	770/1336
6	770/1477
7	852/1209
8	852/1336
9	852/1477
0	941/1336
*	941/1209
#	941/1477
A	697/1633
B	770/1633
C	852/1633
D	941/1633

Tone Dial Duration

70 ms on, 70 ms off

Tone Dial Amplitude

-2 ± 1 dBm

Pulse Dial Rate

10 pulses per second

Make/Break Ratio

60 ms break, 40 ms make

Interdigit Time

750 ms

Blind Dial Delay

5 sec

A
Specifications

Call Progress Detection	Dial tone	350/440 Hz. precision or 600 Hz
	Ring back tone	Cadence on time - 0.88 to 2.24 sec
	Busy tone	Cadence on time - 320 to 880 ms
	Reorder busy tone	Cadence on time - 160 to 320 ms
	Answer back tone	2025 or 2100 Hz. min lvl: – 43 dBm
	Alien answer back tone	2225 Hz.
Dial Tone Abort	10 sec	
Answer Tone Abort	60 sec	

Appendix B
Data Interface

EIA-232 MODEM/ DTE INTERFACE

The following section describes EIA-232D signal functions for the modem. Descriptions of the signal functions for the 801 dialer can be found in Chapter 6 Autodialer. Table B-1 lists signal functions and Figure B-1 shows the connector pin numbering.

Pin # EIA-232	Pin # EIA-366 **	EIA-232 Designation	V.24 Designation	EIA-366 Designation	Function
1	1	AA	101	FG	Frame ground
2	---	BA	103	---	Transmit data
3	---	BB	104	---	Receive data
4	---	CA	105	---	Request to send
5	---	CB	106	---	Clear to send
6	---	CC	107	---	Data set ready
7	7	AB	102	SG	Signal ground
8	---	CF	109	---	Data carrier detect
9	6	---	---	PW1	+V test only
10	---	---	---	---	–V test only
11	17	---	---	NB8	Binary digit 8
12	2	---	---	DPR	Digit present
13	22	---	---	DLO	Data line occupied
14	5	---	---	PND	Present next digit
15	---	DB	114	---	Transmit clock
16	13	---	---	COS	Call origination status
17	---	DD	115	---	Receive clock

** EIA-366 pin numbers refer to female DB25 at the dialer port end of the Y cable.

Table B-1
EIA-232 and EIA-366 Interface Pin Functions

Pin # EIA-232	Pin # EIA-366 **	EIA-232 Designation	V.24 Designation	EIA-366 Designation	Function
18	14	---	---	NB1	Binary digit 1
18	---	LL	141	---	DTE AL CMD
19	15	---	---	NB2	Binary digit 2
20	---	CD	108/2		Data terminal ready
21	3	---	---	ACR	Abandon call/retry
21	---	RL	140	---	DTE DL CMD
22	---	CE	125	---	Ring indicator
23	16	---	---	NB4	Binary digit 4
23	---	CH	111	---	DTE fallback
24	---	DA	113	---	EXT transmit clock
25	4	---	---	CRQ	Call request
25	---	TM	142	---	Test mode

** EIA-366 pin numbers refer to female DB25 at the dialer port end of the Y cable.

Table B-1 Continued
EIA-232 and EIA-366 Interface Pin Functions

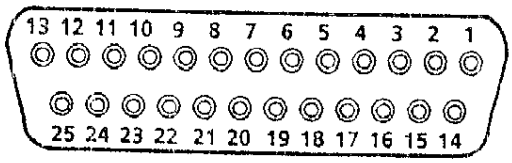


Figure B-1
EIA-232D Connector Pin Numbering

Transmitted Data

TD carries serial data either for autodialer commands from the DTE or data to be sent to another modem. The modem only accepts data when CTS is on. The transmitter clock is used to keep the data synchronized. The TD LED is on when a space condition exists on the TD line.

Received Data

RD carries serial data either for autodialer response messages to the DTE or data received from another modem. RD is held to a mark when the CD signal is off. Data is clocked out with the receiver clock signal. The RD LED is on when a space condition exists on the RD line.

Request to Send

The DTE turns RTS on when data or commands are to be sent to the modem/autodialer. When offline with the autodialer enabled, the modem responds with CTS after 10 µs minimum if RTS is turned on while DTR is on. The modem then begins looking for a valid dial message on the transmit data line. The RS LED turns on or off with the signal.

Clear to Send

CTS is supplied to the DTE by the modem to indicate that it can transmit a message. CTS follows the off to on transition of RTS after the selected delay time when online. When offline with the autodialer enabled, CTS follows the off to on transition of RTS with a 10 µs minimum delay.

Data Set Ready

DSR is supplied by the modem to the DTE to indicate that the modem is connected to the telephone network, or online. Options are available to modify the conditions that turn DSR on. These options are used for terminals that require DSR to be on at different times to communicate with the autodialer.

Carrier Detect

CD, or Received Line Signal Detect, is furnished by the modem to the DTE when online to indicate that a carrier is received and the received DTE data is present at the EIA-232D

interface. Offline, carrier detect indicates the autodialer is sending a message on the received data line to the DTE. The CD LED turns on or off with the signal.

Transmitter Clock

TC, or Transmit Signal Element Timing, keeps transmitted data synchronized. Transmitter data is clocked-in with this 4800/2400 Hz ± .01% square wave. When offline with autodialer enabled, the clock will always be at 4800 Hz. If 201 mode is selected, the modem shifts its clock to 2400 Hz when it enters data mode.

Receiver Clock

RC, or Receiver Signal Element Timing, keeps received data synchronized. Receiver data is clocked out with this 4800/2400 Hz ± .01% square wave. When offline with autodialer enabled, the clock will always be at 4800 Hz. If 201 mode is selected, the modem shifts its clocks to 2400 Hz when it enters data mode.

DTE Local Analog Loopback

When enabled by the EDIT OPTIONS? menu, the on condition of this input from the DTE forces the modem into Local Analog Loopback test mode. Front panel controls are overridden in this mode. This function is not available when 801 autodialing is selected.

Data Terminal Ready

In PSTN and autodialer modes, the modem is activated when DTR is turned on. It can then send or receive commands. It can autoanswer or take control of the line via the TALK/DATA switch. When DTR is turned off, the modem goes on hook and all communication is terminated. The TR LED turns on or off with the signal. An option is provided to force DTR on inside the modem. This is convenient when the DTE does not control DTR. The front panel TR LED monitors the EIA-232D interface and does not indicate when DTR is forced on inside the modem. In leased line modes, DTR is not required for normal operation.

Local DTE Digital Loopback

When enabled by the EDIT OPTIONS? menu, the on condition of this input from the DTE forces the modem into Local Digital Loopback test mode. Front panel controls are overridden in this mode. This function is not available when 801 autodialing is selected.

> **NOTE**
> This is not a standard EIA-232D function.

Ring Indicator

When an incoming call activates the ring detector, the RI output is turned on and off with the ring signal. RI can be used by the DTE to turn on DTR if this function is software controlled. The MR/RI LED turns on or off with the signal.

DTE Fallback

When enabled by the EDIT OPTIONS? menu, the off condition of this input from the DTE forces the modem to fall back to 201 (2400 bps) mode. This option is not available unless the modem is configured for 208 mode and 801 autodialing is not selected.

Transmitter Clock Input

A square wave at 4800/2400 Hz ± 0.01% can be supplied by the DTE as a timing reference for the modem (also called external transmit clock). If used, the external transmit clock option must be enabled.

Test Mode

This output from the modem is an indication that the modem is in a test mode. The output is on when a test mode is selected and off at other times. This function is not available if 801 autodialer is enabled.

Signal Ground

This is the common return path for all EIA-232D interface signals.

Appendix C
LCD Menu

GENERAL

Table C-1 is a summary of all LCD commands, diagnostics, and options. When operating in the LCD menu, pressing NO advances the LCD vertically down the column and pressing YES advances it horizontally across the columns. One exception to this standard is in the EDIT OPTIONS? Submenu Item column.

Viewing Options

When EDIT OPTIONS? appears press YES to advance to the first submenu item (either PSTN or LEASED). The option that appears is the active option. Press YES to advance down the column to review all the active options. To change any active option press NO. This advances you to the Item Option column where repeatedly pressing NO scrolls through the available options.

Selecting Options

When the desired option is shown on the LCD, with a question mark, press YES. This activates that option and advances the display to the next Submenu Item.

Limited Options

Some options are limited and appear only when certain other options have been selected. For example, options pertaining to a 4-wire system will not appear if the 2-wire option has been selected. The limiting factor will be in parentheses next to the option in Table C-1.

Storing Options

Option changes are temporarily stored in RAM. As long as the unit remains energized, option changes remain active. If power is cycled the option returns to the EEPROM value. To permanently change options press YES at the SAVE OPTIONS? display. This will store the currently selected options in the EEPROM.

C
LCD Menu

MAIN MENU	DESCRIPTION
MAIN 1 A. DATA MODE 4800 BPS PSTN OR LL B. DATA MODE 2400 BPS PSTN OR LL C. DATA IDLE MODE PSTN D. DATA IDLE MODE SYNC DIALER PSTN E. DATA IDLE MODE 801 DIALER PSTN (Press NO to advance to MAIN 2)	After initial power-on and self test sequence, one of these five mode displays appears. The mode that appears depends on previously made option selections in the Quick Strap, Select Bit Rate, and Option menus. Each mode has unique option selections that may not appear if another mode is selected. The default is MAIN 1, C Data Idle Mode PSTN.

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION /NOTES
MAIN 2 DIAL FROM FRONT PANEL? (If MAIN 1, A or B is active, MAIN 2 is bypassed)	DIAL STORED NUMBER?	DIAL NUMBER n? (n = 1-9)	If a stored number exists, the modem will front panel dial. If no number is stored, the modem display will return to MAIN 2 after several seconds.
	EDIT/REVIEW STORED NUMBERS?	STORED NUMBER n (n = 1-9)	Press NO to review next number. Press YES to edit displayed number. Refer to Chapter 3 for editing numbers.
MAIN 3 HANG UP LINE?			MAIN 3 appears only if the modem is off hook in PSTN modes. This provides an alternate method of hanging up. Pressing YES returns to MAIN 1, C, D, or E as determined by options selected.
MAIN 4 DISPLAY RECEIVE LINE LEVEL?	RECEIVE LINE LEVEL < – n dBm (n = < – 40 to > 0) (CD = – 34) (n = < – 50 to > 0) (CD = – 44)		MAIN 4 and 5 appear only if the modem is in data mode. These are status displays only.
MAIN 5 DISPLAY RECEIVE LINE QUALITY?	LINE QUALITY POOR - - - - GOOD		An * will appear representing relative line quality.

Table C-1
Menu Option Summary

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION OR STATUS
MAIN 6 TEST MODE?	SELF TEST?	ST (Initiate)	Test pattern results are displayed by the LEDs. Other tests are verified by sending a data message via keyboard and checking monitor for same message.
	TRANSMIT TEST PATTERN? (2-wire only)	TTP (Initiate)	
	RECEIVE TEST PATTERN? (2-wire only)	RTP (Initiate)	
	LOCAL ANALOG LOOPBACK?	LAL (Initiate)	
	LOCAL DIGITAL LOOPBACK?	LDL (Initiate)	
	END TO END? (4-wire only)	E TO E (Initiate)	
	LOCAL LINE LOOPBACK? (4-wire only)	LLL (Initiate)	
	CENTRAL OFFICE TEST? (PSTN only)	THIS IS MODEM UNDER TEST?	MUT (Initiate)
		THIS IS CO MODEM?	Originate call from telset. Press TALK/DATA twice. Follow prompts to initiate and complete test.
MAIN 7 QUICK STRAP?	PSTN?	YES / NO	A YES response to any QUICK STRAP submenu item will activate that particular QUICK STRAP display and deactivate any other choice.
	PSTN WITH SYNC DIALER ENABLED?	YES / NO	
	PSTN WITH 801 DIALER ENABLED?	YES / NO	
	LEASED 4-WIRE PT TO PT MASTER?	YES / NO	
	LEASED 4-WIRE MULTI-PT SLAVE?	YES / NO	
MAIN 8 SELECT BIT RATE?	BIT RATE IS 2400	SAVE NEW BIT RATE?	YES / NO
	BIT RATE IS 4800	SAVE NEW BIT RATE?	YES / NO

Table C-1 (Continued)
Menu Option Summary

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION OR STATUS
MAIN 9		↓ YES —► NO	
SELECT OPTIONS?	EDIT OPTIONS? (Press NO here to advance to RESET TO STORED EEPROM OPTION and bypass the SELECT OPTIONS menu.)	PSTN/LEASED	YES / NO
		2-WIRE / 4-WIRE (Leased only)	YES / NO
		SIGNAL QUALITY RETRAIN (Leased only)	ENABLED / DISABLED
	RESET TO STORED EEPROM OPTIONS? YES / NO	ANTI STREAM (Leased only)	ENABLED / DISABLED
		BUSY OUT WITH DTR OFF (PSTN only)	ENABLED / DISABLED
	RESET TO FACTORY ROM OPTIONS? YES / NO	BUSY OUT IN AL (PSTN only)	ENABLED / DISABLED
		IDLE TONE (PSTN only)	ON / OFF
		CARRIER DETECT LEVEL	– 44 dBm / – 34 dBm
		TX PRE-EQUALIZER (208 Only)	ENABLED / DISABLED
		RX PRE-EQUALIZER (201 Only)	ENABLED / DISABLED
		CTS DELAY	8.5 / 50 / 150 / 600 ms (208 only)
			0 / 9 / 25 / 150 ms (201 only)
		TRANSMIT CLOCK SOURCE	INTERNAL / EXTERNAL
			INTERNAL / EXTERNAL / RCV CLOCK (4-wire leased only)
		DL CLOCK SOURCE	TX BAUD CLK / EXT TX CLK
		201 SCRAMBLER	ENABLED / DISABLED
		201 DTE FALLBACK (208 only)	ENABLED / DISABLED
		201 AUTO FALLBACK (208 only)	ENABLED / DISABLED
		DTE INITIATED TESTS	ENABLED / DISABLED

Table C-1 (Continued)
Menu Option Summary

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION OR STATUS
MAIN 9 (cont)		↓ YES → NO	
SELECT OPTIONS?		TRANSMIT LEVEL	PERMISSIVE / PROGRAMMABLE (PSTN)
			0 / – 2 / – 4 / – 6 / – 8 / – 10 / – 12 dBm (Leased)
		DATA FORMAT	SYNC / 8, 9, 10, or 11 BIT ASYNC
		SPEAKER (PSTN only)	ON WHILE DIALING / ALWAYS ON / ALWAYS OFF / ON UNTIL DSR COMES ON / ON FOR 30 SEC AFTER DSR / OFF WHILE DIALING
		SPEAKER VOLUME (PSTN only)	LOW / HIGH
		SQUELCH DELAY (201 2-wire only)	100 ms / DISABLED
		SATELLITE DELAY (201 PSTN only)	8 / 100 / 200 ms
		DSR IN AL	ENABLED / DISABLED
		FORCE DTR (PSTN only)	ENABLED / DISABLED
	DISCONNECT OPTIONS? (PSTN only)	LINE CURRENT DISCONNECT	8, 90, 200 ms / DISABLED
		RTS/DCD ACTIVITY DISCONNECT	ENABLED / DISABLED
		SIGNAL QUALITY DISCONNECT	ENABLED / DISABLED
	DIALER OPTIONS? (Press NO here to advance directly to SAVE OPTIONS?)	AUTOANSWER IN DIALER	ENABLED / DISABLED
	SELECT SYNC DIALER OPTIONS?	SYNC DIALER	ENABLED / DISABLED
		DSR ON IN DIALER MODE	ENABLED / DISABLED
		DSR FOLLOWS DTR	DSR FOLLOWS DTR DSR FOLLOWS RTS
		DTR OFF DELAY	ENABLED / DISABLED
		BLIND DIAL IN DIALER	ENABLED / DISABLED

Table C-1 (Continued)
Menu Option Summary

MAIN MENU	SUBMENU	SUBMENU ITEM	ITEM OPTION OR STATUS
MAIN 9 (cont)		↓ YES → NO	
SELECT OPTIONS?	SELECT 801 OPTIONS?	801 DIALER	ENABLED / DISABLED
		CHAR SET	PULSE ENABLED / DTMF ENABLED
		CALL ORIGINATION STATUS ON IF END OF NUMBER CHARACTER RECEIVED	ENABLED / DISABLED
		SELECT ACR TIME DELAY	15, 30, 45, 60 sec
		ACR ON FOR INVALID DIAL DIGIT	ENABLED / DISABLED
	SAVE OPTIONS? (Pressing YES or NO here responds to the display then returns to MAIN 1 header)		

Table C-1 (Continued)
Menu Option Summary

WARRANTY

UDS warrants that equipment manufactured and sold by us is free from defects in material and workmanship. Under this warranty, our obligation is limited to repairing or replacing any equipment or parts (not already carrying a separate warranty of their supplier) proved to be defective by our inspection within one year after sale to their original purchaser. This warranty shall not apply to equipment or parts thereof which are normally consumed in operation, or to any equipment which shall have been repaired or altered outside our plant in any way, so as to, in the judgment of UDS, affect its stability or reliability, nor which has been operated in a manner exceeding its specifications, nor which has been altered, defaced, or has had the serial number removed. UDS does not assume any liability for consequential damages and, in any event, our liability shall not exceed the original purchase price.

The foregoing constitutes the sole and exclusive remedy of the Buyer and exclusive liability of UDS AND IS IN LIEU OF ANY AND ALL OTHER WARRANTIES EXPRESSED OR IMPLIED OR STATUTORY AS TO MERCHANTABILITY, FITNESS FOR PURPOSE SOLD, DESCRIPTION, QUALITY, PRODUCTIVENESS OR ANY OTHER MATTER. Without limiting the foregoing, in no event shall UDS be liable for the loss of use or profit or other collateral, special or consequential damages.

TECHNICAL SERVICE - RETURNED EQUIPMENT AND PARTS

UDS has instituted a toll-free WATS line for the technical support of our customers. The number is 1-800-221-4380 between 7:00 AM and 6:00 PM Central Time, Monday through Friday. Do not return any item without first calling the toll-free number to receive service or technical instructions. The toll-free number is direct to the technical services department. Please feel free to use it for technical information, application information, and modem/data communication fault isolation. If the lines are busy, please call back.

PLEASE CALL US. WE'RE HERE TO HELP YOU.