HOW TO USE THIS MANUAL

This manual is written for users of the 208A/B Modem. Please read it before you change any strap on the printed circuit board or operate the modem. This manual includes the following:

- Chapter 1, Introduction - Contains introductory information and equipment specifications;
- Chapter 2, Installation - Contains installation planning information and instructions for mechanical and electrical installation of the modem;
- Chapter 3, Operation - Describes modem operation and test procedures;
- Chapter 4, Testing and Fault Isolation - Describes how to isolate a fault in the modem or in the communications network by using the built-in diagnostic capabilities of the modem;
- Chapter 5, Principles of Operation - Briefly describes the operation of the modem power supply, transmitter, and receiver.

TABLE OF CONTENTS

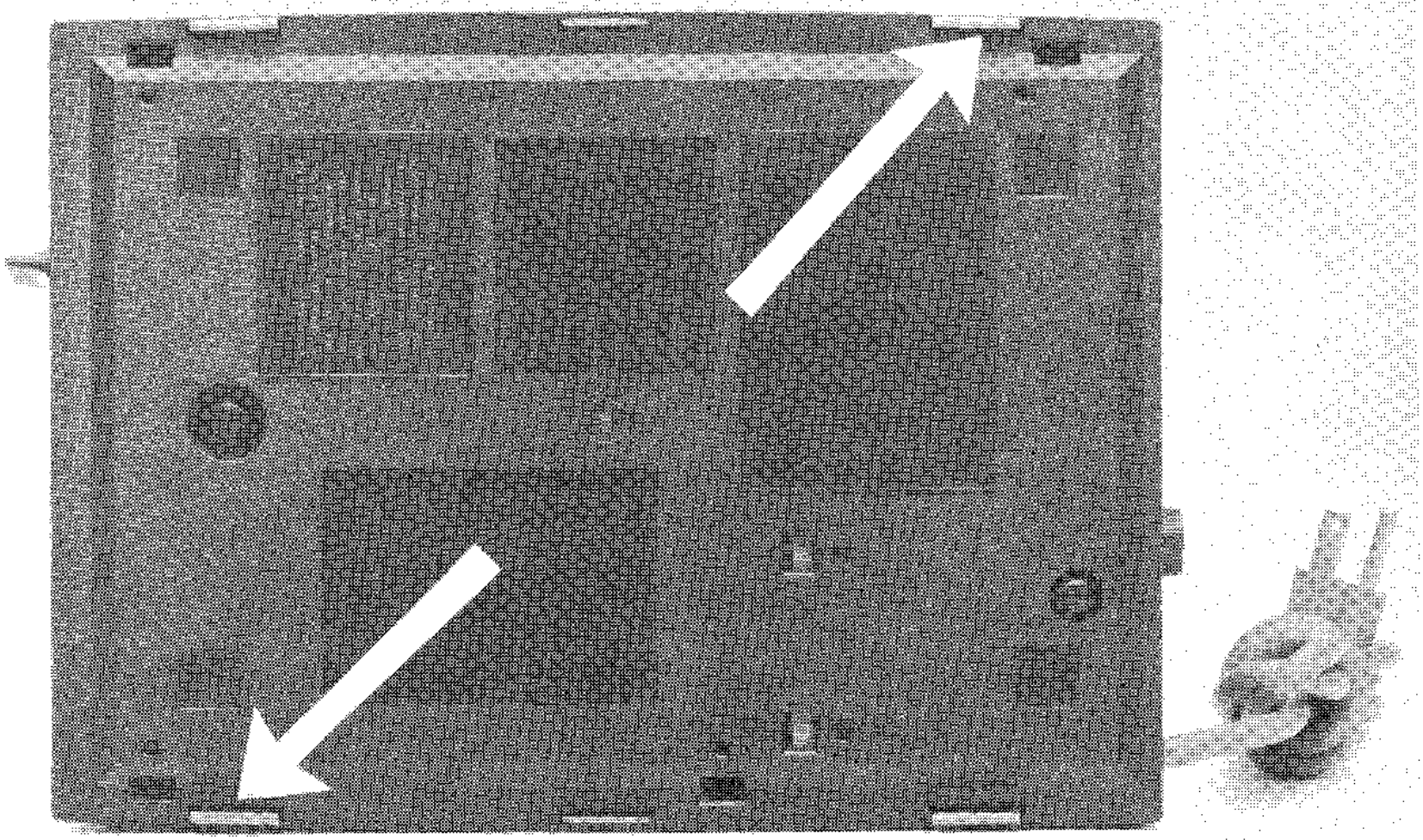
Para. **Page**

CHAPTER 1. INTRODUCTION

CHAPTER 2. INSTALLATION

Para. Page

LIST OF ILLUSTRATIONS



The bottom cover of the modem is secured with two locking tabs. To remove the tabs, pry them up with a screwdriver.

Chapter 1
Introduction

Contents

1.1 GENERAL

This chapter contains a detailed description of the physical and electrical specifications of the UDS 208A/B data modem. Environmental requirements, power requirements and interface information are also given in this chapter.

1.2 DESCRIPTION

A modem is a data communications device which converts digital data into an analog signal so that it can be transmitted over domestic or international telephone circuits and reconverts a received analog data signal from these circuits to a digital format compatible with computer terminal equipment.

The UDS 208A/B data modem is a 4800 bits per second (bps) synchronous data communication device that strictly adheres to Bell System specifications for 208A/B data modems. This unit also complies with CCITT Recommendations V.24 and EIA Standards RS-232-C.

The use of state-of-the-art digital signal processing and adaptive equalization assures this product's superior quality and performance.

1.3 DIMENSIONS AND WEIGHT

a) Width: 7.00 inches (17.8 cm)
b) Height: 2.25 inches (5.7 cm)
c) Depth: 9.6 inches (24.4 cm)
d) Weight: 2 pounds, 9 ounces (1.16 kg)

1.4 TECHNICAL DATA

GENERAL SPECIFICATIONS

Data Rate	4800 bps
Modulation	Eight-phase differentially coherent phase shift keying.
Carrier Frequency	1800 Hz
Internal Transmit Clock Frequency	4800 Hz ±0.01%
External Transmit Clock Frequency	4800 Hz ±0.02%
Transmitter Output Level	0, -2, -4, -6, -8, -9, -10, -12 dBm and externally programmed.
Line Impedance	600 ohms, transformer coupled and transient protected.
Operation Mode	2-wire, half-duplex PSTN or private line operation and 4-wire full-duplex operation.
Digital Interface	Conforms to EIA Standards RS-232-C and CCITT V.24.
Analog Interface	FCC registered direct connect or leased line circuit.
Clear to Send	8.5 ms, 50 ms, or 150 ms
Carrier Detect Range	0 to -34 dBm for private lines or 0 to -44 dBm for PSTN network.
Line Equalizer	Equalized for C2 conditioned lines or for 3002 unconditioned lines.
Function Switch	Rotary switch for Analog and Digital Loopback, Self Test, Transmit Test Pattern, Receive Test Pattern, Data and Talk modes.

TRANSMITTER SPECIFICATIONS

Transmitter Output Level (PSTN)	The transmitter output level (PR strap position) is set by an external resistor in the RJ45S data jack. The transmit level is factory strapped for -9 dBm.
Transmitter Output Level (Private Lines)	The transmitter output level is set by a strap option to any level as given in the general specifications above. The externally programmed (PR) position is not used.
DTE Interface	Pulse train or square wave inputs and outputs with a maximum frequency of 4800 Hz complying with EIA RS-232-C and CCITT V.24.
Transmitter Clock Output	The transmitter provides a clock output to shift serial data into the transmitter with the proper phasing and data rate. At the DTE interface, the positive edge of the transmit clock is coincidental with the data transitions.
External Transmit Timing Signal*	The modem allows for the use of either the internal transmit clock, receiver clock, or an external clock to provide system timing. If an external clock is desired, a 4800 Hz signal with 50 ±2% duty cycle should be applied to the external clock input. The modem will then phase and frequency lock all internal transmitter timing to this external clock. Data presented to the transmitter input should be phased to this external clock. External or internal clock operation is strap selectable.
Request to Send/ Clear to Send Delay	The On delay from Request to Send to Clear to Send is as follows: 8.5 ms ±0.5 ms - (Continuous carrier operation with switched RTS option). Constant carrier is made regardless of RTS state changes. When RTS turns On, there is an 8.5 ms CTS delay. When RTS turns Off, CTS turns Off within 0.625 ms (When CTS is off, scrambled mark data is transmitted). 50 ms ±0.5 ms - (Switched carrier option). Carrier signal responds to RTS. There is a delay of 50 ms from RTS to CTS.

*When strapped for external clock (EXT), DTE timing information must be provided at pin 24 to the RS-232-C interface.

RECEIVER SPECIFICATIONS

Telephone Line Interface (Leased) Telephone Line Interface (PSTN)	Connection to leased and dial lines is made through an 8-pin RJ45S jack at the rear of the unit.
Data and Signaling Rates	The 208A/B modem processes serial synchronous binary data at 4800 bps. It employs a 1600 baud line signaling rate using double-sideband suppressed-carrier eightphase DPSK modulation.
Receive Input Level	The receive input level is strap selectable to cover a range of 0 to -34 dBm or 0 to -44 dBm. The -44 dBm strap position is recommended for dial-up line use.
Compromise Equalizer	Preconditioning of the transmitter carrier is strap selectable to improve performance for severe line conditions.
Automatic Equalizer	The 208A/B has an automatic adaptive equalizer which is trained when a carrier is detected and the training pattern is received. Once trained, and while in the data mode, the equalizer will be continually updated 1600 times per second. This allows the system to automatically track changes in the line characteristics.
Idle Tone	600 Hz ±.01% level: 7.5 dB +2 dB below transmit carrier level. Present only at answering modem output in dial line operation with RTS and Carrier Detect Off when iTone/Stream strap is enabled.

1.5 ENVIRONMENTAL CONDITIONS

a) Temperature
   Operating: 0° to 50°C
   Storage: -40° to +85°C

b) Humidity: 95% relative, non-condensing

1.6 PRIMARY POWER

The line voltage is 115 Vac ± 10%, single phase, 47 to 63 Hz at 10 watts maximum.

1.7 INTERFACE

The interface to the modem is as follows:

a) DTE Connector - The modem DTE connector is a DB25S or equivalent. All interface functions via the DTE connector are RS-232-C compatible. For more detailed pinout information, see Table 2-1 (page 9).

b) TELSET Connector - The modem TELSET connector is a RJ45S type. For more detailed pinout information, see Section 2.6.

c) TELCO Connector - The modem TELCO connector is a RJ45S type. For more detailed pinout information, see Section 2.6.

PAGE IS BLANK

Chapter 2
Installation

Contents

2.1 GENERAL

This chapter provides the information required for the mechanical and electrical installation of the modem, definition of connector pin functions, and reconfiguring the modem with strap options. You should be familiar with the complete installation procedure before installing the modem. After completing the entire installation, refer to the operating and system checkout information in Chapters 3 and 4.

2.2 UNPACKING AND INITIAL INSPECTION

After unpacking the equipment, check the contents against the packing list. Inspect the equipment carefully for any damage that may have occurred in shipment. If any damage or material shortage is noted, contact the shipper's agent and Universal Data Systems. Our address is:

Universal Data Systems
5000 Bradford Drive
Huntsville, AL 35805
Phone: (205) 837-8100

2.3 INSTALLATION PROCEDURE

2.3.1 Site Preparation

The installation area should be clean, well lighted and free from extremes of temperature, humidity, appreciable shock and vibration. Be sure that there is a 4-inch minimum space at the rear of the modem for signal line and interface cable clearance. The modem should be installed within 6 feet of a grounded ac outlet capable of furnishing 115 Vac at 10 VA, and no farther than 50 feet from the associated data terminal.

2.3.2 Tools/Equipment/Material Required

No special tools or test equipment are required for installation of the modem.

2.3.3 Mechanical Installation

The modem is designed for placement on a table top or bench and arrives at the site completely assembled. Provisions are not made for securing the modem to its mounting surface.

2.3.4 Electrical Installation

Ac power is supplied to the modem through a 6-foot line cord with a grounded 3-wire plug. If chassis (protective) ground is connected through the third prong of the ac power plug, a separate chassis ground is not required.

2.4 DATA TERMINAL EQUIPMENT (DTE) CONNECTION

2.4.1 Modem Data Terminal Interface/Pin Functions

The modem interfaces with the DTE via a 25-pin connector located on the rear panel of the unit. This connector is labeled DTE and is a DB-25S or equivalent. The DTE should have a cable no longer than 50 feet with a Cinch or Cannon plug per DB-19604-432 plus a DB-51226-1 hood or equivalent. All interface functions are RS-232-C compatible.

Table 2-1
Digital Interface Pin Functions

EIA RS-232-C	CCITT V.24	Pin No.	Signal Name	Description
AA	101	1	Protective Ground or Earth	Chassis Ground. Isolated from Signal Ground or Common Return (AB, pin 7).
BA	103	2	Transmitted Data	Serial digital data from a data terminal or other digital data source accompanied by DB. If accompanied by an external data rate clock (DA), data transitions must occur on positive-going transitions of the external transmit input clock.
BB	104	3	Received Data	Serial digital data at the output of the modem receiver. The data is accompanied by an internal data rate clock (DD) whose positive-going transitions occur on the data transitions.
CA	105	4	Request to Send	A positive level to the modem when data transmission is desired.
CB	106	5	Clear to Send	A positive level from the modem with a selectable delay, after receipt of Request to Send (CA) and when the modem is ready to transmit. Clear to Send is negative during training or when Request to Send is negative.
CC	107	6	Data Set Ready	A positive level from the modem when power is on and the modem is not in a test mode. In dial-up operation, DSR is On when the modem is Off Hook and not in any test mode.
AB	102	7	Signal Ground	Common signal and dc power ground. Isolated from protective ground (AA, pin 1).
CF	109	8	Received Line Signal Detector	A positive level from the modem except when a loss of the received input signal is detected (carrier detect).
--	---	9, 10	Test Circuits	These interface leads are used only for data set testing. These leads are not to be extended to the data terminal equipment. Data set +9.3 Vd and -9.3 Vdc power supply voltages are present on pins 9 and 10, respectively. Each of these leads is protected by a 10K ohm series resistor to prevent inadvertant damage to the power supply.
--	---	11	Not Used	
--	---	12	Dial Enable	A positive level provides a switch hook signal during pulse dialing. After dialing is complete, a negative level causes the modem to go off hook.
--	---	13	Not used.	
--	---	14	Local Loop	The circuit is enabled by setting the Local Loop strap to the E position. When this circuit is used a positive RS-232-C level is applied to pin 14 of the modem DTE interface to place the modem in analog loopback.

Table 2-1 (Cont)
Digital Interface Pin Functions

EIA RS-232-C	CCITT V.24	Pin No.	Signal Name	Description
DB	114	15	Transmitter Bit Rate Clock	A transmit data clock output for use by an external data source. Positive clock transitions correspond to data transitions.
--	---	16	Transmitter Baud Clock	The data set generates a 1600 Hz square wave signal on this non-EIA standard circuit that correspondsto the symbol rate of the transmitted signal at the modulator. The positive and negative transitions of this signal are respectively coincident with positive and negative transitions of the signal on circuit lead DB (pin 15).
DD	115	17	Receiver Bit Rate Clock	A receive data rate clock output for use by the external data sink. Positive clock transitions correspond to data transitions.
--	---	18	Receiver Baud Clock	The positive and negative transitions of this timing signal occur on positive and negative transitions respectively of the timing signal on circuit lead DD (pin 17).
CD	108	20	Data Terminal	This circuit is positive when the DTE Ready is ready to originate or answer a call in dial up operation. An Off condition lasting less than 10 ms is ignored by the modem. The circuit is held On when TTP* or RTP modes are selected.
CG	110	21	Signal Quality Detector	This circuit is a fast response indicator of the presence, absence, or quality of a data carrier signal at the receiver input.
CE	125	22	Ring Indicator	In PSTN operation, this circuit output is positive when a ring signal is present on the telephone line.
DA	114	24	External Transmitter Clock	A serial data rate clock input from the data source. Positive clock transitions correspond to data transitions.
--	---	25	Busy (Dial Pulse)	In PSTN operation, a positive level on this input forces the modem off-hook.

* Self Test Digital = Transmit Test Pattern (TTP)
Receive Only = Receive Test Pattern (RTP)

2.5 TELSET CONNECTION

There are two basic type of telephone sets that may be connected to the modem. These two types of telephone sets are ordinary rotary dial or push button telephone sets and a special type called an exclusion key telephone.

The deciding factor in choosing which type of telephone to use is the modem's location in relation to the telephone. If the modem will be remotely located away from the controlling telephone, the correct telephone to use is the exclusion key telephone. This telephone allows the modem operator to control the modem talk/data function without physically changing any controls at the modem. If the modem operator is going to be located where he will have easy access to the modem, the correct telephone to choose is an ordinary rotary dial or push button type. If further information is needed on this topic, see the detailed explanation of jacks and telephones given in Section 2.6.

2.6 TELCO CONNECTION

The UDS 208A/B modem provides three possible ways that it may be connected to the telephone network. These three modes are:

1) Permissive
2) Programmable
3) Private Line

The permissive mode is a two-wire (half-duplex) connection to the telephone network. In this mode, the modem output level is set by a strap selection within the modem.

NOTE

The maximum modem output level allowed by most telephone networks is -9 dBm.

The programmable mode is a two-wire (half-duplex) connection to the telephone network. In this programmable mode, the modem output level is set externally by the phone company.

The private line mode is a mode typically requiring the use of a leased private line that is installed by your local phone company. This mode is commonly used on circuits that are dedicated to high quality data transmission only.

2.5 TELSET CONNECTION

There are two basic type of telephone sets that may be connected to the modem. These two types of telephone sets are ordinary rotary dial or push button telephone sets and a special type called an exclusion key telephone.

The deciding factor in choosing which type of telephone to use is the modem's location in relation to the telephone. If the modem will be remotely located away from the controlling telephone, the correct telephone to use is the exclusion key telephone. This telephone allows the modem operator to control the modem talk/data function without physically changing any controls at the modem. If the modem operator is going to be located where he will have easy access to the modem, the correct telephone to choose is an ordinary rotary dial or push button type. If further information is needed on this topic, see the detailed explanation of jacks and telephones given in Section 2.6.

2.6 TELCO CONNECTION

The UDS 208A/B modem provides three possible ways that it may be connected to the telephone network. These three modes are:

1) Permissive
2) Programmable
3) Private Line

The permissive mode is a two-wire (half-duplex) connection to the telephone network. In this mode, the modem output level is set by a strap selection within the modem.

NOTE

The maximum modem output level allowed by most telephone networks is -9 dBm.

The programmable mode is a two-wire (half-duplex) connection to the telephone network. In this programmable mode, the modem output level is set externally by the phone company.

The private line mode is a mode typically requiring the use of a leased private line that is installed by your local phone company. This mode is commonly used on circuits that are dedicated to high quality data transmission only.

The FCC Part 68 Universal Service Order Code (USOC) specifies a series of registered jack arrangements for use on the Public Switched Telephone Network (PSTN). This is the dial-up network. The wiring configurations and modes of operation are specified in the USOC. When installing a new modem, the user has the choice of using the existing registered jack or ordering a new one from the telephone company. An understanding of the types of jacks, their operation, and modem connection will make choosing the jack arrangement for direct connection of a modem easier.

2.6.1 Common Types of Registered Jacks

2.6.1.1 Permissive (Voice Jacks).

This jack allows a fixed level of transmitted signal no greater than -9 dBm. This type of arrangement does not guarantee the signal level at the Central Office (CO). The optimum CO signal level is -12 dBm. The normal telephone line loss between the customer and the CO is 3 dB to 6 dB. Thus, the level received at the CO will be between -12 dBm and -15 dBm. This type of arrangement is typically sufficient for most modem applications. However, if you experience problems with the telephone line characteristics, the telephone company will be very reluctant to fix the problems. This is because this type of line is defined as a voice grade line. In other words, if you can talk on the line, it is within specification. Parameters such as P/AR, attenuation distortion, envelope delay distortion, line loss, and signal to noise ratio are not guaranteed on a permissive arrangement. If you experience problems with the telephone line characteristics, you may have to order a data jack to correct the problems.

RJ11C is the most common permissive arrangement. This is the type that will most often be found in home or office. It is a 6-pin modular jack for single line bridged tip and ring connection. The RJ11C has only two wires (tip and ring) that are connected. There are other 6-pin permissive modular jacks that use the same housing. RJ12C and RJ13C are special permissive arrangements that are

associated with key telephones. Caution should be used if connecting a modem to these arrangements. The RJ16X is a special permissive arrangement that permits the use of an exclusion key phone.

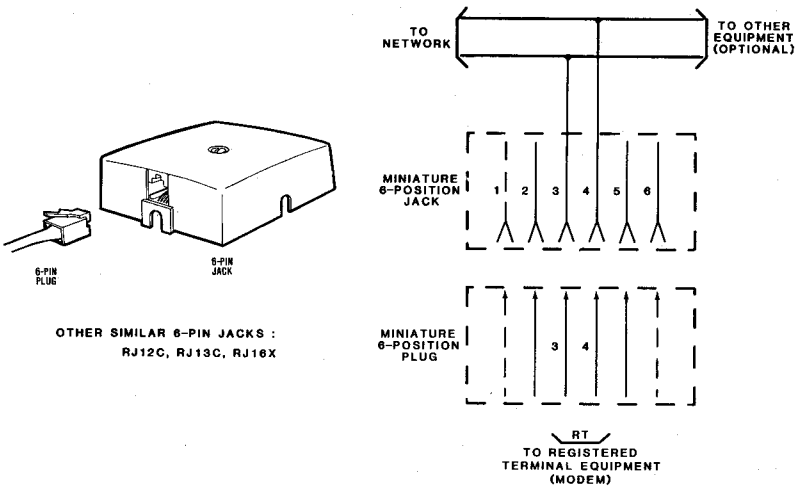


Figure 2-1
RJ11C Permissive Jack

2.6.1.2 Data Jacks.

Data jacks provide a means of adjusting the signal level that is received at the CO. There are two methods of adjusting the CO signal level, programmable and fixed loss loop.

In the programmable arrangement, the modem's output level is adjusted with a telephone company selected programming resistor. This resistor is located inside the data jack. The telephone company measures the local loop loss at the time of installation and selects a resistor value that allows the transmitted signal to arrive at the CO at the optimum signal power level of -12 dBm. A table of resistor values used for implementing the automatic control of signal power output is provided in FCC Part 68. Therefore, the telephone company can adjust for the optimum level without having the modem connected.

In the fixed loss loop arrangement (FLL), the modem output level is fixed at a signal level of -4 dBm. An adjustable attenuator is installed in series with the modem output. This attenuator is installed or adjusted by the telephone company at the time of installation. The attenuator that is located in the data jack is adjusted to compensate for the local loop loss of the telephone line. It is adjusted to have an optimum power level of -12 dBm at the CO. **UDS modems are not designed to work in a fixed loss loop arrangement.**

In addition, Bell operating companies have specified parameters for the local loop characteristics when a data jack is used. These specifications are for parameters such as P/AR, attenuation distortion, envelope delay distortion, line loss and signal to noise ratio. The telephone company is more likely to fix telephone problems when you have a data jack. A data jack will cost a little more at installation, but the monthly tariff will be the same as the permissive jack.

There are two categories of data jack configurations. These are the "universal" configuration RJ41S (97A) and the "programmed" configuration RJ45S (97B). The "universal" RJ41S configuration incorporates both a programming resistor for programmed (PROG) transmit signal level and an attenuator for "fixed loss loop" (FLL) transmit signal level. The programmed configuration (RJ45S) incorporates only a programming resistor for programmed transmit signal level. UDS modems are designed to operate with the RJ45S and RJ41S. When using the RJ41S, the switch **must** be in the PROG position. If the switch is placed in the FLL position, both the received and transmit signals will be attenuated. This may cause a higher than normal error rate.

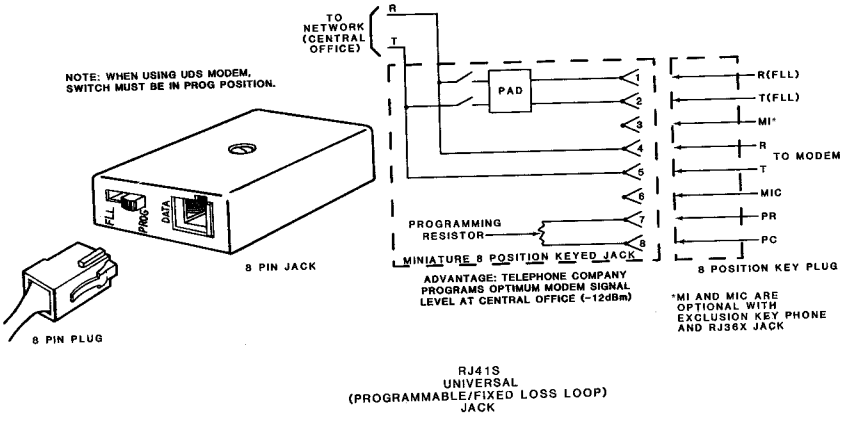


Figure 2-2
RJ41S Jack

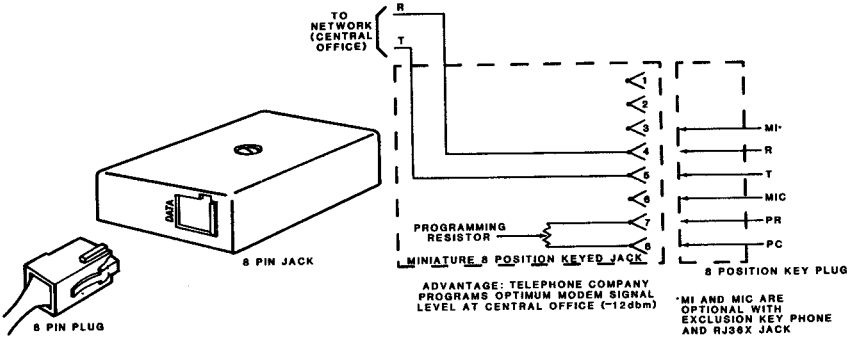
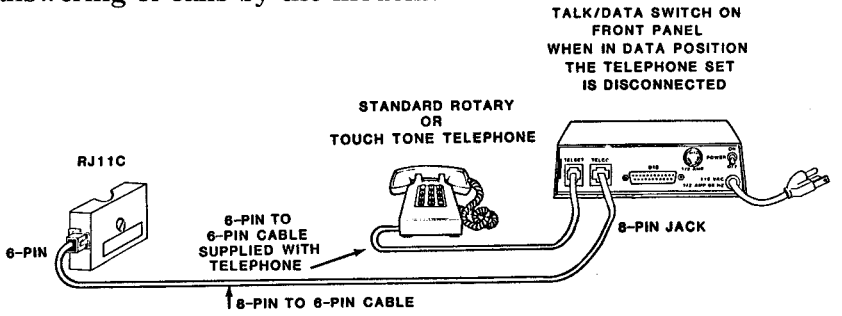


Figure 2-3
RJ45S Jack

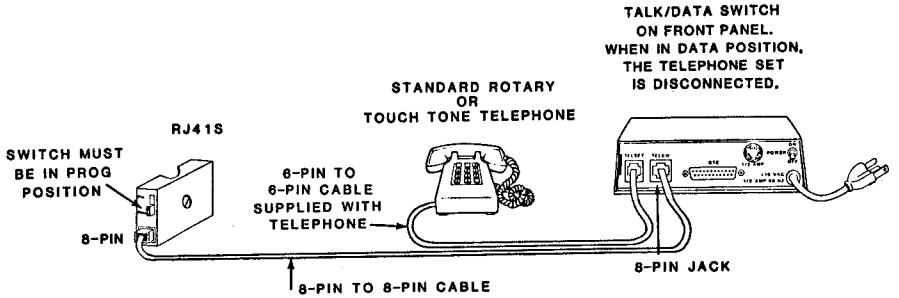
2.6.2 Typical Modem Connection

To connect the modem to a permissive RJ11C jack, an 8-pin to 6-pin modular jack cable (UDS cable code 68, part number 61020202) should be used between the TELCO jack (8-pin) on the modem and the RJ11C jack (6-pin) on the wall. A standard rotary or tone type telephone should be connected into the TELSET jack (6-pin) on the rear of the unit. The cable that comes with the telephone should be used for this connection. A talk/data switch on the front panel is used to connect the telephone line to the modem or the telephone. This switch should be placed in the data position to permit answering of calls by the modem.



TYPICAL STANDALONE MODEM CONNECTION
FOR PERMISSIVE RJ11C ARRANGEMENT

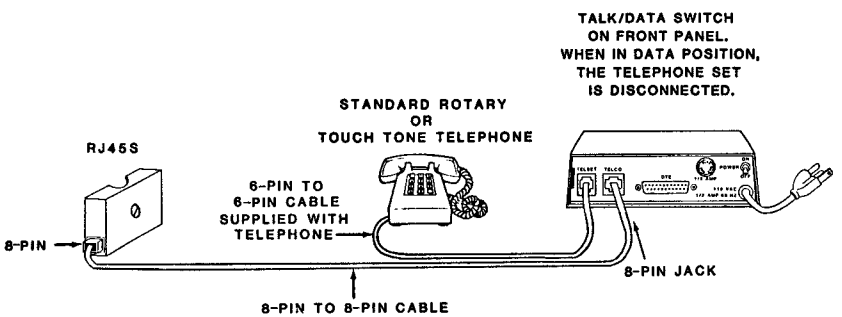
Figure 2-4
Modem Connection with RJ11C



TYPICAL STANDALONE MODEM CONNECTION
FOR UNIVERSAL RJ41S ARRANGEMENT

Figure 2-5
Modem Connection with RJ41S

To connect the modem to a data jack (RJ41S or RJ45S), an 8-pin to 8-pin modular jack cable (UDS cable code 66, part number 61020192) should be used between the TELCO jack (8-pin), and the RJ41S or RJ45S jack (8-pin) on the wall. If the RJ41S jack is used, be sure the switch is placed in the PROG position. A standard rotary or tone type telephone should be connected into the TELSET jack (6-pin) on the rear of the unit. The cable that comes with the telephone should be used for this connection. A talk/data switch on the front panel is used to connect the telephone line to the modem or the telephone. This switch should be placed in the data position to permit answering of calls by the modem.



TYPICAL STANDALONE MODEM CONNECTION
FOR PROGRAMMABLE RJ45S ARRANGEMENT

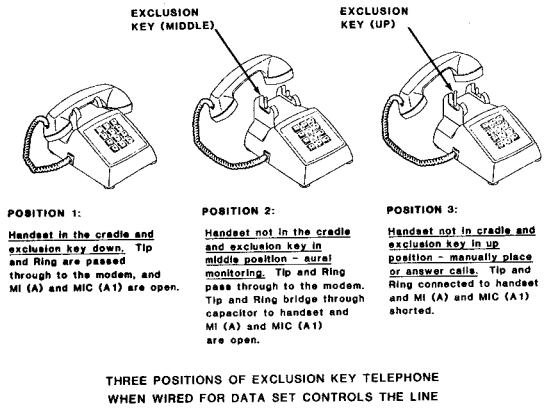
Figure 2-6
Modem Connection with RJ45S

2.6.3 Special Modem Connection for Use with Exclusion Key Telephones

UDS standalone modems will operate with an exclusion key telephone. An exclusion key telephone has a special switch hook button on the left hand side. Special control leads called mode indication (MI/A) and mode indication common (MIC/A1) are connected to the switch. There are two types of exclusion key telephone configurations: "data set controls the telephone line" and "telephone set controls the telephone line."

The "data set controls the line" configuration is most commonly used. In this configuration, there are three positions that the telephone may be placed in: handset in the cradle, handset lifted with exclusion key down and handset lifted with exclusion key up. When the telephone handset is in the cradle, the tip and ring leads are passed through the telephone to the modem and MI(A) and MIC (A1) are open. This allows an incoming call to be routed directly to the modem. When the telephone handset is not in the cradle, the tip and ring leads are passed through the telephone to the modem and MI(A) and MIC(A1) are open. If the telephone is in the middle position (handset lifted with exclusion key down) and is optioned for aural monitoring, the tip and ring leads are bridged through a capacitor to the ear piece of the handset. This permits monitoring of the modem's analog signal. When the handset is not in the cradle and the exclusion key is pulled up, the tip and ring leads are connected to the handset instead of the modem. This permits calls to be manually placed and answered. In the up position of the exclusion key, the MI(A) and MIC(A1) leads are

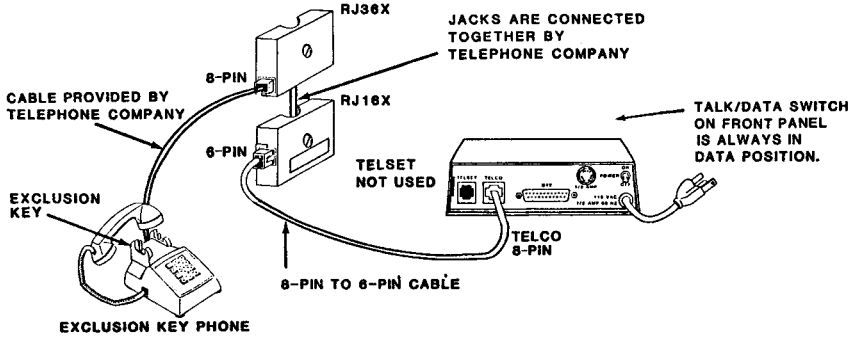
shorted. This tells the modem that the telephone is in a voice mode. After a call is manually placed or answered through the exclusion key telephone, the handset is normally placed in the cradle. This causes the MI(A) and MIC(A1) leads to go from a shorted state to an open state. It is this transition from shorted to open that causes the modem to go off hook and connect to the telephone line.



THREE POSITIONS OF EXCLUSION KEY TELEPHONE
WHEN WIRED FOR DATA SET CONTROLS THE LINE

Figure 2-7
Data Set Controls the Line

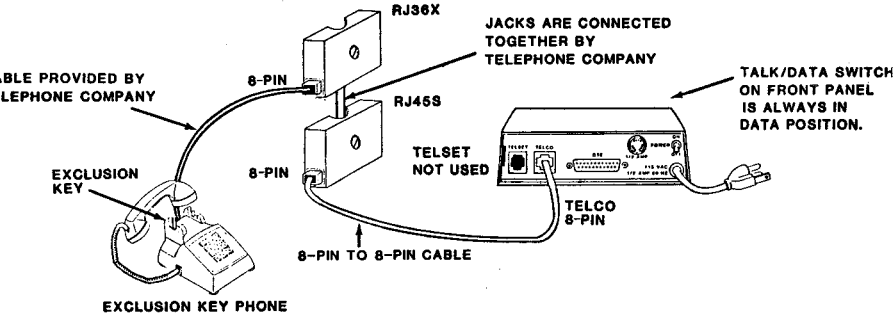
To connect the modem to a permissive RJ16X jack through an exclusion key telephone, an 8-pin to 6-pin modular jack cable (UDS cable code 59, part number 61020418) should be used between the TELCO (8-pin) and the RJ16X (6-pin) jack on the wall. The TELSET jack on the rear of the modem is not normally used. The exclusion key telephone will be connected to an RJ36X (8-pin) jack. This cable will be provided by the telephone company. The RJ36X and RJ16X jack are connected together by the telephone company. The modem's talk/data switch on the front panel should remain in the data position when originating or answering calls.



TYPICAL STANDALONE MODEM CONNECTION
FOR PERMISSIVE RJ16X ARRANGEMENT.
RJ36X SERIES JACK AND EXCLUSION KEY TELEPHONE
(WIRE FOR "DATA SET CONTROLS THE LINE")

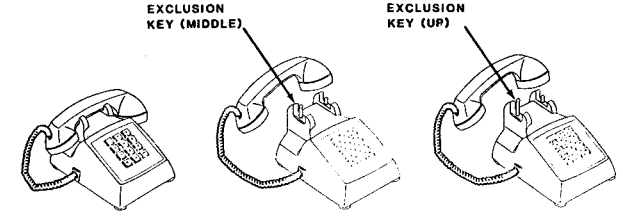
Figure 2-8
Modem/Exclusion Key Telephone Connection with RJ16X

To connect the modem to a data jack (RJ41S or RJ45S), an 8-pin to 8-pin modular jack cable (UDS cable code 66, part number 61020192) should be used between the TELCO jack (8-pin) and the RJ41S or RJ45S (8-pin) jack on the wall. If the RJ41S jack is used, be sure the switch is placed in the PROG position. The TELSET jack on the rear of the modem is not normally used. The exclusion key telephone will be connected to an RJ36X jack (8-pin). This cable will be provided by the telephone company. The RJ36X and the RJ16X jack are connected together by the telephone company. The modem's talk/data switch on front panel should remain in data position when originating or answering calls.



TYPICAL STANDALONE MODEM CONNECTION
FOR PROGRAMMABLE RJ45S ARRANGEMENT.
RJ36X SERIES JACK AND EXCLUSION KEY TELEPHONE
(WIRED FOR "DATA SET CONTROLS THE LINE")

Figure 2-9
Modem/Exclusion Key Telephone Connection with RJ45



POSITION 1:
HANDSET IN THE CRADLE AND EXCLUSION KEY DOWN. TIP AND RING ARE CONNECTED TO THE TELEPHONE. MI (A) AND MIC (A1) ARE OPEN. VOICE IS DISCONNECTED.

POSITION 2:
HANDSET NOT IN THE CRADLE AND EXCLUSION KEY IN MIDDLE POSITION - VOICE MODE. TIP AND RING ARE CONNECTED TO THE TELEPHONE HANDSET. MI (A) AND MIC (A1) ARE SHORTED. MANUALLY PLACE OR ANSWER CALLS.

POSITION 3:
HANDSET NOT IN CRADLE AND EXCLUSION KEY IN UPWARD POSITION - DATA MODE. TIP AND RING ARE PASSED THROUGH TO THE MODEM. MI (A) AND MIC (A1) ARE OPEN.

THREE POSITIONS OF EXCLUSION KEY TELEPHONE
WHEN WIRED FOR "TELEPHONE SET CONTROLS THE LINE"

Figure 2-10
Telephone Set Controls the Line

The "telephone set controls the line" configuration is very seldom used. In this configuration, there are three positions that the telephone may be placed in: handset in the cradle, handset lifted with exclusion key down, and handset lifted with exclusion key up. When the telephone handset is in the cradle, the tip and ring leads are connected to the telephone and the MI(A) and MIC(A1) are open. If the telephone is in the middle position, the tip and ring leads are connected to the telephone handset and the MI(A) and MIC(A1) leads are shorted. In the middle position, calls may be manually placed or answered. In this position, the telephone is in the voice mode. When the handset is not in the cradle and the exclusion key is pulled up, the tip and ring leads are passed through the modem, and the MI(A) and MIC(A1) leads are open. Pulling the exclusion key to the upward state causes the MI(A) and MIC(A1) to go from a shorted to open condition. It is this transition from shorted to open that causes the modem to go Off Hook and connect to the telephone line.

2.7 OPTION STRAP SELECTION

The 208 A/B has several option straps on the PC board inside the unit. These option straps are plugs placed on or removed from pairs of pins on the PC board and are used to change the operating characteristics of the modem. Two different option strap layouts are shown in Figure 2-11.

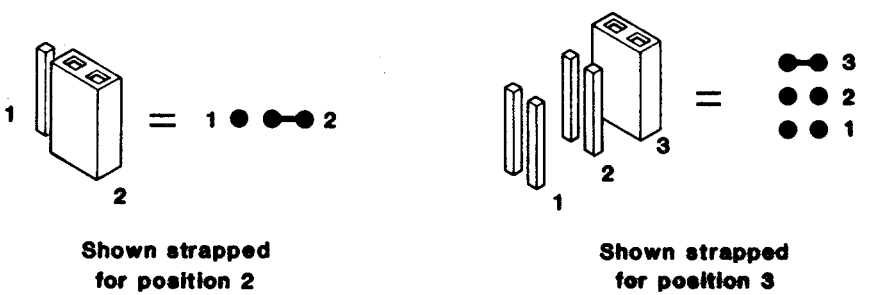


Figure 2-11
Option Strap Layouts

CAUTION

Unplug the power cord before removing the cover of modem.

The cover on the modem has to be removed to change the option straps. To remove the cover:

1) Stand the modem on its side. On each side there are two tabs snapped into slots in the base.

2) Using your thumbs, press the tabs toward the center of the unit (see Figure 2-12) to release the cover.

3) Repeat on the other side.

4) To replace the cover, line up the tabs in the slots. Gently press the top and base together until the tabs snap into place.

After removing the cover, you can locate and change the strap settings. The strap map in Figure 2-13 shows the location of each strap or strap block on the PC board.

2.7.1 Line Type Selection Straps

Seven option straps are used to determine the operating characteristics of the modem when it is connected to a telephone network. These straps are named **LS1, LS2, LS3, LS4, LS5, LS6,** and **LS7.**

LS1

Strap Description: This strap in conjunction with strap **LS2** determines whether the modem is in a private line or direct connection mode. Direct connect refers to a 2-wire half duplex connection to the Public Switched Telephone Network (PSTN).

Strap Options: **PL** (Private Line)
DC (Direct Connection to PSTN)

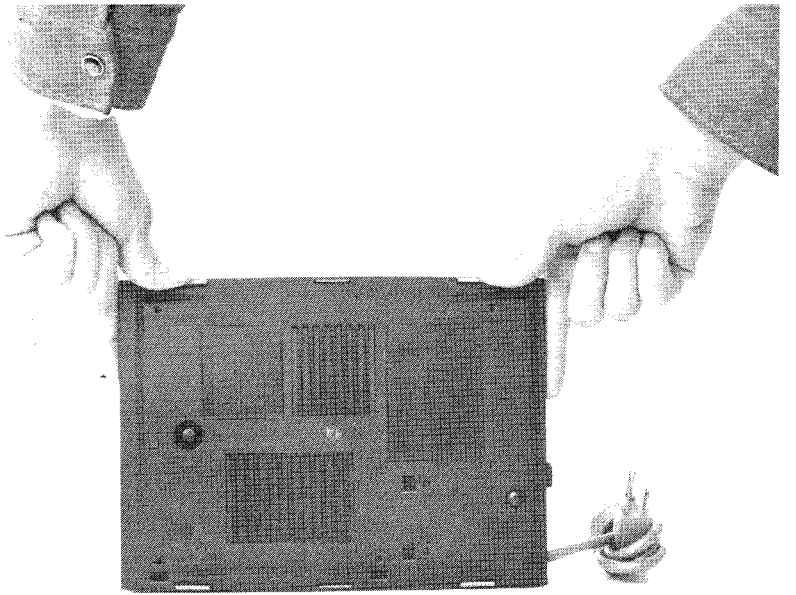


Figure 2-12
Removal of Cover

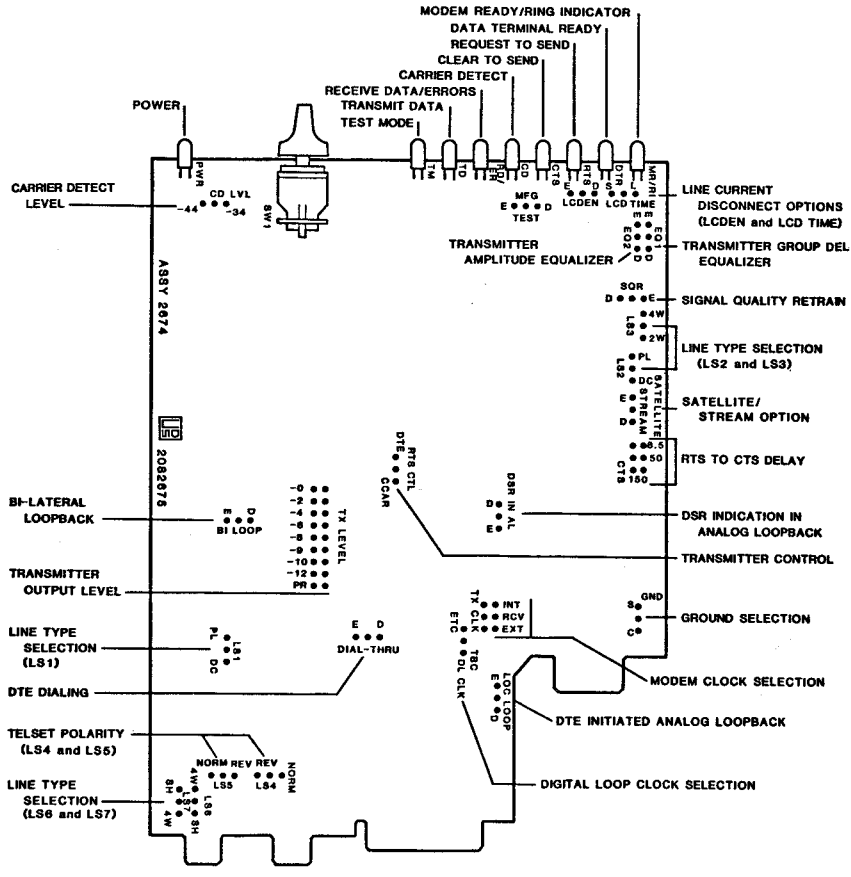


Figure 2-13
Option Strap Location

NOTE:

If the **PL** option is selected for **LS1** then **LS2** must also be strapped in the **PL** position. If the **DC** option is selected for **LS1** then **LS2** must also be strapped in the **DC** position.

LS2

Strap Description: This strap in conjunction with strap **LS1** determines whether the modem is in a private line or direct connection mode. Direct connect refers to a 2-wire half duplex connection to the PSTN.

Strap Options: **PL** (Private Line)
DC (Direct Connection to PSTN)

NOTE:

If the **PL** option is selected for **LS1** then **LS2** must also be strapped in the **PL** position. If the **DC** option is selected for **LS1** then **LS2** must also be strapped in the **DC** position.

LS3

Strap Description: This strap in conjunction with straps **LS6** and **LS7** determines whether the modem is in a 2-wire half duplex or 4-wire full duplex connection mode.

Strap Options: **2W** (Two-wire)
4W (Four-wire)

NOTE:

If the **4W** option is selected for **LS3** then **LS6** and **LS7** must also be strapped in the **4W** position. If the **2W** option is selected for **LS3** then **LS6** and **LS7** must be strapped in the **SH** position.

Two Wire Selection	Four Wire Selection
o 4W	▮ 4W
▮ 2W	o 2W

LS4

Strap Description: This strap in conjunction with strap **LS5** determines whether the polarity of the modem Telset tip and ring is standard or reversed. You may need to change these straps for some brands of push button phones if the dial tone is still present after attempting to dial.

Strap Options: **REV** Reverse, change Telset polarity
NORM Normal Telset polarity

NOTE:

If the **REV** option is selected for **LS4** then **LS5** must also be strapped in the **REV** position. If the **NORM** option is selected for **LS4** then **LS5** must also be strapped in the **NORM** position.

Normal Polarity	Reversed Polarity
o REV	▮ REV
▮ NORM	o NORM

LS5

Strap Description: This strap in conjunction with strap **LS4** determines whether the polarity of the modem Telset tip and ring is standard or reversed. You may need to change these straps for some brands of push button phones if the dial tone is still present after attempting to dial.

Strap Options: **REV** Reverse, change Telset polarity
NORM Normal Telset polarity

NOTE:

If the **REV** option is selected for **LS4** then **LS5** must also be strapped in the **REV** position. If the **NORM** option is selected for **LS4** then **LS5** must also be strapped in the **NORM** position.

Normal Polarity

o REV

NORM

Reversed Polarity

REV

o NORM

LS6

Strap Description: This strap in conjunction with straps **LS1, LS2, LS3** and **LS7** determines whether the modem is in a 2-wire half duplex or 4-wire full duplex connection mode.

Strap Options: **4W** Four-wire leased line
SH (Exclusion Key Phone)

NOTE:

If the **4W** option is selected for **LS6** then **LS3** and **LS7** must also be strapped in the **4W** position. If the **SH** option is selected for **LS6** then **LS3** should be strapped in the **2W** position and **LS7** must be strapped in the **SH** position. The (SH) option allows the use of an exclusion key phone.

4-Wire Full Duplex Selection

4W

o SH

Switch Hook Selection

o 4W

SH

LS7

Strap Description: This strap in conjunction with straps **LS1, LS2, LS3** and **LS6** determines whether the modem is in a 2-wire half duplex or 4-wire full duplex connection mode.

Internal Clock Selection	Receiver "Slave" Clock Selection	External Clock Selection
●— INT	o o INT	o o INT
o o RCV	●— RCV	o o RCV
o o EXT	o o EXT	●— EXT

2.7.3 DTE Dialing

Dial Thru

Strap Description: When enabled, this strap allows pulse dialing through the modem DTE interface. Application of the appropriate signals to the dial pulse (pin 25 of the modem DTE connector) and dial enable (pin 12 of the modem DTE connector) must follow Figure 2-14.

Strap Options: **E** Enable Dialing through the DTE
D Disable Dialing through the DTE

Dial Through Option Enabled	Dial Through Option Disabled
E	o E
o D	D

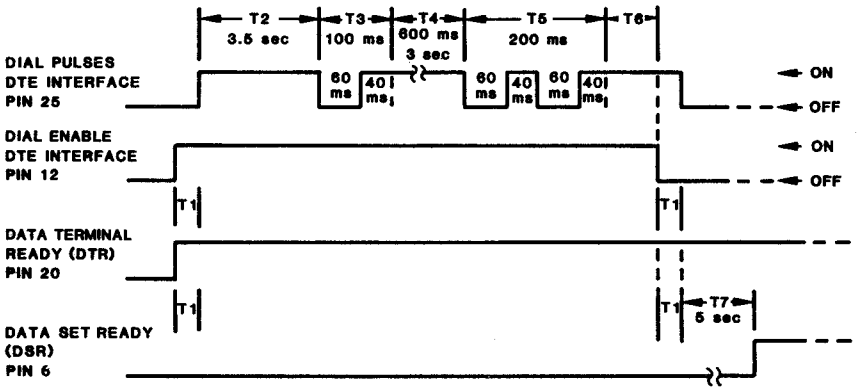


Figure 2-14
Dial Through Timing Diagram

2.7.4 DTE Initiated Analog Loopback

LOC LOOP

Strap Description: When enabled, this strap allows DTE control of the modem analog loop function. With this function enabled, a positive RS-232-C level must be placed on pin 14 of the modem DTE connector to place the modem in analog loopback.

Strap Options: **E** Enable DTE initiated analog loop
D Disable DTE initiated analog loop

Local Loop Option Enabled

Local Loop Option Disabled

2.7.5 Transmitter Control

RTS CTL

Strap Description: This strap allows the modem transmitter either to be controlled by the DTE RTS signal (pin 4 of the modem DTE connector) or be in a constant transmit only condition.

Strap Options: **DTE** Transmitter control is via RTS from the DTE
CCAR Transmitter is Constant Carrier

RTS Control From DTE

Constant Carrier

2.7.6 DSR Indication in Analog Loopback

DSR IN AL

Strap Description: When this strap is enabled, it forces On the DSR (Data Set Ready) line of the modem DTE when the modem function switch is in the AL position.

Strap Options: **E** DSR On in analog loop
D DSR Off in analog loop

DSR in AL Option Enabled

DSR in AL Option Disabled

2.7.7 Satellite/Stream

Stream

Function when used on private line.

Strap Description: When enabled, this strap prevents the modem from transmitting continuously for more than 40 seconds. The transmitter carrier is re-enabled when RTS is turned Off and then On again. This option is normally enabled at remote sites in a multi-drop polled network to prevent malfunctioning data terminal equipment from transmitting continuously and preventing normal network operation.

Strap Options: **E** Enable, limit maximum continuous transmit time to 40 seconds
D Disable continuous transmit timer

Stream Option Enabled

Stream Option Disabled

NOTE:

This option used only in conjunction with 50 or 150 ms CTS Delays and DTE control of RTS.

SATELLITE (2W/DC)

Function when used on dial-up network.

Strap Description: When disabled, an idle tone is generated by the modem in answer mode. For satellite communications applications, enable the Satellite Strap for reliable operation.

Strap Options: **E** Enable satellite operation
D Disable satellite operation

Satellite Enabled

Satellite Disabled

2.7.8 Signal Quality Retrain

SQR

Strap Description: When enabled, this strap forces the modem receiver adaptive equalizer to re-initialize when signal quality is poor.

Strap Options: **E** Enable, retrain if poor signal quality
D Disable signal quality retrain

Signal Quality Retrain Option Enabled

Signal Quality Retrain Option Disabled

2.7.9 RTS to CTS Delay

CTS

Strap Description: This strap sets the time delay between the On state of the modem DTE RTS signal (pin 4 of modem DTE connector) to the On state of the modem DTE CTS (pin 5 of modem DTE connector). Three choices of CTS delay are available, namely **8.5** millisecond, **50** millisecond, and **150** millisecond. The **8.5** millisecond RTS to CTS delay is used in constant carrier operation where the data terminal equipment must see a CTS transition after RTS.

The **50** millisecond RTS to CTS delay is used for normal controlled carrier operation. The **150** millisecond RTS to CTS delay is used on telephone circuits where echo suppressors are used or where Bell 208 compatibility is required.

Strap Options:

8.5 8.5 millisecond RTS to CTS delay
50 50 millisecond RTS to CTS delay
150 150 millisecond RTS to CTS delay

8.5 Millisecond CTS Option Enabled	50 Millisecond CTS Option Enabled	150 Millisecond CTS Option Enabled
●—● 8.5 o o 50 o o 150	o o 8.5 ●—● 50 o o 150	o o 8.5 o o 50 ●—● 150

2.7.10 Ground Selection

GND

Strap Description: This strap allows connection of modem signal ground to the ac power system ground (modem chassis ground).

Strap Options:

S Connect signal ground to chassis ground
C Isolate chassis ground from signal ground

Connect Signal Ground to Chassis Ground	Isolate Chassis Ground from Signal Ground
S o C	o S C

2.7.11 Line Current Disconnect Options

LCD TIME

Strap Description: This strap sets the minimum time that the telephone line current must be interrupted before the modem will hang up the line. The **S** option of this strap sets a line current interruption length of 8 milliseconds for line disconnection. The **L** option of this strap sets a line current interruption length of 90 milliseconds for line disconnection.

NOTE:

The **LCDEN** strap must be in the **E** position for a line current interruption to automatically disconnect the telephone line.

Strap Options: **S** Short Line Current Disconnect (8 ms)
L Long Line Current Disconnect (90 ms)

Short Disconnect Time - 8 ms

Long Disconnect Time - 90 ms

LCDEN

Strap Description: When enabled, this strap allows the modem to automatically disconnect from the phone line when a valid line current interruption has been detected. A valid line current interruption is a line current disruption for a minimum length of either 8 or 90 milliseconds. The line current disconnection time is set by the **LCD TIME** strap.

Strap Options: **E** Enabled Line Current Disconnect
D Disabled Line Current Disconnect

Line Current Disconnect Option Enabled

Line Current Disconnect Option Disabled

2.7.12 Transmitter Group Delay Equalizer

EQ1

Strap Description: This strap option allows the use of a fixed value group delay transmitter pre-equalizer. This equalizer should only be used on phone lines with very poor group delay characteristics.

NOTE:

Neither **EQ1** or **EQ2** should be used on good quality lines. These options should only be enabled when line quality is marginal and the modem cannot reliably pass data without transmitter equalization.

NOTE:

This strap should only be enabled on lines where the group delay characteristics are very poor. If this strap is enabled on good quality lines, a pre-distortion will be placed on the transmitter signal. This unnecessary distortion will cause the modem to make errors.

Strap Option:

E Enable, transmitter group delay pre-equalizer
D Disable transmitter group delay pre-equalizer

Group Delay Pre-Equalizer Option Enabled

Group Delay Pre-Equalizer Option Disabled

2.7.13 Transmitter Amplitude Equalizer

EQ2

Strap Description: This strap option allows the use of a fixed value high end transmitter pre-emphasis. This equalizer should only be used on phone lines with poor high end amplitude characteristics. This strap is commonly used in cases where phone lines are unloaded and thus have more amplitude attenuation above 1.8 kilo-hertz than below 1.8 kilo-hertz.

NOTE:

Neither **EQ1** or **EQ2** should be used on good quality lines. These options should only be enabled when line quality is marginal and the modem cannot reliably pass data without transmitter equalization.

NOTE:

This strap should only be enabled on lines where high frequency amplitude characteristics are poor. When enabled, this option places a 3 dB high frequency pre-emphasis on the transmitter signal. If this strap is enabled on good quality lines, a pre-distortion will be placed on the transmitter signal. This unnecessary distortion will cause the modem to make errors.

Strap Option: **E** Enable Transmitter Pre-emphasis
D Disable Transmitter Pre-emphasis

High End Amplitude Pre-Emphasis Option Enabled

High End Amplitude Pre-Emphasis Option Enabled

2.7.14 Transmitter Output Level

TX LVL

Strap Description: This strap selects the modem transmitter level (in dBm) that will be placed on the telephone network. This strap is factory set for **-9** dBm. This strap should not have to be changed unless an externally programmable telephone jack is used or unless a private line mode is used.

NOTE:

Most telephone networks do not allow levels greater than -9 dBm to be placed on their equipment. Therefore, before placing this strap in the range of **0** to **-8** dBm, contact your local telephone company.

Strap Option: **0, -2, -4, -6, -8, -9, -10, -12** dBm levels.
PR externally programmable.

o o 0
o o - 2
o o - 4
o o - 6
o o - 8
●—● - 9 (-9 dBm shown)
o o -10
o o -12
o o PR

2.7.15 Carrier Detect Level

CD LVL

Strap Description: This strap selects the signal level at which the modem will detect a valid carrier. The carrier detect circuit has a carrier detect hysteresis of approximately 5 dBm. This hysteresis is to prevent carrier detect chatter at levels near the threshold level.

NOTE:

All carrier detect levels are measured ±2 dBm.

Strap Option: **-34** -34 dBm carrier ON level, -39 dBm carrier OFF level
-44 -44 dBm carrier ON level, -49 dBm carrier OFF level

-34 dBm Carrier Detect Option Enabled

-44 Carrier Detect Option Enabled

2.7.16 Digital Loop Clock Selection

DL CLK

Strap Description: This strap selects the source for digital loop clocking. If the **TBC** option is selected, then a baud rate clock (1600 hertz square wave) is provided by the modem and is used to clock the data through the modem digital interface. This option allows the user to check the modem/computer interconnection by only supplying data to the RS-232-C interface.; If the **ETC** strap option is selected then a clock must be supplied by the data terminal equipment to pin 24 of the modem DTE.

Strap Option: **ETC** External transmitter clock

TBC Internal transmitter baud clock

External Transmitter Clock Option Enabled

Internal Transmitter Baud Clock Option Enabled

2.7.17 Bilateral Loopback

BI LOOP

Strap Description: This strap applies only to the modem analog loopback test function in a 4-wire leased line configuration. With the **E** option selected and the modem strapped for 4-wire leased line, the Telco line receiver circuit will be looped back to the Telco transmit circuit with a 12 dBm gain. With the **D** option selected, the receiver circuit is presented a 600 ohm load but the receive circuit is not looped back to the transmit circuit.

Bilateral Loopback Option Enabled

Bilateral Loopback Option Disabled

DSR IN AL	E	D, if you want DSR Off in AL
SATELLITE/ STREAM	D	
SQR	D	
CTS	50	
LCD TIME	L	
LCDEN	D	
EQ1	D	
EQ2	D	
MFG TST	D	Always disabled
TX LVL	0	
CD LVL	-34	
DL CLK	TBC	ETC, if you want to supply the digital loop clock
BI LOOP	D	E, if you want the receive line looped to the transmit line in analog loop.
GND	C	

Chapter 3
Operation

Contents

3.1 GENERAL

This chapter contains a functional description of the 208A/B's controls and indicators; an operating procedure consisting of power turn-on, operating instructions and power turn-off, and a modem test procedure for use by the operator. Complete and check out the installation procedures in Chapter 2 before attempting to operate the modem. Following initial power turn-on, the modem is designed to operate totally unattended.

3.2 CONTROLS AND INDICATORS

Except for the ac power switch which is located on the rear of the unit, all controls and indicators are located on the front panel (see Figure 3-l). Eight LEDs monitor the status of the modem/DTE interface signals. An additional LED monitors the power supply and will be On when the modem is operating.

The front panel controls and indicators and their functions are described in Section 3.5.

3.3 AC POWER OPERATION

No elaborate power-up procedure is needed with the 208A/B. After you have set the internal straps as needed, turn the power switch on the rear panel to On.

3.4 MODEM FUNCTIONAL VERIFICATION

After a communications link between the local and remote modems has been established, your UDS 208A/B will operate unattended.

After you power off and strap the modem as required and replace the top cover, perform the brief functional test described below.

1. Make sure that the top cover is correctly installed and locked in place.

2. Disconnect all cables from the modem DTE, TELSET and TELCO connectors.

3. Place the front panel switch in the ST position.

4. Plug in the ac power cord and turn the power ON to the modem with the rear panel switch. The POWER LED and the TM LED should come ON immediately. The CD LED should come ON and stay ON. If the POWER LED fails to illuminate then proceed to Step 6. If the CD LED fails to illuminate or if the RD LED flickers or remains on constantly then the unit is defective.

5. If the POWER LED fails to illuminate, turn off the modem by unplugging the power cord and check the fuse for continuity. Remove the fuse by pushing the fuseholder on the rear panel forward and counterclockwise. If the fuse has continuity, reseat the fuse and fuse holder and repeat steps 1 through 5 of this test. If the unit continues to fail or if the fuse is blown then the unit is defective and should be returned for repairs.

6. If the unit passes sequences 1 through 5, the unit is functional and should operate normally.

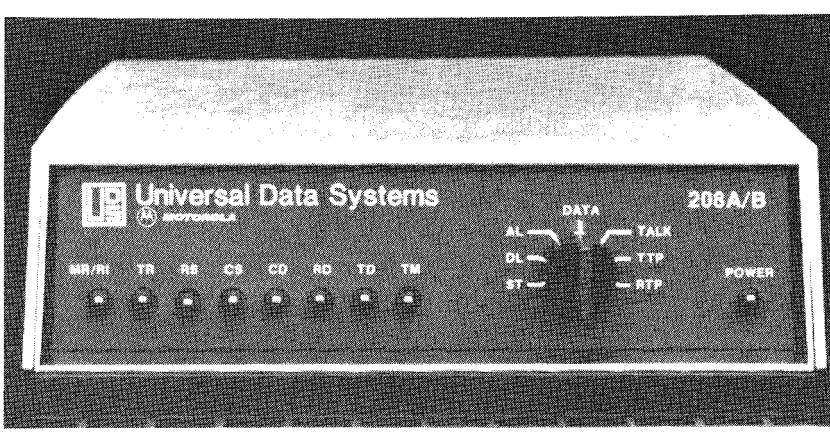


Figure 3-1
Front Panel Controls and Indicators

3.5 FRONT PANEL FUNCTION SWITCH POSITIONS AND INDICATORS

The following sections describe the function of each switch position and LED indicator.

3.5.1 Function Switch

TALK ..... With the switch in this position during dial line (PSTN) operation, the TELSET jack at the rear of the modem is connected to the telephone line. The modem is also given a switch hook signal but does not go off hook. A call can be originated or answered with a telephone connected to the TELSET jack.

When the switch is moved from the TALK position to DATA, the modem goes off hook if DTR is On, and the TELSET is disconnected from the line. If a call is answered in the talk mode, an answer back tone is provided prior to entering the data mode. The TALK position defaults to the data mode in private line operation.

DATA ..... This position of the switch permits regular modem operation. No diagnostic functions are enabled.

ST ..... When the switch is in this position , (Self Test) the modem operates in the same manner as the ANALOG LOOPBACK position, except that the transmit data is replaced by a mark hold and DSR is unconditionally held Off (the RD LED flashes during receive data errors).

DL ..... (Digital Loopback)

With the switch in this position, the DTE functions are looped back as follows:

- Transmit Data is connected to Receive Data.
- If the ETC position is selected for the DL CLK strap, the external transmit clock is connected to receive clock. If the TBC position is selected for the DL CLK strap, the data clocks are provided by the modem.
- RTS is connected to CTS and DCD.
- SQR is held On.
- DSR is held Off.
- In 4-wire lease line operation, the modem receiver and transmitter provide a digital repeater function.

AL ..... (Analog Loopback)

When the switch is in this position, the transmitter is internally looped to the receiver.

In 4-wire mode, the receive line is looped to the transmit line through a +12 dBm gain amplifier if the biloop feature is enabled. If the BI LOOP feature is disabled (BI LOOP strap in the D position), then the receive line is terminated in 600 ohms and the transmit line is not looped.

In 2-wire private line mode, the line is terminated in 600 ohms.

In 2-wire dial mode, the modem is forced on hook.

AL is also used to initialize the test modes RTP and TTP.

TTP (Transmit Test Pattern) — With the switch in this position, the modem operates in the same manner as the DATA position except that the DSR LED is held Off unconditionally, transmit data is replaced by a mark hold, and the RD LED flashes during receive data errors. Data Terminal Ready is overridden. This test can be run with or without DTR on.

RTP (Receive Test Pattern) — With the front panel switch in this position, the modem receiver is set up to detect a scrambled mark test pattern. The modem will give a visual indication of anyreceived data errors by illuminating the RD LED. This test can be run with or without DTR on.

3.5.2 LED Indicators

RS (Request to Send) — This LED is On when RTS is On and the function switch is in the DATA position. The LED also is On when RTS is On and the switch is in the DL position. The RTS LED is On when a positive voltage level is present on pin 4 of the RS-232-C interface.

CD (Carrier Detect) — When the CD LED is On and the function switch is not in the DL position, this LED denotes the presence of a carrier wave at the modem receiver.

TD (Transmit Data) — This LED is On for space data and Off for mark data.

MR/RI (Modem Ready/ Ring Indicator) — This LED is also On when the modem is off hook and line current is present. The LED is On when a ring signal is received.

This LED is On when DSR is On. In dial-up mode, this LED is On when the modem is off hook and not in a self test mode.

CS (Clear to Send)	This LED is On when CTS is On.
RD (Receive Data)	This LED is On for space data and Off for mark data. This LED will flash for receive data errors when the switch is in either the RTP or TTP modes.
TR (Terminal Ready)	This LED indicates the state of the modem DTE data terminal ready signal line (DTR).
TM (Test Mode)	This LED indicates that a test mode has been selected.

3.6 ORIGINATING A CALL

A call may be originated from the UDS 208A/B modem in two ways. The first and most commonly used is to originate a call using a regular tone type or rotary telephone. The second method is to originate a call from an exclusion key telephone. These methods will be further explained in the following sections.

3.6.1 Originating a Call Using a Regular Rotary or Tone Type Telephone

Step 1 With the modem properly connected and strapped, turn the modem On using the modem rear panel power switch.

Step 2 If planning to run RTP or TTP tests and DTR is off, first put the modem function switch in the AL position to initialize the call.

Step 3 Place the modem function switch in the TALK position.

Step 4 Lift the receiver of the telephone. You should hear a dial tone. If you do not hear a dial tone, check the modem TELCO and TELSET cable connections. Once you hear a dial tone, dial the number of the remote site. If the dial tone is still present after attempting to dial a digit, the TELSET polarity needs reversing. Straps **LS4** and **LS5** need to be placed in the **REV** position for TELSET polarity reversal. Once the number is successfully dialed and the remote site modem answers (indicated by a high-pitched 2025 Hertz tone followed by a low-pitch 600 Hertz tone), place the modem front panel switch in the DATA position. The originating modem should go off hook (MR/RI LED should illuminate) and be ready for data transmission.

3.6.2 Originating a Call Using an Exclusion Key Telephone

Step 1: With the modem properly connected and strapped, turn On the modem using the rear panel power switch. See Section 2.6.3 for further details on cable connection.

Step 2: Place the modem function switch in the DATA position.

Step 3: Lift the receiver of the telephone and pull up the exclusion key on the left side of the telephone cradle. You should hear a dial tone. If no dial tone is heard, check the modem cable connections. Once a dial tone is heard, dial the number of the remote site. Once the number is successfully dialed and the remote site modem answers (indicated by a high-pitched 2025 Hertz tone followed by a low-pitched 600 Hertz tone), hang up the telephone. Hanging up the phone will push down the exclusion key and thus connect the phone line to the modem. The originating modem should go off hook (MR/RI LED should illuminate) and be ready for data transmission.

3.7 AUTOMATICALLY ANSWERING A CALL

Step 1: With the modem properly connected and strapped, turn On the modem using the rear panel power switch.

NOTE

If the modem will be used to automatically answer calls, place the **LCDEN** strap in the **E** position and the **LCD TIME** strap in the **S** position. Without line current disconnect enabled, the modem will not hang up the phone until a negative RS-232-C level is placed on the DTR line (pin 20) of the modem DTE interface.

Step 2: Place a positive RS-232-C level on the DTR line (pin 20) of the modem DTE interface connector. The modem is now ready to answer a call.

NOTE

If planning to run RTP or TTP tests, put the function switch in AL position first, then to RTP or TTP. The modem will then be ready to auto answer a call and begin transmitting or receiving marks with or without DTR On.

3.8 DIAL THROUGH

To use the dial through feature of the modem, apply the appropriate modem DTE signals according to the dial-through timing diagram in Section 2.7.3.

Chapter 4
Testing and Fault Isolation

Contents

4.1 GENERAL

As communication networks become increasingly complex so do the problems associated with modems, telephone lines and data terminal equipment. To control these problems, the network manager must have a large repertoire of diagnostic capability to quickly locate and alleviate the network problem. The 208A/B provides all the necessary test features to isolate the communications problems that can occur in even the most complex networks. The following sections relate the 208A/B test features to fault isolation techniques. This allows a more efficient troubleshooting technique.

4.2 SYSTEM FAULT ISOLATION

The first step in fault isolation is defining the type of network in which the modem is used. Once the network type has been defined, the problems associated with each particular type of modem/network interconnection can be addressed.

1. If the network is a 2-wire, public switched telephone network (common dial-up network), turn to Section 4.3.

2. If the network is a 2-wire, leased line network, turn to Section 4.4.

3. If the network is a 4-wire, leased line network, turn to Section 4.5.

4.3 TROUBLESHOOTING A 2-WIRE PSTN INSTALLATION

There are four tests you can use to troubleshoot the modem's installation in a 2-wire PSTN. **TEST 1** lets you determine if the modem is functioning correctly. **TEST 2** checks the option strapping for the type of installation in which the modem is used. **TEST 3** checks the connection of the modem to the data terminal. **TEST 4** lets you determine if the modem/telephone connection and the telephone line are functioning correctly.

4.3.1 Test 1, Modem Functional Test (Figure 4-1)

Step 1: Turn the power to the modem OFF with the rear panel power switch and unplug the ac line cord from the receptacle.

Step 2: Make sure that the top cover is correctly installed and locked in place.

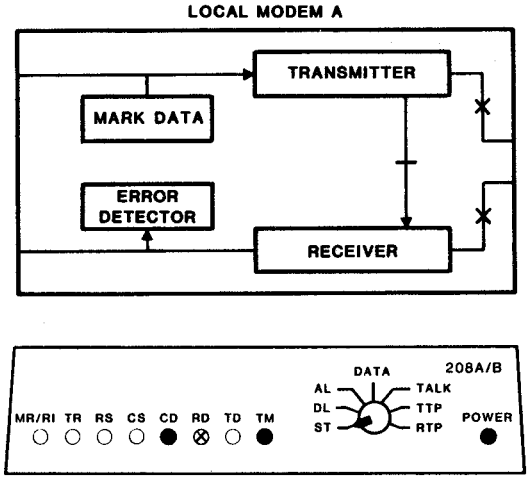
Step 3: Disconnect all cables from the modem DTE, TELSET and TELCO connectors.

Step 4: Place the front panel function switch in the **ST** position. Plug the ac line cord into the receptacle.

Step 5: Turn ON the power to the modem. The POWER LED and the TM LED should illuminate immediately. The CD LED should illuminate and remain in this state.

Step 6: If the POWER LED fails to illuminate, turn the modem OFF and unplug the ac line cord. Check the ac line fuse. The fuse may be removed by pushing the fuse holder on the rear panel forward and counterclockwise. If the CD LED fails to illuminate or if the RD LED flickers or remains on constantly then the unit is defective.

If the fuse has continuity, reseat the fuse and fuse holder and repeat Steps 1 through 5 of this test. If the unit continues to fail or if the fuse is blown, the unit is defective and should be returned for repairs.



LEGEND

PATH CLOSED

PATH OPEN

LED STATUS

ON

OFF

MAY BE ON OR FLASHING

NOTES

1. RD LED constantly On or flashing indicates received data errors.

Figure 4-1
Test 1 - Self Test

If the modem passes all the steps in Test 1, it is functional. However, the modem may still not function properly in the network if it is strapped incorrectly. To verify that the unit is strapped correctly, implement Test 2.

4.3.2 Test 2 - Option Strap Check (Figure 4-2)

This is a check to verify that the modem is strapped correctly for a 2-wire PSTN.

Turn the power to the modem OFF with the rear panel power switch and unplug the ac line cord from the receptacle. Remove the modem's top cover and check the strap settings against the table below. If the strap settings are set according to the table, the modem is strapped correctly and should function normally.

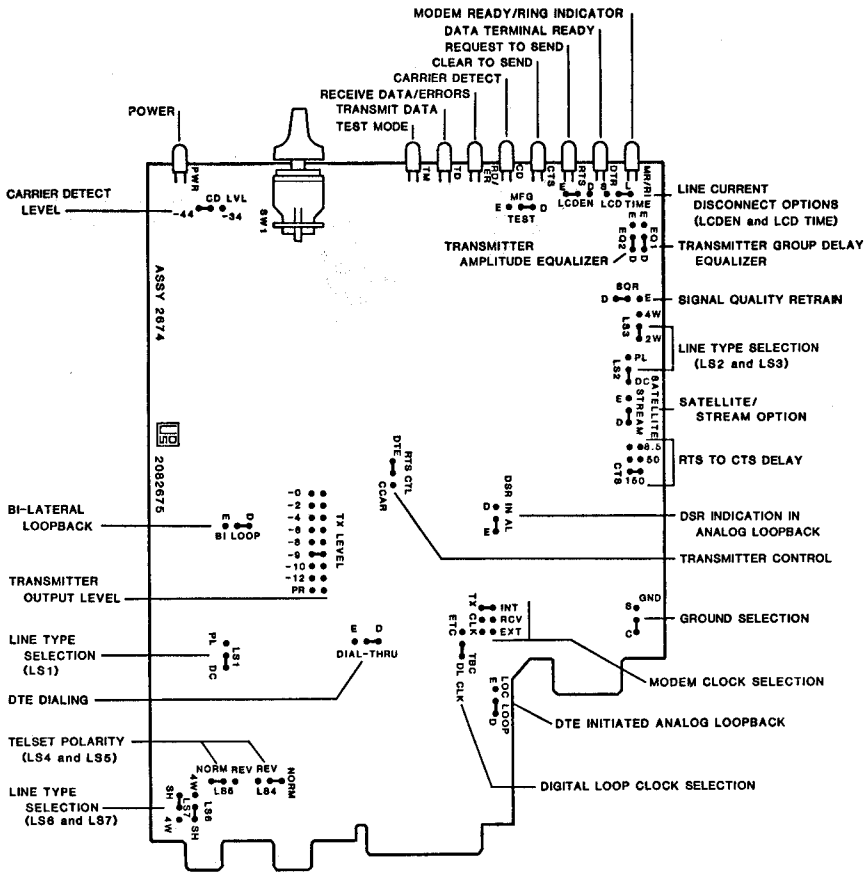


Figure 4-2
Strapping for 2-Wire PSTN

Test 2

Strap Name	Strap Setting	Comments
LS1	DC	DC is the only valid setting
LS2	DC	DC is the only valid setting
LS3	2W	2W is the only valid setting
LS4	NORM	**Note:** If a tone type telephone is being used as the modem Telset and the dial tone is still present after attempting to dial a digit, set **LS4** and **LS5** to **REV** .
LS5	NORM	
LS6	SH	SH is the only valid setting
LS7	SH	SH is the only valid setting
TX CLK	INT	EXT, if you want to supply a clock to the modem
DIAL THRU	D	E, if you want to dial from DTE **Note:** See Section 2.7.3 for dial thru timing
LOC LOOP	D	E, if you want to control AL from DTE **Note:** If this option strap is in the **E** position, a positive RS-232-C level must be placed on pin 14 of the modem DTE connector to activate analog loopback via the DTE. If this option strap is in the **E** position, a negative RS-232-C level must be placed on pin 14 of the modem DTE connector to disable analog loopback via the DTE. With this option enabled, pin 14 of the modem should never be left floating.
RTS CTL	DTE	
DSR IN AL	E	D, if you want DSR Off in analog loop.
SATELLITE/ STREAM	D	**Note:** Select the E position for satellite communication.
CTS	150	The 50 millisecond option may be used if fast line turnaround time is needed but this is not normally the case on the public switched network. **Note:** If the 50 millisecond option is chosen, all modems with which this modem communicates should be strapped for the 50 millisecond option also.
GND	C	
LCD TIME	L	
LCDEN	E	**Note:** The modem will not automatically hang up after line current has been interrupted unless this option is enabled. If the modem is going to be used frequently in the answer mode then this option should be enabled.

Test 2 (cont.)

Strap Name	Strap Setting	Comments
EQ1	D	Enable only if Telco line has poor group delay characteristics
EQ2	D	Enable only if Telco line has poor amplitude characteristics
MFG TST	D	Always disabled
TX LVL	-9	Never set this in the range 0 to -8 dBm without first consulting your local phone company
CD LVL	-44	-34 setting should not be used
DL CLK	TBC	ETC, if you want to supply the clock for digital loopback
BI LOOP	D	D is the only valid setting
SQR	D	

4.3.3 Test 3 - Connection of Modem to the Data Terminal (Analog Loopback Figure 4-3).

Step 1: Turn the power to the modem OFF with the rear panel power switch and unplug the ac line cord from the receptacle.

Step 2: Connect the data terminal equipment cable to the modem.

Step 3: Place the modem function switch in the **AL** position.

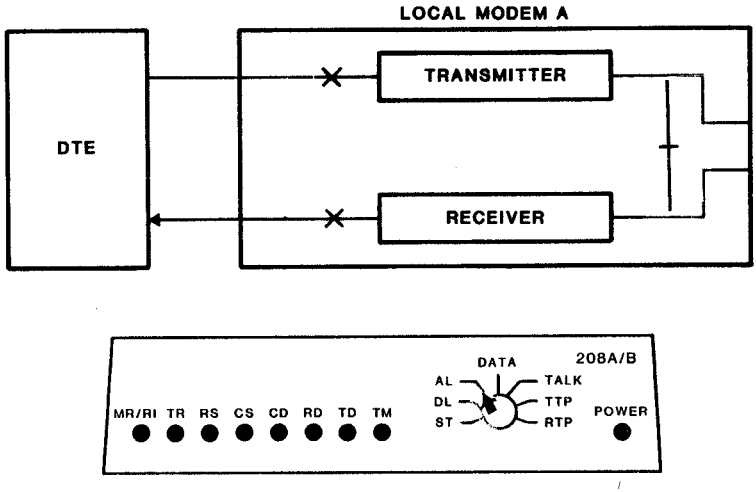
Step 4: Plug the ac line cord into the receptacle and turn the power ON to the modem.

Step 5: Data may now be sent through the DTE cable to the modem DTE interface. This data is looped back by the modem to the data terminal equipment.

This analog loopback feature checks the DTE cable connectors and the data terminal equipment.

If the modem passes Tests 1, 2, and 3, the problem lies in the telephone line or telephone line connection cables.

To isolate the problem further execute Test 4.



LEGEND

PATH CLOSED

PATH OPEN

LED STATUS

ON

OFF

MAY BE ON OR FLASHING

NOTES

1. The TR LED indicates the state of the data terminal DTR signal. DTR is not used in this test and therefore may be On or Off.

Figure 4-3
Test 3 - Analog Loopback Test

4.3.4 Test 4 - Telephone Line Integrity Test (Figure 4-4)

Test 4 determines if the modem/telephone connection and the telephone line are functioning correctly.

For this test, you will need another Bell compatible 208 A/B modem.

Step 1: Both modem A and B must be functioning correctly. If either of the modems have not been evaluated by running Tests 1 through 3 on them, do so before proceeding.

Step 2: Local modem A will be used to originate the test and therefore should have a telephone plugged into the TELSET connector.

Step 3: Have the remote site operator place the modem B function switch in the **TTP** test position. Modem B should have the **LCDEN** strap in the **E** position.

Step 12: Repeat Test 4, Steps 1 through 5. If local modem A does not indicate errors now, the telephone circuit is of marginal quality for data transmission. If local modem A still indicates errors, the line quality is not adequate for data transmission.

Step 13: Contact your local phone company if your phone line quality is unacceptable for data transmission.

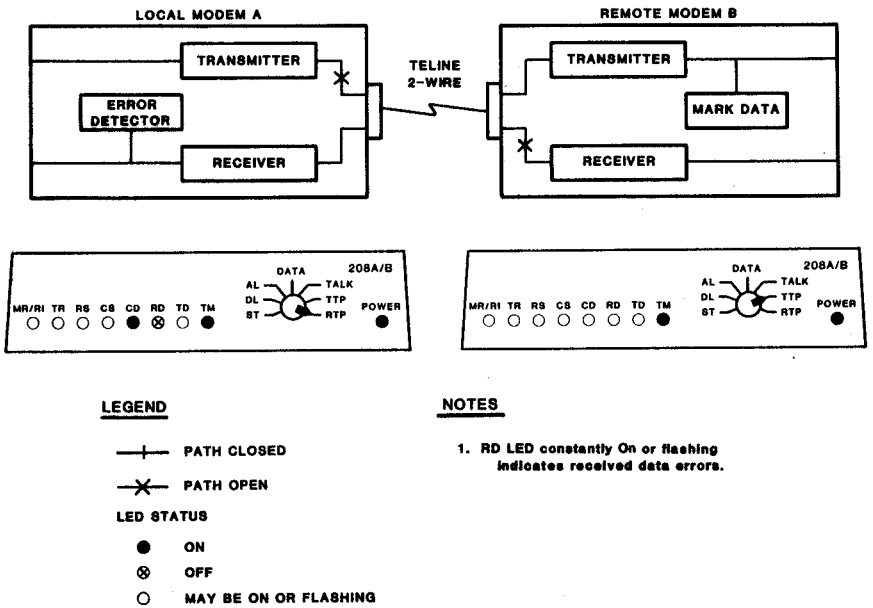


Figure 4-4
Test 4

4.4 TROUBLESHOOTING A 2-WIRE LEASED LINE INSTALLATION

There are four tests you can use to troubleshoot the modem's installation in a 2-wire leased line network. **Test 5** lets you determine if the modem is functioning correctly. **Test 6** checks the option strapping for the type of installation in which the modem is used. **Test 7** checks the connection of the modem to the data terminal. **Test 8** lets you determine if the modem/telephone connection and the telephone line are functioning correctly.

4.4.1 Test 5 - Modem Functional Test (Figure 4-5)

Step 1: Turn the power to the modem OFF with the rear panel power switch and unplug the ac line cord from the receptacle.

Step 2: Make sure that the top cover is correctly installed and locked in place.

Step 3: Disconnect all cables from the modem DTE, TELSET and TELCO connectors.

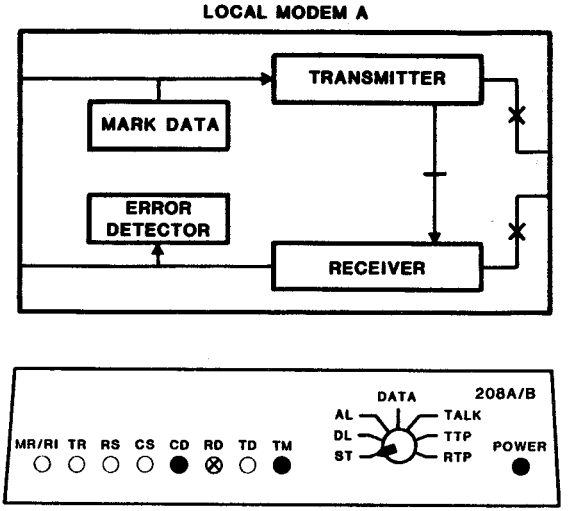
Step 4: Place the function switch in the **ST** position. Plug the ac line cord into the receptacle.

Step 5: Turn ON the power to the modem. The **POWER** LED and the **TM** LED should illuminate immediately. The **CD** LED should turn On and stay On.

Step 6: If the **POWER** LED fails to illuminate, turn the modem OFF and unplug the ac line cord. Check the ac line fuse. The fuse may be removed by pushing the fuse holder on the rear panel forward and counterclockwise. If the CD LED fails to illuminate or if the RD LED flickers or remains on constantly, then the unit is defective.

If the fuse has continuity, reseat the fuse and fuse holder and repeat Steps 1 through 5 of this test. If the unit continues to fail or if the fuse is blown, then the unit is defective and should be returned for repairs.

If the modem passes all the steps in Test 5, it is functional. However, the modem may still not function properly in the network if it is strapped incorrectly. To verify that the unit is strapped correctly, implement Test 6.



LEGEND

PATH CLOSED

PATH OPEN

LED STATUS

ON

OFF

MAY BE ON OR FLASHING

NOTES

1. RD LED constantly On or flashing indicates received data errors.

Figure 4-5
Test 5 - Self Test

4.4.2 Test 6 - Option Strap Check (Figure 4-6)

Test 6 is a check that the modem is strapped correctly for a 2-wire leased line network. Turn the power to the modem OFF with the rear panel power switch and unplug the ac line cord from the receptacle. Remove the modem top cover and check to the strap settings against the table below. If the strap settings are set according to the table, the modem is strapped correctly and should function normally.

Strap Name	Strap Setting	Comments
LS1	PL	PL is the only valid setting
LS2	PL	PL is the only valid setting
LS3	2W	2W is the only valid setting
LS4	NORM	
LS5	NORM	
LS6	SH	SH is the only valid setting
LS7	SH	SH is the only valid setting
TX CLK	INT	EXT, if you want to supply a clock to the modem
DIAL THRU	D	
LOC LOOP	D	E, if you want to control AL from DTE **Note:** If this option strap is in the E position, a positive RS-232-C level must be placed on pin 14 of the modem DTE connector to activate analog loopback via the DTE. If this option strap is in the E position then a negative RS-232-C level must be placed on pin 14 of the modem DTE connector to disable analog loopback via the DTE. With this option enabled pin 14 of the modem DTE should never be left floating.
RTS CTL	DTE	The CCAR setting may be used in cases where transmit only is necessary
DSR IN AL	E	D, if you want DSR off in analog loopback
SATELLITE/ STREAM	D	**NOTE:** If this strap is in the E position, then the maximum continuous transmit time is limited to 40 seconds.
CTS	50	The 150 millisecond option may be used if fast line turnaround cannot be achieved due to poor line quality. **NOTE:** If the 150 millisecond option is chosen, all modems with which this modem communicates should be strapped for the 150 millisecond option also.
LCD TIME	L	
LCDEN	D	

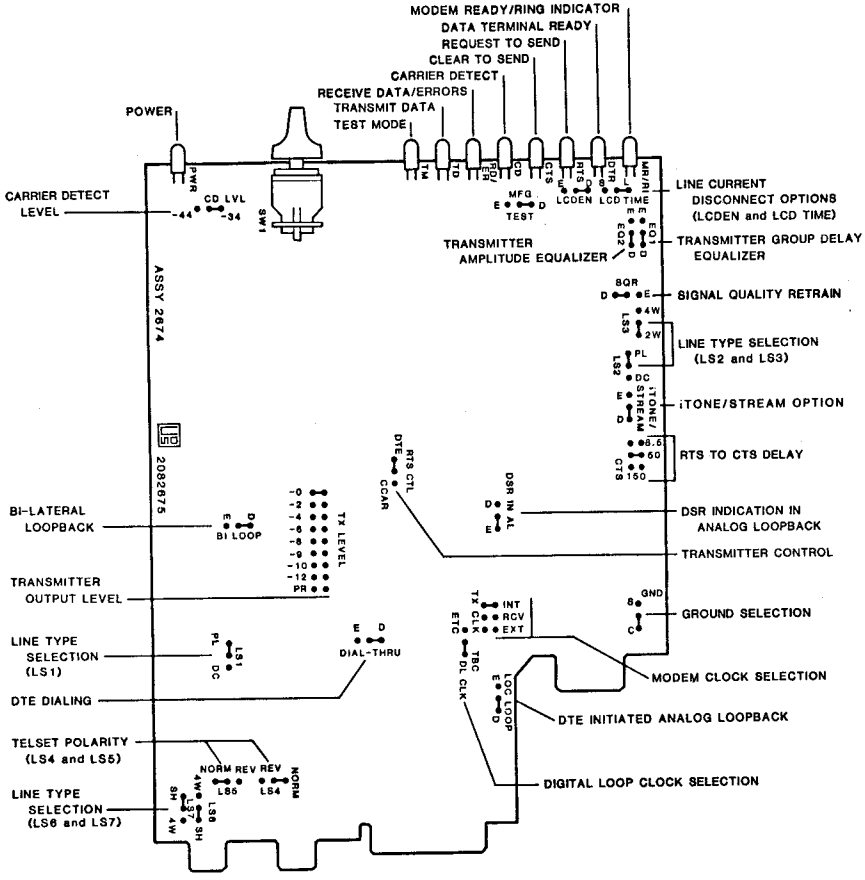
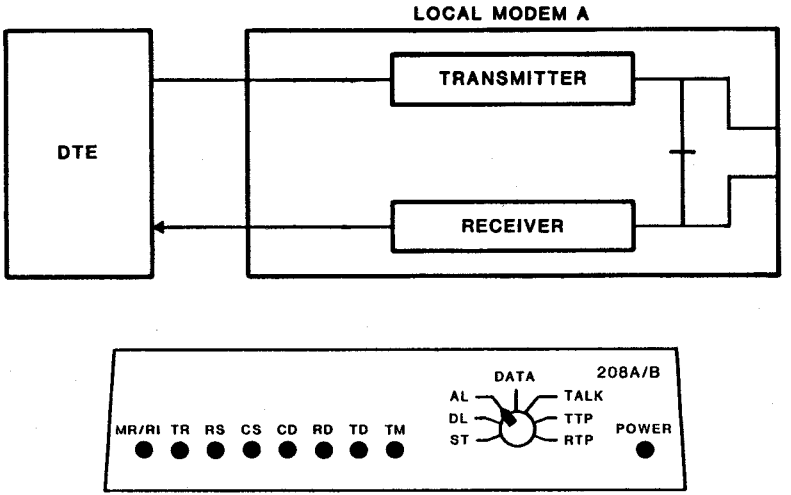


Figure 4-6
Strapping for 2-Wire Leased Line Network



LEGEND

PATH CLOSED

PATH OPEN

LED STATUS

ON

OFF

MAY BE ON OR FLASHING

NOTES

1. The TR LED indicates the state of the data terminal DTR signal. DTR is not used in this test and therefore may be On or Off.

Figure 4-7
Test 7 - Analog Loopback Test

Note:

When the **DL CLK** option strap is in the **TBC** position, the modem will clock data through the modem DTE interface at the baud rate (1600) and not the bit rate (4800 bits per second).

If the modem passes Tests 5, 6 and 7, the problem lies in the telephone line, or modem telephone line connection cables. To isolate the problem further(execute Test 8.

4.4.4 Test 8 - Telephone Line Integrity Test (Figure 4-8)

Test 8 determines if the modem/telephone connection and the telephone line are functioning correctly. For this test you will need another Bell compatible 208 A/B modem.

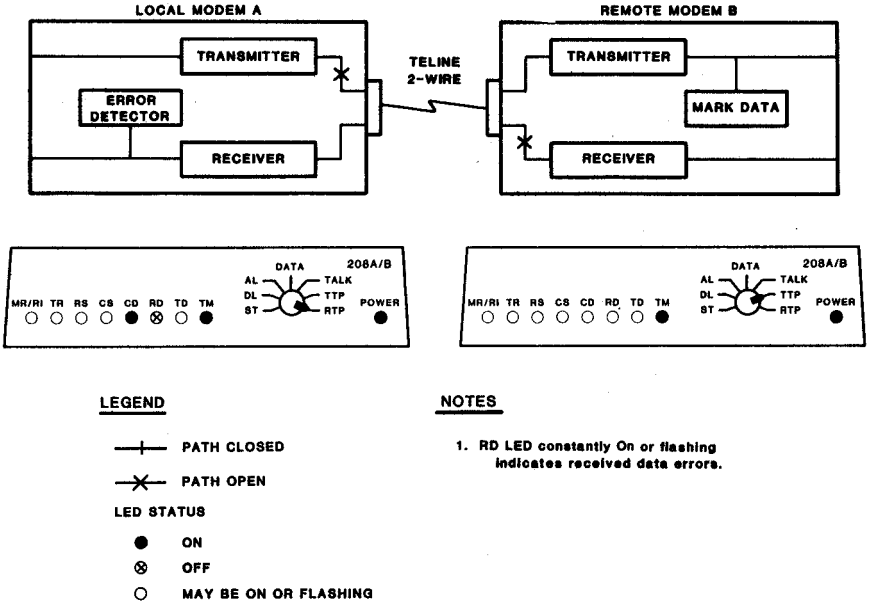
Step 1: Both modem A and B must be functioning correctly. If either of the modems has not been evaluated by running Tests 5 through 7 on them, do so before proceeding.

Step 2: Place local modem A function switch in the **TTP** position. Have the remote modem B operator place the modem B function switch in the **RTP** position.

Step 3: Have the remote modem B operator check the **RD** LED for illumination. If this LED illuminates, the telephone line/telephone line to modem interconnection is suspect.

Step 4: Turn **OFF** the power to the modem with the rear panel power switch and unplug the ac line cord from the receptacle.

Step 5: Remove and reseat the Telco connector cables at the local modem A site and at the remote modem B site. Repeat Test 8, steps 1 through 3. If the remote unit B continues to indicate errors, the phone line is the source of the problem.



LEGEND

PATH CLOSED

PATH OPEN

LED STATUS

ON

OFF

MAY BE ON OR FLASHING

NOTES

1. RD LED constantly On or flashing indicates received data errors.

Figure 4-8
Test 8

4.5 TROUBLESHOOTING A 4-WIRE LEASED LINE INSTALLATION

There are four tests you can use to troubleshoot the modem's installation in a 4-wire leased line network. **Test 9** lets you determine if the modem is functioning correctly. **Test 10** checks the option strapping for the type of installation in which the modem is used. **Test 11** checks the connection of the modem to the data terminal. **Test 12** lets you determine if the modem/telephone connection and the telephone line are functioning correctly.

4.5.1 Test 9 - Modem Functional Test (Figure 4-9)

Step 1: Turn the power to the modem OFF with the rear panel power switch and unplug the ac line cord from the receptacle.

Step 2: Make sure that the top cover is correctly installed and locked in place.

Step 3: Disconnect all cables from the modem DTE, TELSET and TELCO connectors.

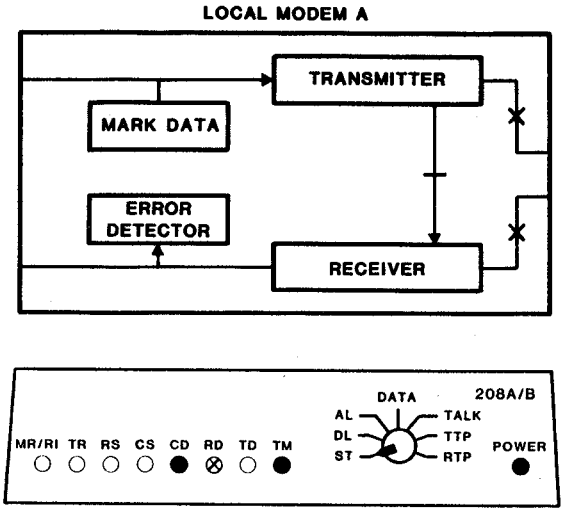
Step 4: Place the front panel switch in the **ST** position. Plug the ac line cord into the receptacle.

Step 5: Turn the power to the modem **ON** . The **POWER** LED and the **TM** LED should illuminate immediately. The **CD** LED should turn On and stay On.

Step 6: If the **POWER** LED fails to illuminate, turn the power to the modem OFF and unplug the ac line cord. Check the ac line fuse. The fuse may be removed by pushing the rear panel fuse holder forward and counterclockwise. If the CD LED fails to illuminate or if the RD LED flickers or remains on constantly then the unit is defective.

If the fuse has continuity, reseat the fuse and fuse holder and repeat Steps 1 through 5 of this test. If the unit continues to fail or if the fuse is blown, the unit is defective and should be returned for repairs.

If the modem passes all the steps in Test 9, it is functional. However, the modem may still not function properly in the network if it is strapped incorrectly. To verify that the unit is strapped correctly, implement Test 10.



LEGEND

PATH CLOSED

PATH OPEN

LED STATUS

● ON

⊗ OFF

○ MAY BE ON OR FLASHING

NOTES

1. RD LED constantly On or flashing indicates received data errors.

Figure 4-9
Test 9 - Self Test

4.5.2 Test 10 - Option Strap Check (Figure 4-10)

Turn power to the modem OFF with the rear panel power switch and unplug the ac line cord from the receptacle. Remove the modem top cover and check the strap settings against the table below. If the strap settings are set according to the table, the modem is strapped correctly and should function normally.

Strap Name	Strap Setting	Comments
LS1	PL	PL is the only valid setting
LS2	PL	PL is the only valid setting
LS3	4W	4W is the only valid setting
LS4	Norm	
LS5	Norm	
LS6	4W	4W is the only valid setting
LS7	4W	4W is the only valid setting
TX CLK	INT	EXT, if you want to supply a clock to the modem
DIAL THRU	D	
LOC LOOP	D	E, If you want to control AL from DTE **NOTE:** If this option strap is in the **E** position, a positive RS-232-C level must be placed on pin 14 of the modem DTE connector to activate analog looptack via the DTE. If this option strap is in the **E** position, a negative RS-232-C level must be placed on pin 14 of the modem DTE connector to disable analog loopback via the DTE. With this option enabled pin 14 of the modem DTE should never be left floating.
RTS CTL	DTE	The CCAR setting may be used in cases where transmit only is necessary
DSR IN AL	E	D, if you want DSR off in analog loop.
SATELLITE/ STREAM	D	**Note:** If this strap is in the **E** position, then the maximum continuous transmit time is limited to 40 seconds.
CTS	50	The 150 millisecond option may be used if fast line turnaround cannot be achieved due to poor line quality. **Note:** If the 150 millisecond option is chosen, all modems with which this modem communicates should be strapped for the 150 millisecond option also.

LCD TIME	L	
LCDEN	D	
EQ1	D	Enable only if Telco line has poor amplitude characteristics
EQ2	D	Enable only if Telco line has poor group delay characteristics
GND	C	
MFG TST	D	Always disabled
TX LVL	0	
CD LVL	-34	-44 setting should not be needed and should not be used on very noisy Telco lines
DL CLK	TBC	ETC, if you want to supply the clock for digital loopback
BI LOOP	D	
SQR	D	

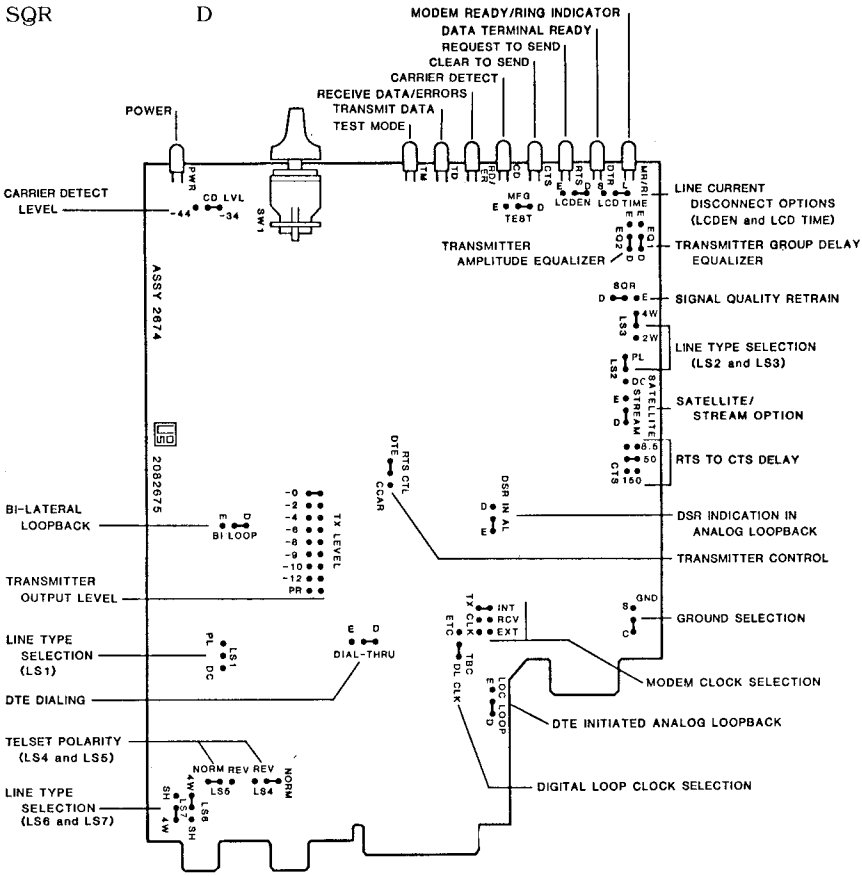


Figure 4-10
Strapping for 4-Wire Leased Line Network

4.5.3 Test 11 - Connection of Modem to the Data Terminal (Analog Loopback Test, Figure 4-11)

Step 1: Turn the power to the modem OFF with the rear panel power switch band and unplug the ac line cord from the receptacle.

Step 2: Connect the data terminal equipment cable to the modem.

Step 3: Place the modem front panel switch in the **AL** position. Plug the ac line back in the receptacle.

Step 4: Turn the power to the modem ON.

Data may now be sent through the DTE cable to modem DTE interface. This data will be looped back by the modem to the data terminal equipment.

By using this analog loopback feature, the DTE cable, connectors and data terminal equipment can be functionally verified.

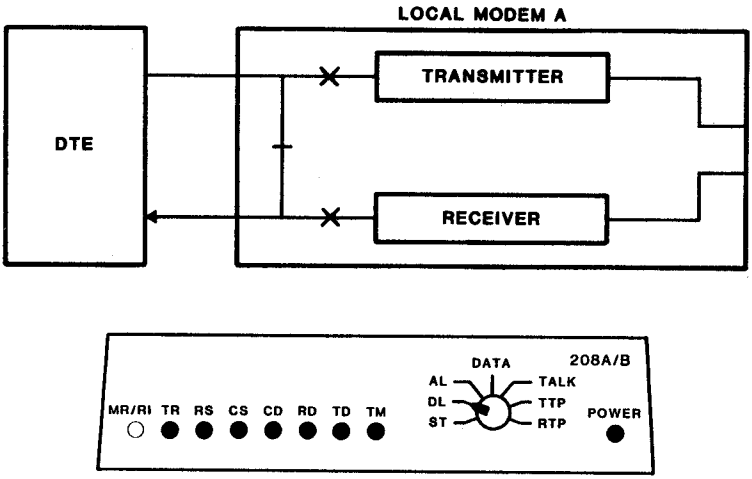
If the modem passes Tests 9, 10 and 11, the problem lies in the telephone line, modem, or telephone line connection cables.

4.5.4 Test 12 - Telephone Line Integrity Test (Figure 4-12)

Test 12 determines the integrity of the telephone line or modem/telephone line interconnection. For this test you need a second Bell compatible 208A/B modem.

Step 1: Both modem A and B must be functioning correctly. If either of the modems has not been evaluated by running Tests 9 through 11 on it, do so before proceeding.

Step 2: Place the local modem A function switch in the **TTP** position. Have the remote modem B operator place the modem B function switch in the **RTP** position.



LEGEND

PATH CLOSED

PATH OPEN

LED STATUS

ON

OFF

MAY BE ON OR FLASHING

NOTES

1. The TR LED indicates the state of the data terminal DTR signal. DTR is not used in this test and therefore may be On or Off.

Figure 4-11
Test 11 - Digital Loopback Test

Step 3: Have the remote modem B operator observe the **RD** LED for illumination. If this LED illuminates, the telephone line pair from A to B or the telephone line/modem interconnection is suspect.

Step 4: To check the integrity of the telephone line pair from B to A, place the local modem A function switch in the **RTP** position. Have the remote modem B operator place the modem B function switch in the **TTP** position. Observe the modem A front panel **RD** LED for illumination. If this LED illuminates, the telephone line pair from B to A or the telephone line modem interconnection is suspect.

Step 5: Turn the power to the modems OFF with the rear panel power switch and unplug the ac line cord from the receptacle.

Step 6: Reseat all Telco connectors at modems A and B and repeat Test 12, steps 1 through 4. If the unit(s) still fail, the line(s) are not of sufficient quality to transmit data.

Step 7: Contact your local phone company for assistance with line quality problems.

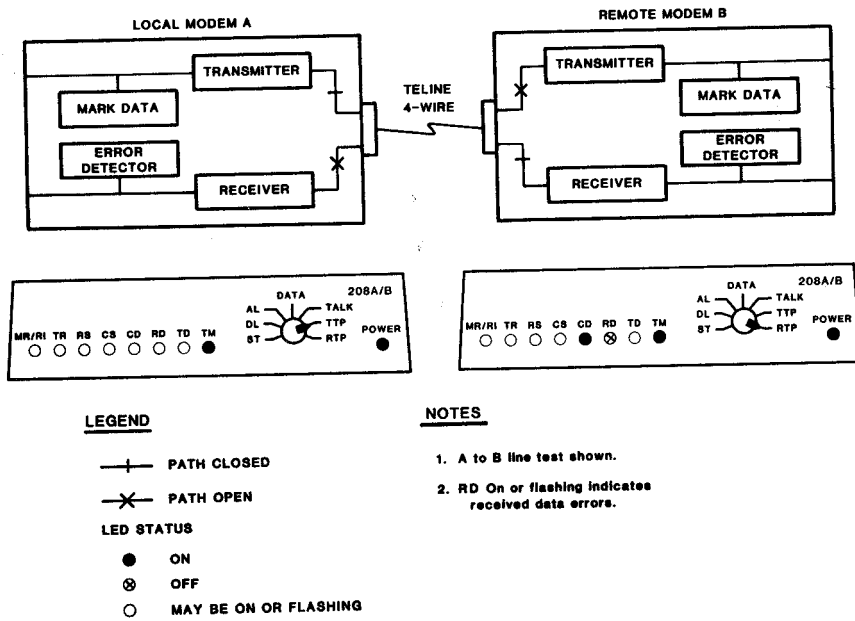


Figure 4-12
Test 12

Chapter 5
Principles of Operation

Contents

This chapter contains a brief overview of the major building blocks of the UDS 208A/B modem. These major building blocks are the power supply, the transmitter, and the receiver.

5.1 THE MODEM POWER SUPPLY

The standalone 208A/B modem unit contains a linear type power supply. All the power supply components are contained on the modem board except for the ac step down transformer.

The maximum ac power input to the unit at a line voltage of 110 Vac is 10 watts. The maximum dc power used by the unit is 3.5 watts.

5.2 THE MODEM TRANSMITTER

The UDS 208 A/B transmitter is a 4800 bits per second synchronous quadrature modulated transmitter with a Bell 208A/B compatible data scrambler. The transmitter provides the option of a strap selectable fixed pre-equalizer to improve performance on poor quality phone lines.

5.3 THE MODEM RECEIVER

The UDS 208A/B receiver is a 4800 bit per second synchronous quadrature demodulator with a Bell compatible 208A/B descrambler. The receiver front-end contains an improved adaptive equalizer that provides for dynamic telephone line equalization.