

201BC/AS



**MOTOROLA**

## **PREFACE**

This manual is written for users of the 201BC/AS Modem. Please read it before you change any jumper on the printed circuit board or operate the modem. This manual includes the following:

<b>Chapter 1</b>	<b>Introduction - Contains introductory information;</b>
<b>Chapter 2</b>	<b>Installation - Contains instructions for mechanical and electrical installation of the modem;</b>
<b>Chapter 3</b>	<b>Option Selection - Describes strap and switch option selections;</b>
<b>Chapter 4</b>	<b>Operation - Outlines modem operating procedures plus descriptions of the controls and indicators;</b>
<b>Chapter 5</b>	<b>Diagnostics - Describes tests that can locate and isolate network component malfunctions;</b>
<b>Chapter 6</b>	<b>Maintenance - Provides maintenance information;</b>
<b>Appendix A</b>	<b>Specifications;</b>
<b>Appendix B</b>	<b>Strap Options;</b>
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## **Chapter 1 Introduction**

### **GENERAL**

The 201BC/AS (see Figure 1-1) is a 2400 bits per second modem designed for synchronous or asynchronous data communications. The unit combines two modem types:

- 201B for leased line operation
- 201C for operation on the Public Switched Telephone Network (PSTN).

This combination and the addition of local and remote diagnostic tests provide flexibility in designing communication networks using any synchronous or asynchronous data protocol at 2400 bps. The 201BC/AS is available in either a 115 Vac or a 230 Vac powered version.

When used as a 201B in leased line operation, data is transferred in half-duplex mode on 2-wire and in full-duplex mode on 4-wire lines. Switched line operation in 201C mode is always half-duplex.

Numerous options are provided so the 201 BC/AS may be tailored to your particular application. These options are set by straps and switches on the modem printed circuit board.

Control of local and remote diagnostic tests is provided by a rotary switch on the front panel. Modem operation is monitored by observing the nine LED indicators on the front panel.

The printed circuit board containing the 201BC/AS also fits in the UDS RM-16 shelf. Contact your nearest UDS Sales office or UDS if this installation could be useful to you.



## 1 Introduction

### RELIABILITY

Reliability is assured by a conservative electrical design and parts selection program as well as by extensive testing and environmental conditioning of components and assemblies, followed by an acceptance test of the finished product.

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

### SPECIFICATIONS

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

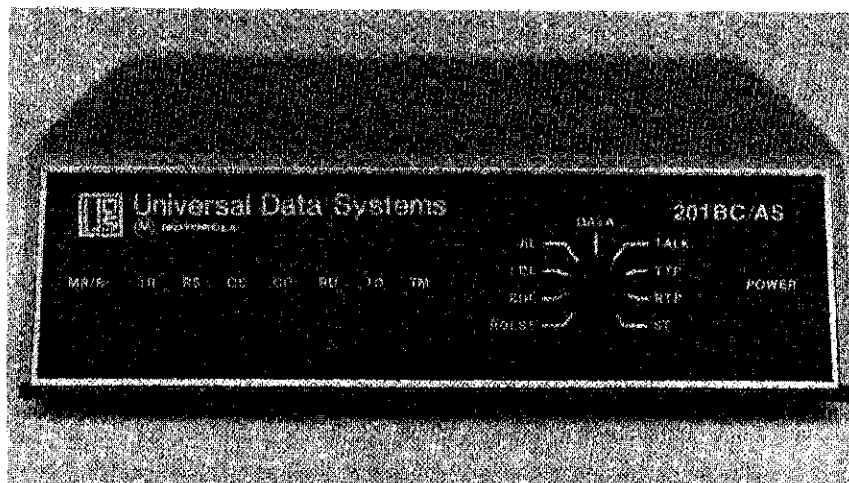


Figure 1-1  
201 BC/AS



## **Chapter 2 Installation**

### **GENERAL**

This chapter provides the 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 shipper's agent and the nearest UDS representative or Universal Data Systems, 5000 Bradford Drive, Huntsville, Alabama 35805-1953, for advice and assistance. The telephone number is (205) 721-8000. UDS suggests that the shipping container and packing material be retained for future shipment.

### **SITE PREPARATION**

Install the modem within six feet of a 115 or 230 Vac grounded outlet as required for the specific model and no further than 50 feet from the terminal equipment. The 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 an unobstructed flow of cooling air.

## **2**

### **Installation**

#### **TELEPHONE LINES**

##### **Leased Lines**

On leased lines, 2-wire or 4-wire connection is possible. The telephone company will install the leased line and wall jack at your site. The line connects to the modem at the 8-position TELCO receptacle. Pin assignments are shown in Table 2-1.

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

**Table 2-1**  
**Leased Line Pin Assignments**

##### **Switched Lines (PSTN)**

Switched lines also connect to the modem at the 8-position TELCO receptacle. Pin assignments are shown in Table 2-2. Some pins are not used depending on the type of data jack installed.

Pin	Name	Description
1	Not used	
2	Not used	
3	MI or (A)	Switch-hook signal for exclusion key
4	R	Ring side of telephone line
5	T	Tip side of telephone line
6	MIC or (A1)	Switch-hook signal for exclusion key
7	PR	Programming resistor (not used in permissive)
8	PC	Programming resistor common (not used in permissive)

**Table 2-2**  
**Switched Line Pin Assignments**

<b>Connection Types</b>	<p>Permissive - This is the most common type of telephone line connection. Normal voice telephone lines are used in this arrangement. The type of jack the telephone company usually installs is an RJ11. Signal quality may suffer with this type.</p> <p>Programmable - The other type of telephone line connection is called programmable. The telephone company applies higher standards to the quality of programmable lines. In some installations, the programmable arrangement will give better performance than permissive. The telephone company installs a special jack for this, typically an RJ45 or RJ41. If an RJ41 jack is installed, it must be selected to programmable with the integral switch.</p>
<b>Telephone Handset</b>	<p>TELSET receptacle provides the connection for a telephone to make normal voice calls. Voice and data cannot be used at the same time.</p>
<b>Exclusion Key Telephone</b>	<p>A special exclusion key telephone can be used with the modem. In this arrangement, the telephone company installs a special jack and telephone that gives control of the telephone line to the handset. This feature allows the phone to be used for normal voice calls when the phone is located away from the modem. If an exclusion key phone is used in permissive mode, the jack used will be an RJ16. Programmable jacks already have connections for the exclusion key phone, but the telephone company must be told what options to install. The options are shown in Table 2-3.</p>

Connection	Option
A1	Telephone set controls line
A2	Data set controls line
B3*	No aural monitoring
B4	Aural monitoring provided
C5	Pushbutton dial phone
C6	Rotary dial phone
D7	Switch hook indication
D8*	No switch hook indication

\* Normally selected

**Table 2-3**  
**Exclusion Key Telephone Options**

**Telephone Line  
Connection**

If you are operating on leased lines, connect a cable to the modem jack labeled TELCO. Figure 2-1 shows how you connect this cable to the telephone lines.

As stated previously for switched phone lines, the telephone company will install a jack that connects to the modem with a cable. This cable plugs into the modem jack labeled TELCO. A typical hook-up for a permissive arrangement is shown in Figure 2-2. The programmable arrangement is similar.

**Telephone Handset  
Connection**

If a normal 500 series telephone is used it connects with a cable between the phone and the modem jack labeled TELSET. See Figure 2-2.

If an exclusion key phone is desired, the telephone company will wire it to the connection arrangement shown in Figure 2-3.

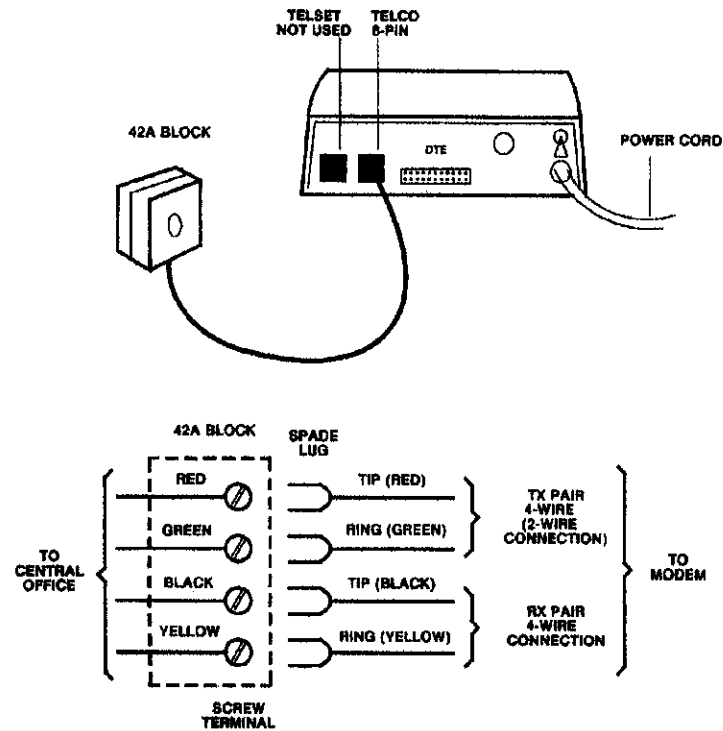
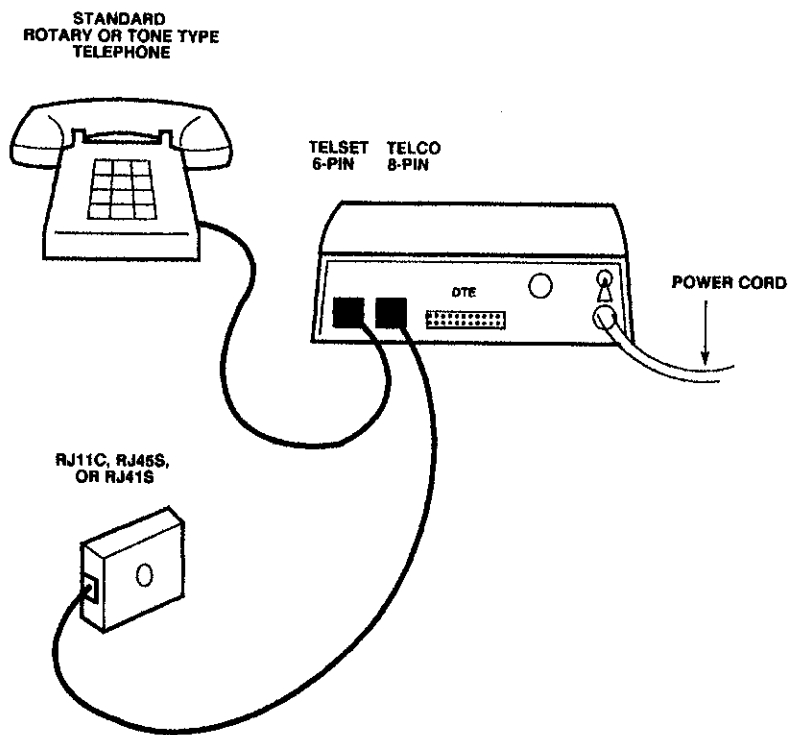
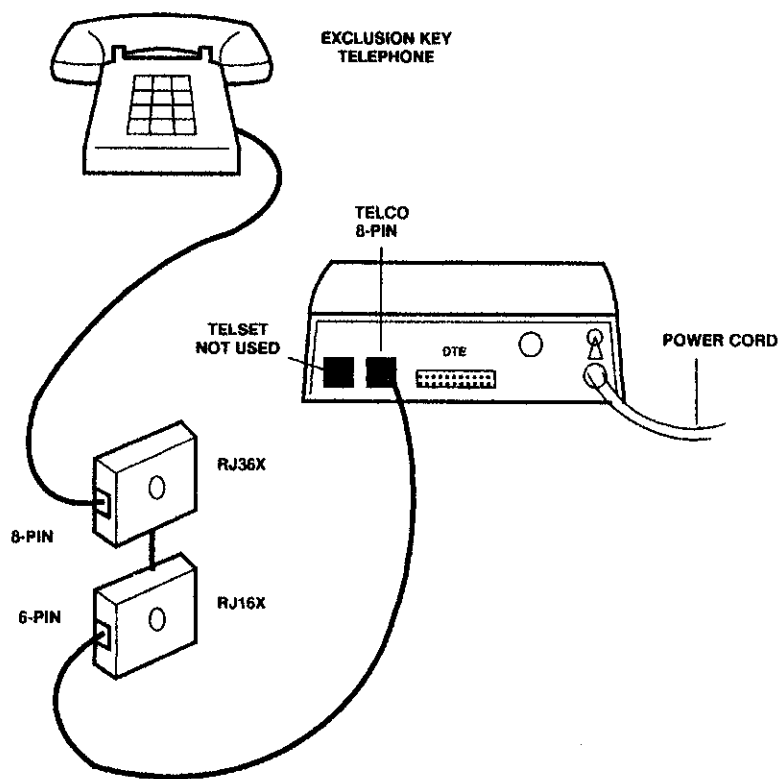


Figure 2-1  
Leased Line Cabling



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**Figure 2-2**  
**Phone Line and Handset Cabling with Standard Telephone**



**Figure 2-3**  
**Phone Line and Handset Cabling with Exclusion Key Telephone**



## 2 Installation

### UDS Telephone Cables

The cables used for connection between the modem and the various TELCO jacks are illustrated in Figure 2-4.

### DTE EIA-232C INTERFACE CONNECTION

The interface between the modem and DTE uses the 25-pin connector labeled DTE. Use a small blade screwdriver to fasten the cable in place. This interface is further described in the Operation chapter.

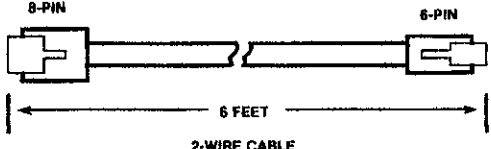
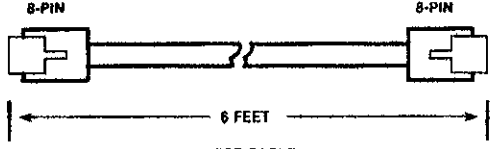
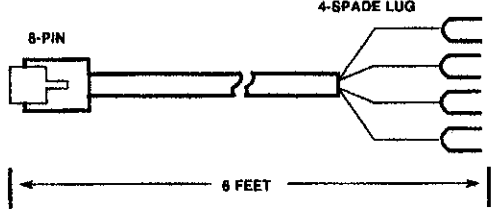
UDS PART NUMBER	MODEM CONNECTION	MECHANICAL LAYOUT	TELCO CONNECTION	TELCO JACK
610202020301	8-PIN		6-PIN	RJ11C PERMISSIVE
610201920301	8-PIN		8-PIN	RJ45S PROGRAMMED RJ41S (PROG ONLY)
610206360000	8-PIN		4-SPADE LUG	PRIVATE LINE

Figure 2-4  
UDS Telephone Cables



## **Chapter 3 Option Selection**

### **GENERAL**

The modem is factory configured to current industry standards. Because of the number of possible applications, most modems will require some option changes to fit into a particular network. This chapter describes the various options and how to apply them. Appendices B and C feature strap and switch option tables.

### **STRAPS AND SWITCHES**

#### **Removing Cover**

To select or inspect options, remove the modem cover.

#### **WARNING**

Do not remove the cover unless the power cord is unplugged.

Stand the unit on its side with the bottom facing you. Release the cover by pressing the locking tabs through the slots with your thumbs (see Figure 3-1). Repeat this with the tabs on the other side and remove the cover. The front of the cover is inscribed "front" on the underside.

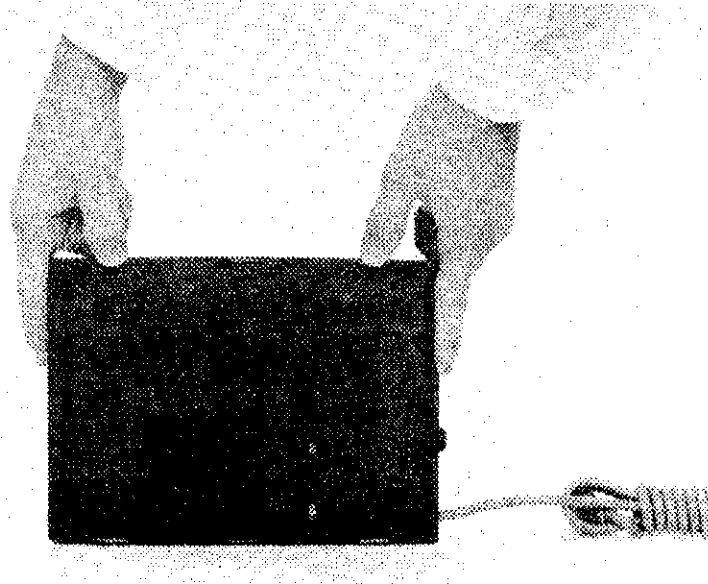
#### **CSA SECURITY REQUIREMENTS**

On modems sold in Canada, security latches are inserted alongside two of the locking tabs. To disengage those locking tabs, the security latches must first be pried out with a small screwdriver.

Replace the cover by aligning front and rear guide grooves, then the lock tabs in the slots and press until they engage.

### **3** **Option Selection**

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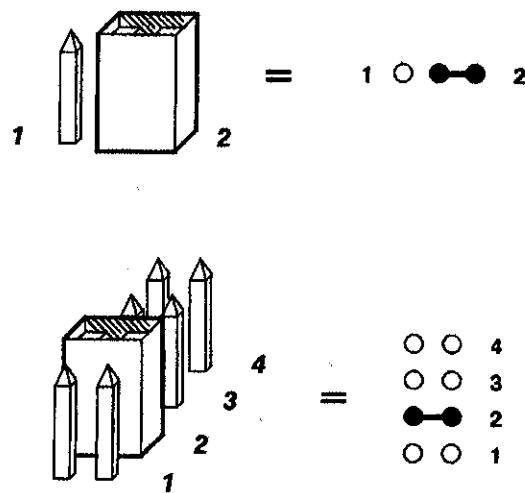


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**Figure 3-1**  
**Cover Removal**

Figure 3-2 shows a typical strap application.  
 Figure 3-3 shows the positions of the straps and  
 DIP switches on the printed circuit board that  
 select the modem options.

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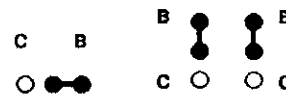
Strapped to position 2

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**Figure 3-2**  
**Typical Strap Application**

**Leased Line/PSTN**

To use the modem on leased telephone lines, it must be strapped in 201B mode using the three B or C mode straps. Switched lines require the 201C mode. These straps should be in one of the configurations shown below. *Do not mix "B" and "C" straps.*



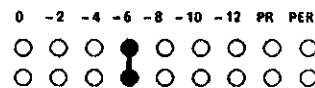
201B Mode (Leased Line)  
Selected

**CAUTION**

The 201B and 201C modes of operation require specific selection of transmit level strap options. For safe operation of the modem, follow the written directions for the transmit level strap options.

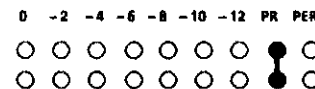
**Transmit Level**

Transmit level settings must correspond to the 201B/201C mode setting above. In leased line operation, transmit level can be set from -12 to 0 dBm in 2 dB steps.



-6 dBm Selected-201B Mode

In switched line operation the strap must correspond to the PSTN telephone line type either permissive (PER) or programmable (PR).



Programmable Selected-201C Mode

### 3 Option Selection

#### Telephone Line Reversal

If no dial tone or touch tones can be heard when dialing, reverse both straps on this strap option.



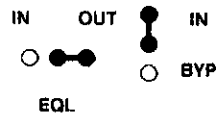
Reverse Selected



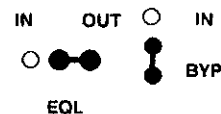
Normal Selected

#### Equalizer

If electrical characteristics of the telephone lines are distorted, the equalizer should be enabled. Normally the equalizer is disabled. Select bypass if line characteristics are optimal.



Equalizer Disabled  
Selected



Equalizer Bypassed  
Selected

#### Equalizer Path

The equalizer can be put in either the transmit or receive path. This choice depends on line characteristics and modem applications.



Equalizer in Receive Path Selected

#### NOTE

Connected modems should have either equalized transmitters or equalized receivers, but not both.

**Bilateral Diagnostic Loop**

When Analog Loop test is being performed in 4-wire leased line operation, one option loops the received signal back to the transmitted signal on the telephone lines so the lines can be checked. In multipoint networks this means the entire network is tied up. If "Line Loop" is disabled, the only equipment tested in Analog Loop is the modem itself.

LN LOOP

IN ○ ●● OUT

Bilateral Diagnostic Loop  
Disabled Selected

**Signal to Chassis Ground**

Normally signal ground is connected to chassis ground. If interference exists, isolate signal ground from chassis ground.

○ SGND  
●● CGND

Signal Ground Connected to  
Chassis Ground Selected

**Carrier Detect Level**

If there is excessive signal loss in the telephone lines, set the modem receiver to the most sensitive setting of - 45 dBm. If signal level is above - 25 dBm, the - 30 dBm setting will give better noise immunity.

○ - 45  
●● - 30

Carrier Detect Level Set to - 30 dBm  
Selected

### 3 Option Selection

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#### SWITCH SETTINGS

- Force DTR  
(S1 Position 1)** In leased line mode, DSR follows DTR. Place this switch to ON to force DTR ON.
- In PSTN mode DTR controls the telephone line connection. DTR must be on for call transmissions. The modem drops the line when DTR goes off. As in the 201B mode, DTR is forced on if this switch is turned on.
- Scrambled Data  
(S1 Position 2)** In certain circumstances where long strings of repeated data are sent it may be advantageous to have the data scrambled with a 511 pseudo-random pattern. The modem on the remote end must have a 511 pattern descrambler.
- (S1 Position 3)** Not used.
- DSR in Test Mode  
(S1 Position 4)** Some diagnostic tests involve communications between the modem and the DTE. Since some terminals want DSR to only indicate connection to the telephone lines, this switch On forces DSR off in test modes.
- External Clock  
(S1 Position 5)** With this switch On, the modem is configured to use a transmit clock provided from DTE. The modem provides the clock with this switch Off.
- Clear to Send Delay  
(S1 Positions 6 and 7)** When RTS goes On, a synchronization signal is sent to the remote receiver. Signal length is set with these two switches. See Table 3-1.

S1-6	S1-7	Signal Length
ON	OFF	No delay
OFF	ON	9 milliseconds
OFF	OFF	25 milliseconds
ON	ON	150 milliseconds

Table 3-1  
Clear to Send Delay



The longer delays are necessary on distorted telephone lines. In leased line operation where line quality is usually good, the CTS delay of 9 ms is usually selected. On the PSTN the 150 ms setting may be needed.

**Force RTS  
(S1 Position 8)**

With this switch On, CTS is constantly on and the modem is constantly transmitting.

**Squelch  
(S3 Position 6)**

When operating on a 2-wire half-duplex connection, the receiver is forced off when the modem is transmitting. To let the signal echoes dissipate on the telephone line after transmission is completed, a receiver delay of 110 milliseconds is selected by turning this switch On. Ensure the modem on the other end has a CTS delay of at least 110 ms.

**Clock Trainer  
(S3 Position 7)**

Normally the clock trainer should be enabled. In some instances where very long strings of repeated data are received, it may be an advantage to disable the clock trainer. However, the scrambled data option may be preferable in some situations.

**CAUTION**

DIP switch S3 switch positions have different functions for 201B and 201C modes of operation. S3 position 8 selects between B and C modes. For safe operation of the modem, follow the written directions for S3 switch settings.

**Leased Lines/  
Switched Lines  
(S3 Position 8)**

This switch setting must match the corresponding leased line/PSTN strap settings. To operate on leased lines, this switch must be Off. To operate on PSTN, switch to On.

### 3 Option Selection

#### Line Current Disconnect (S3 Positions 1 and 2)

201C Mode Only - When operating on PSTN, the modem can be configured to drop the telephone line by sensing when the phone line has been dropped on the other end. Since the disconnect time that must be sensed may vary with different telephone companies, four selections have been provided as shown in Table 3-2.

S3-1 and 2 Dual Function Switch Positions					
201C	S3-1	S3-2	201B	S3-1	S3-2
Disabled	OFF	OFF	Slave Clock Enabled	N/A	ON
8.5 milliseconds	ON	OFF	---	---	---
90 milliseconds	OFF	ON	Slave Clock Disabled	N/A	OFF
200 milliseconds	ON	ON	---	---	---

Table 3-2  
Line Current Disconnect / Slave Clock

#### Slave Clock (S3 Position 2)

201B Mode Only - When the Slave Clock option is enabled by turning this switch On, the modem receiver clock is also used as the transmitter clock (see Table 3-2). This is useful when the modem is used as a slave in a 4-wire multipoint leased line environment. The slave clock is automatically disabled in any 2-wire configuration.

#### Satellite Delay (S3 Positions 3 and 4)

201C Mode Only - After the modem answers an incoming call, a silent time is necessary after the Answer Back Tone to let echo suppressors be enabled. The length of this silent time may vary for different phone systems. Four options are provided as shown in Table 3-3.

S3-3 and 4 Dual Function Switch Postions					
201C Only	S3-3	S3-4	201B Only	S3-3	S3-4
Disable	OFF	OFF	RDL Disable	ON	---
100 milliseconds	OFF	ON	RDL Enable	OFF	---
200 milliseconds	ON	OFF	Antistreaming Enable	---	ON
400 milliseconds	ON	ON	Antistreaming Disable	---	OFF

**Table 3-3**  
**Satellite Delay / RDL Disable - Antistreaming**

**RDL Disable  
(S3 Position 3)**

201B Mode Only - To keep a remote modem from placing the local modem in Remote Digital Loop, disable the RDL function by placing this switch On (see Table 3-3).

**Antistreaming  
(S3 Position 4)**

201B Mode Only - The modem can be optioned to place a time limit of 55 seconds on how long Request to Send can be active. This will prevent one tributary of a multipoint system from monopolizing the network. This switch On enables the antistreaming option (see Table 3-3).

**Automatic/Manual  
Answering  
(S3 Position 5)**

201C Mode Only - An incoming call can be automatically answered by the modem if this switch is On. If the switch is Off, manual answering must be performed (see Table 3-4).

**2-wire/4-wire  
(S3 Position 5)**

201B Mode Only - On configures the modem to operate half-duplex on 2-wire leased lines. Off allows full-duplex operation on 4-wire lines (see Table 3-4).

### 3 Option Selection

S3-5 Dual Function Switch Positions			
201C Only	S3-5	201B Only	S3-5
Automatic Answer	ON	2-Wire Half Duplex	ON
Manual Answer	OFF	4-Wire Full Duplex	OFF

**Table 3-4**  
Auto-Manual Answer / 2-Wire - 4-Wire

**Synchronous/  
Asynchronous  
Character Format  
(S2 Positions 1, 2,  
and 3)**

The modem must be configured for data format according to Table 3-5.

S2-1	S2-2	S2-3	Data Format
Ignored	Ignored	ON	Synchronous
OFF	OFF	OFF	Asynchronous, 8 bits per character
ON	OFF	OFF	Asynchronous, 9 bits per character
OFF	ON	OFF	Asynchronous, 10 bits per character
ON	ON	OFF	Asynchronous, 11 bits per character

**Table 3-5**  
Data Format for S2-1, 2, and 3

**Analog Loop  
From DTE  
(S2 Position 4)**

If this switch is On, Analog Loop can be initiated from pin 25 of the EIA-232C interface. If you are not using this feature, this switch should be turned Off.



## Chapter 4 Operation

### INTRODUCTION

The modem is controlled by the front panel switch and DTE input through the EIA-232C interface. A simplified block diagram is shown in Figure 4-1.

### CONTROLS AND INDICATORS

#### Power On

Power to the modem is turned On with the switch on the back panel of the unit.

#### Rotary Switch

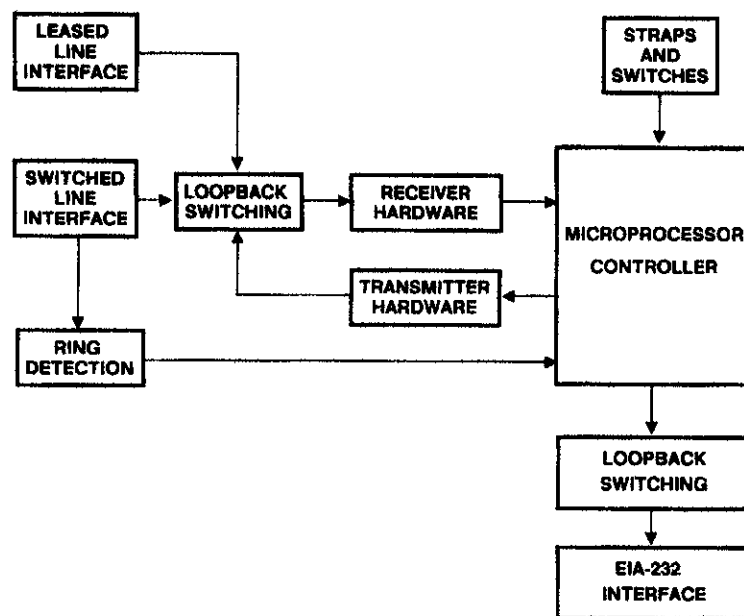
The nine position rotary switch controls modem and telephone operation plus diagnostic tests of the modem.

- Talk . . . . Allows normal phone calls
- Data . . . . Allows modem data transmissions
- Test . . . . The remaining seven positions are described in Chapter 5.

#### Indicators

Modem operation is monitored by nine LED indicators.

- MR/RI . . . Modem Ready (Data Set Ready)/Ring Indicator
- TR . . . . . Data Terminal Ready
- RS . . . . . Request to Send
- CS . . . . . Clear to Send
- CD . . . . . Carrier Detect
- RD . . . . . Received Data
- TD . . . . . Transmitted Data
- TM . . . . . Test Mode/Error
- POWER . . . Power



---

Figure 4-1  
Block Diagram

## CALL CONTROL

<b>Leased Lines</b>	Telephone line connection is continuous on leased lines .
<b>Switched Line Manual Connection</b>	On switched lines, Data Terminal Ready is the master control for placing or answering data calls. DTR must be on for the modem to control the line. Turning DTR off will drop the line.
<b>Normal Telephone</b>	For normal voice telephone calls, the TALK position on the front panel switch gives control of the phone line to the handset. You can make or answer calls normally. If you have been in talk mode and you want to change to data communications, ensure that DTR from DTE is On and rotate the switch to the DATA position. The modem takes control of the line and goes to data mode. Replace the handset on the cradle.
<b>Exclusion Key Telephone</b>	<p>Exclusion key refers to the special button on the telephone cradle. The modem TALK switch position is not used with exclusion key phones. If the option "Data Set Controls Line" has been selected, the exclusion key must be lifted for the telephone to have control of the line. To go to data mode, ensure DTR is on and place the phone on cradle.</p> <p>If the option "Telephone Controls Line" is selected use the handset like a normal phone until you want to go to data mode. Turn DTR On and lift the exclusion key, the unit will go to data mode.</p>
<b>Switched Line Auto-answer</b>	<p>To configure the modem to automatically answer an incoming call, the following conditions must be present:</p> <ul style="list-style-type: none"><li>● Front panel switch in DATA position</li><li>● Manual/Auto-answer turned on</li><li>● DTR turned on</li></ul>

#### 4 Operation

- If an exclusion key phone is used, the modem (or data set) must be in control

#### EIA-232C DTE/DCE INTERFACE

The interface between the modem and DTE conforms to EIA-232C for serial digital interface. Pin functions are described in Table 4-1 and illustrated in Figure 4-2.

Pin	EIA-232C Circuit	CCITT V.24 Circuit	Functional
1	AA	101	Protective Ground
2	BA	103	Transmit Data (TD)
3	BB	104	Receive Data (RD)
4	CA	105	Request to Send (RTS)
5	CB	106	Clear to Send (CTS)
6	CC	107	Data Set Ready (DSR)
7	AB	102	Signal Ground
8	CF	109	Carrier Detect (CD)
9	--	--	+ 12 Volt Test Voltage
10	--	--	- 12 Volt Test Voltage
15	DB	114	Transmit Clock (TC)
17	DD	115	Receiver Clock (RC)
20	CD	108/2	Data Terminal Ready (DTR)
22	CE	125	Ring Indicator (RI)
24	DA	113	External Transmit Clock (ETC)
25	--	--	Analog Loop (AL)

Table 4-1  
EIA-232C Pin Functions



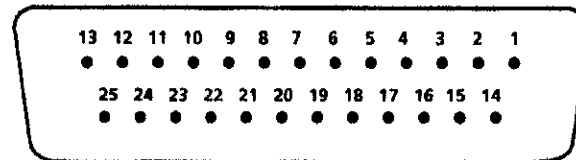


Figure 4-2  
EIA-232C Pin Numbers

<b>Data Terminal Ready (DTE to DCE)</b>	DTR allows the modem to prepare to go to data mode. With this signal on, the modem can take control of the line. The modem drops the connection when this signal is off. The TR LED turns On or Off with the signal.
<b>Data Set Ready (DCE to DTE)</b>	DSR on signals the DTE that connection has been made to the telephone network. Communications can not be performed when this signal is off. The MR/RI LED will flash if a ring is detected and turns On when DSR turns on.
<b>Ring Indicator (DCE to DTE)</b>	RI turns on when an incoming ringing signal is detected. The MR/RI LED will function as described above.
<b>Request to Send (DTE to DCE)</b>	DTE turns RTS on to make the modem prepare to transmit data sent to it by DTE. To make the modem stop transmitting, this signal must be turned off. The RS LED turns On or Off with the signal.
<b>Clear to Send (DCE to DTE)</b>	CTS signals the DTE that the modem is ready to transmit data. The CS LED turns On or Off with the signal.
<b>Carrier Detect (DCE to DTE)</b>	CD acts as a receiver enable. When CD is off, the receive data signal is clamped to a mark state. When the modem receives a signal, it

	turns the CD signal on. This tells DTE that the Receive Data line is active. The CD LED turns On or Off with the Carrier Detect signal that is internal to the modem so that it can be monitored even during diagnostic tests.
<b>Transmitted Data (DTE to DCE)</b>	TD carries serial data from the DTE for transmission to a receiving modem. The TD LED is On when a space condition is on the TD line.
<b>Received Data (DCE to DTE)</b>	RD carries data that has been received from a transmitting modem to DTE. The RD LED is On when a space condition is on the RD line.
<b>Transmit Clock (TC from DCE to DTE)</b>	As a synchronous modem, data is clocked in with a 2400 Hz square wave on this interface line.
<b>External Transmit Clock (DTE to DCE)</b>	ETC is used when DTE provides the 2400 Hz square wave to clock in the transmitted data.
<b>Receive Clock (RC, from DCE to DTE)</b>	RC is the interface line that provides the 2400 Hz square wave that is used to clock Received Data from the modem to DTE.
<b>Analog Loop (DTE to DCE)</b>	The local AL test can be initiated by turning this signal On. This capability can be disabled by switch option if EIA-232C pin 25 is used for a different purpose or if AL will not be controlled from DTE.
<b>Test Voltage</b>	EIA-232C voltage levels of + 12 and - 12 are available for testing.
<b>Ground</b>	Both frame and signal ground are available at the interface.



## Chapter 5 Diagnostics

### GENERAL

The various diagnostic tests establish "loops" so data can be generated and checked at various points in the data link. The Test Mode (TM) LED will turn On when the modem is performing any test.

### Test Categories

Diagnostic tests fall into two categories; those with test patterns, and those without. For test pattern diagnostics, the TM LED indicates errors. For other tests the DTE transmission is the test signal. Disparity between DTE transmitted and received characters indicates errors.

### SELF TEST

In ST the modem generates a 511 pseudorandom (PN) test pattern and sends it to the transmitter. The modem modulates the signal, then loops it back to the receiver where the signal is demodulated. The data is checked and errors are indicated by the TM LED blinking. The EIA-232C interface is ignored in this test and the telephone line is made busy in 201C mode. This test verifies the internal workings of the modem. See Figure 5-1.

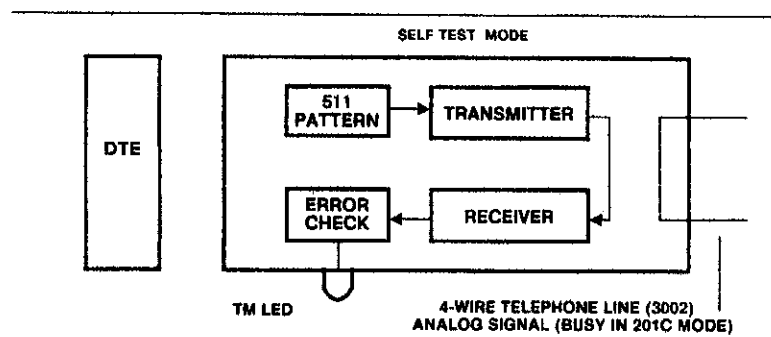


Figure 5-1  
Self Test

## 5 Diagnostics

### ANALOG LOOP

In AL, data is sent to the modem from DTE. The data is modulated in the transmitter and looped back into the receiver for demodulation. The data is sent back to DTE for checking. The EIA-232C interface signals are active in this test. This test verifies the workings of the DTE and the modem.

When the modem is configured for 4-wire private line operation, the modem can also be set up to loop the received signal on the telephone line back to the transmit lines. This is sometimes called "bilateral looping". In this way, a remote modem can have its signal looped, thus checking the telephone lines. However, this loop may not be desirable on multipoint networks. A strap is provided to disable this part of the Analog Loop Test. See Figure 5-2.

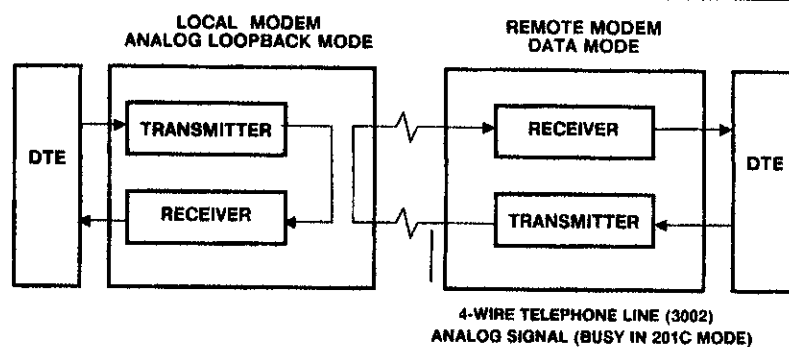


Figure 5-2  
Analog Loopback

**LOCAL DIGITAL LOOP** The LDL test takes inputs from the DTE and loops them back to their logical counterparts as follows:

- DTR to DSR
- RTS to CTS and CD
- TD to RD
- TC equals RC

This tests the DTE and EIA-232C interface independently of the modem.

When operating in 4-wire leased line mode, the bilateral aspect of the test may be used. The signal received from the telephone line is demodulated, and the received data is looped back to the transmitter. The data is retransmitted to the remote modem so it can be checked. See Figure 5-3.

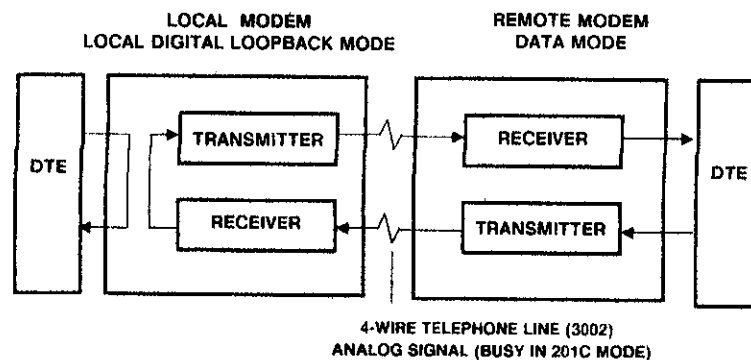


Figure 5-3  
Local Digital Loopback Test

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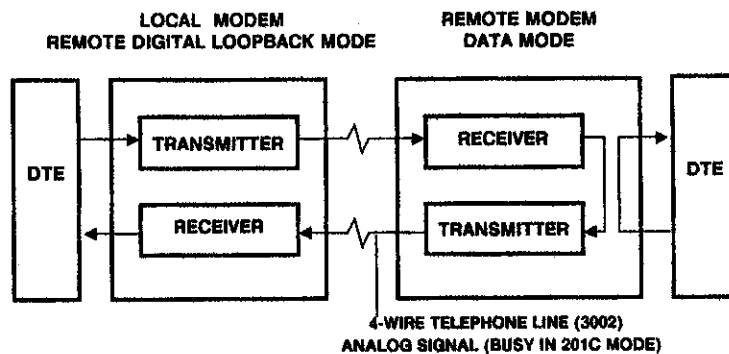
## 5 Diagnostics

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### REMOTE DIGITAL LOOP (4-Wire only)

In 2-wire leased or switched lines, the RDL position of the front panel switch performs the DTE loop as in all Digital Loops.

In 4-wire leased line operation, this switch position allows unattended testing of a remote modem. When the front panel switch is rotated to RDL, a special signal is transmitted placing the receiving modem in Digital Loop. The local modem can send data to the remote DTE interface which is then looped back for checking. When the switch is rotated out of the RDL position, another signal is sent to terminate the test. If the remote modem loses carrier for more than 30 seconds, the remote modem will go back to data mode. See Figure 5-4.

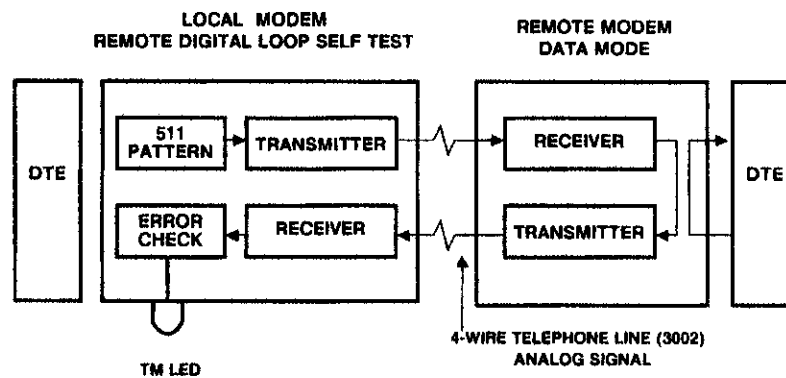


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Figure 5-4  
Remote Digital Loopback Test

**REMOTE DIGITAL  
LOOP SELF TEST  
(4-Wire Only)**

RDLST is the same as RDL except the local modem generates a 511 PN test pattern and ignores signals on the EIA-232C interface. If errors are received from the test, the TM LED will go Off. The remote modem will return to data mode if it loses carrier for more than 30 seconds. See Figure 5-5.

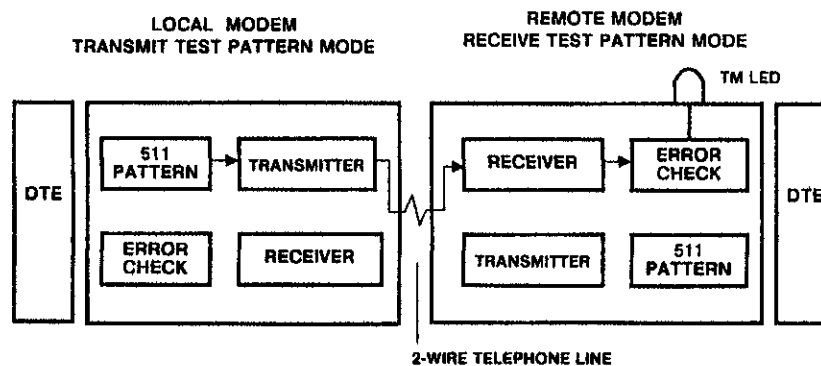


**Figure 5-5**  
**Remote Digital Loop Self Test**

## 5 Diagnostics

### TRANSMIT TEST PATTERN (2-Wire Only)

TTP provides a 511 pseudorandom pattern transmitted over the telephone lines to be received and checked by a receiving modem. See Figure 5-6. On switched lines the call may be placed and answered manually or answered automatically by placing the switch in TTP with auto answer enabled. After the connection has been established, placing the switch in the TTP position begins the transmission. The EIA-232C interface is ignored. If data errors are detected the TM LED goes Off.



**Figure 5-6**  
Transmit Test Pattern



**RECEIVE TEST  
PATTERN  
(2-Wire Only)**

In RTP the modem checks the incoming line signal for a 511 pseudorandom pattern. If data errors are detected, the TM LED goes Off. When operating on switched lines, the call may be placed or answered manually. The call may be answered automatically by placing the switch in RTP with auto answer enabled. See Figure 5-7.

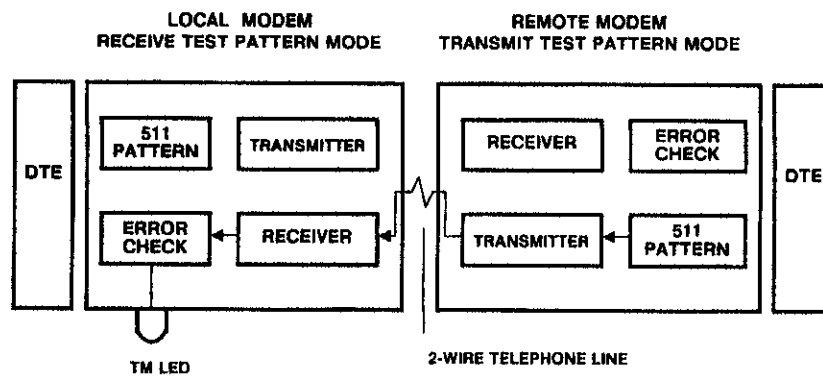


Figure 5-7  
Receive Test Pattern

## Chapter 6 Maintenance

### WARNING

Disconnect ac power before performing maintenance. Although no dangerous voltage levels are exposed, disconnecting power will ensure no electric shock hazard is present.

### GENERAL

The modem provides **maintenance-free** service. Periodically it is necessary to remove dust that has collected on internal electrical components. Remove dust with low pressure air and a soft bristle brush.

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

### FUSE

A blown fuse is indicated when the power LED is out, the power switch is on, and power is available at the plug. If a fuse fails, replace it with one of equal rating. Repeated failure indicates a more serious problem. If this happens, refer to the section on maintenance.

### MAINTENANCE

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

If the modem is 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

**FCC**                      FCC Registration No. AK396F-67811-DM-E  
REN 0.5B

### GENERAL

<b>Data Rate</b>	2400 bits per second, synchronous
<b>Character Format</b>	Synchronous, or 8, 9, 10, or 11 bit asynchronous
<b>Communication Mode</b>	Over PSTN              2-wire, half duplex Over leased lines      2-wire, half duplex or 4-wire, full duplex
<b>Modulation</b>	Differentially Phase Shift Keyed (DPSK).
<b>Carrier Frequency</b>	1800 Hz $\pm$ 0.01%.
<b>Receiver Sensitivity</b>	- 45 dBm or - 30 dBm selectable
<b>Telephone Line Interface</b>	600 ohms $\pm$ 10%, transformer coupled, transient protected
<b>Line Connection</b>	Over PSTN              Permissive or programmable Over leased lines      Transmit levels selectable for 0 to - 12 dBm
<b>Line Conditioning</b>	Telephone line conditioning is not required.
<b>Digital Interface</b>	EIA RS-232C and CCITT V.24.
<b>Automatic Answer</b>	Over PSTN              Optional automatic or manual answering; Answer Back Tone = 2025 Hz for 1.7 seconds.
<b>Originate</b>	Over PSTN              Manual using exclusion key telephone.

## Appendix B Strap Options

FEATURE	STRAP SETTING	FUNCTION
Leased Line/ PSTN*		201B leased line mode
		201C PSTN mode
Transmit Level*		201B -6 dBm
		201C programmable
Telephone Line Polarity Reversal		Reverse polarity
		Normal polarity

\*201B or 201C must match

Table B-1  
Strap Options

**B**  
**Strap Options**

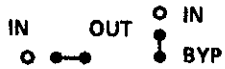
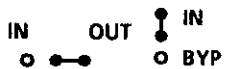









FEATURE	STRAP SETTING	FUNCTION
Equalizer		Equalizer bypassed
		Equalizer disabled
		Equalizer enabled
Equalizer Path		Receive path equalized
		Transmit Path equalized
Bilateral Diagnostics Loop		Bilateral diagnostic loop disabled
		Bilateral diagnostic loop enabled
Signal to Chassis Ground		Signal ground connected to chassis ground
		Signal ground isolated from chassis ground
Carrier Detect Level		Carrier detect level set to -30 dBm
		Carrier detect level set to -45 dBm

Table B-1, continued

## Appendix C Switch Options

S1 201B LEASED LINE		
Function	ON	OFF
Force DTR	1	
Scramble Data	2	
Not used	3	
MR Test	4	
Internal Clock		5
External Clock	5	
CTS Delay 0 ms	6	7
CTS Delay 9 ms	7	6
CTS Delay 25 ms		6, 7
CTS Delay 150 ms	6, 7	
Force RTS	8	

S2 201B LEASED LINE		
Function	ON	OFF
Sync Mode	3	
Async Mode		3
8 bits		1, 2
9 bits	1	2
10 bits	2	1
11 bits	1, 2	
DTE-LLB Enable	4	
DTE-LLB Disable		4

S3 201B LEASED LINE		
Function	ON	OFF
Not used	1	
Slave Clock	2	
RDL Disable	3	
Antistream	4	
2-W Half-Duplex	5	
4-W Full-Duplex		5
Squelch Enable	6	
Clock Trainer En		7
Clock Trainer Dis	7	
Leased Line 201B		8*

\* Must be selected.

Table C-1  
Switch Option Table for 201B Mode

## C Switch Options

S1 201C PSTN		
Function	ON	OFF
Force DTR	1	
Scramble Data	2	
Not used	3	
MR Test	4	
Internal Clock		5
External Clock	5	
CTS Delay 0 ms	6	7
CTS Delay 9 ms	7	6
CTS Delay 25 ms		6, 7
CTS Delay 150 ms	6, 7	
Force RTS	8	

S2 201C PSTN		
Function	ON	OFF
Sync Mode	3	
Async Mode		3
8 bits		1, 2
9 bits	1	2
10 bits	2	1
11 bits	1, 2	
DTE-LLB Enable	4	
DTE-LLB Disable		4

S3 201C PSTN		
Function	ON	OFF
LCD Off		1, 2
LCD 8.5 ms	1	2
LCD 90 ms	2	1
LCD 100 ms	1, 2	
Satellite Delay 8 ms		3, 4
Satellite Delay 100 ms	3	4
Satellite Delay 200 ms	4	3
Satellite Delay 400 ms	3, 4	
Auto Answer	5	
Manual Answer		5
Squelch Enable	6	
Clock Trainer En		7
Clock Trainer Dis	7	
PSTN 201C	8*	

\* Must be selected.

Table C-2  
Switch Option Table for 201C Mode

