

OPERATING AND INSTALLATION INSTRUCTIONS  
FOR

# DataComm 202S/T and 202T Modems



**General DataComm, Inc.**  
NAUGATUCK, CONNECTICUT  
06770



## **ATTENTION! STATIC SENSITIVE DEVICES**

### **PROPER HANDLING AND GROUNDING PRECAUTIONS REQUIRED**

This equipment contains electrostatic sensitive devices. Use ESD precautionary procedures when removing or inserting parts or printed circuit (pc) cards. Keep parts and pc cards in their antistatic packaging material until ready to install.

The use of an antistatic wrist strap, connected to the grounded equipment frame or chassis, is recommended when handling pc cards during installation, removal, or setting of on-board option switches. Do not use a conductive tool, such as a screwdriver or paper clip, to set the position of the option switches.

### **UL INSTALLATION SAFETY INSTRUCTIONS**

- a. Never install telephone wiring during a lightning storm.
- b. Never install telephone jacks in a wet location unless the jack is specifically designed for wet locations.
- c. Never touch uninsulated telephone wires or terminals unless the telephone line has been disconnected at the network interface.
- d. Use caution when installing or modifying telephone lines.

# DataComm 202S/T and 202T Modems

**(GDC PART NOS. 058A001-001, -003, -011,  
053A002-002, -004, 053A003-002 through -004,  
053M001-001, 053M002-001, 053M003-001,  
053M004-001, 053M005-001, and 053M006-001)**

This product was designed and manufactured by



**General DataComm, Inc. (GDC)**  
Naugatuck, Connecticut 06770



**WARNING**

This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

**CRC-REQUIRED NOTIFICATION**

This equipment is a Class A digital apparatus which complies with the Radio Interference Regulations, CRC c.1374.

**PUBLICATION NOTICE**

This manual has been carefully compiled and checked for accuracy. The information in this manual does not constitute a warranty of performance.

Furthermore, GDC reserves the right to revise this publication and make changes from time to time in the content thereof. GDC assumes no liability for losses incurred as a result of out-of-date or incorrect information contained in this manual.

**READER'S COMMENTS**

Comments regarding this manual should be addressed to:

**Publications Department  
General DataComm, Inc.  
6 Rubber Avenue  
Naugatuck, Connecticut 06770**

## **TABLE OF CONTENTS**

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**FCC-REQUIRED NOTIFICATION**

**FOR USERS OF FCC-REGISTERED EQUIPMENT**

*Read before using this technical manual or installing subject equipment.*

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This equipment complies with Part 68 of the Federal Communications Commission (FCC) Rules and Regulations. Connection of data communication equipment to the public telephone network is regulated by the FCC Rules and Regulations. These regulations require:

- A. All connections to the telephone network must be made through standard plugs and telephone company provided jacks or equivalent.
- B. Connection of this equipment to party lines and coin telephones is prohibited.
- C. If the telephone company asks you what equipment is connected to the telephone line, tell them to which line the equipment is connected, and give them the FCC Registration number and Ringer Equivalence number of the equipment. These numbers can be found on a label located on the back of the front panel on all DataComm-type equipment and on the underside or rear panel of other equipment.
- D. If you experience trouble, disconnect the equipment from the telephone line to determine if the equipment is malfunctioning. If it is, remain disconnected until the problem is corrected. Should this equipment cause harm to the telephone network, the telephone company may discontinue your service temporarily. If possible they will notify you in advance. But if advance notice is not practical, you will be notified as soon as possible. You will be informed of your right to file a complaint with the FCC.
- E. The telephone company may change its communication facilities, equipment, operations, and procedures where reasonably required for operation. If this occurs, the telephone company will notify you in writing.
- F. It is the user's obligation to notify the telephone company prior to disconnecting equipment from 1.544 Mbps digital service.
- G. According to Part 68 of the FCC Rules and Regulations, customers are not authorized to repair or modify this equipment. Any repair or modification will null and void the FCC registration and the warranty of this equipment.

**CANADIAN DEPARTMENT OF COMMUNICATIONS (DOC) REQUIRED  
NOTIFICATION**

**FOR USERS OF DOC-CERTIFIED EQUIPMENT**

*Read before using this technical manual or installing subject equipment.*

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The Canadian Department of Communications label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational, and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

*Caution:* Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.



## TABLE OF CONTENTS

## TABLE OF CONTENTS

---

<b>Section &amp; Subject</b>	<b>Page</b>
<b>1 — INTRODUCTION</b>	
DataComm 202T AND 202S/T MODEM FEATURES .....	1-1
DESCRIPTION .....	1-1
DIAGNOSTICS .....	1-2
APPLICATIONS.....	1-2
SERVICE AND TRAINING .....	1-2
<b>2 — INSTALLATION</b>	
UNPACKING AND HANDLING.....	2-1
PREOPERATIONAL CHECK .....	2-1
OPTION SELECTION.....	2-1
INSTALLATION PROCEDURES .....	2-13
Standalone Installation.....	2-13
Rackmount Installation.....	2-13
ELECTRICAL CONNECTIONS.....	2-13
Standalone Enclosure.....	2-13
Rackmount Shelf.....	2-14
DETERMINING TRANSMIT OUTPUT LEVEL AND COMPATIBLE DATA JACK TYPES FOR OPERATION ON THE SWITCHED NETWORK (202S/T ONLY) .....	2-14
Programmed Output .....	2-14
Permissive Output .....	2-15
BUSINESS EQUIPMENT CONNECTIONS (DATA TERMINAL) .....	2-15
VF LINE CONNECTIONS .....	2-15
Switched Network Connections .....	2-15
Private Line Connections.....	2-15
Private Line Connections with Alternate Voice .....	2-16
<b>3 — OPERATION</b>	
OVERVIEW.....	3-1
CONTROLS, INDICATORS, AND CONNECTORS.....	3-1
RACKMOUNT SHELF.....	3-1
REVERSE CHANNEL OPERATION .....	3-3
PRIVATE LINE OPERATION .....	3-3
SWITCHED NETWORK OPERATION.....	3-3
Manual Operation .....	3-3
Automatic Answering .....	3-3
565 AND 2565 TELEPHONE SET OPERATION .....	3-4

Originating a Call .....3-4  
 Answering a Call.....3-4

**TABLE OF CONTENTS (Cont.)**

---

<b>Section &amp; Subject</b>	<b>Page</b>
Returning to Talk Mode from Data Mode .....	3-4
Terminating a Call.....	3-4
<b>GDC 502, 2502, OR 503 TELEPHONE SET OPERATION.....</b>	<b>3-4</b>
Originating a Call .....	3-4
Answering a Call.....	3-4
Terminating a Call.....	3-7
Monitoring Data Signals .....	3-7
Automatic Operation.....	3-7

**4 — TESTS**

OVERVIEW .....	4-1
LOCAL SELF-TEST.....	4-3
ANALOG TEST.....	4-4
REMOTE TESTS.....	4-5
Remote Two-Wire Test by DTC (202S/T Only).....	4-5
Remote Four-Wire Tests (Private Line Only).....	4-6
TECHNICAL ASSISTANCE PROCEDURE .....	4-7
TRAINING .....	4-8

**APPENDIX A — TECHNICAL CHARACTERISTICS**

**APPENDIX B — BUSINESS MACHINE FUNCTIONS EXCHANGED THROUGH BUSINESS INTERFACE CONNECTOR P3 (EIA)**

**APPENDIX C — FUNCTIONS EXCHANGED THROUGH AUX TELEPHONE INTERFACE CONNECTOR (P1) (202S/T)**

**APPENDIX D — GLOSSARY**

**INDEX**

# SECTION 1

## INTRODUCTION

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### **DATAComm 202T AND 202S/T MODEM FEATURES**

- End-to-end compatible and full featured to Bell 202 Series data sets
- Built-in diagnostics and performance monitoring . . . immediate fault isolation
- Optional 5-baud reverse channel . . . data acknowledgment and circuit assurance
- Single DataComm card . . . up to 16 modems fit into a DataComm shelf
- CCITT V.23 compatible
- Operates over satellite circuits

### **DESCRIPTION**

The DataComm 202S/T microprocessor based modem provides up to 1200 bps asynchronous half-duplex switched network and 1800 bps full-duplex private line data communications, with an optional 5 baud reverse channel.

The optional reverse channel can be used for primary channel supervision or circuit assurance.

The DataComm 202S/T can be used with a 502, 565 (pushbutton or dial), 503 RTC-type or an AE/186 telephone for external modem control and alternate voice/data communication. It is also compatible with an 801 Automatic Calling Unit.

A cost-effective modem with a wide range of advanced features and switch-selectable options, the DataComm 202S/T offers superior performance over virtually any data communications network.

For simplicity of operation and complete performance verification, the front panel design incorporates easily accessible pushbutton controls and highly visible light-emitting diode indicators.

The DataComm 202T modem offers high performance full- or half-duplex 1200/1800 bps asynchronous data communications in private line applications. In addition, an optional 5-baud reverse channel is also available for primary channel supervision and circuit assurance.

End-to-end compatibility, product standardization and full feature equivalence make the DataComm 202T a direct replacement for Bell 202T or equivalent data sets regardless of network application requirements.

## **INTRODUCTION**

The DataComm 202T represents the most versatile cost effective solution to multiple unit, private line installations without sacrifice to performance or capability.

The DataComm 202S/T and 202T modems are available in four different voltage ranges in both standalone and shelf assemblies. Part numbers of the models and assemblies available are listed in Table 1-1. Technical characteristics for the modems are given in Appendix a.

## **DIAGNOSTICS**

The DataComm 202S/T and 202T modems incorporates comprehensive integral diagnostic functions, all of which are controlled from the front panel. These functions, Analog Loopback, Digital Loopback and Self-Test afford the operator continuous performance monitoring, quick fault isolation, and rapid system restoral. The diagnostic tests offered by the DataComm 202S/T and 202T can pinpoint a failure anywhere in the network telephone line, terminal, or modem.

## **APPLICATIONS**

The high performance DataComm 202S/T and 202T modems provide asynchronous, 1800 bps, full- or half-duplex data communications over voice-grade circuits.

The 202T is designed as a Bell 202T compatible modem and incorporates special carrier detect and receiver control features:

- Carrier detected only in the 1000 to 2400 Hz baud to ensure valid carrier.
- Receiver squelch timing switch selectable for 9 or 156 ms.
- Optional soft transmit carrier turnoff eliminates problems of abrupt carrier turnoff and erroneous data bits at turnoff.
- Optional quick receive carrier turnoff.

Both modems offer greater immunity to line impairments normally present in unconditioned voice-grade communications. They employ a strong user-selectable compromise equalizer which controls the transmit line signal to ensure worry-free unattended normal operations. Normal modem operations are initiated and controlled by front panel mounted pushbutton switches. Other operating parameters are easily established and reconfigured using simple DIP switches and jumper plugs conveniently located on the modem. All pushbuttons and plugs are readily accessible whether the modem is mounted in a desktop enclosure or compact high density rackmount shelf.

## **SERVICE AND TRAINING**

See Section 4 for information on service and training available from GDC.

TABLE 1-1. EQUIPMENT LIST

Item No.	Item	GDC Part No.
1	202S/T Standalone modem (FCC/DOC) PL or SN	
	117 V	053A002-001
	220 V	053A002-002
	100 V	053A002-003
	240 V	053A002-004
2	202S/T Standalone modem, Canada*	053A001-003
3	202S/T Standalone modem, with reverse channel, FCC/DOC	053M001-001
4	202S/T Standalone modem, with reverse channel, Canada	053M002-001
5	202S/T Rackmount, FCC/DOC	053P001-002
6	202S/T Rackmount, Canada	053P001-001
7	202S/T Rackmount, with reverse channel, FCC/DOC	053M003-001
8	202S/T Rackmount, with reverse channel, Canada	053M004-001
9	202T Standalone modem, private line	
	117 V	053A001-002
	220 V	053A003-002
	100 V	053A003-003
	240 V	053A003-004
10	202T Standalone modem, private line with Fast Carrier Reset	053A001-011
11	202T Rackmount with Fast Carrier Reset	053P001-004
12	202T Standalone modem, with reverse channel	053M005-001
13	202T Rackmount, private line	053P001-003
14	202T Rackmount, with reverse channel	053M006-001
15	5 baud reverse channel card	033P041-001
16	DataComm Enclosure, DE-1	010M001-001
17	DataComm Enclosure, DE-3	010M003-001
18	DataComm Shelf, DS-1	010B015-001
* Contains two 0.25 A/250 V Slo-Blo fuses (GDC Part No. 215-202-001).		



## **SECTION 2**

### **INSTALLATION**

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#### **UNPACKING AND HANDLING**

The DataComm 202S/T and 202T are shipped in packing material that is enclosed in a corrugated box. Inspect the unit for damage; if any is observed, notify the shipper immediately. Do not discard the box and packing material; their use will facilitate reshipping the unit, if necessary.

#### **PREOPERATIONAL CHECK**

The modem should be given a preoperational check by performing a Local Self-Test to verify normal operation before it is connected to the VF line, telephone, and terminal and *before any factory-set option strapping is changed*. See Section 4 for instructions on performing this test. First verify that option strapping is the same as shown in Figures 2-1 through 2-4, Option Locations, and perform the test on a standalone modem before it is connected to anything except ac power, and on shelf plug-in modems as they are individually installed.

If the modem passes the test but subsequently fails to perform in data communications operation the modem is not at fault; an error has been made in the installation or option selection or there is a faulty VF line or remote modem, if connected. Recheck the cable and VF line connection and the option strapping, and if necessary perform the tests in Section 4 to isolate the fault. Also verify that the remote modem is a compatible type and is optioned in a compatible manner. In the event that the modem does not check out properly, replace it with a spare modem, if available, and repeat the test. Do not attempt to repair the modem. For assistance, contact DataComm Service Corporation (refer to the Technical Assistance Procedures in Section 4).

#### **OPTION SELECTION**

The field-selectable options adapt the modem to a variety of configurations. These options are selected by the positioning of switches and straps on the components boards. Before selecting any options, consult Table 2-1 to determine which options should be selected for your modem's applications.

After determining which options should be selected, refer to Figure 2-6 which describes the method of implementing each option. Also refer to Figures 2-1 through 2-4, which illustrate the location of each option and how each option has been selected as shipped from the factory. Options have been selected for the most common usage and may not have to be changed. To gain access to the modem component board in a standalone enclosure, refer to Figure 2-5.

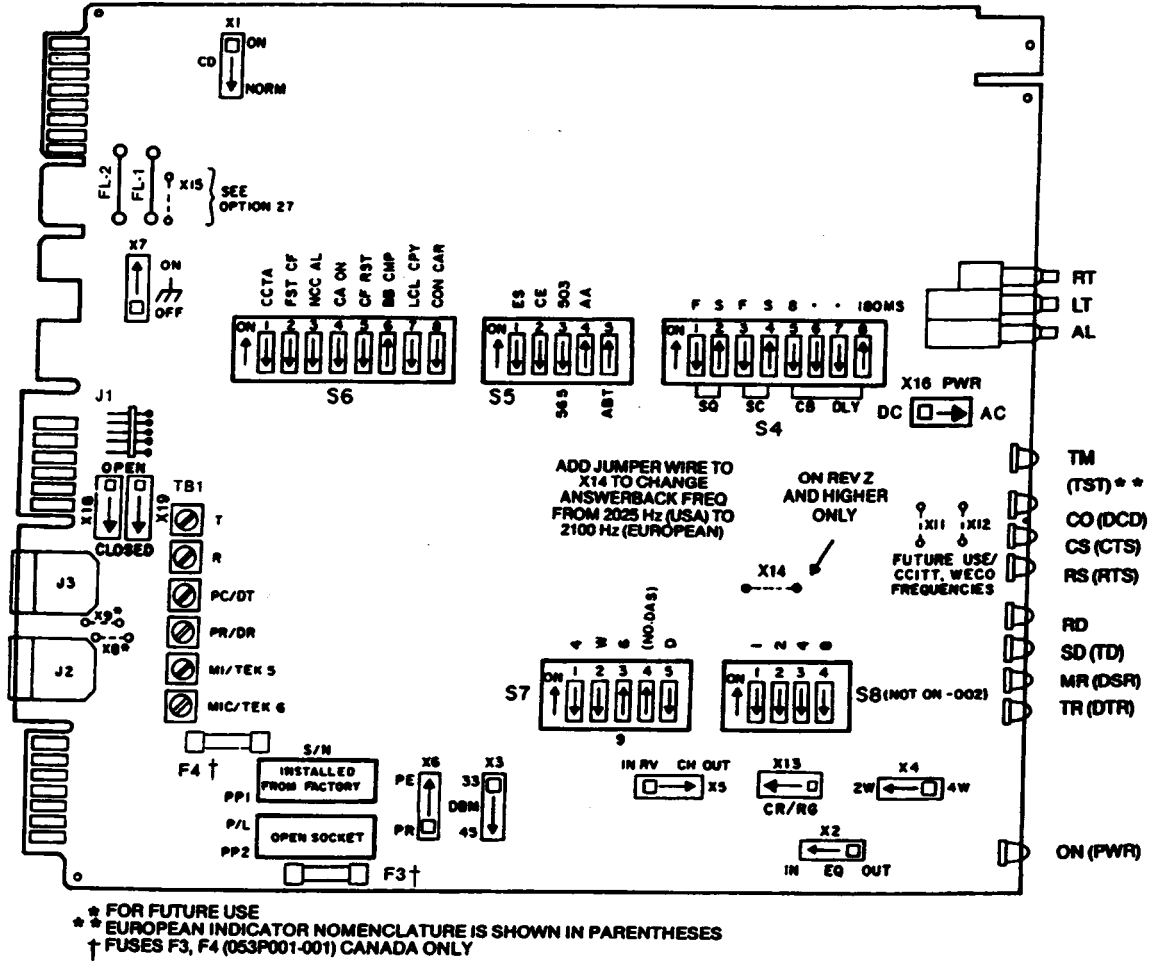


FIGURE 2-1. DataComm 202S/T (053P001-000, -002) OPTION SELECTIONS FOR SWITCHED NETWORK OPERATION



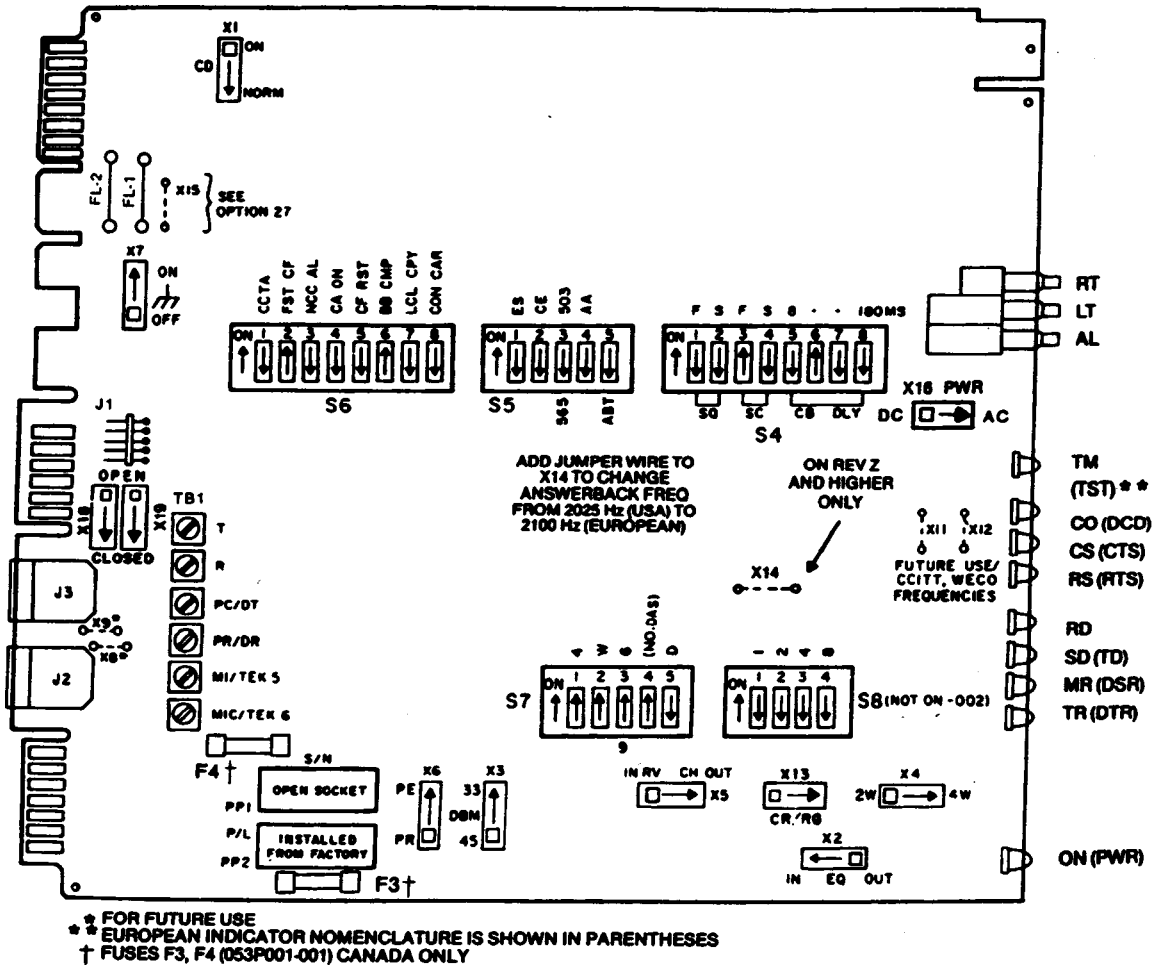


FIGURE 2-2. DataComm 202S/T (053P001-000, -002) OPTION SELECTIONS FOR PRIVATE LINE OPERATION

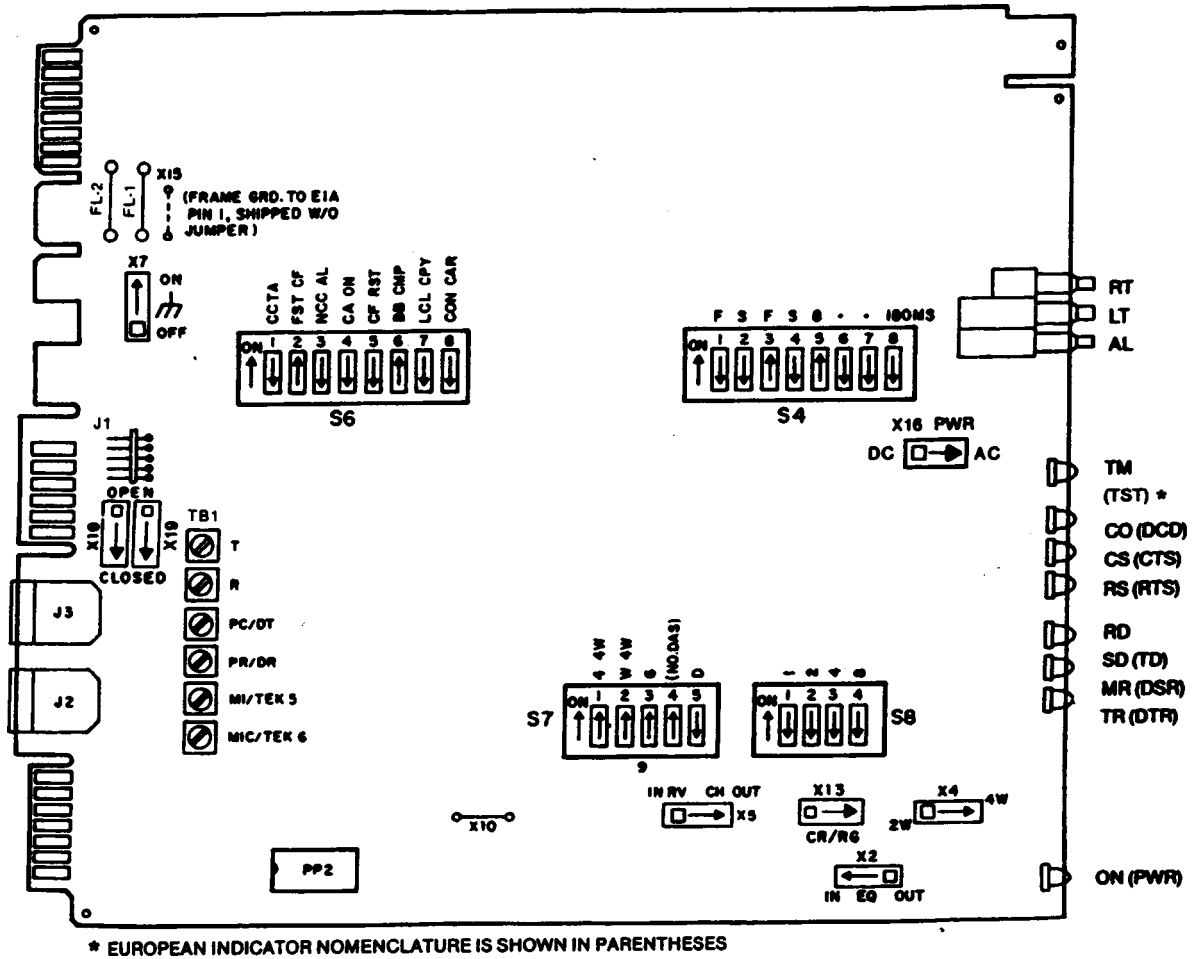


FIGURE 2-3, DataComm 202S/T (053P001-000, -002) OPTION SELECTIONS FOR FOUR-WIRE PRIVATE LINE OPERATION

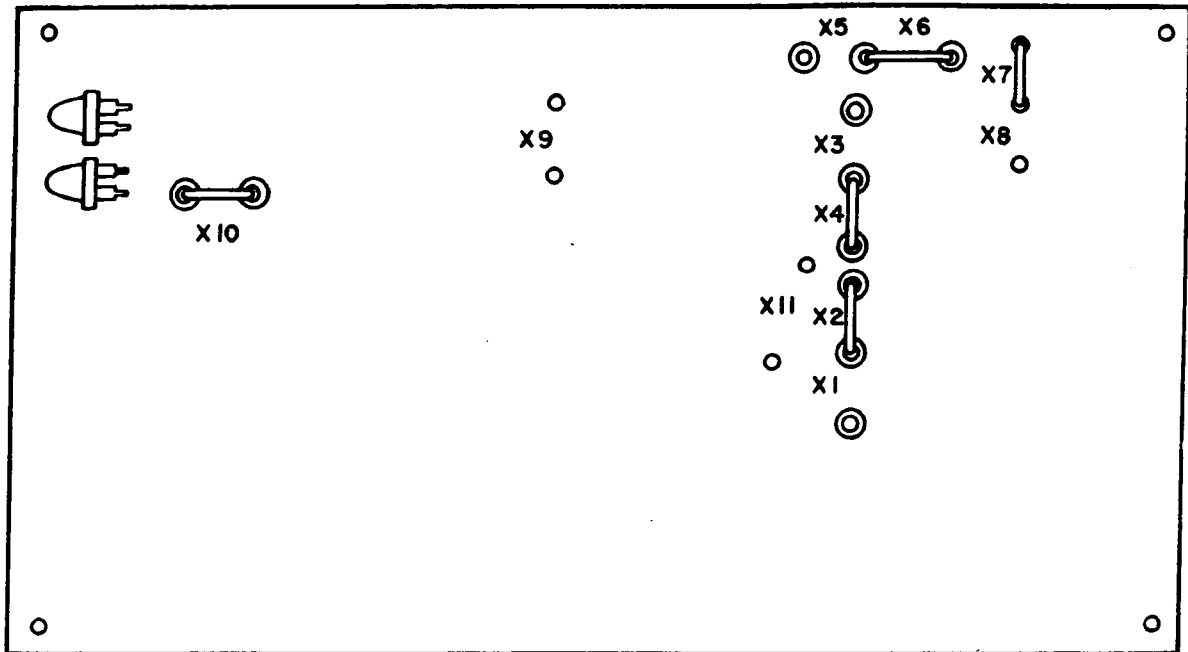


FIGURE 2-4. REVERSE CHANNEL STRAP LOCATION

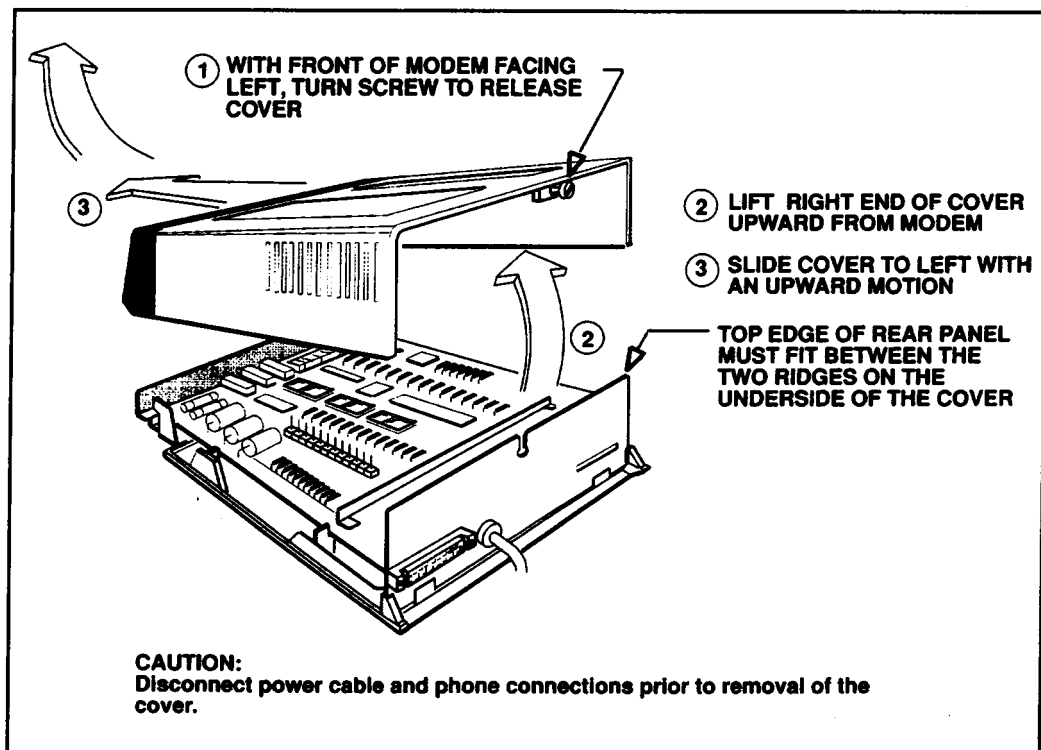


FIGURE 2-5. STANDALONE COVER REMOVAL PROCEDURE

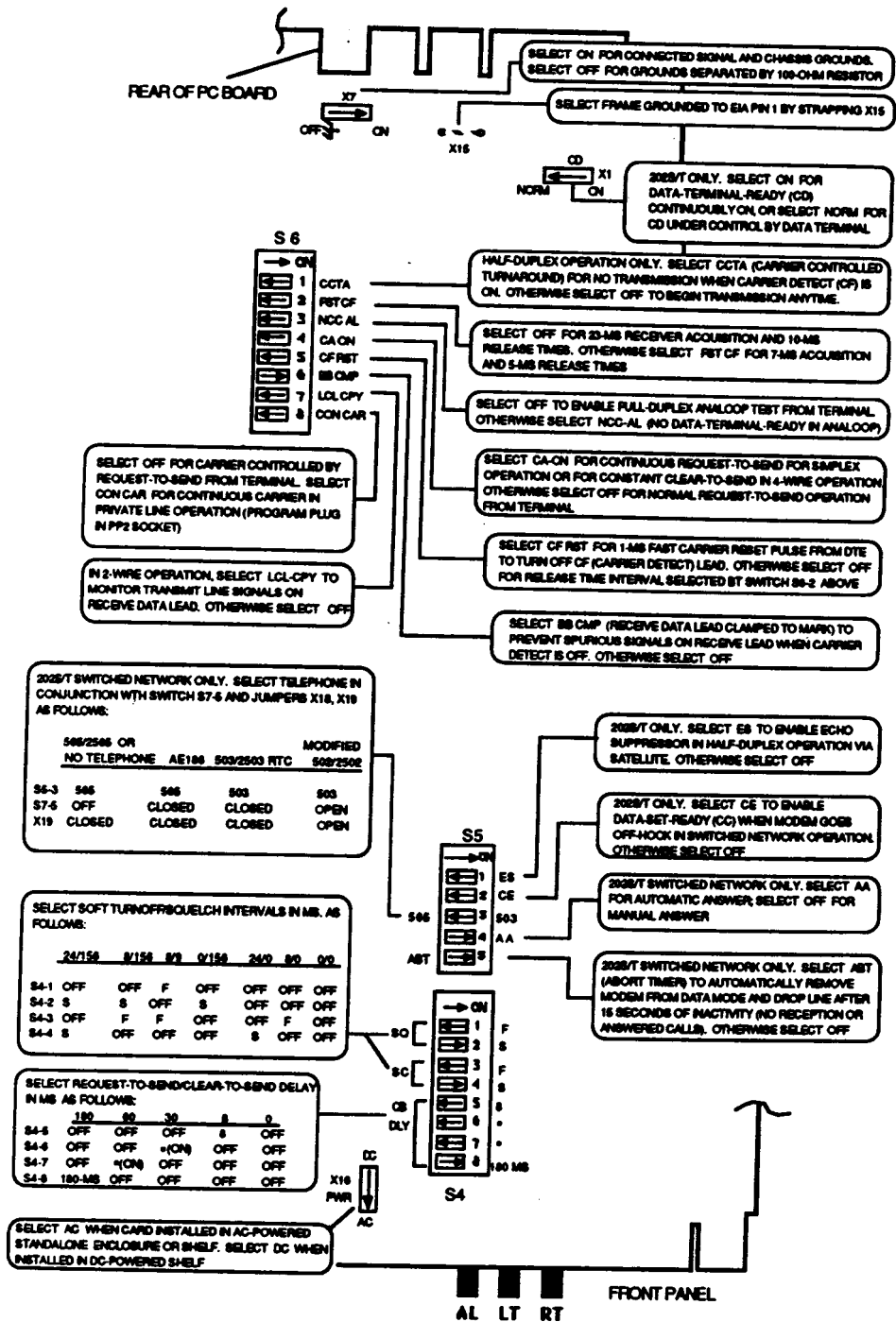


FIGURE 2-6. OPTION SWITCH AND JUMPER SELECTION (Sheet 1 of 3)

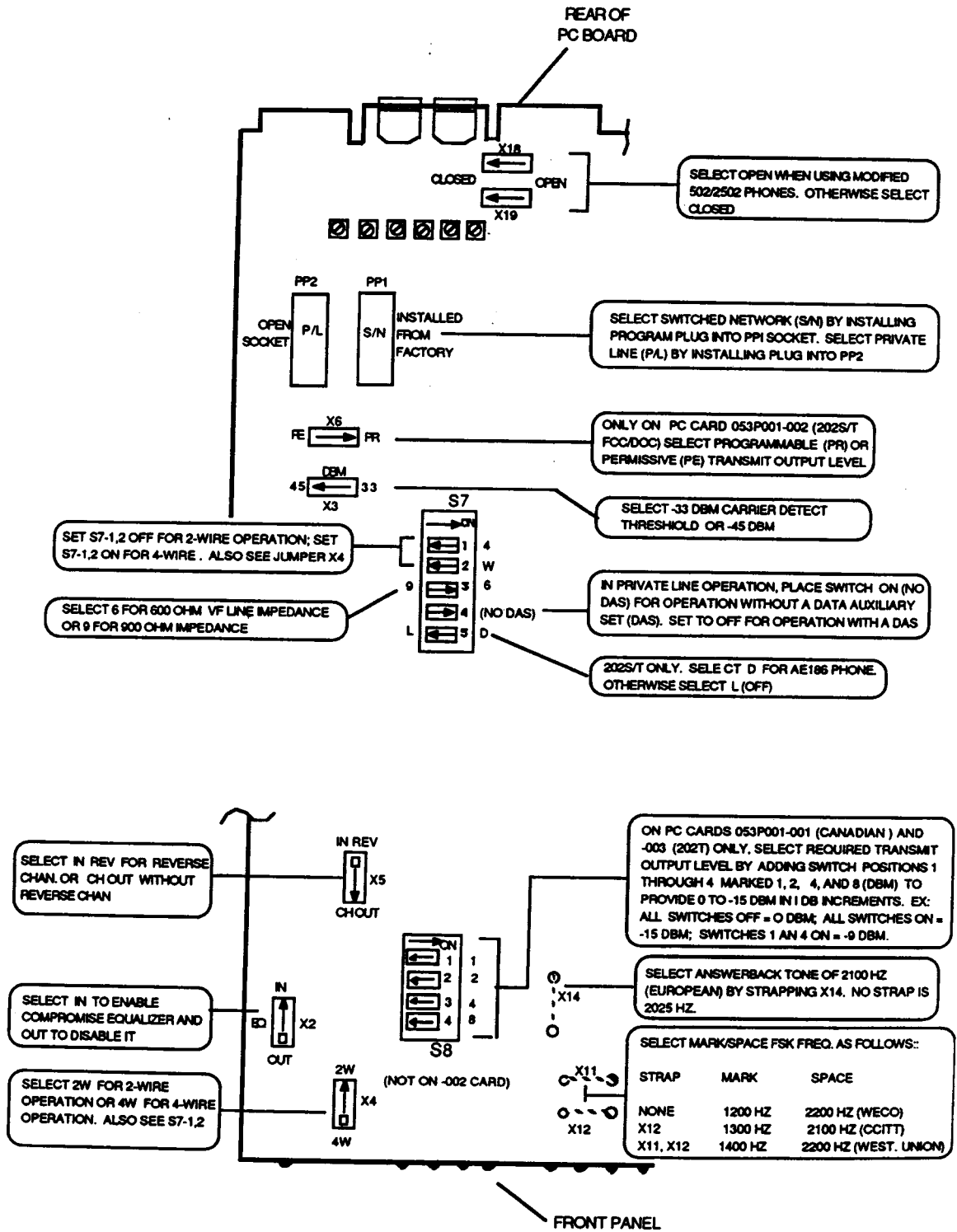


FIGURE 2-6. OPTION SWITCH AND JUMPER SELECTION (Sheet 2 of 3)

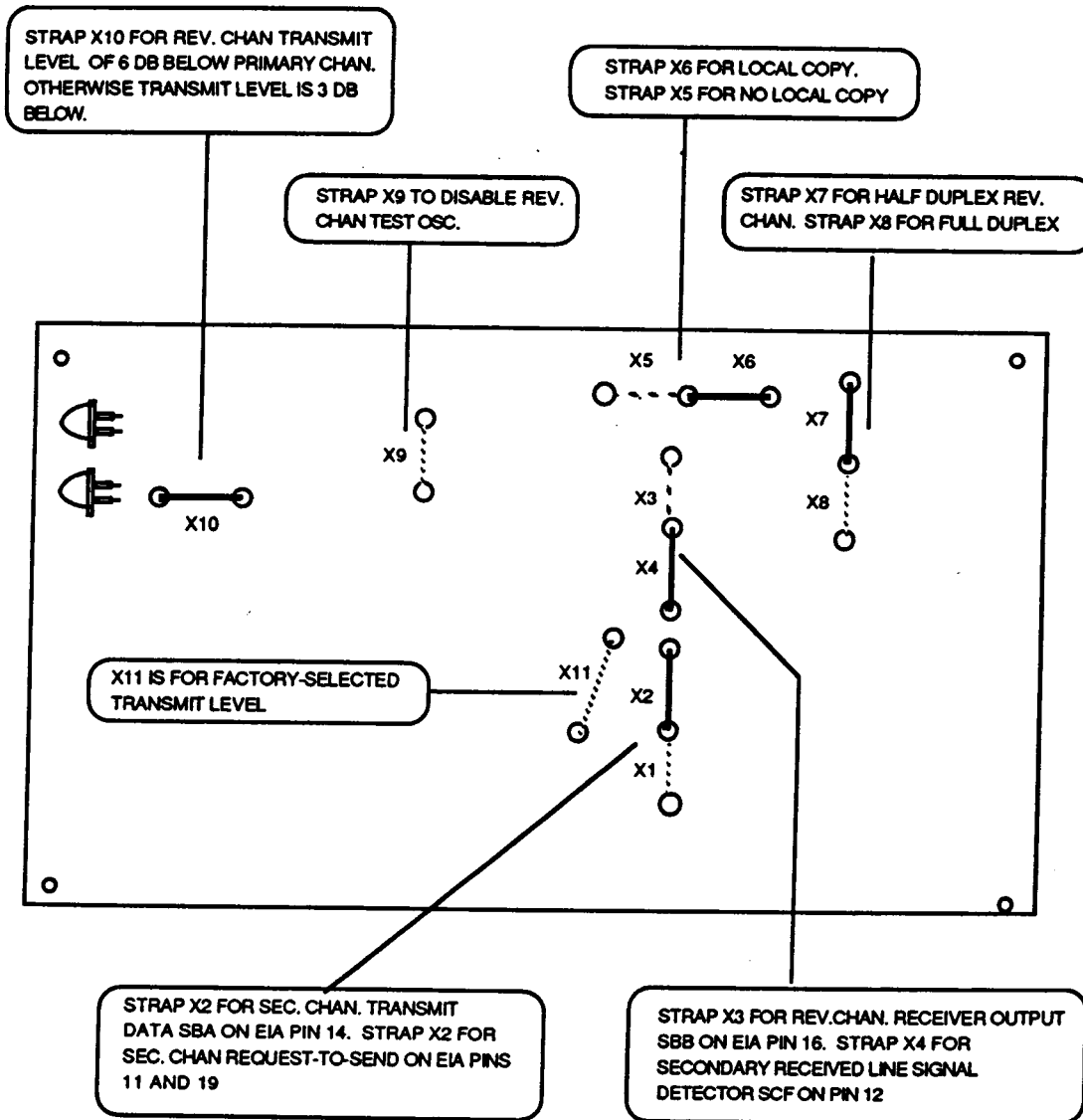


FIGURE 2-6. OPTION SWITCH AND JUMPER SELECTION (Sheet 3 of 3)

TABLE 2-1. DataComm 202S/T AND 202T MODEMS, OPTION APPLICATION NOTES

Code	Option	Option, Switch and Jumper	Description and Comments
1*	Manual/automatic answer	S7-4 S5-4 PP1,2	For switched network operation, provides for either automatic or manual answer.
2	Request-to-send (CA) to clear-to-send (CB) delay	S-4,-5, -6,-7,-8	<p>Provides one of five selectable time intervals: 0, 8 ms, 30 ms, 60 ms, or 180 ms.</p> <p>For switched network operation, the 180 ms is usually selected. The remaining time intervals are generally used for private line operation. The 180-ms interval is also used in private line operation where the round trip is greater than 400 miles or the distant-end modem has the 150-ms squelch option selected. The 60-ms and 30-ms intervals are used on four-wire point-to-point facilities and are compatible with the turn-on time of the received signal detector of 202C, 202D, and 202R modems.</p> <p>The 8-ms interval is used only on duplex multipoint systems requiring fast startup of the modem and is compatible only with a 202T Modem at the distant end. When the 8-ms option is selected, the business machine must keep the transmitter data level (BA) in the mark state when requested to send (CA) is on until clear to send (CB) is turned on; additionally, the distant-end modem must have the fast carrier detector option selected.</p> <p>0 ms normally used in four-wire continuous carrier operation.</p>
3	Carrier detector (CF) time constant	S6-2	The turn-on and the turnoff of the received line signal detect (CF) lead are controlled by this option. Two carrier acquisition time (turn-on) intervals, 23 ms or 7 ms, are available and two carrier release time (turnoff) intervals are available (10 ms and 5 ms).
4	Soft turnoff and squelch intervals	S4-1,-2, -3,-4	<p>Provides for either continuous carrier operation, generally used in four-wire private line operation, or carrier controlled by CA (request to send). For carrier controlled by request to send, an 8- or 24-ms turnoff interval is selectable, during which time a 900-Hz carrier is generated after request to send is turned off. This option should be used in conjunction with the receive data clamp option and will result in a steady mark on the receive data lead of the distant-end modem.</p> <p>The 8-ms interval is used when the fast carrier detection option is installed at the distant-end modem. The 24-ms interval is selected when the distant-end modem has the normal carrier detection option installed or the distant-end modem is not a 202S/T or 202S modem.</p> <p>Neither the 8-ms nor the 24-ms option should be used at remote stations of a multipoint system when intermessage intervals are less than 10 ms. For this case, the 0-ms option should be selected at the remote station in conjunction with the received data clamp and the received line signal detector reset option at the master station. The 0-ms option ensures that the carrier is turned off within 2-ms after request to send is turned off.</p> <p>This option prevents the demodulator (receiver) of the station that has been transmitting from delivering reflections from the line to the receive data lead as legitimate data after request to send is turned off.</p>
* Not applicable to 202T.			

## INSTALLATION

**TABLE 2-1. DataComm 202S/T AND 202T MODEMS,  
OPTION APPLICATION NOTES (Cont.)**

Code	Option	Option, Switch and Jumper	Description and Comments
5	Two-wire operation with/without Reverse Channel	X4,X5 S7-1,-2	When modem is operating over the two-wire facilities, it can be equipped (REV CH IN) with a 387-Hz Reverse Channel module for signaling at speeds up to 5 bps. The Reverse Channel can be used for supervision of the primary channel or for transmit assurance.
6	Local copy on full-duplex Reverse Channel	X5,X6	The Reverse Channel module is configured at the factory for half-duplex operation and with Reverse Channel local copy unavailable. (Strap X6 is installed.) If specified at time of order, the Reverse Channel module can be configured for full-duplex operation and with Reverse Channel local copy available. (Strap X5 is installed for local copy option.)
7	2-wire/4-wire operation	X4 S7-1,-2	Provides for two-wire switched network operation and two-wire or four-wire private line operation.
8	Continuous or controlled carrier	S6-8	Carrier controlled by request to send. Continuous generally used for four-wire private line operation.
9*	Disconnect (abort) timer	S5-5	Used for switched network operation only. When used, the modem will automatically remove the modem from data mode and disconnect modem from telephone line after 15 seconds of inactivity (no transmission, no reception, or an incorrect number dialup).
10*	Carrier detect threshold	X3	Two carrier acquisition thresholds are available (-33 dBm and -45 dBm): -45 dBm acquisition threshold is used in switched network operation, and -33 dBm acquisition threshold is used for two-wire or four-wire private line operation.
11	Transmit level attenuation	S8-1. -2,-3,-4	Step attenuator provides a set transmit level from 0 to -15 dB, using combinations of switch S8-1,2,3,4.
12*	Transmit output level	X6	Either Programmable or Permissive output level is selected for switched network use.
13	Receive data (BB) clamp	S6-6	When option selected, the receive data lead is clamped to a mark when the receive line signal detector (CF) lead is off. This option prevents noise from causing spurious signals on received data (BB) lead when CF is off.
14	Local copy on primary channel	S6-7	With option selected in two-wire operation, receiver continuously monitors transmitted line signals while modem is transmitting, and provides local copy on receive data (BB) lead. (Local copy of Reverse Channel also available and is provided in secondary received line signal detector P lead.)
15	Connect or isolate signal and chassis ground	X7	Signal ground (AB) is normally connected to protective ground (AA) to minimize introduction of longitudinal power line noise into data circuits. Local procedures or conditions may require that signal ground not be connected to protective ground. This option is a jumper plug, X7.

\* Not applicable to 202T.



**TABLE 2-1. DataComm 202S/T AND 202T MODEMS,  
OPTION APPLICATION NOTES (Cont.)**

Code	Option	Option, Switch and Jumper	Description and Comments												
16	Fast carrier detector reset	S6-5	This option enables the fast CF reset pulse, when supplied by the business machine. To turn off CF lead in less than 1 ms, regardless of release time interval selected by carrier detector timing option (EIA pin number 25).												
17	Compromise equalizer	X2	Normally used only in point-to-point private line operation. Compromise equalizer can be switched into or out of receive section of modem. Equalizer compensates for both amplitude and delay distortion and is designed for intentionally partial compensation of a C2 conditioned line. This option also helps data reception on S/N lines, which are more severe.												
18	Mark/space frequency deviation	X11,X12	Equipped with LSI chip, transmit frequencies are available as follows:												
			<table border="1"> <thead> <tr> <th>Strap</th> <th>Mark</th> <th>Space</th> </tr> </thead> <tbody> <tr> <td>None</td> <td>1200 Hz</td> <td>2200 Hz (WECO)</td> </tr> <tr> <td>X12</td> <td>1300 Hz</td> <td>2100 Hz (CCITT)</td> </tr> <tr> <td>X11,X12</td> <td>1400 Hz</td> <td>220 Hz (West. Union)</td> </tr> </tbody> </table>	Strap	Mark	Space	None	1200 Hz	2200 Hz (WECO)	X12	1300 Hz	2100 Hz (CCITT)	X11,X12	1400 Hz	220 Hz (West. Union)
Strap	Mark	Space													
None	1200 Hz	2200 Hz (WECO)													
X12	1300 Hz	2100 Hz (CCITT)													
X11,X12	1400 Hz	220 Hz (West. Union)													
			<p style="text-align: center;"><b>NOTE</b></p> <p><i>Unless specified at time of order, the modem is shipped from the factory strapped for WECO mark and space frequencies.</i></p>												
19*	Echo suppressor	S5-1	This option eliminates echo problems that may be encountered during startup over satellite transmission circuits. Option cannot be used with Reverse Channel installed (full-duplex lines).**												
20*	Telephone options	S5-3,S7-5, X18,X19	Selects each of desired telephone sets.												
21	Carrier controlled turnaround	S6-1	With option selected, modem, in two-wire operation, cannot start transmission while carrier detector (CF) is on. With option disabled, modem can begin transmission anytime. If carrier detector is on at this time, it will be forced off, and reception of data stopped.												
22*	Line impedance	S7-3	Provides proper line impedance for domestic (600 ohms) or Canadian (900 ohms) VF lines.												
23*	Modem ready (CC) early in answer mode	S5-2	When optioned for early, enables data set ready (CC) circuit to turn on when modem goes off hook.												
24	No CC in ANALOOP	S6-3	Determines whether data set ready lead (CC) on EIA pin 6 is ON or OFF when modem is in analog loopback test mode. When ON, allows full-duplex test from terminal. When OFF, CC is on only in data mode and forced off in test modes.												
* Not applicable to 202T.															

## INSTALLATION

**TABLE 2-1. DataComm 202S/T AND 202T MODEMS,  
OPTION APPLICATION NOTES (Cont.)**

Code	Option	Option, Switch and Jumper	Description and Comments
25	Request to send (CA) ON	S6-4	Used for simplex operation. (May be used for constant CB in four-wire operation.)
26*†	Data terminal ready (CD) ON	X1	For terminals that do not supply CD, and for test purposes to verify operation of EIA CD.
27	Frame ground to EIA pin 1	X15	Originally used by customers to tie frame ground together (by jumper) through EIA pin 1. However, this practice is not recommended due to large line current that may be present between these points.
28	Reverse Channel local copy	X5,X6 (Rev. Chan.)	Reverse Channel local copy function can be enabled when desired.
29	Reverse Channel receiver output	X3,X4 (Rev. Chan.)	Reverse Channel received data available at EIA connector pin 16 (SBB). Reverse Channel received data available at EIA connector pin 12 (SB/SCF).
30	Reverse Channel half-full duplex	X7,X8 (Rev. Chan.)	Half-duplex modem operation. Secondary channel, full-duplex operation.
31	Reverse Channel transmitter control	X1,X2 (Rev. Chan.)	Reverse Channel transmitter controlled by EIA connector pin 14 (SBA). Reverse Channel transmitter controlled by EIA connector pins 11 and 19 (SA/SCA).
32	Reverse Channel test oscillator	X9 (Rev. Chan.)	Enables 2.1-Hz test oscillator.
33	Reverse Channel transmit level	X10 (Rev. Chan.)	With strap connected, the Reverse Channel transmit level is 6 dB below the primary channel. With strap removed, the Reverse Channel transmit level is 3 dB below the primary channel.
34	Factory option	X11 (Rev. Chan.)	X11
35	AC/DC Power Source Select	X16	Allows modem to operate with ac shelf and standalone base, or dc shelf.
<p>* Not applicable to 202T. † When this option is used, other methods of disconnection should be used, such as abort timer and loop-current interruption.</p>			

### INSTALLATION PROCEDURES

The modem's printed circuit board assembly may be installed in either a Standalone Enclosure or Rackmount Shelf. Either installation should be located in a ventilated area where the ambient temperature does not exceed 122°F. Do not install the modem directly above other equipment that generates large amounts of heat (such as power supplies).

#### **Standalone Installation**

For standalone installation, the modem is mounted in a Standalone Enclosure. Before making electrical connections to the modem, consult the option diagram (Figure 2-6) to verify that all options have been selected as required.

If it is necessary to remove the component boards from the standalone base, disconnect the power supply connector from J1, which is mounted at the rear center of the base card (the location of J1 is illustrated in Figures 2-1 through 2-3). When reinstalling the component boards in the base, reinstall the connector at J1.

#### **Rackmount Installation**

For rackmount installation, the modem is mounted in a shelf, which may support as many as sixteen DataComm 202S/Ts and 202Ts. The modem may be installed in any unused receptacle in the shelf. To install the modem in the shelf, proceed as follows:

- a. Consult the option diagram (Figure 2-6) to verify that all options have been selected as required.
- b. Position the modem base card in the top and bottom receptacle guides with the front panel pushbutton on top, and carefully slide the assembly into the receptacle until it stops at the rear connectors.
- c. With both hands on the front panel, push the assembly into the rear connectors with a snapping action.

### ELECTRICAL CONNECTIONS

#### **Standalone Enclosure**

The following paragraphs describe the power line, business equipment, and private line connections to the Modem.

The modem is equipped with a captive ac power cord terminated in a molded three-prong plug. Connect the cord to a polarized outlet providing the required ac power. The outlet should not be under switch control. The modem should be powered by the same ac source as the equipment interfaced with the unit to prevent large circulating currents caused by differences in ground potential. If it is not possible to determine whether the equipment is powered by the same ac source, it should be verified that a potential difference of less than 0.25 V rms exists between the grounding circuits of the respective power outlets.

## INSTALLATION

### **CAUTION**

*This unit incorporates internal fusible links, FL1 and FL2 (illustrated in Figures 2-1 through 2-3), which may be opened if the ground potential exceeds 0.25 V rms between the unit and peripheral equipment. Do not apply power to the modem until all connections to peripheral equipment have been made. If a fusible link is opened in a modem, return the unit to the factory for repair.*

### **Rackmount Shelf**

The modem obtains power directly from the shelf when properly installed as instructed under Rackmount Installation.

### **DETERMINING TRANSMIT OUTPUT LEVEL AND COMPATIBLE DATA JACK TYPES FOR OPERATION ON THE SWITCHED NETWORK (202S/T ONLY)**

The USOC-designed data jacks applicable to GDC equipment are six-pin and eight-pin miniature types. (The eight-pin jack also accepts an otherwise conforming six-pin plug from data equipment so equipped.) The jacks are available within internal attenuators of varying value, to accommodate modems with different output signal levels and customer-premises-to-central-office telephone lines with various losses. Typical modem output signal levels are:

- Controlled by means of external resistor in the telephone jack box (referred to as Programmed output level); without external resistor the output level is -12 dBm.
- Factory-set by internal resistor to -9 dBm (Permissive).

The General DataComm equipment covered by these instructions, when purchased for connection by end users to the public switched telephone network, must be configured for one of the output arrangements specified in Part 68 of the FCC Rules. The signal output level of the modem is determined by the cable used, which is factory-set, as described above, or by the setting of the modem PE or PR on-board option jumper.

### **Programmed Output**

The Programmed output is the recommended arrangement since it takes full advantage of the existing central office connection. The value of the external "programming" resistor in the telephone jack box is determined by the loss of the loop facility according to a set of resistor values specified in the FCC Rules. *The resistor value is selected and installed in the data jack at the time of installation by the telephone company.* Without any external resistor installed, the output level is -12 dBm. External resistors increase the gain of the output amplifier and, hence, the output level. A special data jack must be installed by the telephone company to operate in the Programmed arrangement.

**Permissive Output**

The Permissive configuration may be used for portable data equipment or in any application where the output signal level cannot be optimized. In this configuration the output of the modem is set not to exceed -9 dBm. This level represents a calculated median that, in most installations, will produce a usable signal below the region where distortion occurs at the central office. A standard modular telephone jack is used for the Permissive arrangement.

**BUSINESS  
EQUIPMENT  
CONNECTIONS  
(DATA  
TERMINAL)**

Connect the business equipment (data terminal) to the modem by means of the 25-pin EIA RS-232 connector on the rear panels of the Standalone Enclosure and the Rackmount Shelf, as illustrated in Figures 2-7 through 2-13. Before making a shelf connection, verify that the RS-232 connector corresponds with the shelf receptacle in which the modem base card is installed.

**VF LINE  
CONNECTIONS**

VF cables correspond to two output configurations (Permissive or Programmed) authorized by the FCC for connection to the switched network are available from GDC in standardized lengths. Detailed information on these cables is contained in Table 2-2.

Cable arrangements for answer-originate or answer-only service and for operation with auxiliary telephones and automatic calling units are illustrated in Figures 2-7 through 2-10. Connect the telephone cable to be used to either the SWITCHED NETWORK modular plug or the Aux Telephone connectors at the rear of the standalone enclosure. See Appendix C for the circuits available at the connectors and their pin numbers. For a shelf enclosure, connect the cable to the lower connector labeled Telephone or the eight-pin modular jack at the rear of the shelf enclosure. Connect to the right shelf position by counting 1-16 from right to left.

**Private Line  
Connections**

Private line connections are made to the standalone modem at the screw terminals on the base card. Access to these terminals is through the grommeted hole labeled "PRIVATE LINE" at the rear of the standalone enclosure. Programmable plug must be in the PP2 socket on the base card (Program plug is soldered in place on the 202T) and switches S7-1,2 must be On and jumper X4 must be set to Off if DAS 829 is being used (only when TEK5 and TEJ6 inputs are used to control modem ready) and On when DAS 829 is not being used. For private line connection to shelf enclosure, the terminal board at rear of enclosure is used. See Figures 2-11 through 2-13 for private line cable arrangements.

## INSTALLATION

### **Private Line Connections with Alternate Voice**

For alternate voice in four-wire private line configuration, the modem is connected to a DAS 829 (or equivalent) line interface device at the Aux Telephone connector at the rear of the shelf. An alternative method is to connect the cable to the screw terminals on the base card through the grommeted hole on the standalone, or on the TB1 terminal board at the rear of the shelf enclosure. See Figure 2-13 (A or B) for the connections.

**TABLE 2-2. CABLE ASSEMBLIES**

Item	Description	GDC Part No.	Remarks
<b>Switched Network Cables</b>			
CPR-T-14	Programmable switched network and keyset cable (Y cable)	024H516-014	14 feet long; for use with 202S/T.
CPE-T-14	Permissive switched network and keyset cable (Y cable)	024H512-014	14 feet long; for use with 202S/T.
CPR-M-14	Programmable 8-pin modular plug to 8-pin modular plug	830028-814	14 feet long; for use with 202S/T.
CPE-M-14	Permissive 6-pin modular plug to 6-pin modular plug	830027-414	14 feet long; for use iwth 202S/T.
M13F	25-pin connector to 50-pin connector cable for keyset connection	024H502-005	5 feet long. Use with 564, 565, 2565, or AE-186 telephone set; for use with 202S/T.
<b>Private Line Cables</b>			
M8K-61	DAS 828/829 interface cable with 50-pin connector	024H317-005	5 feet lonk; for use with 202S/T or 202T.
M8KL	Same as above but with four spade lugs at 44A connecting block end	024H313-010	10 feet long; for use with 202S/T or 202T.
D25D	Cable for 2- or 4-wire private line connecting block, 66E3	024H503-005	5 feet long; for use with 202S/T or 202T.
D25S	VF cable for 2- or 4-wire private line applications	023H101-020	20 feet long; for use with 202S/T or 202T.

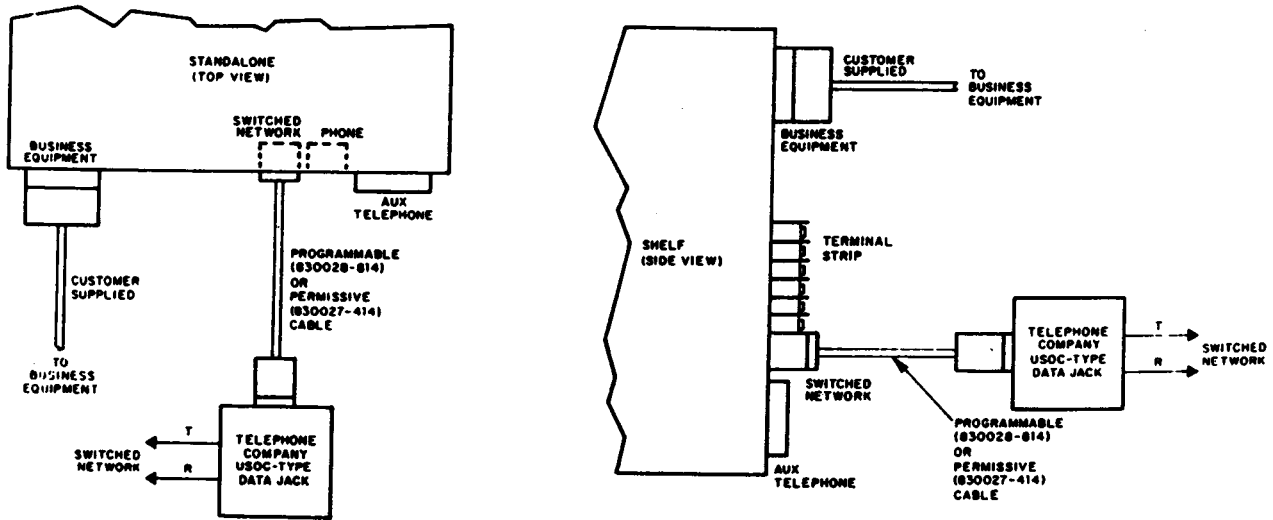


FIGURE 2-7. ANSWER-ONLY CONFIGURATION (202S/T) (NO TELEPHONE)

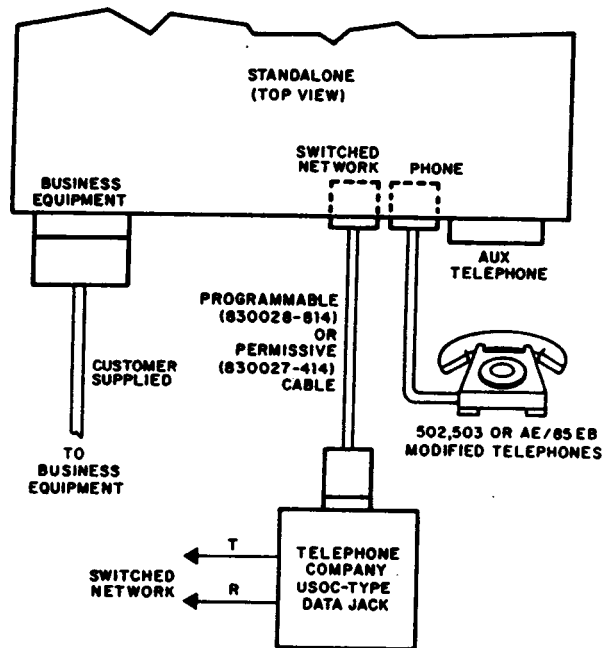


FIGURE 2-8. GDC MODIFIED 502, 503 OR AE/85EB AUXILIARY TELEPHONE CONFIGURATION (RTC/503 MAY ALSO BE CONNECTED) (202S/T)



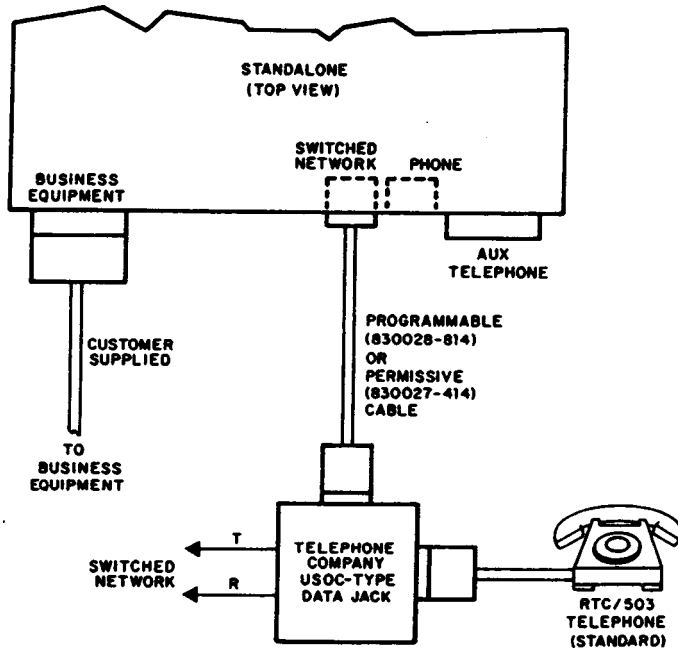
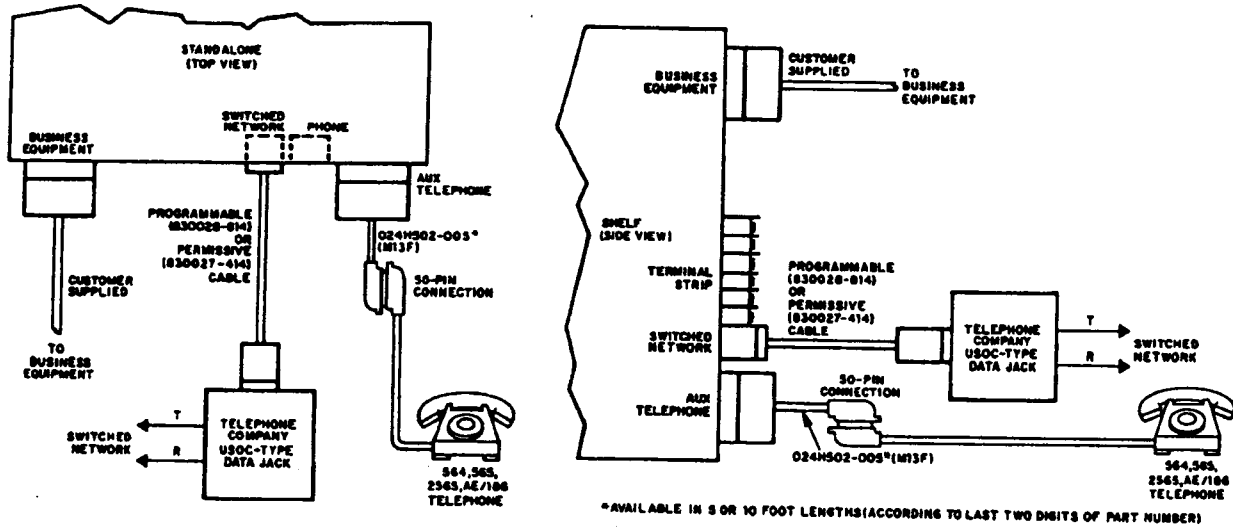
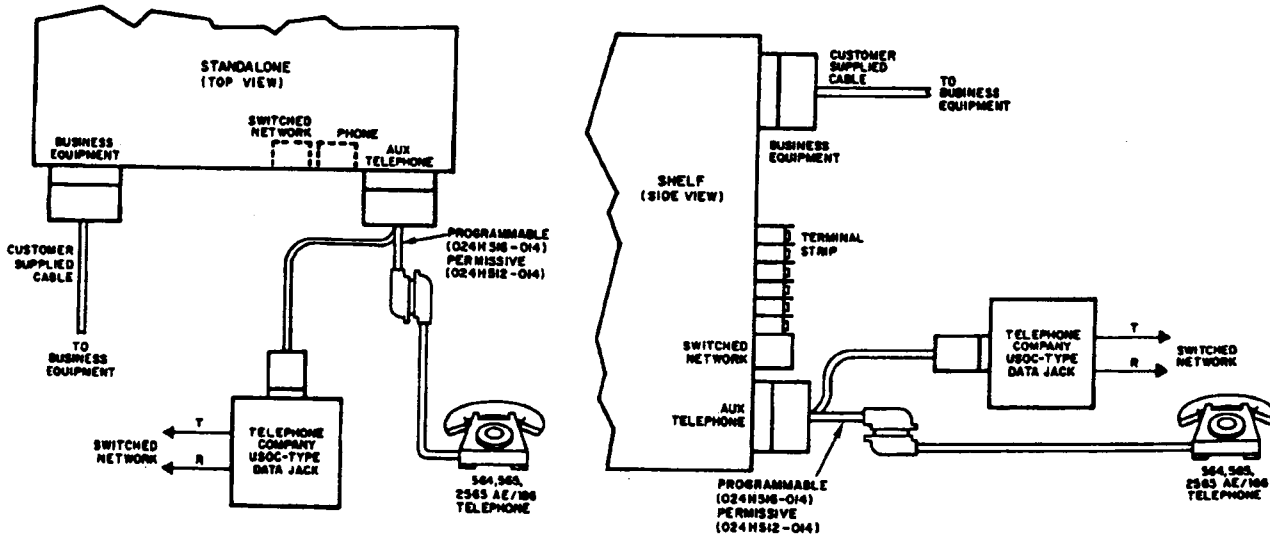


FIGURE 2-9. STANDARD UNMODIFIED TELEPHONE COMPANY-SUPPLIED RTC/503 AUXILIARY TELEPHONE CONFIGURATION (202S/T)



(COMBINATION A)



(ALTERNATIVE)

FIGURE 2-10. 564, 565, 2565, AE/186 AUXILIARY TELEPHONE CONFIGURATION (202S/T)

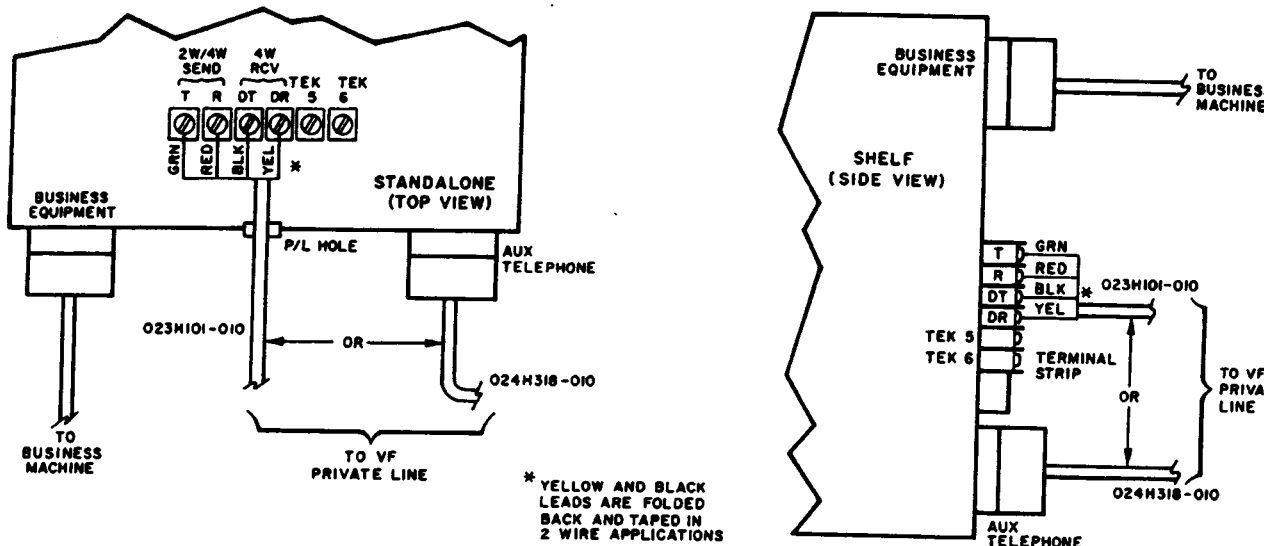


FIGURE 2-11. TWO-WIRE/FOUR-WIRE PRIVATE LINE INTERFACE CONNECTIONS TO MODEM CIRCUIT CARD

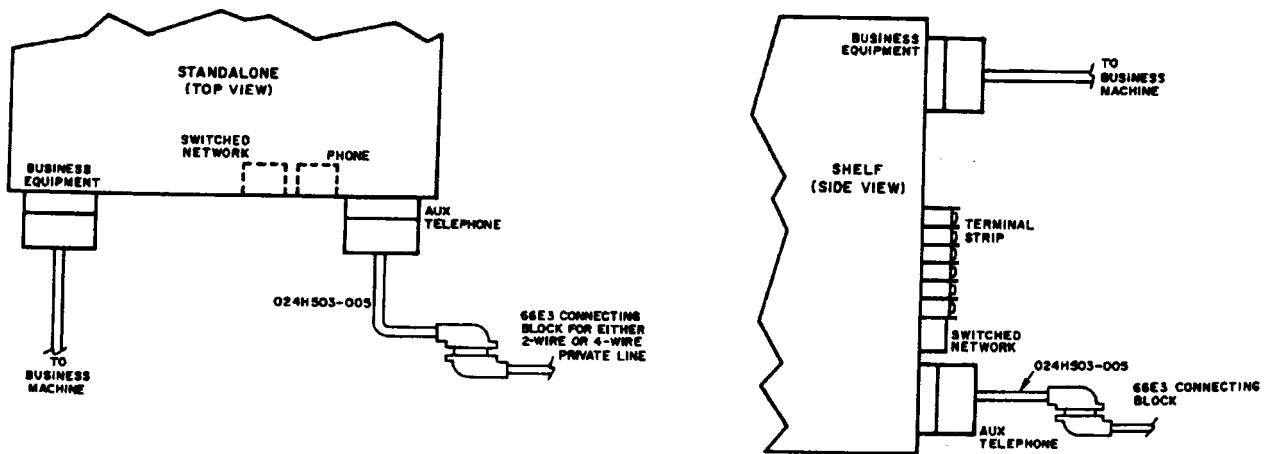
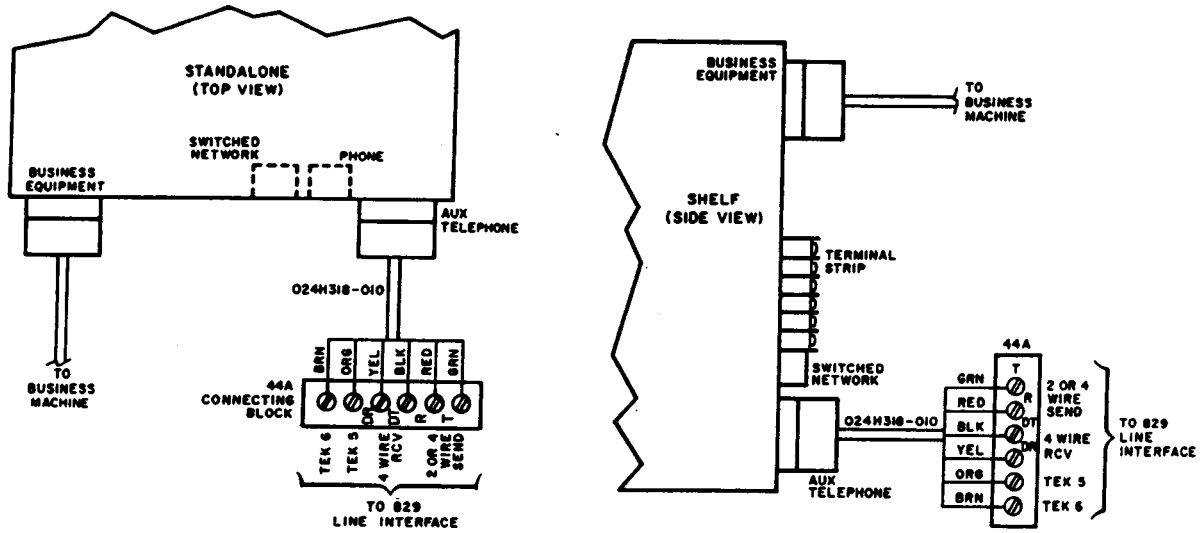
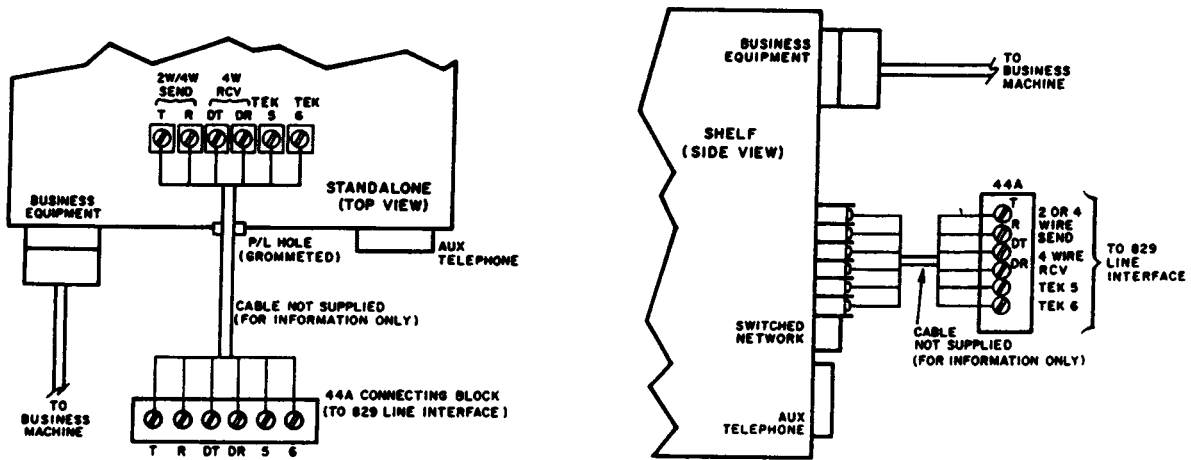


FIGURE 2-12. TWO-WIRE/FOUR-WIRE PRIVATE LINE INTERFACE CONNECTIONS FOR 66E3 CONNECTING BLOCK (202T OR 202S/T)



**A. USING 25-PIN AUX CONNECTOR**



**B. USING TERMINAL STRIP**

**FIGURE 2-13. TWO-WIRE/FOUR-WIRE PRIVATE LINE INTERFACE CONNECTIONS FOR USE IN 829 LINE INTERFACE (202T OR 202S/T)**

## **SECTION 3**

### **OPERATION**

---

#### **OVERVIEW**

When the 202S/T is installed for switched network operation, it operates in conjunction with a telephone unless it is optioned for answer-only. The operating procedures using a telephone are shown in flow charts in this section. When the 202S/T or 202T modem is installed in private line operation, it operates unattended. No attendant control or adjustment is required. This section also describes the front panel controls and indicators and rear panel connectors on the modem.

#### **CONTROLS, INDICATORS AND CONNECTORS**

Figures 3-1 and 3-2 illustrate the modem's front panel and explain the function of each control and indicator. Figure 3-3 illustrates the standalone enclosure rear panel connectors for 117 V ac and international voltage bases.

#### **RACKMOUNT SHELF**

Rackmount shelf front panel controls, indicators, fuses, and rear panel connectors are described in the manual supplied with the shelf. Refer to it if you have a rackmounted modem.

#### **REVERSE CHANNEL OPERATION**

When the optional Reverse Channel module is installed, reverse channel operation is an automatic function in data operation, under the control of the business machine.

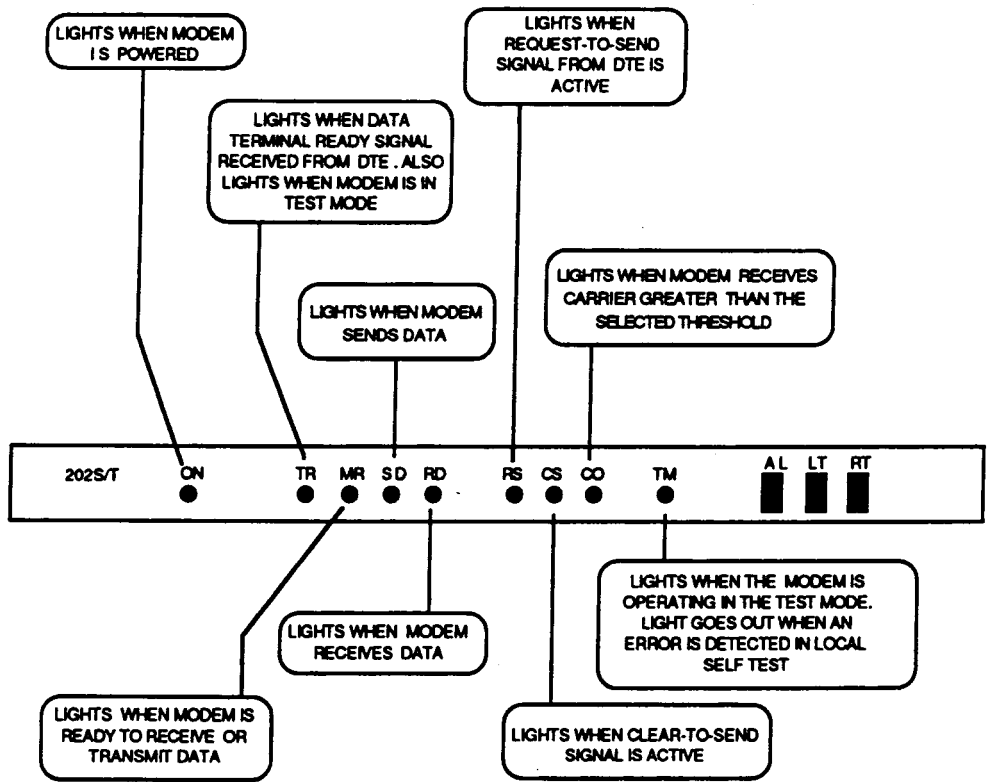


FIGURE 3-1.FRONT PANEL INDICATORS

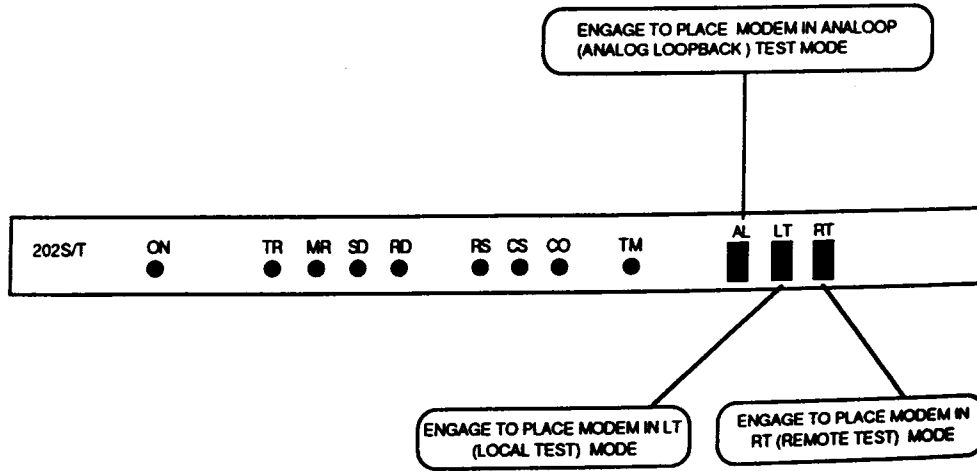


FIGURE 3-2.FRONT PANEL CONTROLS

## **OPERATION**

### **REVERSE CHANNEL OPERATION**

When the optional Reverse Channel module is installed, reverse channel operation is an automatic function in data operation, under the control of the business machine.

### **PRIVATE LINE OPERATION**

When the GDC 202S/T or 202T Modem is installed for private line applications, it operates unattended. Periodically, the attendant can visually verify the operation of the modem by observing the CO (DCD) indicator on the front panel. In two-wire operation, the lighting of the CO indicator signifies that the modem is either transmitting or receiving with the local copy in. In four-wire operation, the lighting of the CO indicator signifies only that the modem is receiving a carrier signal.

### **SWITCHED NETWORK OPERATION**

The following paragraphs describe manual and automatic answering operating procedures.

#### **Manual Operation**

In switched network applications, the attendant can perform a variety of manual operations:

- Originate a talk (voice) call to an attended station.
- Originate a (digital) data call to an unattended, automatically answering station.
- Answer a talk call from an attended station.
- Change from talk to data operation, or vice versa.
- Terminate the call.

#### **NOTE**

*The attendant should be aware that the intelligence in the data in the reverse channel, as interpreted by the business machine, may provide valuable information concerning the status of the communication link (e.g., loss of data, excessive errors, end of data transmission, etc.)*

Operational procedures for originating/answering a call are described below.

#### **Automatic Answering**

For automatically answering any call, the business machine data terminal ready indication TR must be present. These procedures are described below.



**565 AND 2565  
TELEPHONE SET  
OPERATION**

The operating instructions for the 565 or 2565 telephone set used with the 202S/T Modem depend on whether a call is being originated, answered, or terminated.

**Originating a Call**

The following procedures are to be observed when originating a call. (Refer to Figure 3-4.)

**Answering a Call**

Follow the steps in Figure 3-5 for manually answering a call.

**Returning to Talk  
Mode from Data  
Mode**

To return to the talk mode from the data mode, proceed as follows:

- a. Lift the handset from the hook.
- b. Press the lighted line button (corresponding with the modem of concern).
- c. The light in that line button will go out. Your modem is then returned to the talk mode.

You can converse with the attendant of the remote modem when he has also switched from data to talk. This procedure, which applies to both the calling and called modems, should be coordinated by prearrangement.

**Terminating a Call**

The data modem can be reestablished by asking the remote attendant to transfer to the data mode. Proceed as shown in Figure 3-4 after receiving an answertone.

To terminate a call proceed as shown in Figure 3-6. The call can also be terminated by the business equipment when the data terminal ready (TR or DTR) signal is turned off.

**GDC 502, 2502, OR  
503 TELEPHONE  
SET OPERATION**

The operating instructions for the GDC 502 or 2502\* (Figure 3-3) or 503 telephone set, used with the 202S/T Modem, depend on whether a call is being originated, answered, or terminated. The 503 telephone should be ordered from the telephone company with the A2 option.

**Originating a Call**

See Figure 3-4 for a flowchart of the call origination procedure using a 502/2502 or 503/2503 telephone.

**Answering a Call**

See Figure 3-5 for a flowchart of the manual answering procedures using a 502/2502 or 503/2503 telephone.

\* GDC 502 and 2502 telephones are specially modified. Unmodified telephones cannot be used with the 202S/T.

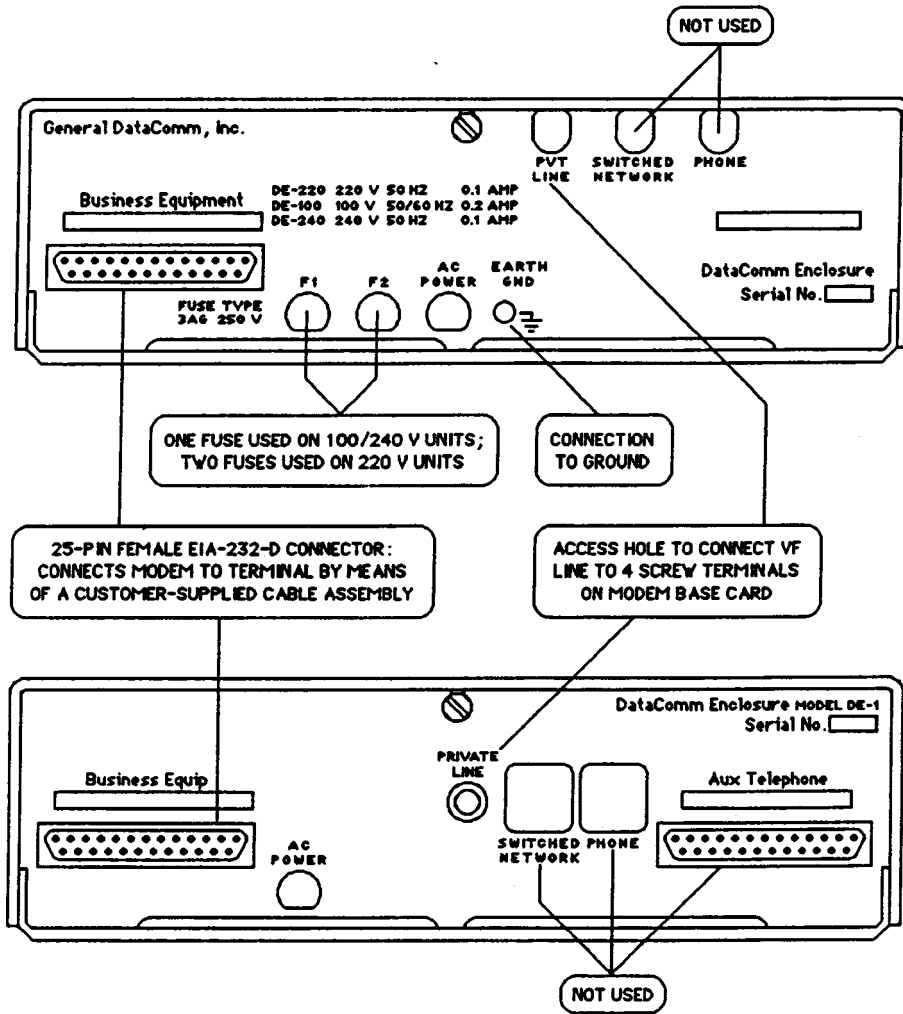
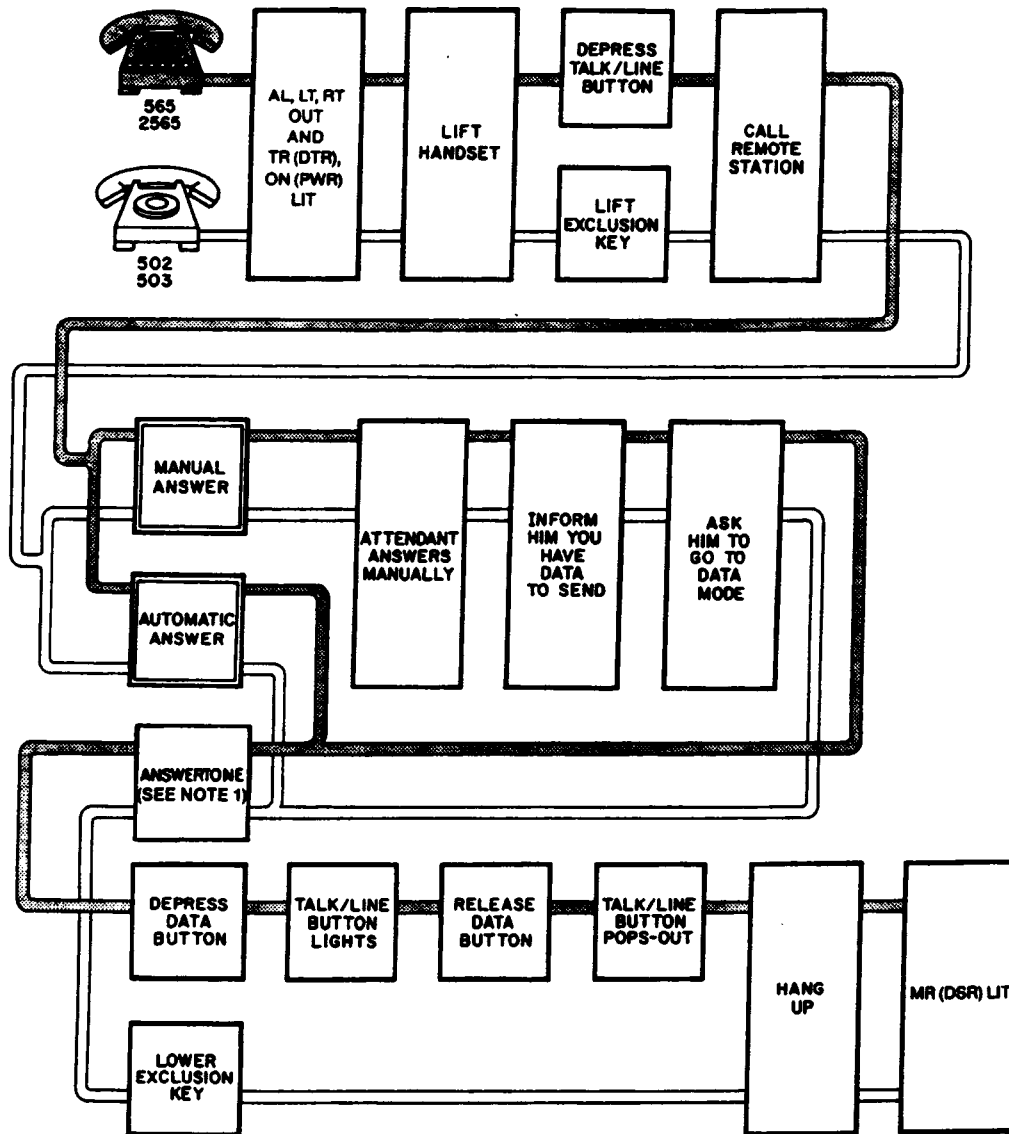


FIGURE 3-3. STANDALONE ENCLOSURE REAR PANELS

**NOTE**

*If the remote station is optioned for automatic answer and its data terminal ready is on, automatic answer will occur, followed by a 1.5-second quiet period and then a high-pitched steady tone (2025 Hz). When the steady tone goes off or shifts to a lower pitch (if a reverse channel is in use), depress the data button on the telephone. When line button lights, release data button and check that line button is released. If the calling modem is a Western Electric Model 202S, it may be necessary for the attendant of both modems to press their data buttons simultaneously.*

**FIGURE 3-4. 202S/T TELEPHONE OPERATION, CALL ORIGINATION**

## **OPERATION**

### **NOTE**

*In order to be used for manual answering, the 503 telephone set must be installed so that the ringer is connected to the line when the handset is on hook to provide an audible indication of incoming calls.*

### **Terminating a Call**

To terminate a call, proceed as shown in Figure 3-6 for a 502/2502 or 503/2503 telephone. The call can also be terminated by the business equipment when the data terminal ready (TR or DTR) signal is turned off.

### **Monitoring Data Signals**

Telephone company 503/2503 telephones with aural monitoring option B4 may be used to monitor data signals. During the data mode, lift the handset, but do not pull up the exclusion key. Data signals should now be audible.

### **Automatic Operation**

The 202S/T may answer and terminate calls automatically. If the modem is optioned for automatic answering all calls are answered without attendant intervention. If the modem is optioned for abort, timer calls to the modem will be terminated without attendant intervention when option's prerequisite conditions are met.

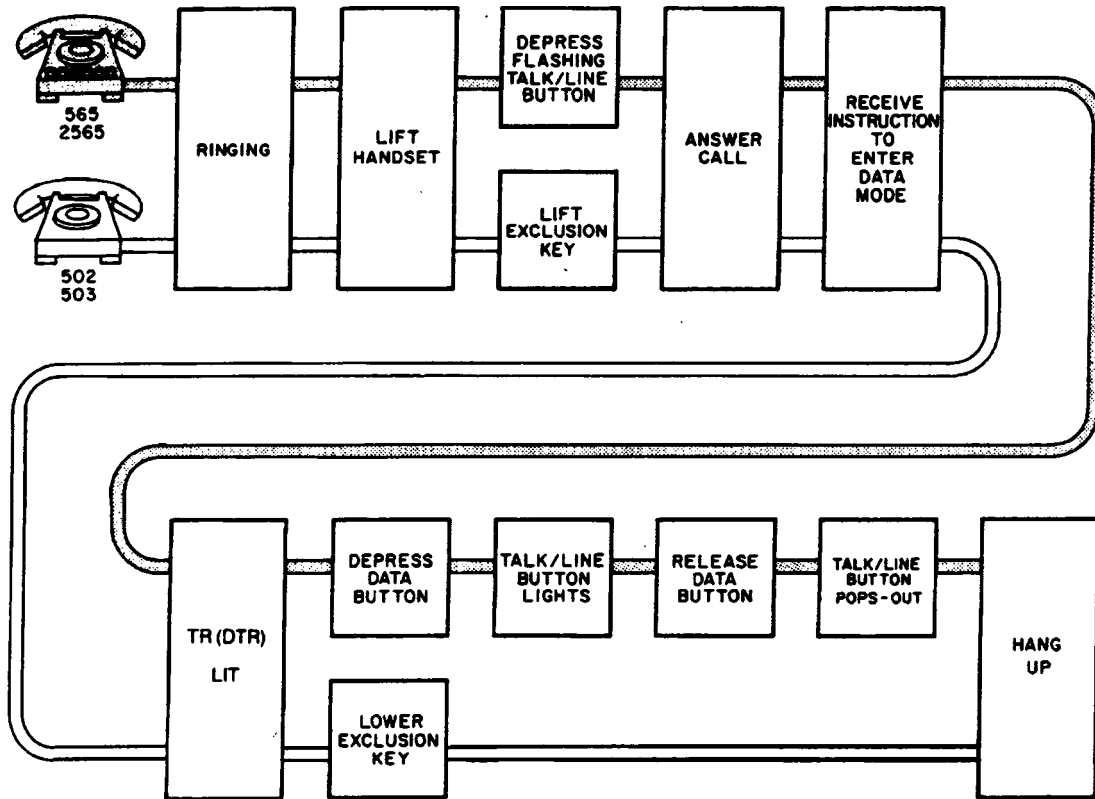


FIGURE 3-5. 202S/T TELEPHONE OPERATION, MANUAL ANSWERING

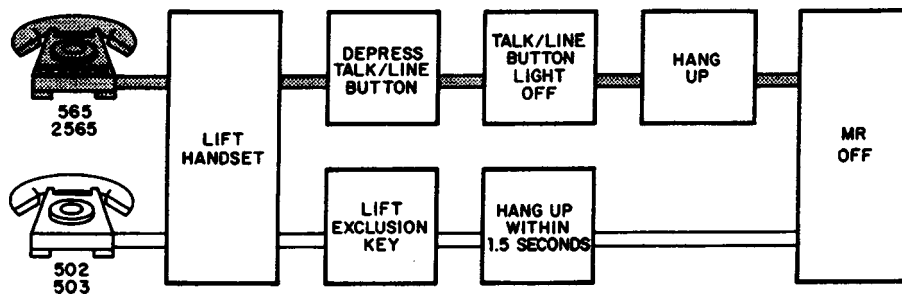


FIGURE 3-6. 202S/T TELEPHONE OPERATION, MANUAL CALL TERMINATION



## SECTION 4 TESTS

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### OVERVIEW

This section describes the built-in tests that may be performed on the DataComm 202S/T and 202T Modems after installation or whenever operation of the modem must be checked. These tests are also used to isolate problems in the data communications system (refer to the fault-isolation sequence in Figures 4-1 and 4-2). A technical assistance procedure is given at the end of this section.

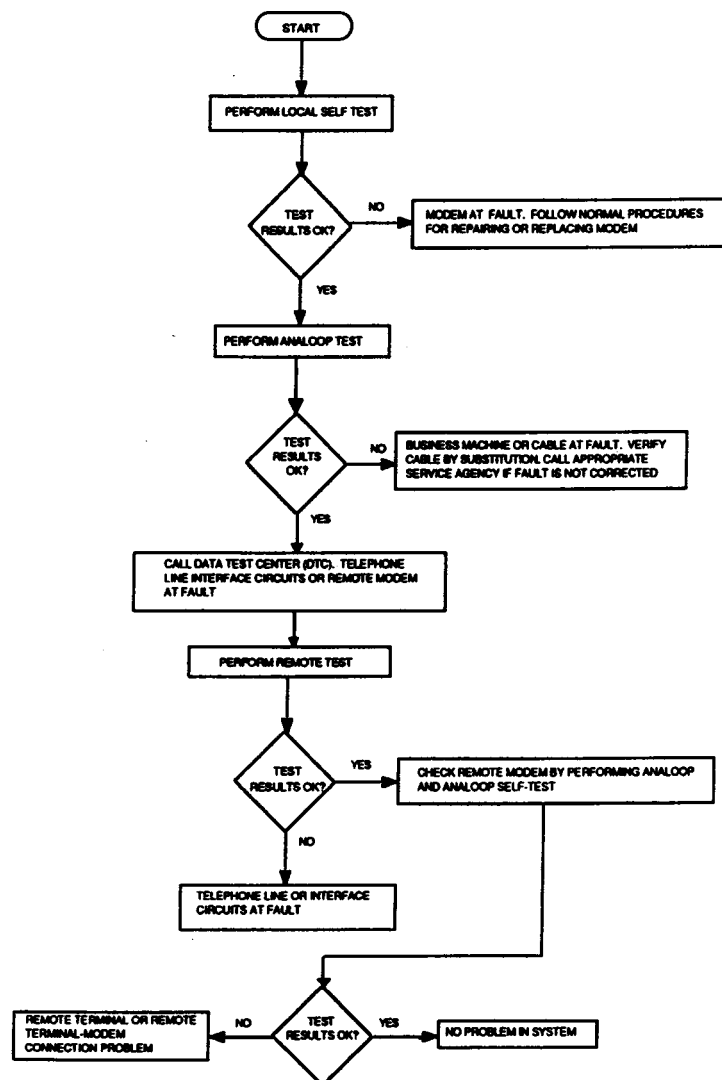


FIGURE 4-1. TROUBLE DIAGNOSTIC FLOWCHART FOR 202S/T MODEM OPERATION OVER TWO-WIRE (SWITCHED NETWORK) TELEPHONE LINES

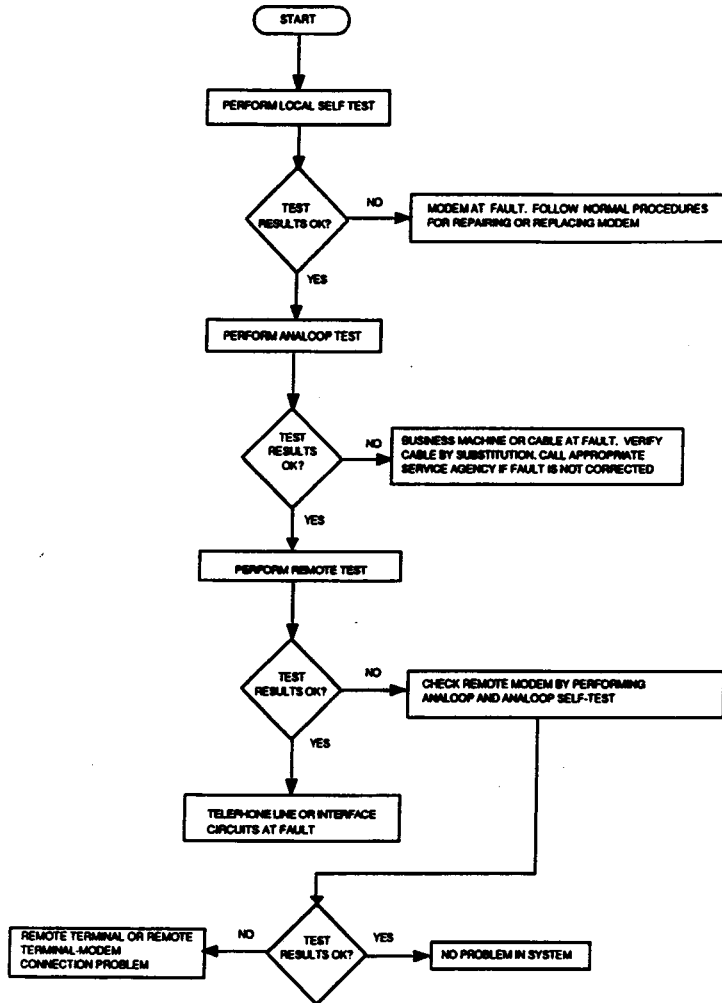


FIGURE 4-2. TROUBLE DIAGNOSTIC FLOWCHART FOR 202S/T MODEM OPERATION OVER FOUR-WIRE DEDICATED TELEPHONE LINES



## LOCAL SELF-TEST

This test is performed by holding the LT pushbutton in (nonlatching). The front panel TM (TST) indicator will light and the modem logic circuits will automatically generate a 63-bit internal program of pseudorandom test pattern signals. These test signals are sent to the modem transmitter and looped back to the modem receiver. If there is an error in the output of the receiver, the error detector will cause the TM light to go out, indicating that a fault exists in the modem.

If there is no error, the TM indicator will remain lit until the switch is released and springs back to Norm position. This continuous lighting indicates that the modem is operable without errors. To perform Local Self-Test, see Figure 4-3.

## NOTE

Before performing a Local Test (LT) move jumper X2 to the OUT position. After performing the Local Test, X2 may be returned to the IN position if desired.

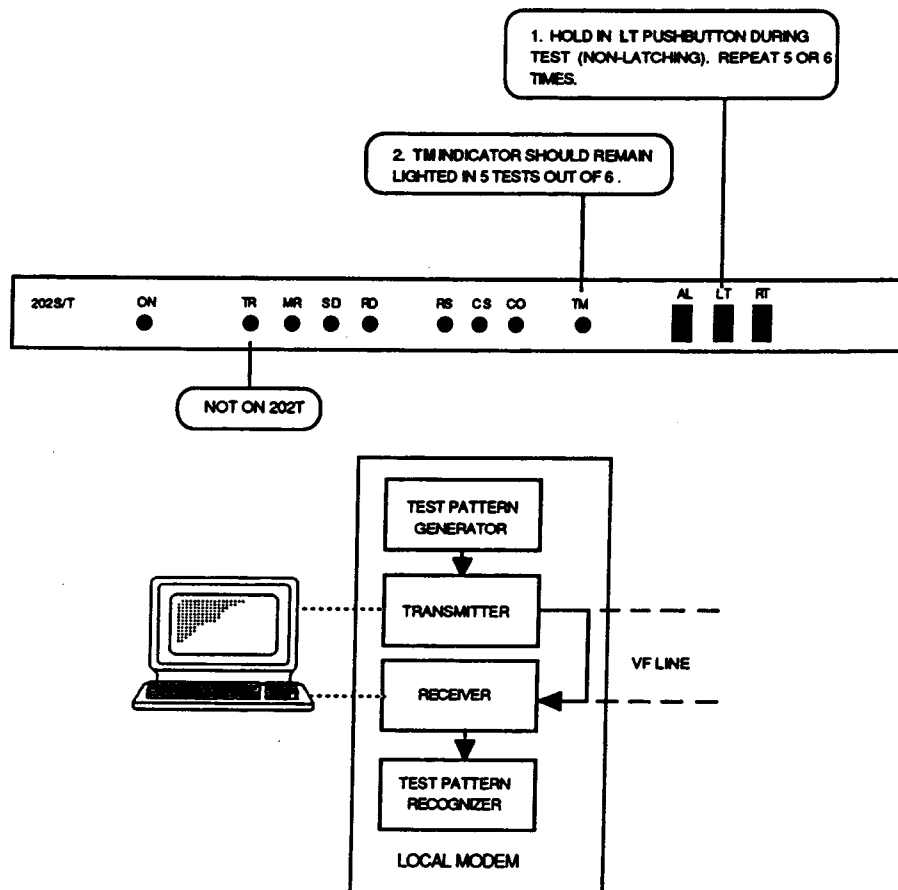


FIGURE 4-3. LOCAL SELF-TEST

ANALOOPT TEST

This test is performed by depressing the AL switch (latching), which electrically isolates the modem from the telephone line, leaving the line(s) terminated. At the same time, the VF output of the modem main channel transmitter is connected to the VF input of the modem channel receiver.

NOTE

If Reverse Channel is used with SCA/SCF optioned, SCF will be on in the ANALOOPT local copy. To perform the ANALOOPT test, see Figure 4-4.

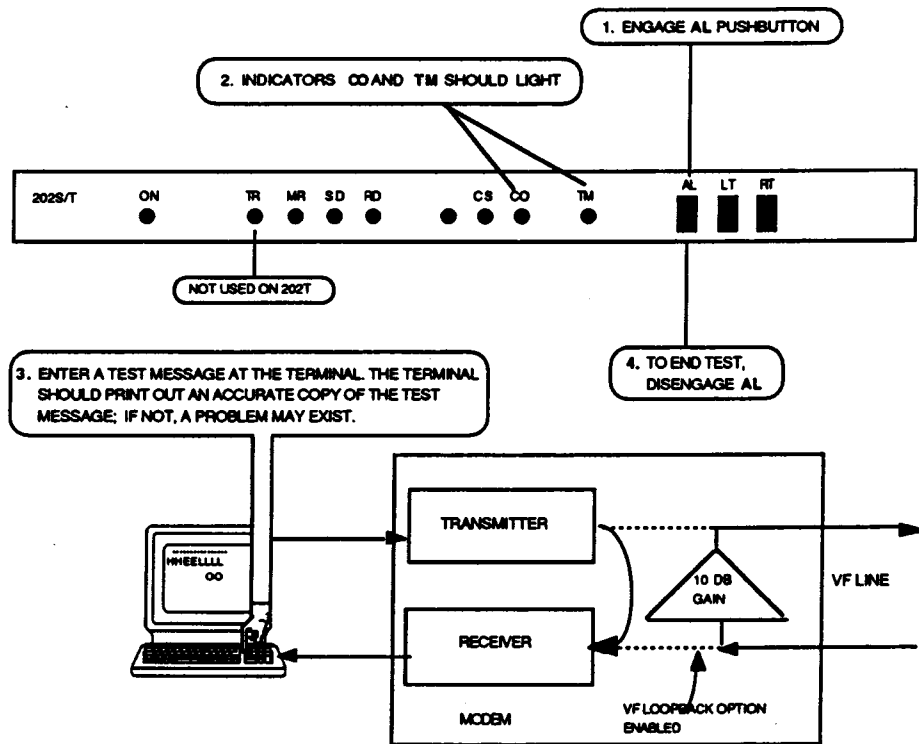


FIGURE 4-4. ANALOOPT TEST

## REMOTE TESTS

The following paragraphs describe two-wire switched network remote tests using a DTC, and four-wire private line remote tests by a remote modem.

Remote Two-Wire Test  
by DTC (202S/T Only)

This test (see Figure 4-5), in which a data test center (DTC) tests a modem strapped for two-wire operation, makes it possible to verify the overall operation of the modem as seen at a remote point. (The Reverse Channel module is also tested by this test.) General DataComm Industries has a DTC that can be used for this purpose. (See Technical Assistance Procedure at the end of this section.)

## NOTE

For GDC 202S/T private line applications, and GDC 202T applications, the DTC and modem personnel will communicate by telephone without automatic answering.

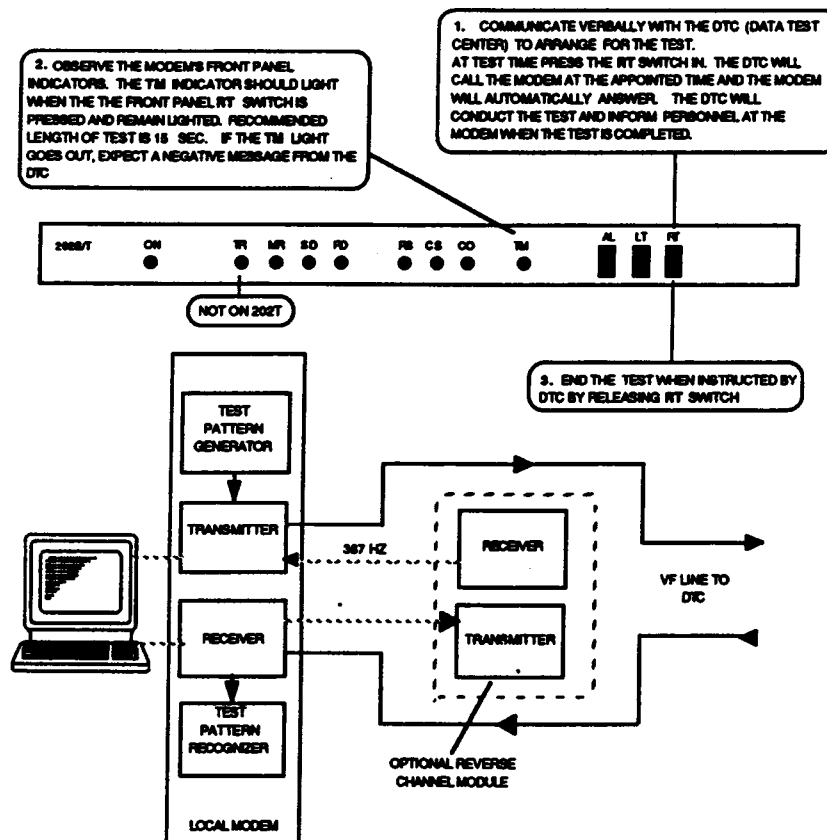


FIGURE 4-5. 202S/T REMOTE TWO-WIRE TEST (202S/T ONLY)

Remote Four-Wire Test  
(Private Line Only)

Remote four-wire tests the originating DTE, the originating and looping modems, and the communications line. Thus, anything received by the modem is transmitted back to its point of origin, where it is checked for errors. An attendant must be present at the looping modem to perform digital loopback. Figure 4-6 illustrates the tests.

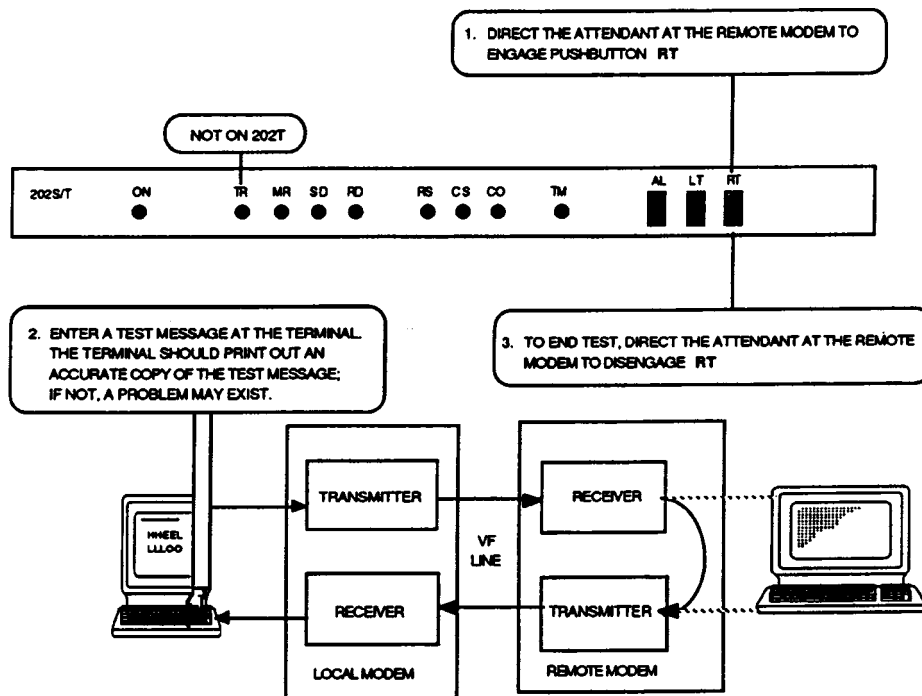


FIGURE 4-6. REMOTE FOUR-WIRE TEST (PRIVATE LINE ONLY)

## APPENDIX A

### TECHNICAL CHARACTERISTICS

Item	Characteristic
Operating Mode	Two-wire simplex or half duplex (four-wire full or half duplex available for private line applications) asynchronous.
Data Rate	Up to 1200 baud over switched telephone network (DDD). Up to 1200 baud on unconditioned lines and up to 1800 baud on C2 unconditioned lines.
VF Interface	Line impedance 600 ohms or 900 ohms, 2-wire, transformer-coupled; 600 ohms, 4-wire, transformer-coupled.
VF Output Level (without reverse channel). Output levels with reverse channel equal values listed (minus) -1 dBm.	Fixed at -9 dBm max. (For connection to USOC standard RJ11C-type telephone jack.) Adjustable via USOC RJ45S-type Programmed dta jack over 0 to -12 dBm range in 1 dB steps. Private line, 0 to -15 dBm adjustable in 1 dB steps (on 202T and Canadian 202S/T only).
Transmitter	
Mark frequency	1200 Hz $\pm$ 6 Hz
Space frequency	2200 Hz $\pm$ 11 Hz
Soft carrier turnoff frequency	900 Hz $\pm$ 4.5 Hz
Answerback tone frequency	2025 Hz $\pm$ 10 Hz (2100 Hz — (European) available by option jumper on pc cards 053P001, 002 marked Rev Z and higher.)
Receiver	
Operating range	0 to -45 dBm
Peak distortion (back to back with equalizer out, 0 to -45 dBm)	8% for 1200 baud
Carrier Detect Energy Thresholds	
Carrier dropout (selectable)	Signals smaller than -51 dBm/-36 dBm
Carrier acquisition (selectable)	Signals greater than -45 dBm/-30 dBm (hysteresis at least 2 dB)
Reverse Channel	
Input signal to transmitter	SCA or SBA (strap option)
Output signal from receiver	SCF or SBB (strap option)
Modulation	100% amplitude (on/off)
Modulation rate	5 baud (max)
Transmitter frequency	387 Hz $\pm$ 5 Hz
Transmitting level	5 dB below level of data channel
Receiver sensitivity	-45 dBm
Received signal operating times	50 ms $\pm$ 50% for on; 55 ms $\pm$ 50% for off
Test oscillator frequency	2.15 Hz $\pm$ 20%

## TECHNICAL CHARACTERISTICS

### TECHNICAL CHARACTERISTICS (Cont.)

Item	Characteristic
Primary Power Requirements	
Domestic:	117 V ac $\pm 10\%$ , 60 Hz $\pm 5\%$ , 10 watts
International:	220 V
	100 V
	240 V
Operating Temperature*	0°C to +50°C (32°F to 122°F)
Humidity	10% to 95% without condensation
Physical Characteristics	
Standalone Enclosure	
Height	3.9 in. (10.0 cm)
Width	10.9 in. (27.5 cm)
Depth	12.5 in. (31.9 cm)
Weight	4.5 lb (2.0 kg)
Printed circuit card assembly	
Height	0.875 in. (22.3 mm)
Width	9.75 in. (248 mm)
Depth	10.77 in. (274 mm)
Weight	1 lb 6 oz (0.625 kg)
Shipping weight	4 lb (1.82 kg)

\* Derate operating temperature by 1°C/1000 ft. above sea level.

## APPENDIX B

### BUSINESS MACHINE FUNCTIONS EXCHANGED THROUGH BUSINESS INTERFACE CONNECTOR P3 (EIA)

Circuit Designation			Modem Function	EIA Connector Pin No.	Remarks
CCITT	EIA	DC 202S/T*			
101	AA	AA	Frame ground	1	Open (may be connected to frame ground).
103	BA	BA	Transmitted data	2	Serial binary data, transmitted from business machine to modem, appears on this lead. Positive voltage is binary 0, or space, and negative voltage is binary 1, or mark.
104	BB	BB	Receive data	3	Serial binary data, transmitted to business machine from modem in response to data signals received from distant modem, appears on this lead. With local option selected in a two-wire configuration, RD lead follows SD lead, delayed by less than 2 ms. (This enables data appearing on SD lead to be monitored.) Positive voltage is binary 0, or space, and negative voltage is binary 1, or mark.
105	CA	CA	Request to send	4	Positive voltage is generated by business machine to turn on transmitter of local modem. The modem then transmits all signals appearing on SD lead as long as On condition is maintained on this RS lead. With local copy option selected, Off condition of this (RS) lead must be delayed by 2 ms after last bit is received on SD lead. (This permits last data bit to clear local receiver P before squelch circuit clamps received data circuit when RS is turned off.)
106	CB	CB	Clear to send	5	Positive voltage is generated by modem to signal business machine to transmit data. The On condition of this (CS) lead is a response to On condition of RS lead, delayed by 8.5, 30, 60, or 180 ms. The Off condition of this lead (CS) is an indication to business machine that it should not transfer data on SD lead. (When RS is turned off, CS is turned off in less than 1 ms.)
107	CC	CC	Data set ready	6	Positive voltage is generated by modem that indicates to local business machine that local modem is in data mode and is capable of transmitting and receiving signals. For operation during test mode, see Section 3.
102	AB	AB	Signal ground	7	Establishes common ground reference for all interface leads. Is connected to FG lead by field-removable strap.

\* DC 202S/T schematic designation.

## BUSINESS MACHINE FUNCTIONS

Circuit Designation			Modem Function	EIA	Remarks
CCITT	EIA	DC 202S/T*		Connector Pin No.	
109	CF	CF	Receiver line signal detector	8	Positive voltage supplied on this lead to business machine indicates that received carrier is being detected and has been received for at least 24 ms (or optionally, 8 ms with fast mode timing option).
—		+V	+12 volts (in series with 1 kilohm resistor)	9	Used for test purposes only.
—		-V	-12 volts (in series with 1 kilohm resistor)	10	Used for test purposes only.
120		SCA	Secondary request to send	11,19	Positive voltage on this lead causes Reverse Channel signals to be transmitted, provided RS lead is Off. (SCA appears on two pins of the customer interface connector to confirm with EIA standard RS-232C and interface with the older 202-type modems.)
122		SCF	Secondary received line signal detector	12	Modem passes to business machine the optional Reverse channel signals on this lead. (Informs business machine transmitting on primary channel of conditions at receiving modem, simultaneously with transmission on primary channel.)
118		SBA	Reverse channel transmit	14	Secondary channel serial binary data from business machine appears on this lead. Positive voltage is binary 0, or space, and negative voltage is binary 1, or mark.
119		SBB	Reverse channel receive	16	Secondary channel serial binary data to the business machine, in response to data signals received from distant modem on reverse channel, appears on this lead. Positive voltage is binary 0, or space, and negative voltage is binary 1, or mark.
108/2	CD**	CD	Data terminal ready	20	Positive voltage is supplied on this lead by business machine and indicates to modem that business machine is ready to transmit or receive data.
125	CE**	CE	Ring indicator	22	Positive voltage is supplied on this lead by modem and indicates to business machine that line-control circuits of modem detect ringing.
		CF Reset	Carrier detect reset	25	Positive pulse of greater than 1-ms duration from business machine resets carrier detector circuits in modem so that latter's turnaround time is reduced to minimum.
<p>* DC 202S/T schematic designation.  ** Not applicable on 202T.</p>					



## APPENDIX C

### FUNCTIONS EXCHANGED THROUGH AUX TELEPHONE INTERFACE CONNECTOR (P1) (202S/T)

Circuit Designation	Telephone Interface Connector Pin	Function
L*	1	Telephone set line lamp controls from modem.
	2,3	Not used.
LG*	4	Telephone set lamp ground from modem.
TD1 (TD) (MI)*	5	Talk/data control from telephone set.
	6	Not used.
T	7	Telephone line tip. (One side of two-wire system transmit/receive pair or one side of transmit pair in four-wire system.)
R	8	Telephone line ring. (One side of two-wire system transmit/receive pair or one side of transmit pair in four-wire system.)
DT	9	Receive telephone line tip. (One side of four-wire system receive pair.)
DR	10	Receive telephone line ring. (One side of four-wire system receive pair.)
TEK6	11	Data set ready (DSR) control ground from 828 series or 829 data auxiliary set.**
RD2 (RNG)*	12	Ring detector contact closure ground from modem.
TEK5	13	Data set ready (DSR) control from 828 series or 829 data auxiliary set. Normally is ground.
C*	14	Control lead to ACU (e.g., type 801). Modem provides contact closure to ground when in data mode.
	15	Not used.
D1*	16	Data mode contact closure to ground from ACU to modem.
RT*	17	This lead switches modem into remote test.
PR*	18	Lead to transmit output attenuator for connection of external resistor to set transmit level.
PC*	19	Lead to transmit output attenuator for connection of external resistor to set transmit level.
	20	Not used.
T1*	21	Telephone set tip network.
R1*	22	Telephone set ring network.
A*	23	Control lead to ACU or KTU (e.g., type 801 aCU). Modem provides contact closure to pin 23.
A1*	24	Control lead to ACU or KTU (e.g., type 801 ACU). Modem provides contact closure to pin 22 when the modem or telephone equipment is holding the line.
TDG (MIC)*	25	Talk/data control ground.
<p>* Not applicable on 202T.  ** Function employed by Western Electric 829A-L1 or 829A-L2 or equivalent for private line/alternate voice capability (GDC cable assembly M8K or M8KL_.</p>		



## APPENDIX D

### GLOSSARY

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<b>Abort Timer</b>	Automatically terminates call when valid carrier not received within X seconds of answered call or after X seconds of inactivity (no transmission, no reception). Protects called modem against false calls, wrong numbers. Eliminates the need for a computer time-out of such calls.
<b>Analog</b>	Transmission employing variable and continuous waveforms to represent information values.
<b>Analog Loopback</b>	Technique for testing transmission equipment and devices that isolates faults to the analog signal receiving or transmitting circuitry; a device, such as a modem, echoes back a received (test) signal that is then compared with the original signal.
<b>ANALOOP<sup>®</sup></b>	General DataComm's version of Analog Loopback Test.
<b>Answerback</b>	The response of a terminal or other communications device to remotely transmitted control signals; typically part of handshaking between devices.
<b>Asynchronous</b>	Transmission that is not related to a specific frequency or to the timing of the transmission facility; transmission characterized by individual characters or bytes with start and stop bits from which a receiver derives the necessary timing for sampling bits; start-stop transmission.
<b>Asynchronous Transmission</b>	Serial transmission of data in which each character is individually synchronized by the use of start and stop bits. A start bit precedes and one or more stop bits follow continuous information bits. Also called start-stop transmission. There is no definite time relationship between transmission of successive characters.
<b>Auto-Answer</b>	Automatic answering; capability of a terminal, modem, computer, or similar device to respond to an incoming call on a dial-up telephone line, and to establish a data connection with a remote device, without operator intervention; unattended operation for incoming dial-up calls.
<b>Autodial</b>	Automatic dialing; capability of a terminal, modem, computer, or similar device to place a call over the switched telephone network and establish connection without operator intervention; also, autocal.
<b>Automatic Calling Unit (ACU)</b>	A unit that automatically dials calls based on digits supplied by the attached business machine. It is used to implement polling techniques by using the public telephone network.
<b>Baud</b>	The maximum number of signaling elements, or symbols, per second that are generated; may be different from bps rate as several bits may be encoded per symbol, or baud, with advanced encoding techniques such as phase-shift keying.

## GLOSSARY

<b>Bps</b>	Bits per second; basic unit of measure for serial data transmission capacity; also kbps (kilobits), for thousands of bits per second; Mbps (megabits), for millions of bits per second; Gbps (gigabits), for billions of bits per second; Tbps (terabits), for trillions of bits per second.
<b>Byte</b>	Generally an 8-bit quantity of information, used mainly in referring to parallel data transfer, memory capacity, and data storage; also generally referred to in data communications as an octet or character.
<b>Carrier Detect</b>	An EIA-232-D Interface modem signal that indicates to the attached terminal that a modem is receiving a signal from the remote modem.
<b>Carrier Detect Threshold</b>	This determines the minimum line signal level at which the modem reliably detects the carrier signal.
<b>CCITT</b>	International Telegraph and Telephone Consultative Committee (from the French, Comité Consultatif International Télégraphique et Téléphonique.)
<b>Channel</b>	Part of a circuit path through several entities in a communication system. A channel runs between two nodes.
<b>Character</b>	Standard bit presentation of a symbol, letter, number, or punctuation mark.
<b>Clear To Send (CTS)</b>	A signal indicating to the terminal that a modem is ready to transmit.
<b>Clear To Send Delay</b>	The time required by a modem to inform a terminal device that it is ready to send or reply to information just received.
<b>Clock</b>	An oscillator-generated signal that provides a timing reference for a transmission link; used to control the timing of functions as sample interval, signaling rate, and duration of signal elements; an "enclosed" digital network typically has only one "master" clock.
<b>Compromise Equalizer</b>	Fixed and statistically derived equalizer that compensates for delay and amplitude distortion on VF lines as opposed to auto-adaptive equalizers, which are in the receive circuits, are variable, and self-adjust at the beginning and during data exchange to compensate automatically for line-induced distortion.
<b>Conditioning</b>	Extra-cost options that users may apply to leased, or dedicated, voice-grade 3002-type, phone company data circuits, wherein line impedances are carefully balanced to allow for higher quality and/or higher speed data transmission; in increasing order of resultant line quality and cost, conditioning may be C1, C2, C4, or D1; allows improved line performance with regard to frequency response and delay distortion.
<b>Continuous Carrier</b>	When optioned for Continuous Carrier, the Clear To Send (CB) lead from the modem (EIA pin 5) to the terminal is permanently held on. The modem's transmitter is always ready to transmit signals (BA) at the data input lead (EIA pin 2). Carrier stays on independently of Request to Send from the terminal.
<b>Control Characters</b>	Any transmitted characters, not message or user data, used to control or facilitate data transmission between data terminal equipment (DTE); includes extra characters associated with addressing, polling, message delimiting and blocking, framing, synchronization, and error checking.
<b>Controlled Carrier</b>	When Controlled Carrier is selected, the modem's transmit carrier is turned on and off by Request To Send (CA) from the terminal. The physical carrier signal is impressed on the line and the terminal is allowed to pass data after the Clear To Send delay.

<b>CTS</b>	Clear To Send.
<b>Data</b>	Digitally represented information, which includes voice, text, facsimile, and video.
<b>Data Carrier Detect (DCD)</b>	A signal sent from a data set which informs the terminal that a carrier waveform is being received; also called Carrier Detected, Carrier Found, Carrier On, etc.
<b>Data Commonality</b>	General DataComm's term to describe a unique packaging technique that provides (1) high density modular packaging, (2) a broad array of versatile data sets and accessories, (3) system flexibility and ease of expansion, (4) low power consumption, (5) heat dissipation, (6) quick and simple installation, (7) at-a-glance monitoring of system operation, (8) convenient, low-cost maintenance, and (9) high reliability.
<b>Data Communications</b>	Transmitting and receiving coded digital signals between computers or other digital devices or systems according to agreed upon specifications or standards.
<b>Data Set</b>	A modem; term infrequently used except within the telephone carrier industry.
<b>Data Terminal Ready (DTR)</b>	A signal from the terminal to the modem indicating that the terminal is ready to receive and transmit.
<b>dB</b>	Decibel; a unit of measurement used to express the ratio of two values, usually the power of electrical or electromagnetic signals; equal to 10 times the logarithm derived from a ratio of the two power levels, which are expressed in watts; the relative gain or loss of a signal when the measured signal value is compared in a ratio to another, usually its input, value.
<b>dBm</b>	Decibel reference to one milliwatt; relative strength of a signal, calculated in decibels, when the signal is compared in a ratio to a value of one milliwatt; used mainly in telephony to refer to relative strength of a signal (e.g., at 0 dBm, a signal delivers 1 milliwatt to a line load, while at -30 dBm a signal delivers 0.001 milliwatts to a load).
<b>DCD</b>	Data Carrier Detect.
<b>DCE</b>	Data Communications Equipment. A term usually meant to refer to the modem portion of a data communications network. Also, data circuit-terminating equipment. In the case of an EIA-232-D (RS-232-C) connection, the modem is the DCE; in a CCITT X.25 connection, the network access and packet-switching node is the DCE.
<b>Dedicated Line</b>	A dedicated circuit, an unswitched channel, a private line.
<b>Demodulation</b>	The extraction of transmitted information from a modulated carrier signal.
<b>Dial-up</b>	The process of, or the equipment or facilities involved in, establishing a temporary connection via the switched telephone network.
<b>Digital Loopback (DL)</b>	Technique for testing the digital processing circuitry of a communications device; may be initiated locally or remotely via a telecommunications circuit; device being tested will echo back a received test message, after first decoding and then reencoding it, the results of which are compared with the original message.
<b>Echo</b>	The reflection back to the sender of transmitted signal energy; amount of delay in an echo depends on the distance from the transmitter to the point of reflection.

## GLOSSARY

<b>Echo Cancellation</b>	Technique being used in new higher speed analog-line modems that allows for the isolation and filtering out of unwanted signal energy resulting from echoes from the main transmitted signal.
<b>EIA</b>	Electronic Industries Association.
<b>Equalization</b>	The process of reducing the effect(s) of amplitude frequency and/or phase distortion of a circuit by the introduction of networks to compensate for the difference in attenuation and/or time delay at the various frequencies in the transmission bands.
<b>Fast Carrier Detect Reset</b>	This option enables the fast CF reset pulse, when supplied by the business machine, to turn off CF lead in less than 1 ms, regardless of release time interval selected by carrier detector timing option (EIA pin number 25).
<b>Four-Wire Circuit</b>	Provision of two-wire pairs (or logical equivalent) for simultaneous two-way transmission.
<b>FSK</b>	Frequency-Shift Keying.
<b>Full Duplex (FDX)</b>	Operation of a data communications link in which transmissions are in both directions at the same time between devices at both ends.
<b>Fusible Link</b>	Thin printed circuit fuses on pc boards that open if ground potential exceeds 0.25 V rms between pc board and peripheral equipment.
<b>Ground</b>	An electrical connection or common conductor that, at some point, connects to the earth.
<b>Half Duplex (HDX)</b>	Operational mode of a communications line where transmission occurs in either direction, but not both directions simultaneously; transmission directions are alternately switched to accommodate two-way data flow.
<b>Handset</b>	That portion of the telephone containing the transmitter and receiver which is hand-held when the telephone is in use.
<b>Hookswitch</b>	The device on which the telephone receiver hangs or on which a telephone handset hangs or rests when not in use. The weight of the receiver or handset operates a switch that opens the telephone circuit, leaving only the bell connected to the line.
<b>Leased Line</b>	A dedicated circuit, typically supplied by the telephone company, that permanently connects two or more user locations; generally voice-grade in capacity and in range of frequencies supported; typically analog, though sometimes refers to DDS substrate digital channels (2.4 to 9.6 kbps); used for voice (2000 Series leased line) or data (3002-type); point-to-point or multipoint; may be enhanced with line conditioning; also private line.
<b>Line Impedance</b>	On some modems, line impedance is selectable for 600 or 900 ohms, two-wire or four-wire. 600 ohms is commonly used in USA. 900 ohms is used in Canada.
<b>Local Copy</b>	When Local Copy option is In, transmit data is provided on Received Data Lead (BB, EIA pin 3) to the terminal. This provides a copy of the transmitted data for display or printout on a full-duplex terminal. When option is Out, transmit data is not provided on Receive Data lead to terminal.
<b>Loopback</b>	Diagnostic procedure used for transmission devices; a test message is sent to a device being tested, which is then sent back to the originator and compared with the original transmission; loopback testing may be within a locally attached device or conducted remotely over a communications circuit.

<b>Mark</b>	One of the two possible conditions of an information element (bit); a closed line in a circuit.
<b>Modem</b>	Modulator/demodulator; electronic device that enables digital data to be sent over (typically) analog transmission facilities.
<b>Multipoint Line</b>	A single communications channel (typically a leased telephone circuit) to which more than one station or logical unit are attached, though only one may transmit at a time; such arrangements usually require some kind of polling mechanism, under the control of a master station, to ensure that only one device transmits data at a time; also, a multi-drop line.
<b>Off-Hook</b>	Condition indicating the active state of a subscriber's telephone circuit; a line state that signals a central office that a user requires service; opposite of on-hook.
<b>On-Hook</b>	Deactivated condition of a subscriber's telephone circuit, where the telephone or circuit is not in use; opposite of off-hook.
<b>Permissive (PE) Arrangement</b>	A connection arrangement used to connect FCC registered equipment to the DDD network. This arrangement utilizes the type USOC RJ11C jack. The output signal level of the communications equipment is fixed at a maximum of -9 dBm. An assumption that at least 3 dB signal loss will occur on the local loop ensures that the signal won't arrive at the central office at more than the maximum allowable level of -12 dBm.
<b>Point to Point</b>	A circuit that connects two points directly, with generally no intermediate processing nodes or computers, although there could be switching facilities; a type of connection, such as a phone-line circuit, that links two, and only two, logical entities.
<b>Private Line</b>	A leased line, an unswitched circuit.
<b>Private Network</b>	A network established and operated by a private organization or corporation for users within that organization or corporation.
<b>Programmable (PR) Arrangement</b>	A connection arrangement used to connect FCC registered equipment to the DDD network, employing either of two telephone company supplied data jacks: programmable or universal. The telephone company measures signal loss over the local loop between the subscriber's site and the central office. A "programming" resistor is selected and installed in the data jack to enable the communication equipment to transmit at a level that delivers the maximum -12 dBm signal at the central office.
<b>Received Data Clamp</b>	When set to Mark, causes Received Data lead (BB, EIA pin 3) to be clamped to a Mark (-V) when a valid carrier is not detected. When set to Space, causes Received Data lead to be clamped to a Space when a valid carrier is not received.
<b>Remote Digital Loopback (RDL)</b>	Similar to the Digital Loopback diagnostic test, except no modem operator is required at the looping modem. With RDL, a signal is sent down the communications line which instructs the remote modem to place itself in digital loopback mode.
<b>Request To Send</b>	A signal to the sending modem that the terminal is ready to transmit; part of modem handshaking.
<b>Reverse Channel</b>	A small-bandwidth channel used for supervisory or error-control signaling; signals are transmitted in the opposite direction that data is sent; the channel in a dial-up telephone circuit from the called party to the calling party.

## GLOSSARY

<b>Rotary Dial</b>	A rotary mechanism having a ten-hole finger wheel which when wound up and released causes pulsing contacts to interrupt the line current and operate the central office selecting equipment in accordance with the digit dialed.
<b>RS-232-C</b>	An EIA-specified physical interface. See EIA-232-D.
<b>RTS</b>	Request To Send.
<b>RTS-CTS Delay</b>	The delay between the time that the data terminal equipment asserts Request to Send (RTS) and the time that the modem asserts Clear to Send (CTS). Sets the time delay or turnaround time from reception to transmission.
<b>Satellite Communications</b>	The use of geostationary orbiting satellites to relay transmissions from one sending earth station to another, perhaps multiple other, earth stations.
<b>Self-Test</b>	A diagnostic test mode in which the modem is disconnected from the telephone facility and its transmitter's output is connected to its receiver's input to permit the looping of test messages (originated by the modem test circuitry) through the modem to check its performance.
<b>Send Data (SD)</b>	Send data from DTE to DCE.
<b>Simplex</b>	One-way data transmission, with no capability for changing direction.
<b>Soft Carrier Turn-Off</b>	When In prevents the detection of transients as data at the remote set by causing the sending modem to shift its transmitted carrier to 900 Hz (typically) when Request to Send (CA) is turned off. The transmitted output level is gradually decreased to 0 over the selected ms interval.
<b>Space</b>	One of the two possible conditions of an information element (bit), an open line in a neutral circuit.
<b>Start Bit</b>	In asynchronous transmission, the first element in each character that prepares the receiving device to recognize the incoming information elements.
<b>Start-Stop Transmission</b>	Asynchronous transmission for a group of data elements that are preceded by a start signal and followed by a stop signal; reference employed primarily by IBM for asynchronous transmission.
<b>Stop Bit</b>	In asynchronous transmission, the last transmitted element in each character, which permits the receiver to come to an idle condition before accepting another character.
<b>Squelch Interval</b>	Option that prevents the demodulator (receiver) of the station that has been transmitted from delivering reflections from the line to the receiver data lead as legitimate data after Request To Send is turned off.
<b>Switched Network</b>	Communications link for which the physical path, established by dialing, may vary with each use (e.g., a dial-up telephone circuit).
<b>Synchronous Transmission</b>	Data communications in which characters or bits are sent at a fixed rate, with the transmitting and receiving devices synchronized, eliminating the need for start and stop bits necessary in asynchronous transmission and significantly increasing data throughput rates.
<b>Terminal</b>	A point in a network at which data can either enter or leave; a device, usually equipped with a keyboard, often with a display, capable of sending and receiving



data over a communications link (IBM); generically the same as data terminal equipment (DTE).

**Touch-Tone®**

Registered AT&T trademark for pushbutton dialing.

**Transmission**

The dispatching of a signal, message, or other form of intelligence by wire, radio, telegraphy, telephony, facsimile, or other means (ISO); a series of characters, messages or blocks, including control information and user data; the signaling of data over communications channels.

**Two-Wire Circuit**

Usually a telephone circuit consisting of two insulated electrical conductors, typical of most local loops.

**USOC**

The Universal Service Order Code (USOC) is accepted telecommunications industry code for identifying servicing arrangements provided by telephone companies, and is used to identify the standard jack required for the equipment.

**VF Loopback**

Local terminal-originated test message is sent over the VF line to a remote modem and back to the terminal for verification to test the local terminal and cabling, the local modem and terminal and VF line interfaces, the VF line, and the remote modem VF line interface and part of its analog circuitry.

**V.23**

600-bps and 1.2-kbps modem standardized for use in the general switched telephone network.



## PATENT NOTICE

*ANALOOP*<sup>®</sup> is a patented method and apparatus of General DataComm, Inc. (U.S. Patent 3,655,915).

*DATALOOP*<sup>®</sup> is a patented method and apparatus of General DataComm, Inc. (U.S. Patent 3,769,454).

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