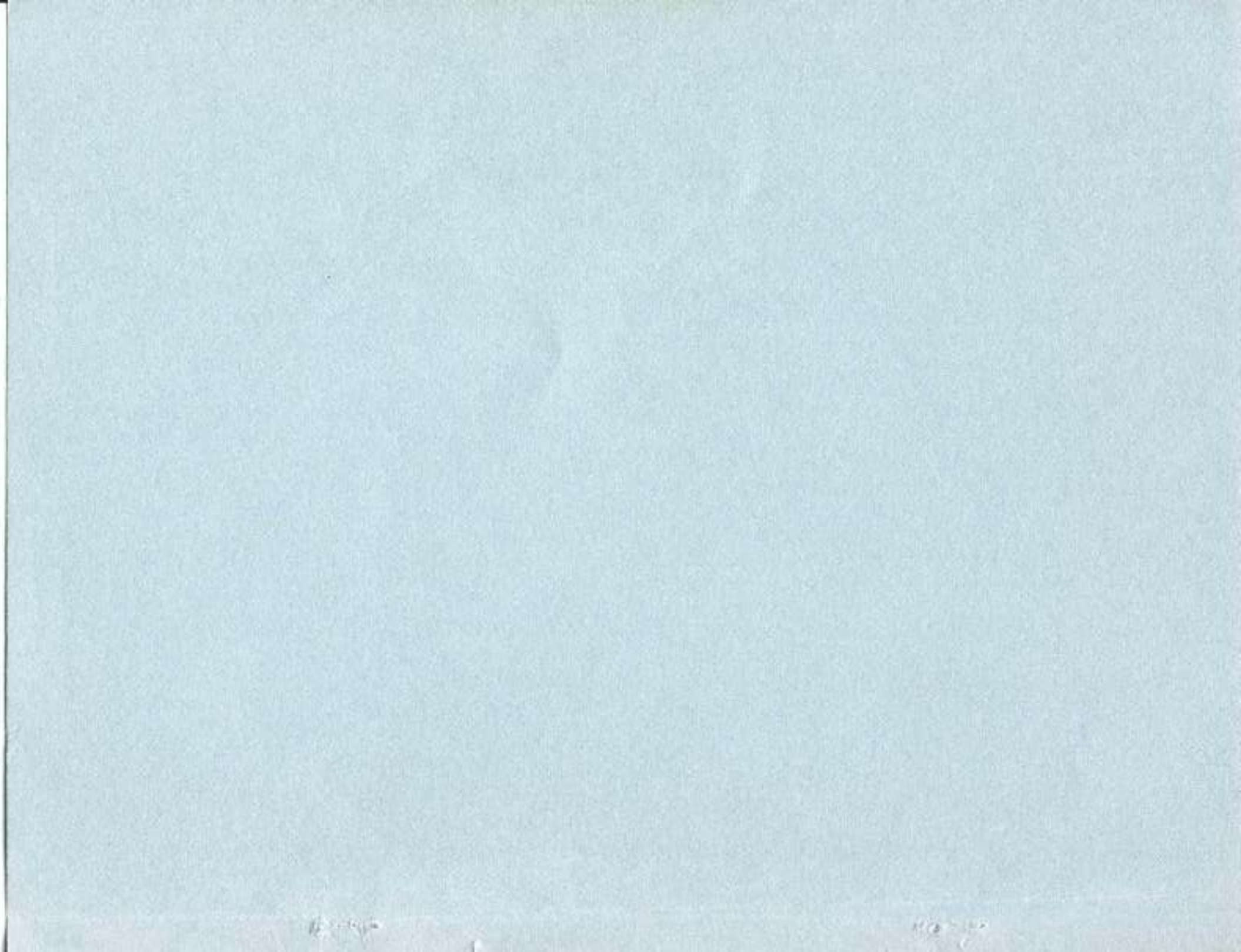


EK-DF124-UG-PRE

# DF124-AA/AM Modem User Guide

PRELIMINARY

**digital**



2nd Preliminary, February 1985

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The DE124 modem generates and uses radio frequency energy and if not installed and used in strict accordance with instructions in this guide, it may cause interference with radio and television reception. The modem complies with the limits for a Class B computing device according to Part 15, Subpart J, of the FCC rules. These rules are designed to provide reasonable protection against interference in a residential environment. There is no guarantee that interference will not occur in any given installation. If interference with radio or television reception does occur, (determined by turning the equipment OFF and ON), try to correct the problem by trying one or more of the following measures.

- o Reorient the receiving antenna.
- o Move the equipment around or away from the receiver.
- o Plug the equipment into a different outlet so that the equipment and receiver are on different branch circuits.

If the above measures fail, consult a dealer or an experienced radio/television technician for other possible suggestions.

"How to Identify and Solve Radio-TV Interference Problems", a booklet prepared by the FCC, is also recommended. This booklet is available from the US Government Printing Office, Washington, DC 20540, Stock No. GSA-500-07045-4.

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This manual provides technical information that enables the user to install, test, and operate the DF124 Modem regardless of whether it is installed in the standalone desk top enclosure or multiple modem enclosure.

Chapter 1 provides a physical description, functional overview, feature summary, and interface data for the DF124 when installed in the standalone or multiple modem enclosure. Chapter 2 contains procedures for proper site setup and installation of the DF124 in all enclosures. Chapter 3 describes the different controls and indicators, describes all modes of operation for DF124 features, and includes examples for the auto dial feature. Chapter 4 contains a step-by-step sequence of test procedures used to correctly verify modem operations. These procedures are common to both standalone and multiple modem configurations. Chapter 5 describes the optional configurations that are available on the DF124 modem and the switchback selections to implement selected options. Chapter 5 also contains information on special jumpers that are provided strictly for manufacturing and field service, and should not be touched by the user. The information is provided only to inform the user that they exist. Chapter 6 identifies actions that should be taken when service is required.

The selections listed in Chapter 5 are presented in tabular format. Each modem module is shipped from the factory with these options preset to select the most popular variation. In the tables describing these options, factory settings are printed in blue for easy reference. Other areas of this manual are printed in blue to bring attention to certain features, operator interactions and conditions.

## CANADIAN RESTRICTION

### CANADIAN APPLICATION NOTICE

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 approved 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 Jack-Plus-cord ensemble (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations. Existing telecommunications company requirements do not permit their equipment to be connected to customer-provided jacks except where specified by individual telecommunications company tariffs.

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.

## 1.1 GENERAL

This chapter contains a functional overview, a physical description, a feature summary and a list of general specifications, for the DF124 modem including the standalone modem and multiple modem enclosures.

Depending upon the application, the standalone modem and the multiple modem enclosures each have distinct advantages. In configurations where data communications volume is low, one or two standalone modems would satisfy the requirement. However, in a high-volume communications environment, where several modems are required, the concentrated packaging of the multiple modem enclosure would be more suitable and cost efficient. The diagram of Figure 1-1 provides a simple view of both high- and low-volume applications.

## 1.2 FUNCTIONAL OVERVIEW

The DF124 converts serial binary data, generated by the Data Terminal Equipment (DTE), into audio tones and transmits the tones over the telephone lines. Conversely, it converts the audio tones from remote stations into serial binary data and routes the data to the local data terminal equipment. The DF124 provides full-duplex, asynchronous or synchronous, binary serial data communications over a 2-wire, switched telephone network or over a 2-wire, private/leased telephone network.

The DF124 modem features include autodial, dial back-up, auto answer, front panel status lights, and a full line of test features.

The autodial feature allows automatic dialing of remote stations using either attended terminal control or unattended program control.

The DF124 operates at 2400 bits per second (b/s) with fallback capability to 1200 b/s. Fallback is controlled either by the DTE interface speed select signal or by a front panel switch. The DF124 modem can be used for both voice and data communications with a standard telephone by using the front panel DATA/TALK (D/T) switch.

The DF124 includes a variety of user selectable options that are factory set for compatibility with the CCITT/V.22 and V.22 bis recommendations. A standard telephone may be used to manually originate and answer calls on the PSTN.

To establish communications between a remote location and a local data terminal, the DF124 can automatically dial the desired number and establish communications using serial binary data supplied through the DTE interface. The autodial feature is explained in Section 3.4.



### 1.3 PHYSICAL DESCRIPTION

The standalone modem contains the electronics (one DF124-AM modem module) to provide one channel of data communications while the multiple modem enclosure is capable of holding up to twelve DF124-AM modem modules. In fact, the multiple modem enclosure may contain a mixture of new, DF100 series of modem modules. For example, it may contain 4 DF03-RCs, 4 DF126-AMs and 4 DF124-AMs. DF124-AM printed circuit boards are identical for both the standalone and multiple modem enclosures and are interchangeable.

#### 1.3.1 Standalone DF124-AA Modem

The standalone (DF124-AA) modem (Figure 1-2) consists of a modem module (DF124-AM), mounted in a desk top enclosure (DF100-DT). Both the modem module and enclosure are field replaceable units (FRUs). The enclosure includes an integral power supply, a rear cover containing line fuse, line filter and telephone line connectors, and a front cover which provides access to eight Light-Emitting Diodes (LED) indicators and six pushbutton switches. The indicators are used to determine modem status, while the pushbuttons are used to select different modes of operation and implement a variety of test features to verify proper modem operation or isolate faults.

The DF124-AA Standalone modem consists of:

- DF100-DT -- Desk top enclosure, including integral power supply;
- DF124-AM -- DF124 modem module.

#### 1.3.2 Multiple Modem Configurations

When mounted in the multiple modem enclosure (Figure 1-3), the DF124-AM modem module contains all of the functionality of the standalone modem plus the advantage of lower cost because the modem modules use a common power supply and common enclosure.

The multiple modem enclosure, with internal power supply, is called the DF100 series of multiple modem enclosures. These enclosures fit any standard 48.26 cm (19 in) rack cabinet.

These enclosures have provisions to include a second power regulator module. In the DF100-RM multiple enclosure, the second power regulator is optional and provides redundant power back-up for all of the outputs. Should one regulator fail, the redundant power regulator feature automatically takes over the power load without disrupting on-line users. Notification of a power regulator failure is indicated when any of the four LEDs on the module is OFF.

In the DF100-RT or DF101-RM multiple enclosures, the second regulator is shipped with the enclosure as standard equipment, to share the +5Vdc load. In this configuration, power regulator 2 provides redundant back-up for the +12Vdc output, but NOT the +5Vdc output.

1/14/2020

The power regulator provides short circuit and over voltage protection circuits. If (for any reason) one of the outputs is shorted, or the voltage increases beyond tolerance, the system shuts down. All power supply LEDs, except for POWER STATUS, are OFF. Once the condition is corrected, the regulator(s) can be reset by placing the ON/OFF power switch to the OFF position, then back to the ON position.

Products available for multiple modem DF124 configurations are:

- DF100-RM Series -- Multiple modem enclosure, including 6 Amp integral power supply (US and Canada) or;
- DF100-RT Series -- Multiple modem enclosure, including 12 Amp integral power supply (US and Canada) and;
- DF100-PR ----- 6 Amp power regulator module for DF100 series multiple modem enclosures.
- DF124-AM ----- DF124 modem module.

#### 1.4 FEATURE SUMMARY

The following features are available with the DF124 modem.

- Operates on public switched telephone networks (PSTN) or on private/leased telephone networks (PLTN). The DF124 requires only two wires for full-duplex communication at either 2400 or 1200 b/s.
- Conforms to CCITT recommendation V.22 bis, at 2400 b/s and V.22, at 1200 b/s.
- Accommodates asynchronous or synchronous transmission.
- Includes automatic calling and automatic answering.
- Provides comprehensive loopback and self-test features, including remote digital loopback.
- Meets FCC and DOC requirements for use in the U.S. and Canada.
- Installation in standalone or multiple modem enclosures is easy and can be done by unskilled persons. Modules can be inserted into multiple modem enclosures without turning power off and without disrupting the operation of other modems in the enclosure.
- All DIGITAL modem products are backed by a worldwide service organization. DIGITAL Field Service offers a wide variety of service contracts to ensure proper maintenance of the product.



## 1.5 GENERAL SPECIFICATIONS

Specifications for the DF124 module, and the standalone and multiple modem enclosures are listed below.

### 1.5.1 DF124-AM Modem Module

Module Size	Standard grid finger (SGF) board 264.2 mm X 203 mm (10.4 in X 8 in)
Operating Temperature	10°C to 40°C (50°F to 104°F) Free air (normal convection)
Storage Temperature	-40°C to +65°C (-104°F to +150°F)
Relative Humidity	10% to 90% noncondensing, noncaustic.
Data Rate	2400 b/s Full-Duplex or 1200 b/s Full-Duplex.
Modulation	Four phase Differential Phase Shift Keying (DPSK) conforming to V.22, V.22 bis and Bell 212A.
Mode	Asynchronous or Synchronous.
Line Connection	2 Wire public switched telephone network (PSTN) or 2 Wire private line (PL). Separate connectors are provided for each type of line, allowing dial back up for private line configurations.
Equalization	Provides automatic and adaptive line equalization.
Line Isolation	3750 Volts RMS minimum.
Operating Modes	Manual Answer Manual Dial Auto Answer (V.25) Auto Call
Diagnostics	Local analog loopback Local digital loopback Remote digital loopback Selftest
Interface	CCITT V.10 (EIA RS-423-A) compatible with distances up to 60 M (200 ft).  CCITT V.28 (EIA RS-232-C) compatible with distances up to 15 M (50 ft).



Interface Connector	25-pin Cinch connector (compatible with ISO 2110) for both standalone and multiple modems enclosures.
Interface Cables	BC22E, BC22F or BCC04 or equivalent for Asynchronous operation. BC22F or BCC04 or equivalent for Synchronous operation.
DC Power Requirements	+5Vdc @ 0.700 Amps Max. +12Vdc @ 0.200 Amps Max. -12Vdc @ 0.150 Amps Max.

1.5.2 Standalone Modem Enclosure

Height	74 mm (2.91 in)
Width	217 mm (8.56 in)
Length	292 mm (11.5 in)
Weight	2.62 kg (5 lbs, 12.5 ozs)
Operating Temperature	10°C to 40°C (50°F to 104°F) Free air (normal convection)
Storage Temperature	-40°C to +65°C (-104°F to +153°F)
Relative Humidity	10% to 90% noncondensing, noncaustic.
AC Input Power	120 Vac, 60 Hz (nominal) Operates with inputs from 104 to 128 Vrms at 57 to 63 Hz with a maximum input current of [0.50] A at 120 Vac. The input power is [100] VA. The primary input is protected by an externally accessible 0.50 A fuse.

Cinch is a trademark of TRW, Inc.

1.5.3 Multiple Modem Enclosure

Height	267 mm (10.5 in)
Width	483 mm (19.0 in) standard rack size
Depth	343 mm (13.5 in) card cage assembly



Weight 12.25 kg (27 lb) without modem modules or power regulator(s).

866 0.680 kg (1 lb, 8 ozs) for each DF124-AM Module and

0.907 kg (2.0 lbs) for the optional DF100-PR power regulator

AC Input Power 120 Vac, 60 Hz (nominal)  
Operates with inputs from 104 to 128 Vrms at 57 to 63 Hz with a maximum input current of ~~1.433~~ mA at 128 Vac (approximately ~~1.433~~ mA for each modem module and 210 mA for the power regulator). Input is protected by a 2.5A circuit breaker.

Power Supply  
DC Output (each regulator) +5Vdc 6.0 Amps Max  
+12Vdc 2.8 Amps Max  
-12Vdc 2.8 Amps Max

NOTE

The +5Vdc output current for multiple modem enclosures below serial number (SN) 2000 is 3.0 Amps maximum, while enclosures with SN2000 and above are capable of 6.0 Amps maximum.

WARNING

If the total +5Vdc current requirements for any combination of modem modules exceed stated maximums, the regulator will shutdown, removing power from the backplane.

Module Capacity

DF100-AM (below serial number K302000) 3.0 Amp Enclosure supports 4 DF124 modules max.

DF100-AM (above serial number K302000) 6.0 Amp Enclosure supports 8 DF124 modules max.

DF100-PR 12.0 Amp Enclosure supports 12 DF124 modules max.

Power Regulator Module

Size 203 mm x 158.7 mm (8 in x 6.25 in) including the heat sink.

Weight 0.907 kg (2.0 lbs)

*Notes 1-7???*

Equal Sign (=) = Access pause; Causes a pause period of 15 seconds to wait for secondary dial tone. If a dial tone is not detected within 15 seconds, the auto dialer responds with the NO DIAL TONE message.

Dial Tone Abort: Aborts call if dial tone is not detected within 40 seconds after initiating a call.

Answer Tone Abort: Aborts call if answer tone is not detected within 30 seconds after initiating a call.

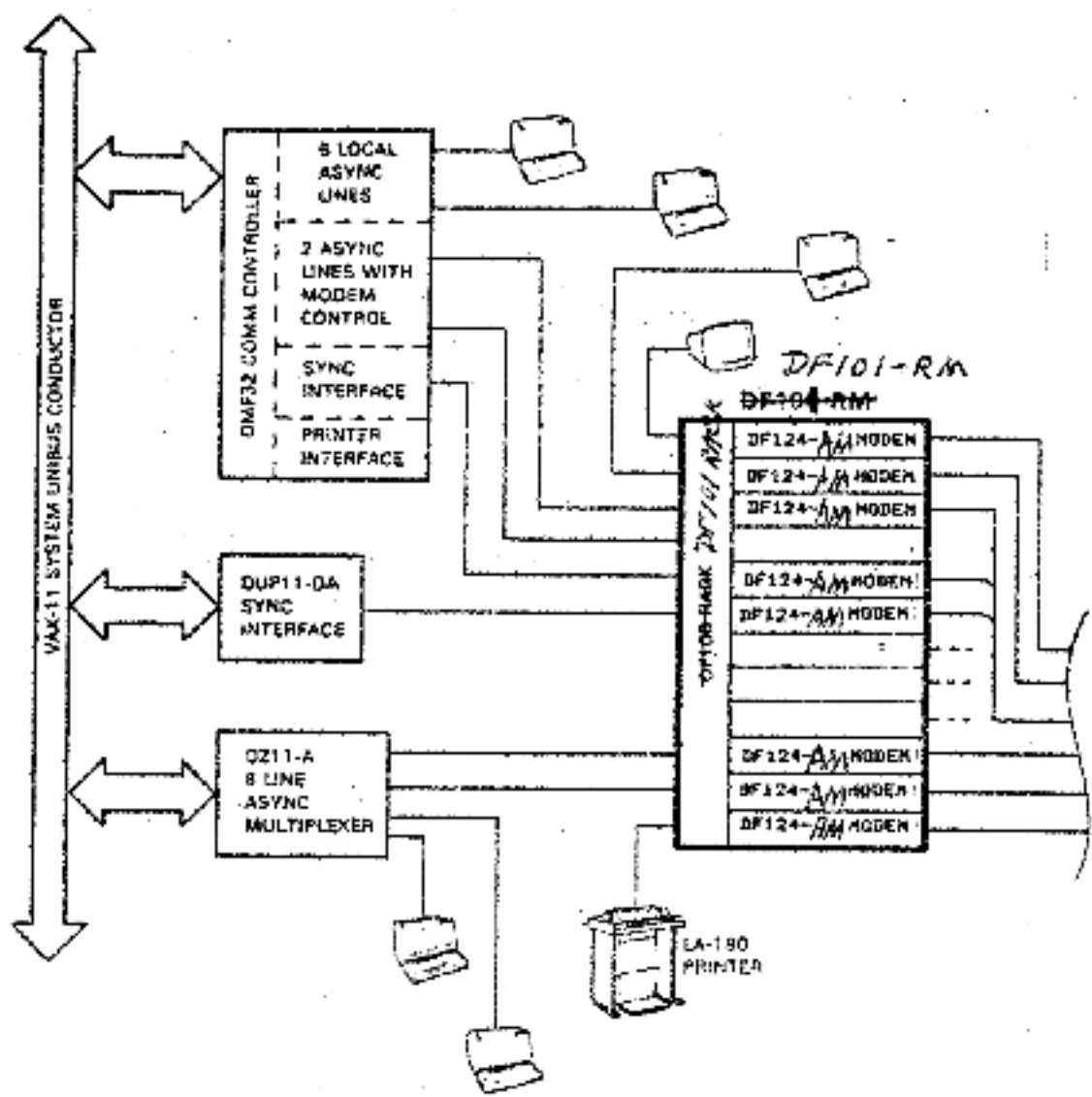


Figure 1-1 DF124 Modem Applications Diagram (Sheet 1 of 2)

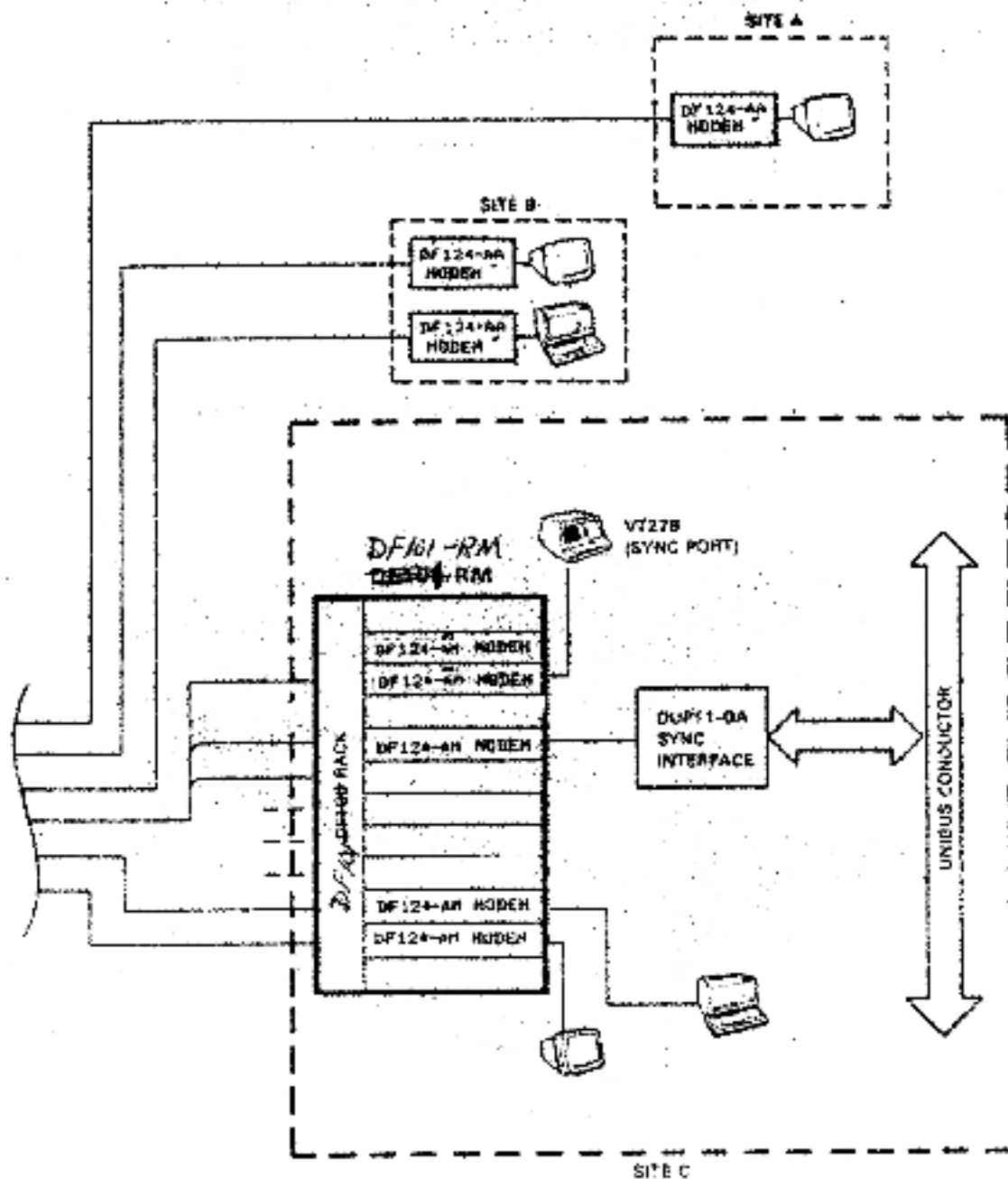


Figure 1-1 DF124 Modem Applications Diagram (Sheet 2 of 2)

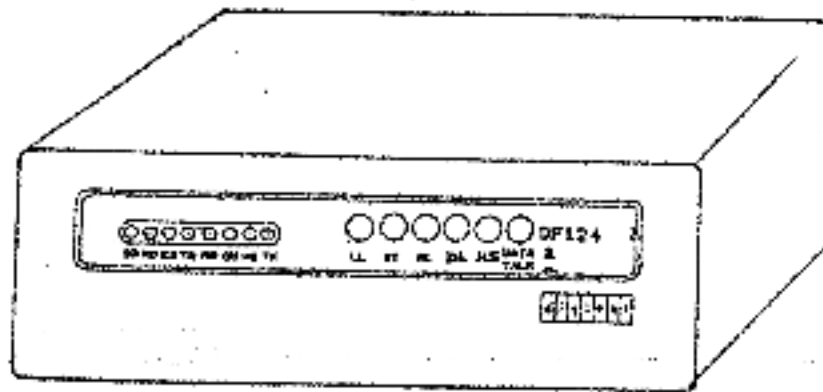


Figure 1-2 Standalone DF124 Modem

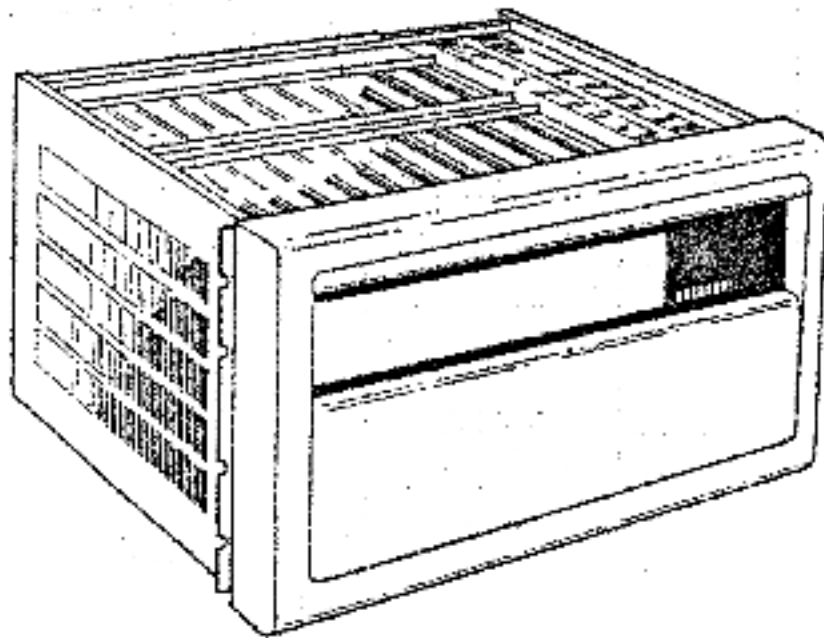


Figure 1-3 The DF100-RM Multiple Modem Enclosure

CHAPTER 2  
SITE PREPARATION AND INSTALLATION

**2.1 GENERAL**

The DF124 is approved by the U.S. Federal Communications Commission (FCC) for direct connection to the telephone network. The DF124 is also certified by the Department of Communications (DOC) for Canadian use. Regulatory requirements outlined in Section 2.2 must be observed before and during installation of the DF124 Modem.

**2.2 REGULATORY AGENCY REQUIREMENTS**

Government controlled communication regulatory agencies require that devices (such as modems) attaching to telephone lines must comply with certain regulations concerning use of standard plugs and jacks, as well as other operational and protective requirements.

Prior to installation, it is necessary to contact the local telephone business office to request data communications service for installation of customer-provided equipment. You must specify the information that is found in paragraphs 2.2.1. Generally, the information required is:

- o Type of communication service required (PSTN or Private/Leased line) to support customer provided equipment.
- o Number of new telephone circuits (lines) required.
- o FCC registration or DOC certification number and the ringer equivalence number.

## 2.2.1 FCC Regulations

2.2.1.1 FCC Part 68-Direct Connection -- The chart below contains FCC information on the DF124 that must be given to the local telephone company when telephone service is requested for U.S. installations. The FCC control number for part 68 assigned to the DF124 modem is A09940-7E734-MD-E.

### U.S. Installations

Topic	Standalone DF124 Modem Enclosure	Multiple DF124 Modem Enclosure
FCC Registration Number	A09940-14327-MD-E	A09940-14327-MD-E
Ringer Equivalence Number	0.8B	0.8B
Type of Service	1) Single switched line with either RJ11C, RJ41S or RJ45S service  2) Single (2 wire) private/leased line	1) Up to 12 public switched lines terminated in RJ21X connector block  2) Up to 12 (2-wire) private/leased lines  3) A combination of 1 and 2 above not exceeding 12

#### NOTE

When installing a multiple modem enclosure, an interconnecting cable is required to attach the enclosure to the RJ21X service. This cable can be obtained from the telephone company. If the telephone company does not supply this cable with the service, then the cable must be ordered. The correct cable type is a Western Electric 825AM cable or equivalent. Contact the local Digital office for ordering information. Careful consideration must be given to the location of the multiple modem enclosure. For details see Section 2.5.2.

2.2.1.2 FCC Part 15J (RFI/EMI) Certification for DF124-AA -- The DF124-AA standalone modem generates and uses radio frequency energy. If this equipment is not installed and used in strict accordance with the instructions in this manual, it may cause interference with radio and television reception. The DF124-AA complies with the limits for a Class B computing device according

to Part 15, Subpart J, of the FCC rules. These rules are designed to provide reasonable protection against interference when operated in a residential environment. If this equipment does cause interference with radio or television reception, (determined by turning the equipment OFF and ON), try to correct the problem by trying one or more of the following measures. The FCC control number assigned to the DF124-AA modem for category B is A09940-DF100.

- o Reorient the receiving antenna.
- o Move the equipment around or away from the receiver.
- o Plug the equipment into a different outlet so that the equipment and receiver are on different branch circuits.

If the above measures fail, consult a dealer or an experienced radio/television technician for other possible suggestions.

"How to Identify and Resolve Radio-TV Interference Problems", a booklet prepared by the FCC, is also recommended. This booklet is obtainable from the US Government Printing Office, Washington, DC 20402, Stock No. 034-000-00345-4.

2.2.1.3 FCC Part 15J (RPI/EMI) Verification for DF124-AM -- The DF124-AM modem module generates and uses radio frequency energy. If this equipment is not installed and used in strict accordance with the instructions in this manual, it may cause interference with radio and television reception. The DF124-AM module is verified to comply with the limits for a Class A computing device according to Part 15, Subpart J, of the FCC rules when tested in the multiple modem enclosure. These rules are designed to provide reasonable protection against interference when operated in a commercial environment.

#### 2.2.2 DOC Regulations

The chart below contains DOC information that must be given to the telephone company when telephone service is requested for Canadian installations.

## Canadian Installations

Topic	Standalone DF124 Modem Enclosure	Multiple DF124 Modem Enclosure
DOC Certification Number	192 923 AB	192 923 AB
Type of Service	1) Single line with either CA11A, CA41A or CA45A service  2) Single (2-wire) private/leased line	1) Up to 12 public switched lines terminated in CA21A connection  2) Up to 12 (2-wire) private/leased lines  3) A combination of 1 and 2 above not exceeding 12

### NOTE

When installing a multiple modem enclosure, an interconnecting cable is required to attach the enclosure to the CA21A service. This cable can be obtained from the telephone company. If the telephone company does not supply this cable with the service, then the cable must be ordered. The correct cable type is a Western Electric 825AM cable or equivalent. Contact the local Digital office for ordering information. Careful consideration must be given to the location of the multiple modem enclosure. For details see Section 2.5.2.

## 2.3 OPERATING ENVIRONMENT

### 2.3.1 Standalone DF124 Modem

The standalone DF124 modem operates within temperatures ranging from 10°C to 49°C (50°F to 104°F) and a relative humidity ranging from 10% to 90% noncondensing. Normal air convection is sufficient for cooling. Nominal power required is 32.8 volt amperes at 120 volts, 60 Hz. The power supply withstands input

voltage changes ranging from 105 Vac to 128 Vac. The input line frequency can change from 57 Hz to 63 Hz without having an effect on the operation of the standalone modem.

### 2.3.2 Multiple DF124 Modem Configurations

The operating environment for multiple DF124 modem configurations is basically the same as the standalone modem except for the following.

The normal power required for a fully configured multiple modem enclosure (DF100-RM) with DF124 modems, is about 86 volt amperes at 120 volts, 60Hz. Each DF124 modem module adds about 42 milliamperes of current to the ac line load.

The maximum power allowed for a fully configured DF100-RM, is 156 volt amperes at 120 volts, 60Hz.

The maximum output of the enclosure's +5Vdc power supply must be considered when installing a variety of the DF100 series modular modems, including the DF124. The maximum +5Vdc current available from DF100-RM enclosures below serial number (SN) 2000 is 3.0 Amps. For DF100-RM enclosures above SN 2000, the maximum +5Vdc current is 6.0 Amps. If more than 6 Amps is needed, a DF100-RT multiple modem enclosure must be used.

#### NOTE

When installing different modems with different +5Vdc current requirements the total current of all the modem modules must not exceed rated maximums of the enclosure power supply.

Refer to the specific users guide for +5Vdc current requirements of the modem module. For example, the DF124 module requires 0.700 Amps of +5Vdc current. This means that only 4 DF124s can be installed in the earlier enclosures with the remaining slots empty, while newer DF100-RM enclosures can accommodate 8 DF124s. The DF100-RM can hold up to 12 DF124 modem modules.

#### NOTE

Earlier enclosures (below SN 2000) can be upgraded to 6 Amp capacity by changing the backplane to REV C or above and changing the power regulator module to REV E or above.

## 2.4 UNPACKING AND INSPECTION

The DF124-AA Standalone modem (DF100-DT enclosure and DF124-AM modem module) are packaged in a single cardboard container together with the power cable, telephone cord and accessories. Check the contents against the list below and compare them with Figure 2-1. Also, check each piece for damage.

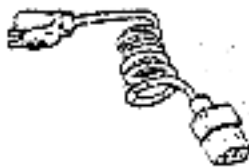
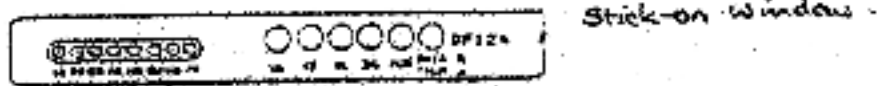
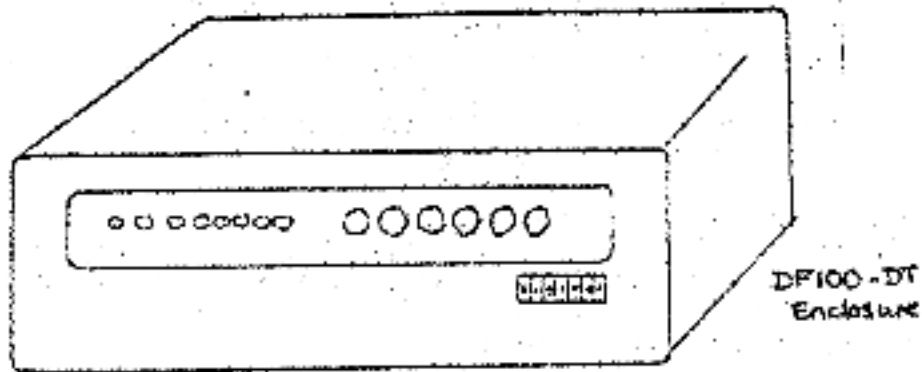
1. DF100-DT Standalone modem enclosure;
2. DF124-AM modem module;
3. Telephone extension cord;
4. Front panel stick-on window and;
5. A current copy of the user's guide.

## 2.5 INSTALLATION

This section describes the installation procedure for both the standalone and multiple modem configurations. The site preparation considerations are: compliance with environmental specifications and ordering the correct telephone service.

The standalone modem may be placed in any convenient location (shelf, desk top, and so on) provided that it conforms to the maximum cabling distances.

The multiple modem enclosure may be placed in any standard 48.26 cm (19 in) cabinet. Do not place either unit in or near electrically noisy equipment which would affect optimum operation.



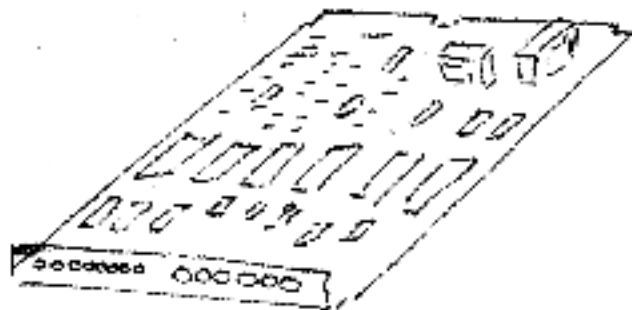
POWER CORD



TELEPHONE  
SUSPENSION  
CABLE  
(1700019-01)



USER GUIDE



DF124-AM MODULE

Figure 2-1 Contents of DF124-AM Shipping Container

#### NOTES

1. The DF124 modem is not suitable for pay telephone facilities.
2. The DF124-AM modem module is factory configured for compatibility with most data communications equipment. However, in some cases it may be necessary to select different options. For option selection guidelines, see Chapter 5.

#### 2.5.1 Standalone DF124-AA Installation

Since the DF100-DT and DF124-AM are shipped individually packaged, the modem module must be installed into the standalone enclosure before connecting to the network. To insert the module in the enclosure, follow the procedure below:

#### 2.5.1.1 Installing Standalone Modem Modules

1. Before removing the front cover on the standalone enclosure to install the modem module, place the stick-on window in the recessed area of the cover making sure that the holes for the pushbutton switches line up. Then peel the backing from the window and place it, permanently. *back in the recessed area*
2. From the bottom, remove the two slotted screws closest to the front cover as shown Figure 2-2 and remove the cover.

#### NOTE

Before installing the module make sure that the switchable option selections are correctly configured for the desired options.

3. With the enclosure up-side-down, insert the modem module (components facing down) into the card guides on each side of the DF100-DT enclosure. Slide the module in until it touches the connector. Then press firmly until the module snaps into the connector.
4. Replace the front cover on the enclosure and secure with the two screws removed in Step 2.

*remove the window from the recessed area,*

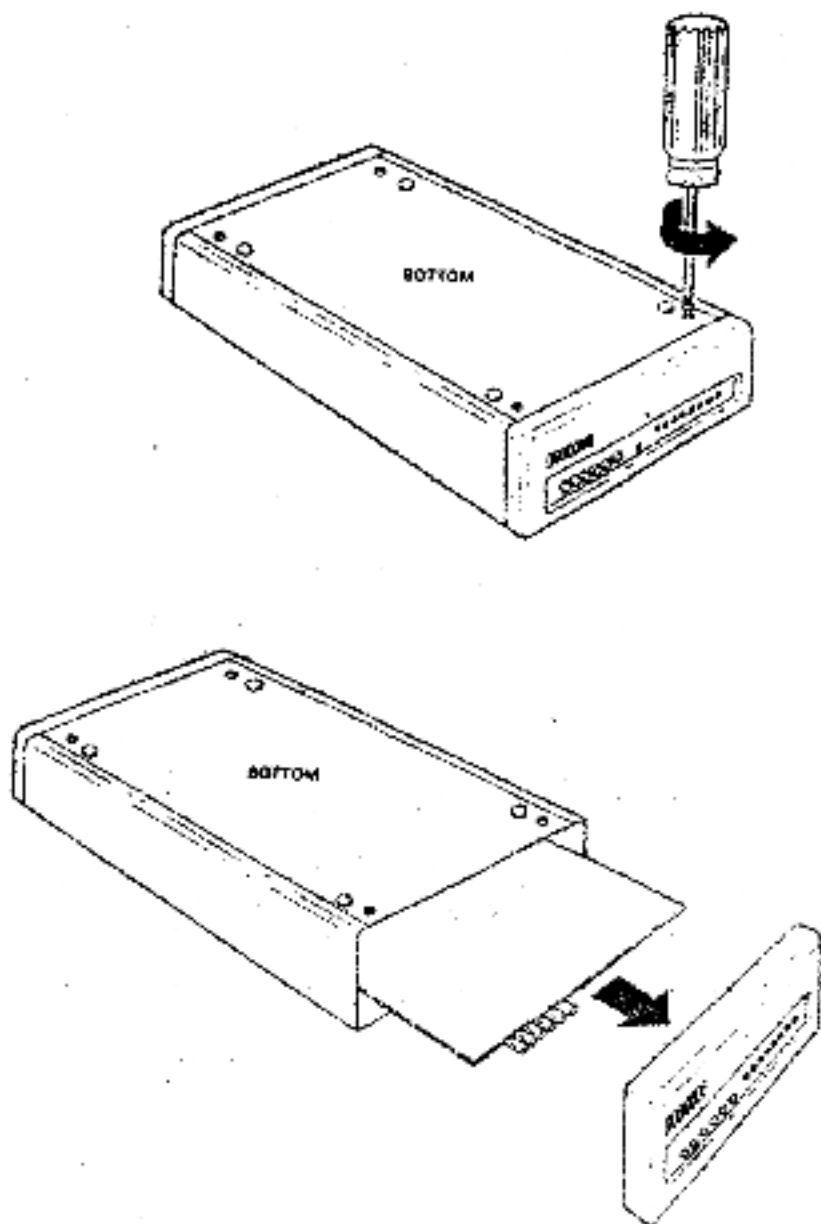


Figure 3-2 Translone Meter Front Cover Removal

Procedures for installing the standalone modem to the public switched telephone network vary, depending on the type of service that is requested and installed by the telephone company. Three types of service connections are possible and are explained in detail below:

1. Connected to RJ11C (US) or CA11A (CAN) service;
2. Connected to RJ41S/RJ45S (US) or CA41A/CA45A (CAN) exclusion key service or;
3. Connected to private/leased line.

**2.5.1.2 Installing the Standalone Modem to RJ11C (CA11A) Service --** RJ11C (CA11A) service is supplied with a 6 position miniature jack. DT124 rear panel connections for the telephone line and headset are 8 position miniature jacks (see Figure 2-3). Standard 6 position plugs will connect to 8 position jacks. It is important however, that 6 position plugs be centered to the 8 position jack when the connection is made. Do not insert the 6 position plug into the 8 position jack at an angle. Refer to Figure 2-4 for the following installation procedure.

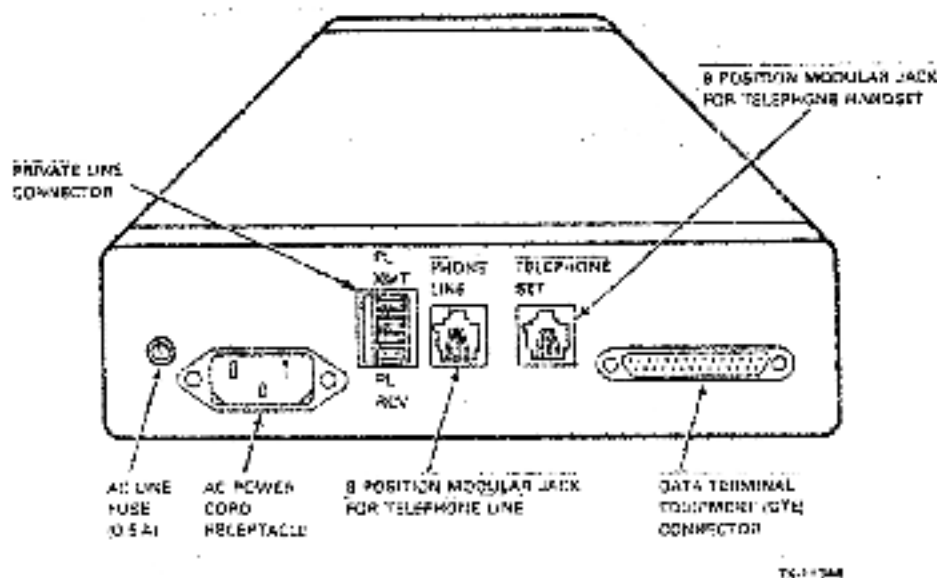


Figure 2-2 Standalone Modem Rear Connector Panel

1. Unplug telephone from wall box.
2. Plug the telephone into the right-hand 8 position jack on the rear panel of the modem.
3. Plug one end of the 4-wire telephone extension cable (1700089-01) into the left-hand 8 position jack on the rear panel of the modem. Plug the other end into the wall box.
4. Plug terminal cable (or other DTE device) into the modem DTE interface connector.
5. Plug the power cord into the rear of the modem, then into the ac wall outlet.

2.5.1.3 Installing the Standalone Modem To RJ41S/RJ45S (CA41A/CA45A) Service -- When exclusion key telephone service is used, no connection is required to the right-hand 8 position jack on the rear panel of the standalone modem. Refer to Figure 2-5 for the following installation procedure.

NOTE

1. To enable exclusion key functions, the MI option (switchpack 2, switch 6) must be enabled. Also, jumper W15 and resistor R198 must be installed, see Chapter 5.
  2. If programmed telephone service is installed, jumpers W10 and W11 must be installed to connect the PR and PC leads (see Chapter 5 for details). Also, an 8-wire telephone extension cable (not supplied) such as MOD TAP 558-015 or Virginia Plastics 105-KK-15DS-SW or equivalent must be used in place of the standard 4-wire (1700089-01) cable supplied.
1. Plug one end of the telephone extension cable into the RJ41S or RJ45S wall box. Plug the other cable end into the left-hand 8 position jack on the rear of the modem.
  2. Plug terminal cable (or other DTE device) into the modem DTE interface connector.
  3. Plug the power cord into the rear of the modem, then into the ac wall outlet.

Using the modem with exclusion key telephone (MI enabled) for a period of time, then at a later date moving the modem to a different service without disabling the MI option, could cause a continuous OFF HOOK condition. Be sure to check the MI option when the modem is being changed between different types of service.

① Plug telephone from wall box.

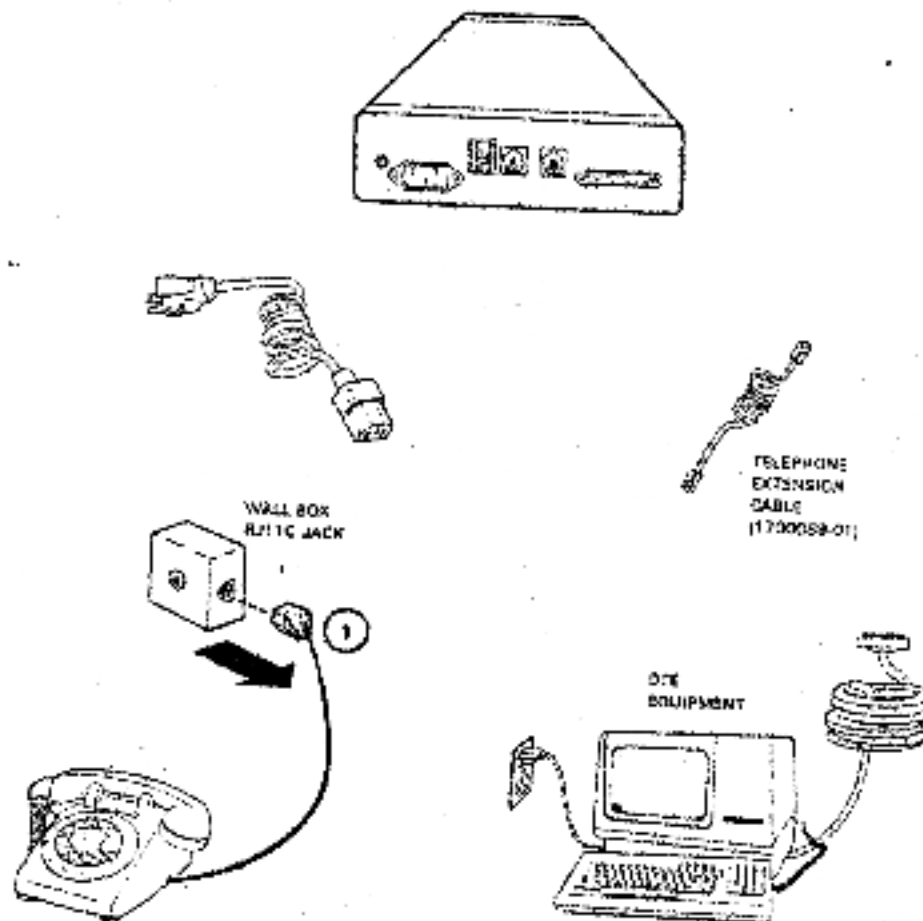


Figure 2-7 Installing Standalone Modems Or B312D or Equivalent Service (Sheet 1 of 4)

- ② Plug the telephone into the right-hand 8 position jack on the modem.

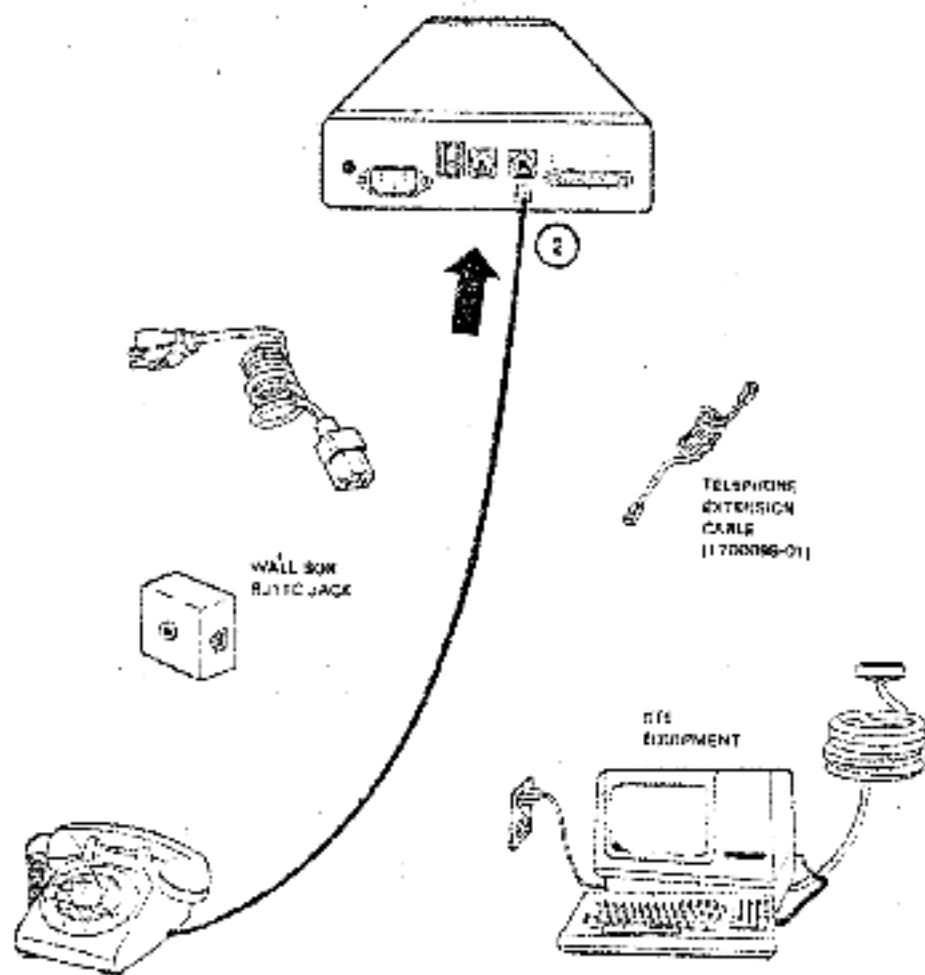


Figure 2-4 Installing Standard Modem On DTE or Equivalent Terminal (Sheet 2 of 4)

2

Plug one end of the 4-wire telephone extension cable (1700089-01) into the left-hand 8 position jack on the modem. Plug the other end into the wall box.

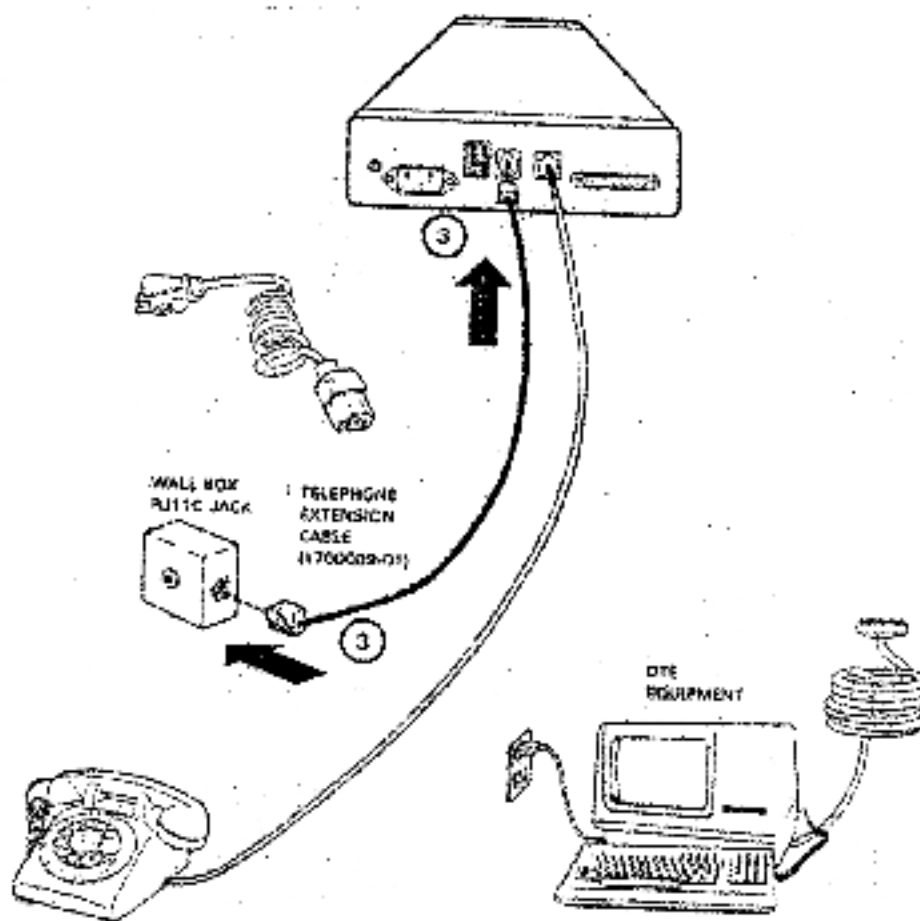


Figure 3-2 Installing Standalone Modems on S11C or Equivalent Service (Sheet 2 of 4)

- ④ Plug terminal cable (or other DTE device) into the modem DTE interface connector.
- ⑤ Plug the power cord into the rest of the modem, then into the ac wall outlet.

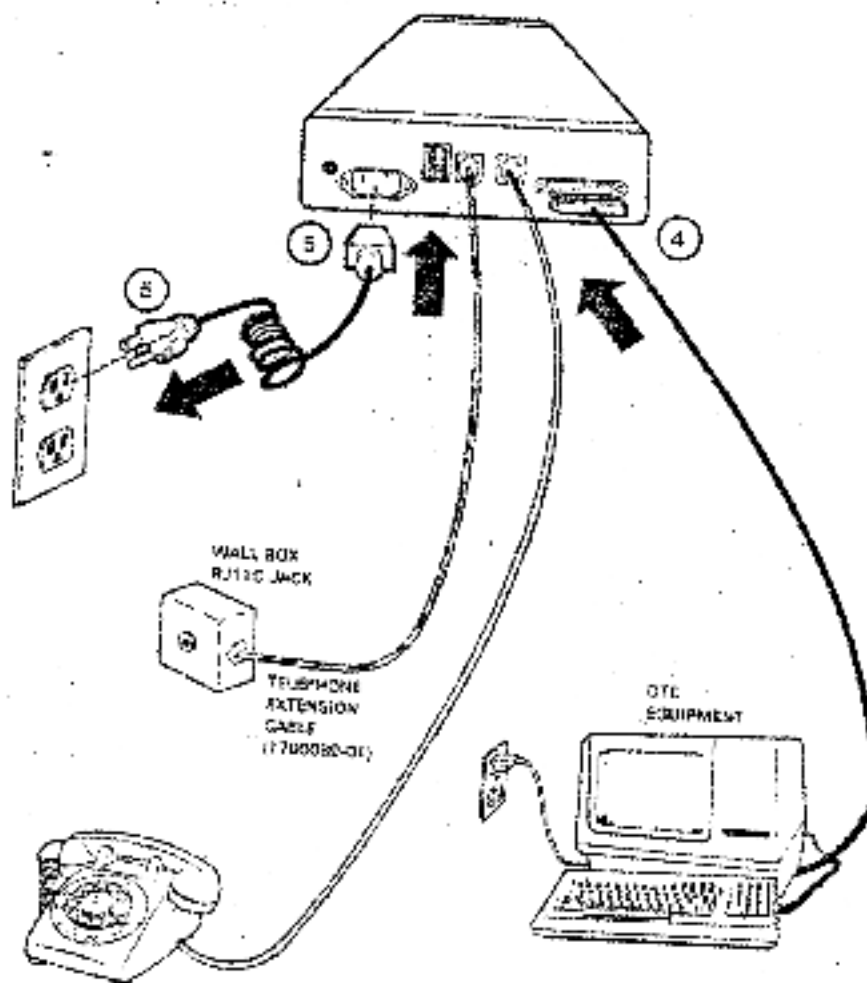
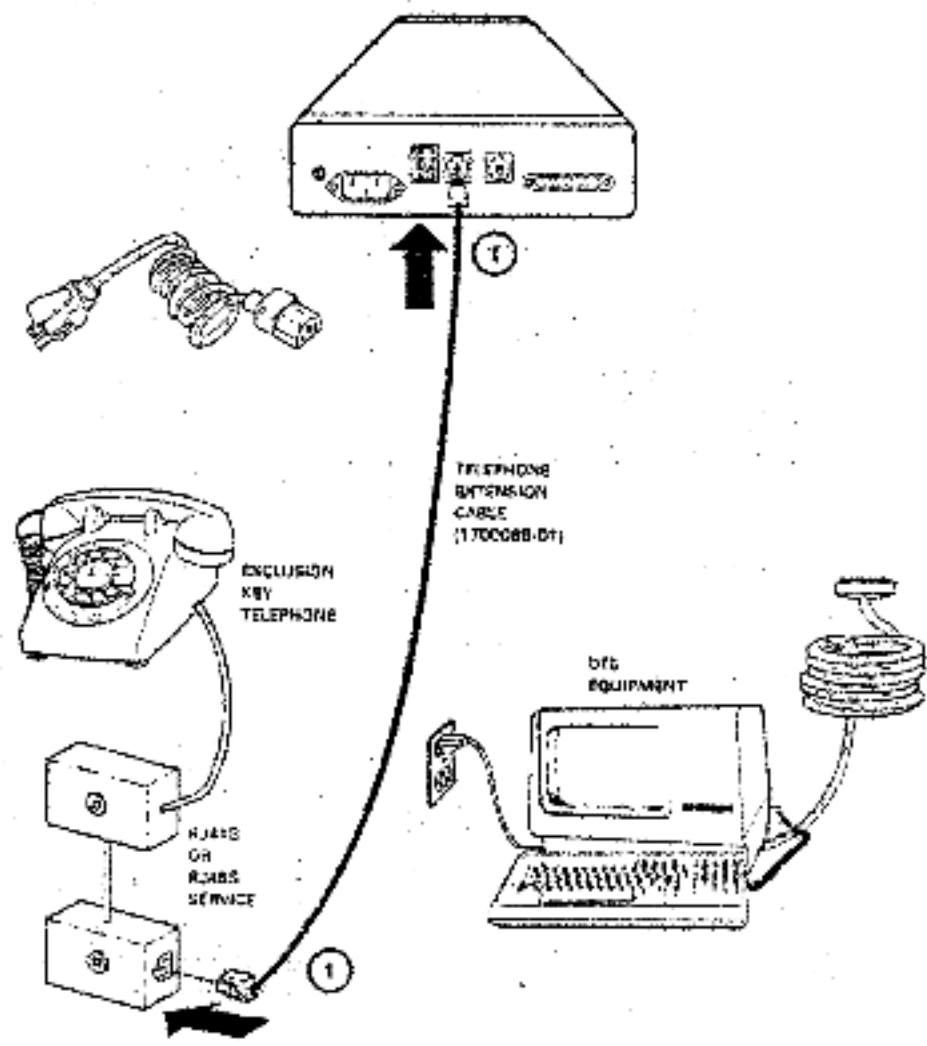


Figure 2-4 Installing Bendix Modems on RJ11 or Conventional Service (Sheet 2 of 4)

1

Plug one end of the telephone extension cable into the RJ41S or RJ45S (or equivalent) wall box. Plug the other cable end into the left-hand B position Jack on the rear of the modem.



76-11351

Figure 2-4 Installing Standalone Modems On RJ41S/RJ45S or Equivalent Service (Sheet 1 of 2)

- 2 Plug terminal cable (or other DTE device) into the modem DTE interface connector.
- 3 Plug the power cord into the rear of the modem, then into the ac wall outlet.

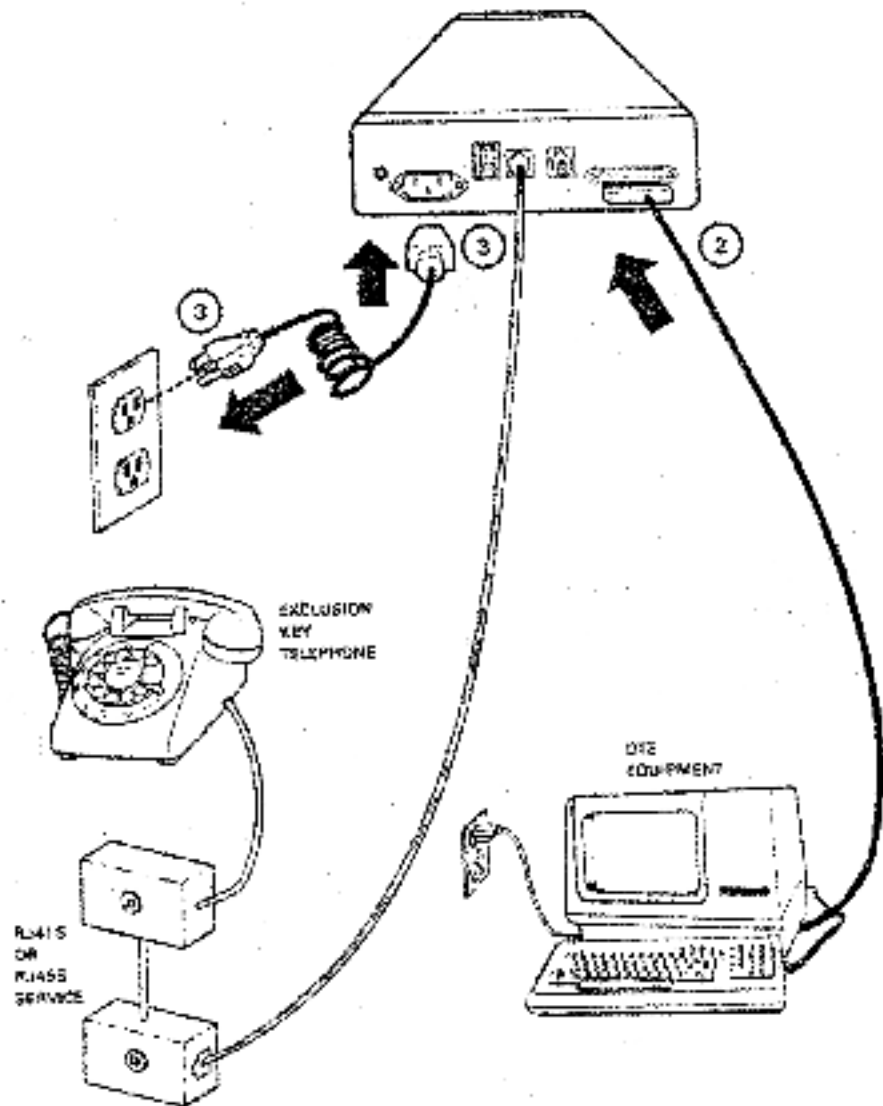


FIG 1-1162

Figure 2-4 Installing Standalone Modems On RJ415/RJ455 or Equivalent Service (Sheet 2 of 2)

**2.5.1.4 Installing the Standalone Modem With Private Line Service.** The private/leased line (PL) connector on the rear of the standalone modem enclosure is detachable. It must be removed to attach the private/leased line wires to each connector position. Refer to Figure 2-6 for the following installation procedure.

1. Unplug the 4 position private line (PL) connector from the rear of the modem. Strip the insulation off each wire in the private/leased line (about 1 cm [ 3/8 inch] from the end. Loosen the 2 bottom screws on the PL connector and insert wires all the way to the insulation as shown in Figure 2-6, tightening each screw after inserting wire.
2. Plug the PL connector into the PL jack on the modem.
3. Plug terminal cable (or other DTE device) into the modem DTE interface connector.
4. Plug the power cord into the rear of the modem, then into the ac wall outlet.

#### **2.5.2 Installing the Multiple Modem Enclosure**

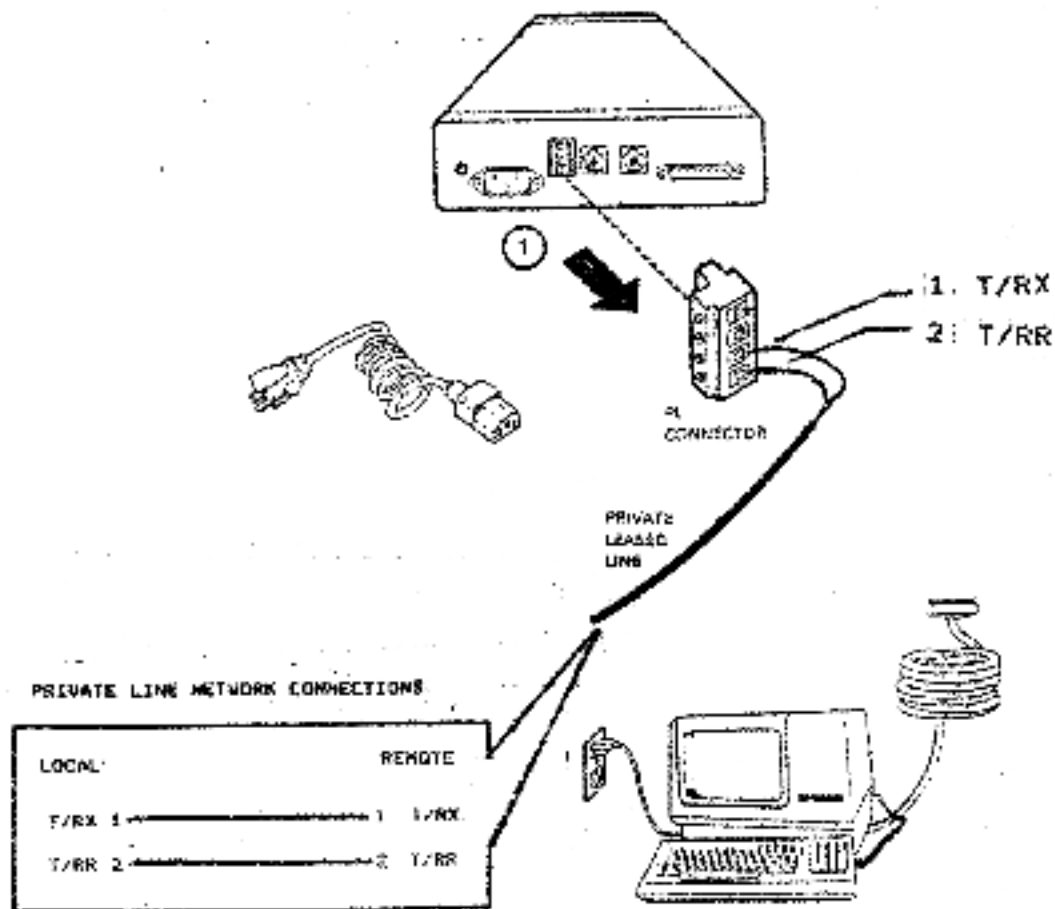
Figure 2-7 is a rear view of the multiple modem enclosure connector panel. DTE connections are made to J1 through J12 for modem lines one through 12 respectively. Installation requires selecting a suitable rack location within cabling distances of the data terminal equipment and the RJ21X (CA21A) telephone service or private line connections.

#### **NOTE**

The location of the RJ21X or CA21A service is very important. When this service is being installed, make sure it is within standard cable distance, typically 5.2 M (15 ft) from the enclosure. In most installations, the RJ21X or CA21A service is installed in the cabinet that houses the enclosure.

1

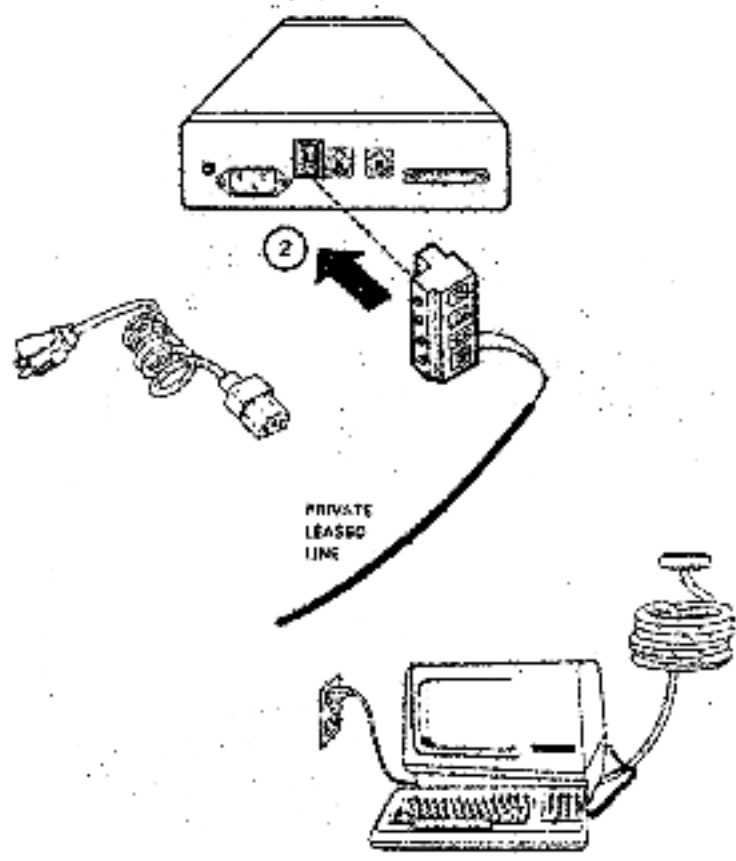
Unplug the 4 position private line (PL) connector from the rear of the modem. Strip the insulation off each wire in the leased line (about 1 cm [ 3/8 inch] from the end. Loosen the 2 bottom screws on the PL connector and insert wires all the way to the insulation as shown in the figure, tightening each screw after inserting wire.



76-11337

Figure 2-5 Installing Standalone Modems On Private Lines (Sheet 1 of 3)

- 2 Plug the PL connector into the PL Jack on the modem.



TC-124

Figure 2-5 Installing Standalone Modems On Private lines (Sheet 2 of 3)

- ③ Plug terminal cable (or other DTE device) into the modem DTE interface connector.
- ④ Plug the power cord into the rear of the modem, then into the ac wall outlet.

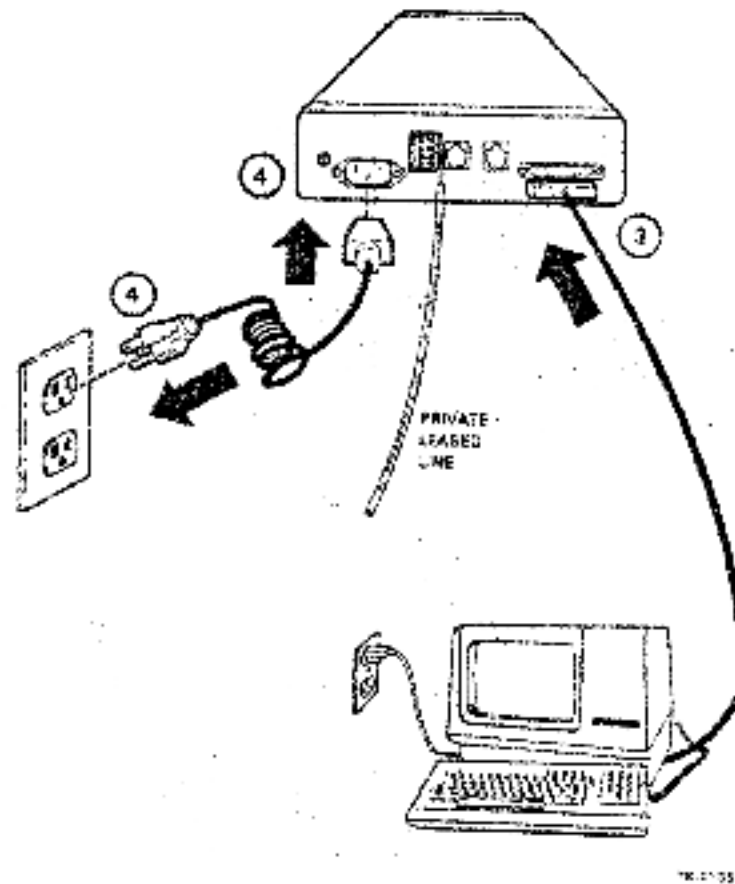
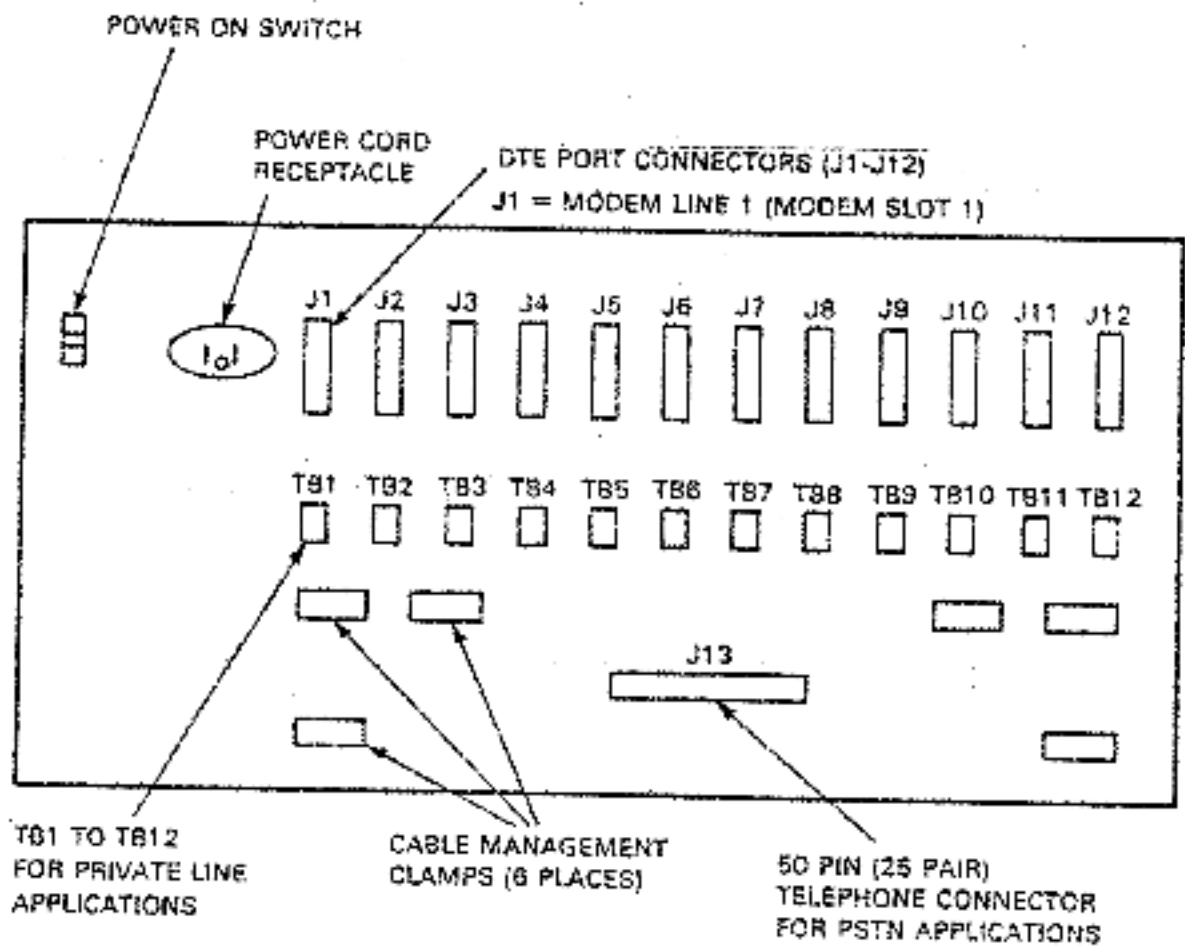


Figure 2-5 Installing Standalone Modems On Private Lines (Sheet 3 of 3)  
2-20

Once the location is selected, follow the procedure below to mount the multiple modem enclosure.

1. Remove the hinged front door by opening the door (pull at the top) and releasing the two bottom spring latches (pull handles toward the center).
2. Remove the front door panel assembly from the DE100-PM enclosure by removing four screws (two on the top flange and two on the bottom flange). Refer to Figure 2-8.
3. Remove all blank filler cards from the enclosure (Figure 2-8). Save these filler cards -- DO NOT throw them away.
4. Locate the proper placement in the computer cabinet for the enclosure and mount it to the multiple position, vertical rail assembly of the cabinet. Standard rack mounting procedures must be observed. Be sure to leave about 2.54 cm (1.25 in) clearance between the enclosure and other equipment for reassembly of the front door panel. The mounting hardware included is eight clip sets and eight 10-32 X 1/2 screws.
5. Reinstall the front door panel assembly that was removed in Step 2.
6. Make sure that the power switch is set to ON (Figure 2-10). Plug the power cord into the rear panel power connector and connect the ac plug to an electrical outlet.
7. For public switched telephone connections, install the interconnecting (BTS) type) cable between J13 of the DE100-PM enclosure and the RJ21X or CA21X service. This cable is not supplied. Pin number/modem slot assignments for the J13 connection are detailed in Appendix C, Table C-1.
8. For private/leased line connections, telephone wires must be stripped of insulation (about 1 or 3/8 inch) from the end) and inserted into the private/leased line connectors as shown in Figure 2-11. To open the spring clip to insert the into the connection port, use a small screw driver as shown in Figure 2-11.
9. Once the telephone cable is connected, apply power to the enclosure and observe that all the power supply status LEDs are ON (see Figure 2-9).
10. This completes multiple modem enclosure installation. The modem modules are installed next. Refer to Section 2.5.3.



TK-11358

Figure 2-6 Multiple Modem Enclosure Rear Connector Panel

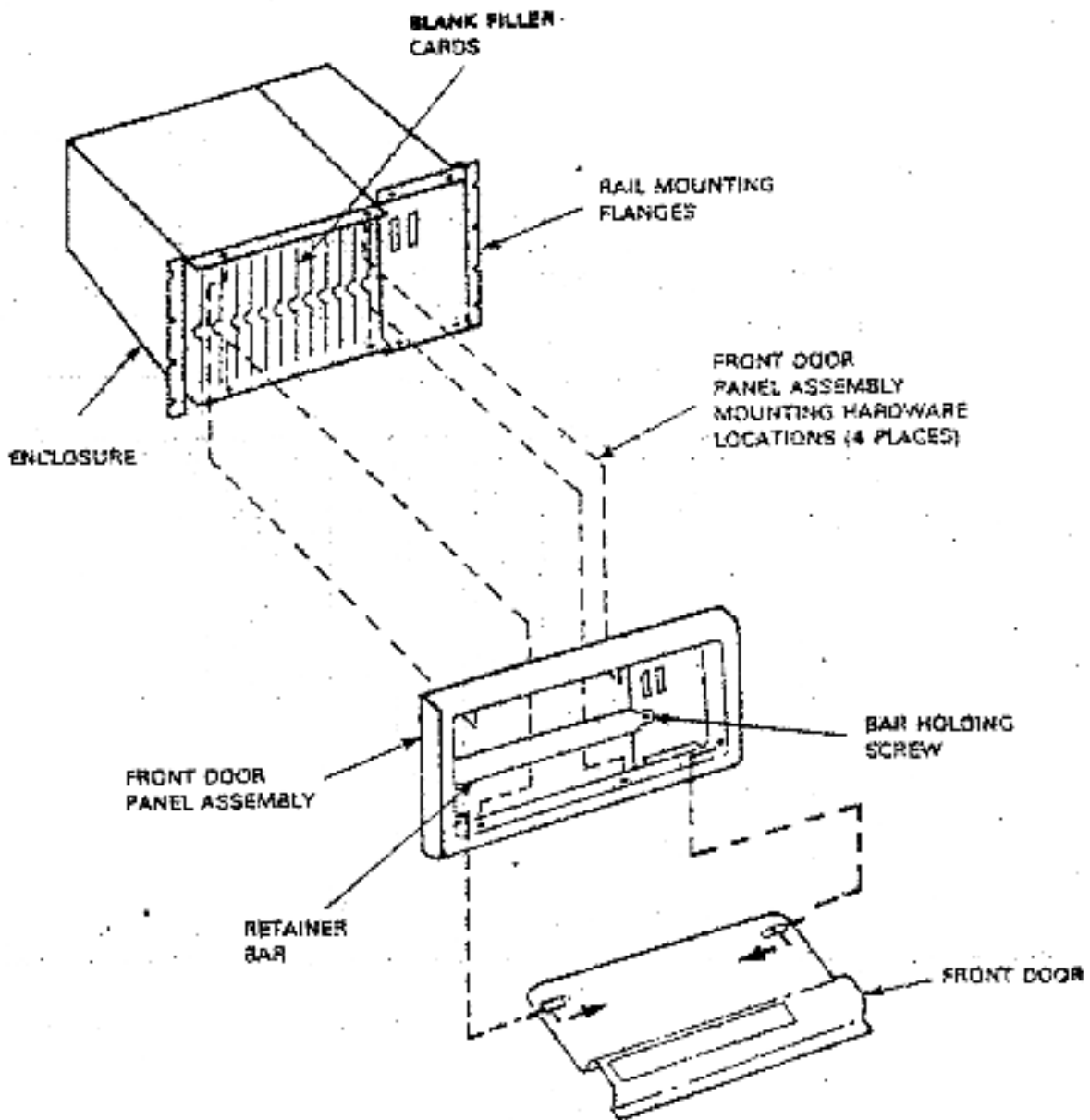


Figure 2-7 Multiple Modem Enclosure Installation Diagram

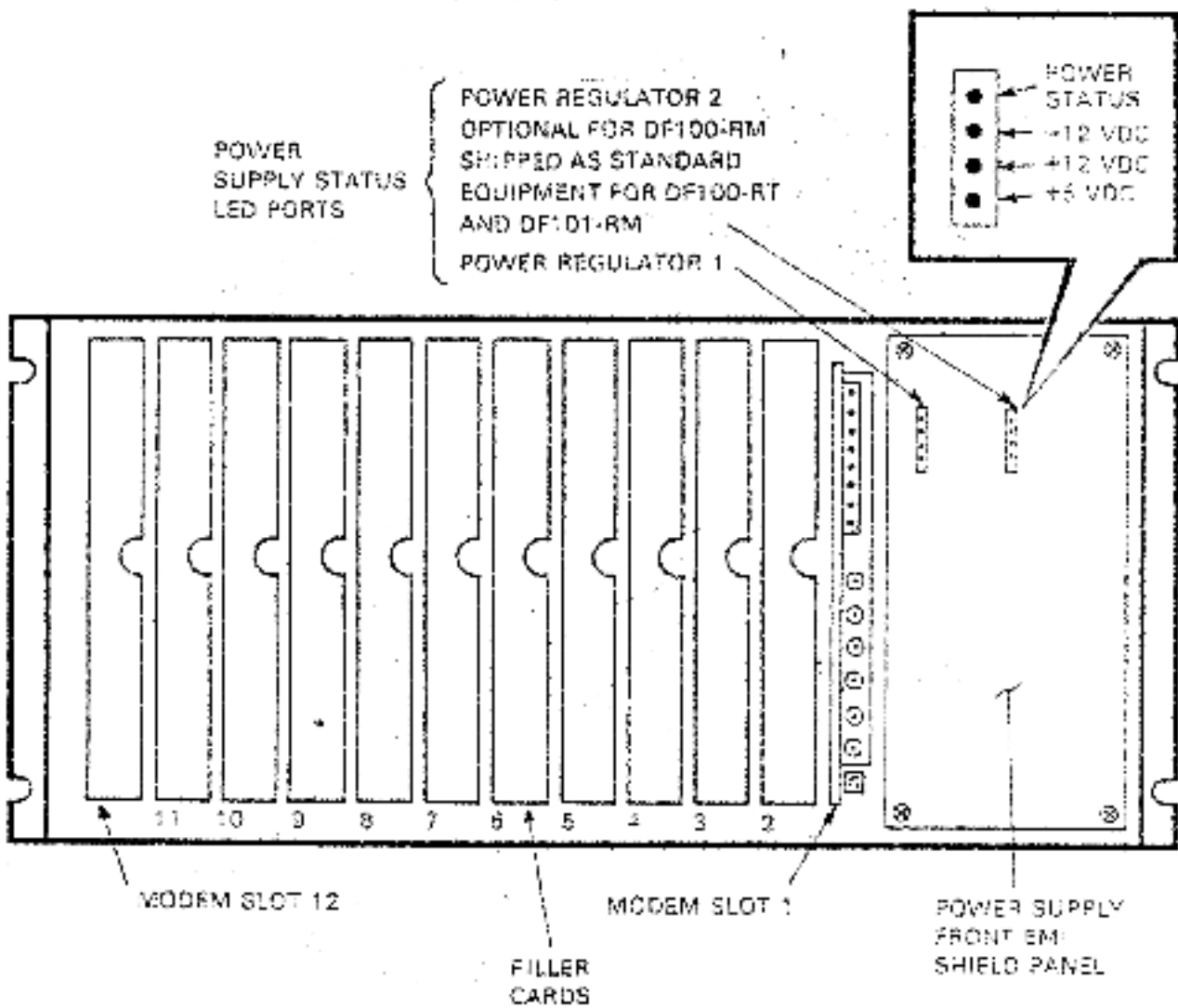


Figure 2-9 Multiple Modem Enclosure Module Placement

### 2.5.3 Installing Multiple Modem Modules

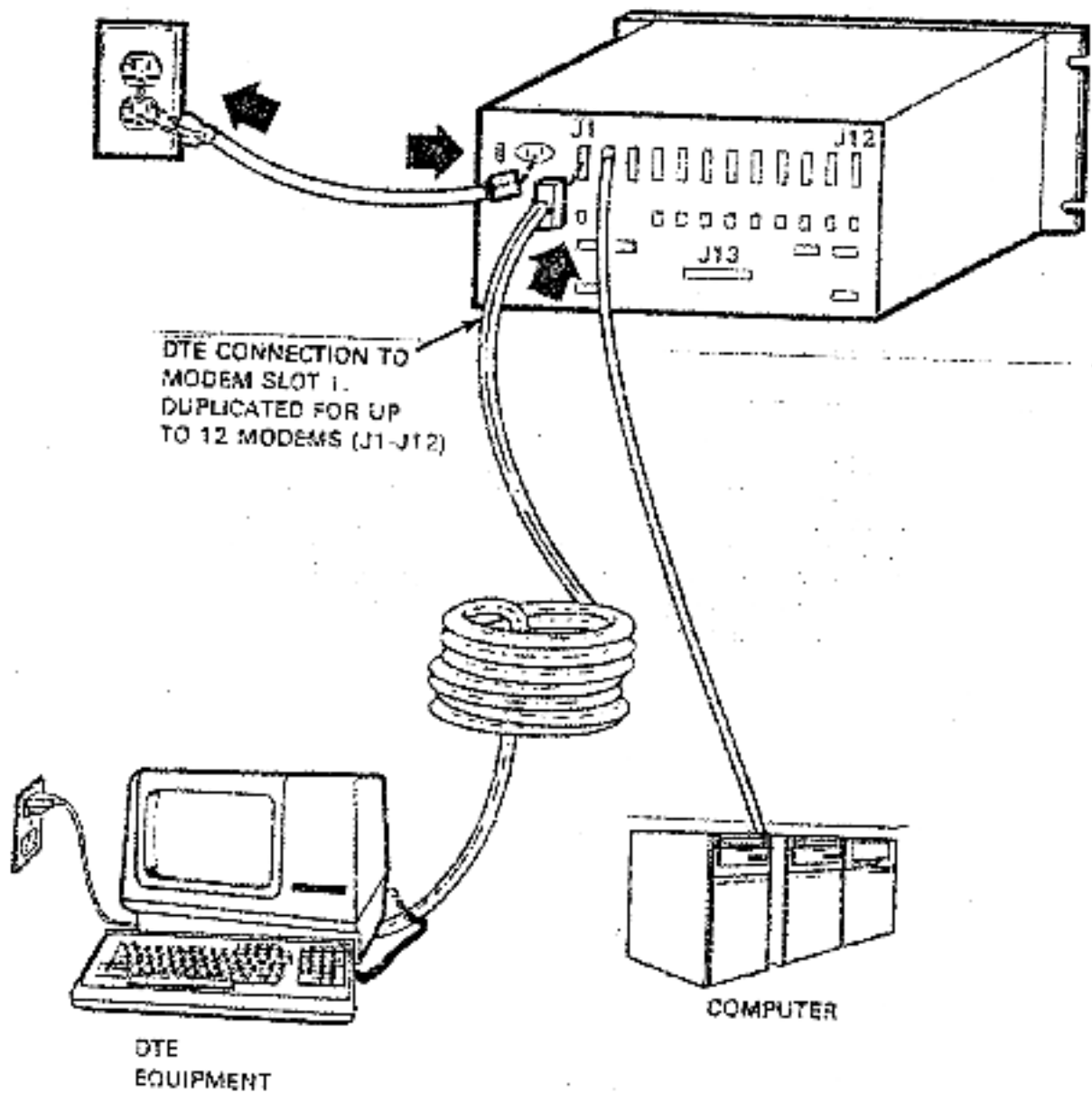
To install modem modules into multiple modem enclosures, follow the procedure below.

1. Verify that each modem module is correctly configured for the desired options (see Chapter 5). Factory selections are compatible with most data communications equipment.
2. If the front door was removed earlier during the enclosure installation, go to Step 3. Otherwise, remove the hinged front door by opening the door (pull at the top) and releasing the two bottom spring latches (roll handles toward the center). The front door must be removed to either remove or insert modules (see Figure 2-8).
3. Remove the module retainer bar from front of the card cage area by unscrewing the holding screw on the right side (see Figure 2-8). Remove the other end of the bar from its retaining slot.

#### NOTE

If the blank filler cards were removed earlier during the installation of the multiple modem enclosure, go to Step 4. Before installing a modem module into its assigned slot, the filler card must be removed and saved. If a modem module is permanently removed, a filler card must be inserted in its place.

4. Insert and firmly seat each modem module into the assigned enclosure slot. Be sure that components are facing the power supply (see Figure 2-9).
5. After installing all modules, be sure to correctly log module characteristics of each modem on the identification label located on the inside surface of the front door (see Figure 2-12). All slots must be filled with either modem modules or filler cards.
6. Connect the DTE cables for each modem line being used to the appropriate modem line, jack J1 through J12. Refer to Figure 2-10.
7. Follow the test procedure in Chapter 4 that apply to your modem configuration.



TK-11357

Figure 2-9 Multiple Modem Enclosure Interface Cabling

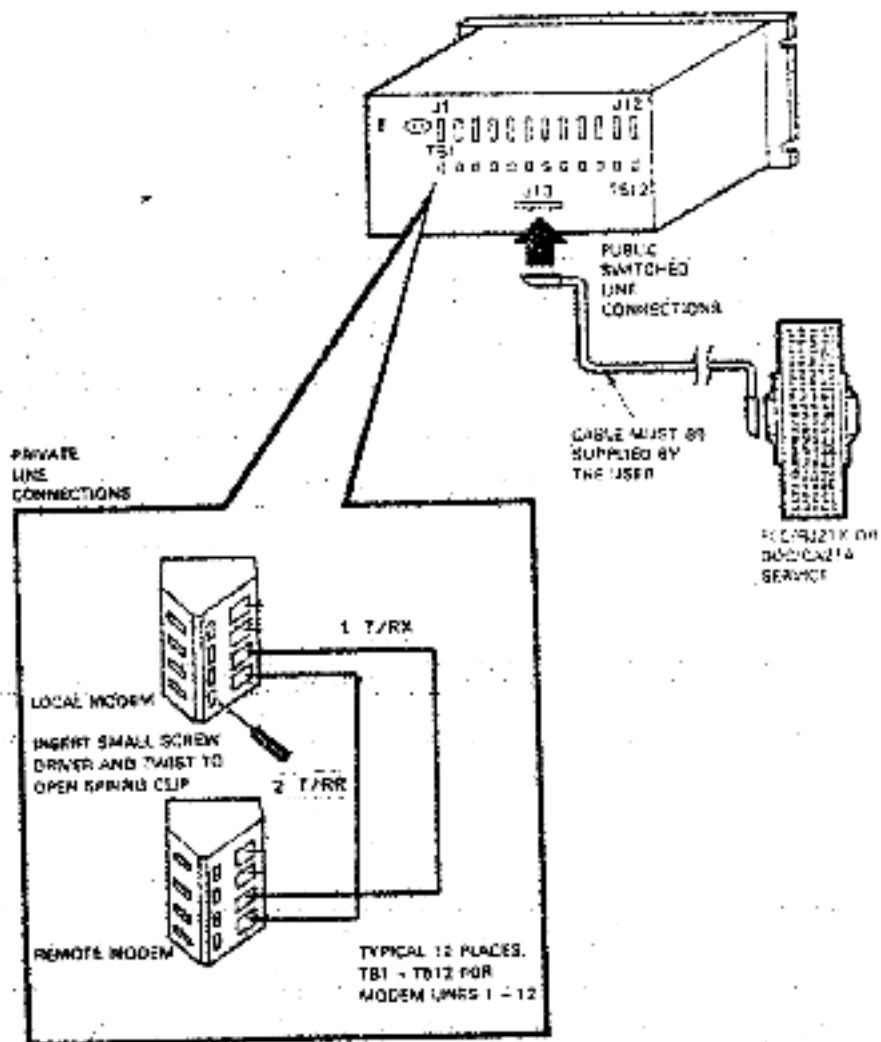
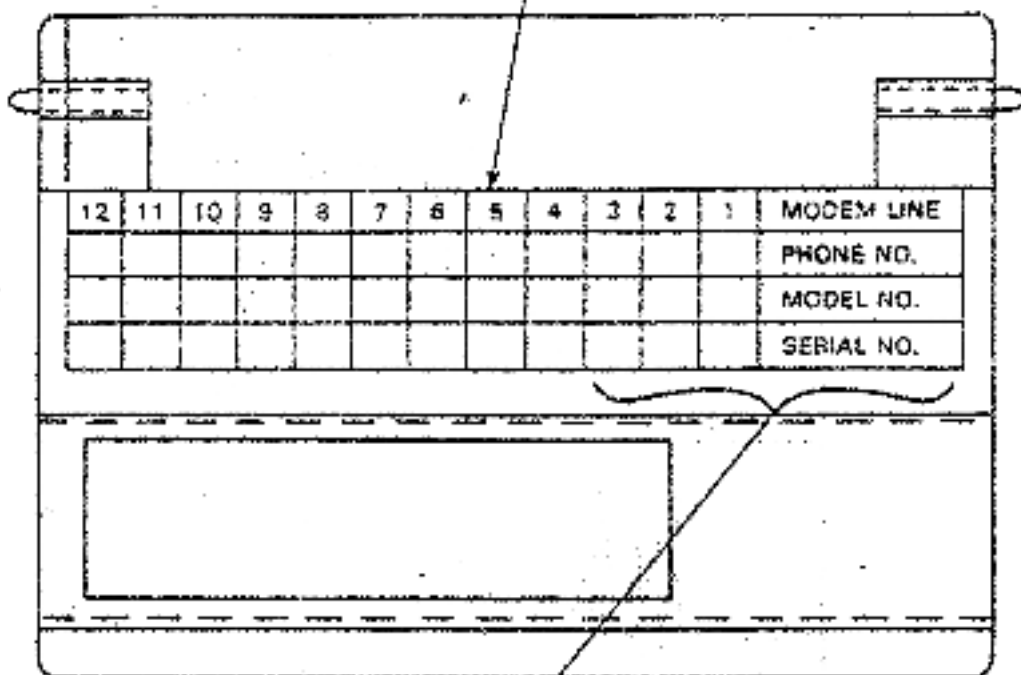


Figure 2-10 Multiple Modem Enclosure PSTN/PLIN Line Connections

MODEM IDENTIFICATION LABEL



3	2	1	MODEM LINE
868321	734-386485	734-873651	PHONE NO.
DF124-AM	DF124-AM	DF124-AM	MODEL NO.
KL00012	NL03294	KL01234	SERIAL NO.

Figure 2-11 Modem Identification Label

#### 2.5.4 Installing DF100-PR Power Regulator Module

For the DF100-RM multiple modem enclosure, power regulator 2 is optional and provides a back-up for power regulator 1. For the DF100-RT multiple modem enclosure, power regulator 2 is shipped as standard equipment to share the + 5 Vdc load. In this configuration, power regulator 2 does provide ~~redundant~~ back-up for the + 12 Vdc output, but NOT the + 5Vdc output.

To install or replace a DF100-PR power regulator, both the front door panel assembly and Electromagnetic Interference (EMI) panel of the multiple modem enclosure must be removed as described in the procedure below.

This procedure is provided for installing an optional power regulator in the DF100-RM. The procedure also applies when replacing either regulator module in the DF100-RT enclosure. The only difference is that the power interconnect cables are different and are not interchangeable. For the DF100-RM, cable 70-10305-01 is used. For the DF100-RT, cable 70-20350-01 must be used (see Figure 2-14).

1. Make sure that the power switch on the back of the enclosure is set to OFF.
2. Remove the four front door panel mounting screws, as shown in Figure 2-13, and remove the panel assembly. Two screws are located on the top flange at point A and two are on the bottom flange at point B.
3. Remove the four EMI panel mounting screws (one at each corner) and remove panel.
4. Remove the existing power regulator module from its mounting slot and attach the interconnecting cable (70-10305-01 for DF100-RM or 70-20350-01 for DF100-RT) between the two regulator modules as shown in Figure 2-14. Be sure not to disconnect the main power cable from the transformer.
5. Insert both regulator modules, with the LEDs on top and facing out, and slide both modules to the backstop.

#### NOTE

Regulator modules do not plug into any type of backplane edge connector, they simply mount in each slot. Connections are made by the correct power cable.

6. Replace the EMI panel and the front door panel assembly, cover up the enclosure and verify that all cover LEDs come ON.

- ① Remove four front door panel mounting screws and remove panel assembly. Two screws are located on the top flange at point A and two are on the bottom flange at point B.
- ② Remove four EMI panel mounting screws (one at each corner) and remove panel.

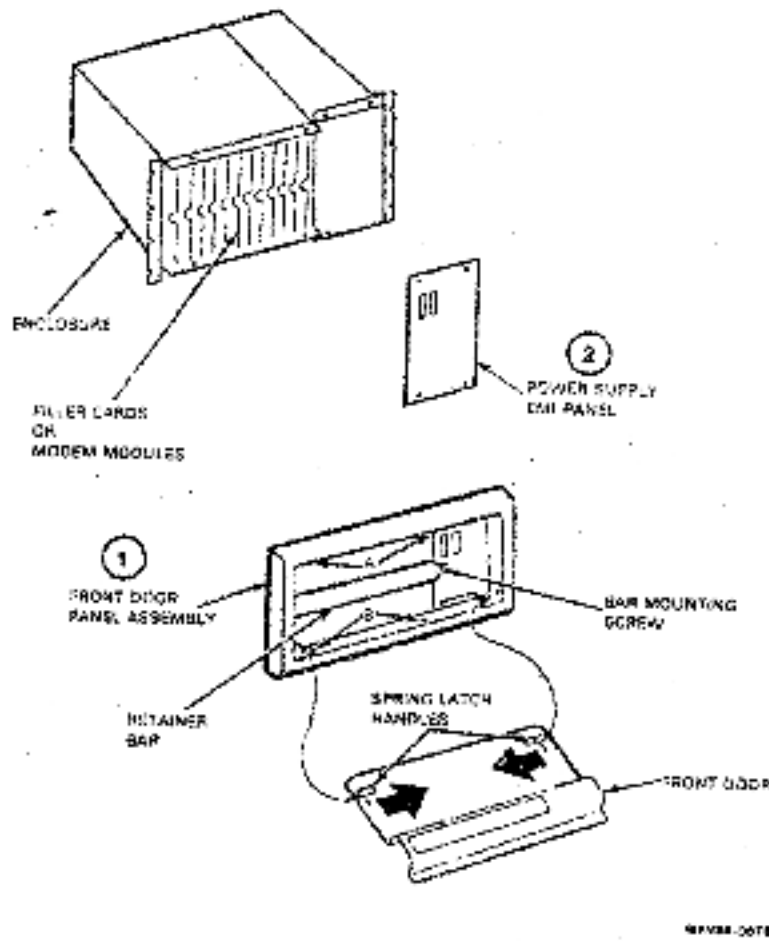
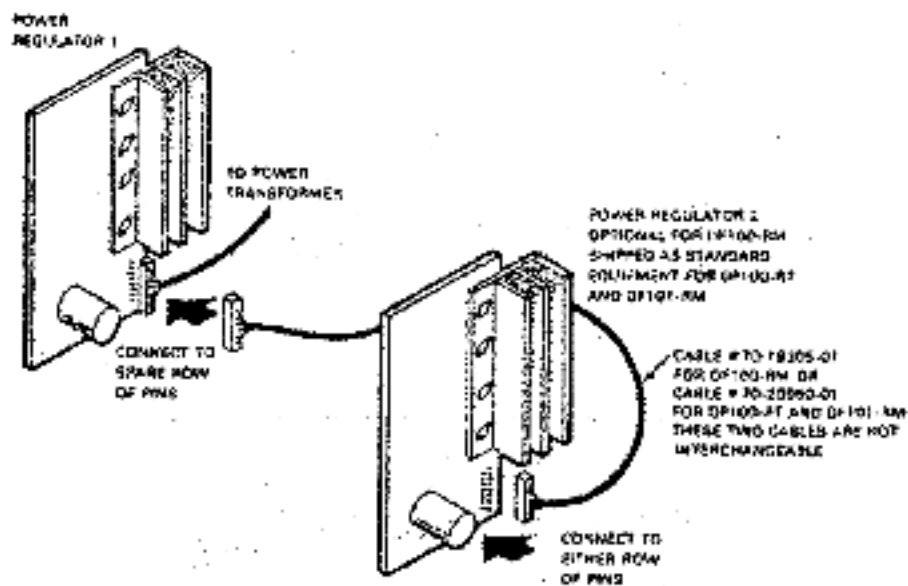


Figure 2-12 Installing the DF100-PR Power Resistor Module



W688A-1218

Figure 2-14 Power Regulator Interconnect Detail

**3.1 GENERAL**

This chapter includes the operational description for the DF124 modem when mounted in either the Standalone or Multiple Modem enclosure. The operation of the controls and indicators are the same regardless of the type of enclosure (see Figures 3-1 and 3-2). The only difference is that the controls and indicators for the standalone are horizontal; in the multiple modem enclosure, they are mounted vertically.

The DF124 modem is EIA RS-423 compatible and may be used with any EIA RS-232-C, ASCII, terminal. When using a VT200 terminal family with the DF124 modem, the terminal must be set to VT200 emulator mode for proper ASCII character response. VT200 mode causes erroneous characters to be displayed.

The auto dialer is also described in this chapter. The auto dialer is an integral part of the modem and is activated only by a Control A or Control B. Any other character causes an error to be displayed (see Section 2.4 for auto dial).

**3.2 CONTROL SWITCHES AND INDICATORS**

The DF124 Modem contains six pushbutton switches and eight Light-Emitting Diode (LEDs) indicators. Figure 3-1 illustrates the standalone configuration and Figure 3-2 shows the multiple modem enclosure layout. Tables 3-1 and 3-2 provide a description of each function.

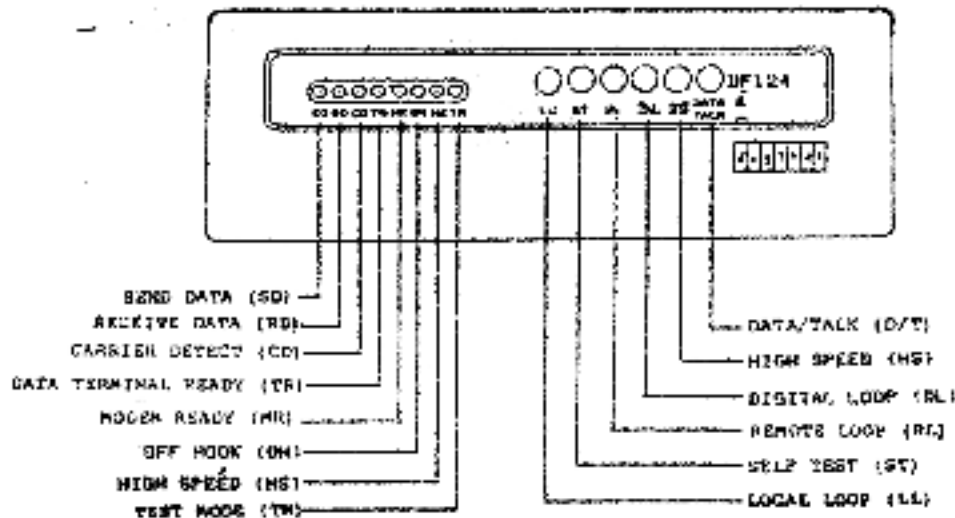


Figure 3-1 Standalone DF124 Modem Controls and Indicators

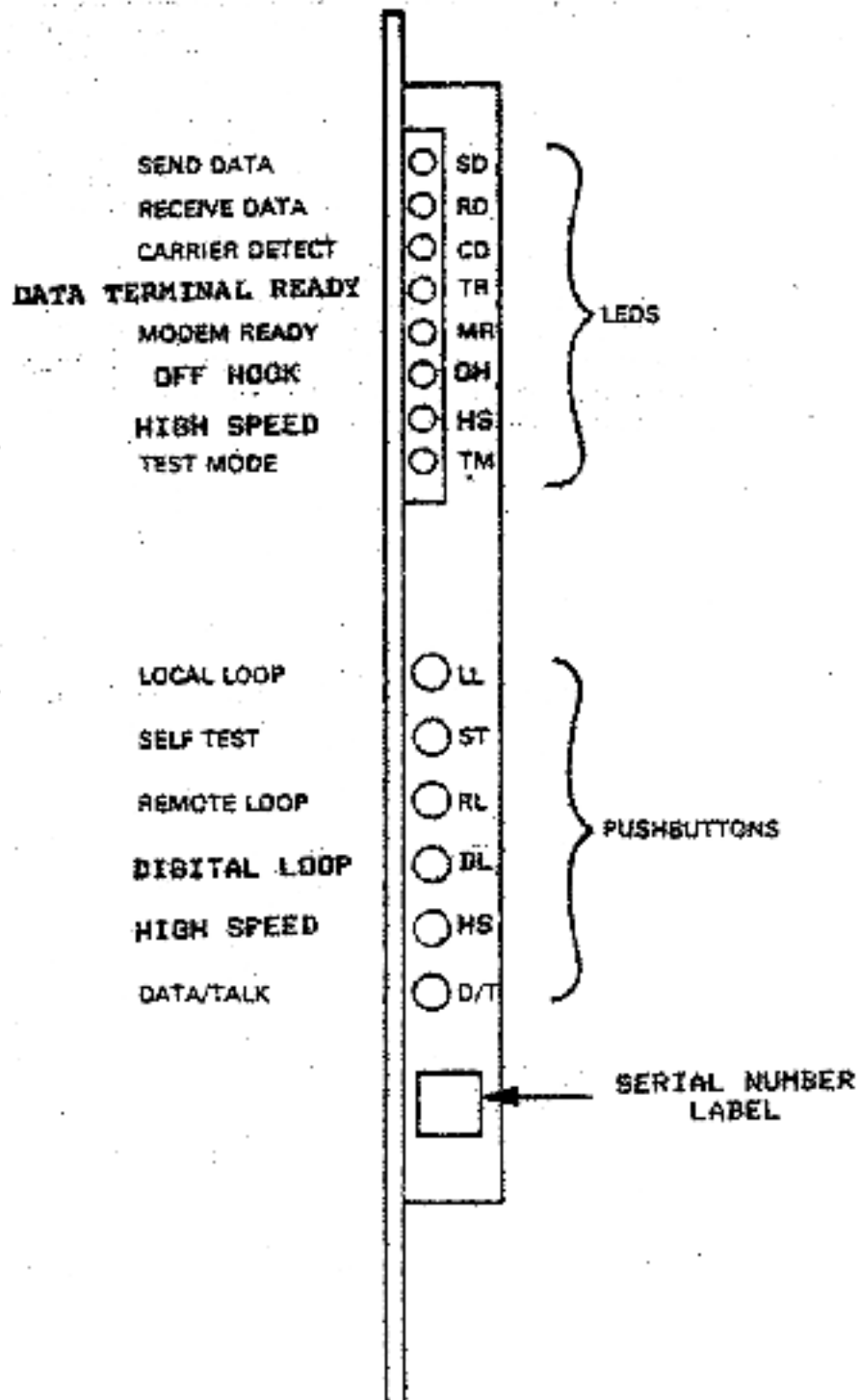


Figure 3-2 Multiple Modem Controls and Indicators

Table 3-1 DF124 Modem Front Panel LED Indicators

Indicator	Status	Function
Send Data (SD)	On	Modem is transmitting data.
	Off	Modem is not transmitting data.
Receive Data (RD)	On	Modem is receiving data.
	Off	Modem is not receiving data.
	Flashing	In test mode, indicates that errors are being detected when selftest loopback tests are run.
NOTE		
When selftest mode is initiated (ST pushbutton pressed in) for any of the loopback tests, the RD indicator is used to indicate errors. It flashes once for each error detected.		
Carrier Detect (CD)	On	Audio carrier from a remote modem is present.
	Off	Carrier is not present.
Data Terminal Ready (TR)	On	Data terminal equipment (DTE) is ready to send or receive data.
	Off	Data terminal equipment is not ready to send or receive data.
Modem Ready (MR)	On	Modem is ready to send or receive data.
	Off	Modem is not ready to send or receive data.
Off Hook (OH)	On	Modem is connected to a dial-up telephone line.
	Off	Modem is not connected to a dial-up telephone line.
High Speed (HS)	On	Modem is prepared to operate at 2400 b/s.
	Off	Modem is prepared to operate at 1200 b/s.
Test Mode (TM)	On	Modem is in test mode.
	Off	Modem is not in test mode.

Table 3-1 DF124 Modem Front Panel LED Indicators (con't)

Indicator	Status	Function
Power Regulator Indicators	Multiple modem enclosure only	
Power Status	On	Power to the regulator board is normal.
-12 Vdc	On	Power supply outputs are normal.
+12 Vdc	On	
+5 Vdc	On	

NOTE

An Off condition on any power indicator indicates a power supply problem.

Table 3-2 DF124 Modem Front Panel Pushbutton Controls

Pushbutton	Status	Function
Local Loop (LL)	In	Modem is placed in an analog loopback test mode of operation.
	Out	Analog loopback is disabled.
Self-Test (ST)	In	Modem is placed in a self-test mode of operation.
	Out	Self-test is disabled.
Remote Digital Loop (RL)	In	Remote station connected to the modem is placed in digital loopback mode.
	Out	Digital loopback is disabled.
Digital Loop (DL)	In	Modem is disabled (out of service) and placed in local digital loopback mode.
	Out	Modem is enabled for normal operation.
High Speed (HS)	In	Modem is conditioned to operate at fallback speed of 1200 b/s instead of the normal 2400 b/s.
	Out	Modem is conditioned to operate at the normal speed of 2400 b/s.
DATA/TALK (D/T)	In	Conditions the modem for voice communications.
	Out	Conditions the modem for serial binary data communications.

### 3.3 USING THE DF124 ON DIAL-UP LINES

The DF124-AA standalone modem can operate in one of four standard modes:

1. Manual Originate
2. Manual Answer
3. Automatic Answer
4. Automatic Originate (Auto Dial)

When mounted in the multiple modem enclosure, the DF124 modem does not have provisions for external telephone handset connections, therefore, DF124 modems can only operate in two modes: automatic originate and automatic answer.

#### 3.3.1 Manual Originate Mode

To manually originate a call with a standalone modem, perform the following.

1. Set the Local Loop (LL), Self-Test (ST), Remote Loop (RL), and Digital Loop (DL) pushbuttons to the OUT position.
2. Verify that the Carrier Detect (CD) indicator is OFF and that the Terminal Ready (TR) and Modem Ready (MR) indicators are ON. TR is asserted from an on-line, powered-up terminal or system. If the terminal does not provide TR, then the force DTR option must be selected (see Chapter 5). ~~If force DTR is enabled, the TR indicator will not be ON.~~ *Not true - correct*
3. Set the HS pushbutton to the OUT position to operate at 2400 b/s. To select operation at the fallback speed of 1200 b/s press HS to the IN position.
4. Set the DATA/TALK (D/T) pushbutton to the TALK (IN) position.
5. Lift the telephone handset and listen for a dial tone.
6. Dial the desired number.

#### NOTE

If the call is answered manually, ask the station attendant to prepare the modem at that location for data reception by either placing the DATA/TALK (D/T) pushbutton to the DATA (OUT) position or if the modem is not easily accessible, by typing a control C (C) at the terminal.

7. When the answer tone is heard, set the modem DATA/TALK (D/T) pushbutton to the DATA (OUT) position or type a control C at the terminal.
8. Hang up the telephone handset. *ON*
9. *High Speed* Verify that the CD, ~~DR~~, and MR indicators are ON. The ~~set-hook~~ (SH) indicator will also be ON if high speed is selected. \*13

### 3.3.2 Manual Answer Mode

To manually answer the phone on a standalone modem, perform the following procedure.

1. Verify that the TR indicator is ON (unless the force DTR option is enabled) and that the DATA/TALK (D/T) pushbutton is in the TALK (IN) position. Also set the TR pushbutton for the desired speed. All other pushbuttons are in the OUT position. TR is asserted from an on-line, powered-up terminal or system.
2. When the telephone rings, answer it and listen.
3. When the call originator asks you to prepare for data reception either place the DATA/TALK (D/T) pushbutton in the DATA (OUT) position or type a control C at the terminal and hang up the telephone handset.
4. Verify that the mode *ON* changes from TALK to DATA by ensuring that the MR, CD, and ~~DR~~ (if high speed) indicators come ON. Once these indicators are ON, the modem is considered "ON-LINE" and data can be transmitted and ~~received~~.

### 3.3.3 Automatic Answer Mode

The modem will auto answer regardless of the position of the DATA/TALK (D/T) pushbutton switch, unless the modem is set for manual answer mode (see Chapter 5). When an automatic answer modem receives a call, it automatically answers and establishes communication. The speed of both the receiving and originating modems must be set to the same speed, otherwise, the modem disconnects from the line within a few seconds.

### 3.3.4 Automatic Originate (Auto Dial)

The autodial feature allows the user to call a remote modem either from an asynchronous terminal keyboard or from an asynchronous computer port instead of from a standard telephone. Since the auto dialer is an asynchronous device, it is only functional when the modem is configured for asynchronous mode. The auto dialer cannot be used when the modem is configured for synchronous operation. A variety of commands and functions are available for making calls automatically. Section 3.4 provides detailed descriptions, procedures and examples on using the auto dial feature.

## 3.4 AUTO DIAL FEATURE

A person may dial many different number sequences depending on a variety of different circumstances. For example, in many business offices, a special access code may be required to obtain an outside telephone line. Further, an area code may be required. And even more complex are international calls containing many special codes and pauses for any number of reasons, including perhaps one or more dial tones.

The auto dialer can be used with both pulse and tone dialing telephone systems. In the dialing sequence, a "P" is used to identify pulse digits and "T" is used for tone digits. In some telephone systems it may be necessary to use both P and T in the same number string. Remember, there are many combinations of dial codes, access codes, pauses and groups of digits depending on the type of telephone service and where you may be calling. All of these human actions and variations in telephone systems and service must be considered and duplicated by the auto dialer when it is expected to make the call.

A variety of commands and response messages are available to the user to communicate with the auto dial feature to place a call under terminal control (dial from keyboard) or software control (dial from computer). The commands are listed in Table 3-3 and explained below, while the response messages are detailed in Table 3-4.

The auto dialing sequence is issued either manually by an operator from an asynchronous terminal keyboard or from a computer, by software control using special routines embedded in the user's program. In either case, the procedure follows a similar sequence, except that under program control it is necessary that the program properly interpret the response characters and take the correct action(s).

The auto dialer is capable of storing 5 (26 character) telephone numbers; four numbers stored in alpha indexed storage registers and one number stored in the current number register. The current number register always stores the last number entered into the auto dialer, regardless of whether the number is entered from a terminal, computer or from one of the alpha indexed storage registers.

#### NOTES

1. Stored numbers are not saved when modem is powered down.
2. The DF124 modem including the auto dial feature does not automatically set the speed to match the terminal or computer speed. Both modems must be set to the same speed.

Table 3-3 Valid Auto Dial Characters

Valid Characters	Function
CTRL/A	Activates the auto dial feature in BURST mode. Typically used with computer configurations or intelligent terminal with memory storage (answerback message feature).
CTRL/B	Activates the auto dial feature in INTERACTIVE mode. This mode provides system responses to prompt the user of actions taken. The first response to control B is READY. If any character other than control B (or control A) is entered, the ERROR response is displayed.
CTRL/C	In manual answer mode, pressing control C connects the modem to the line without having to access the modem to change from TALK to DATA.
P	Indicates pulse dialing of digits that follow.
T	Indicates tone dialing of digits that follow.

NOTE

If a dial code (P or T) is not specified in the number string, the default is pulse (P) dialing. Also, both types of dialing codes may be used in the same number string.

=	Access pause -- Causes a pause period of 15 seconds to wait for secondary dial tone. If a dial tone is not detected within 15 seconds, the auto dialer responds with the NO DIAL TONE message.
!	Indicates end of the number string; start dialing.
Digits 0-9	Digits that make up the telephone number.
Letters A, B, C, or D	When entered at the end of a number string, the letter identifies a memory location for storing that number. When entered at the READY response, the dialer displays the number stored at that location.
Carriage Return (CR)	Pressing CR at the READY response displays the current number in the current number storage register.

NOTE

The auto dialer accepts either upper case or lower case entries. The auto dialer does not accept the hyphen (-) character or space character. This allows the auto dialer to operate more efficiently, because it does not have to be concerned about non-essential characters.

Table 3-4 Response Messages

Response Message	Definition
[Ready	Indicates that auto dialer is ready to perform one of the tasks listed below. This response message is always used to indicate that the dialer is ready with one exception; when control A is used, the initial READY response is omitted. <ol style="list-style-type: none"> <li>1. Accept a new number</li> <li>2. Dial current number</li> <li>3. Store number in memory or</li> <li>4. Retrieve stored number</li> </ol>
[Error	Indicates that the modem is not ready (control B not issued) or that an invalid entry was made in the dialing string. Using invalid characters such as space, hyphen (-), comma (,) or slashes (/) in the number string causes errors. This response places the modem in an idle state which requires a control A or control B to reactivate the auto dialer.
[Attached	Indicates remote end has answered and responded with the answerback tone.
[No Answer	Indicates remote end has not answered the call within the allotted time of 30 seconds. This response places the modem in an idle state which requires a control A or control B to reactivate the auto dialer.
[No Dial Tone	Indicates a dial tone was not detected within the allotted time of 15 seconds (or optional 40 seconds, see jumper W1 description in Chapter 5) after initiating a call. This response places the modem in an idle state which requires a control A or control B to reactivate the auto dialer.

[ ] Brackets indicate valid short form abbreviations.

#### NOTES

1. Some telephone company error messages may accidentally trigger the secondary dial tone detector and/or the answer tone detector, causing a false ATTACHED response from the auto dialer which places the modem in data mode. If this occurs, check the dialed number and try again.
2. For long form response messages, switchpack S2, switch 5 must be set to the OFF position. For short form (abbreviated), set switch 5 ON. See Chapter 5 for details.

The auto dialer provides a dialog that allows the user communicate with the modem to automatically dial telephone numbers from an asynchronous terminal or computer port. Remember, the auto dialer is an asynchronous device and cannot be used when the modem is configured for synchronous operation.

The dialog is activated using one of two modes:

1. Interactive Mode or
2. Burst Mode

#### 3.4.1 Interactive Mode

The interactive mode is most generally used when the modem is connected to a terminal. A control B (^B) must be entered at the terminal keyboard or embedded in the user's program routine to activate interactive mode. The auto dialer immediately responds with a READY message that indicates it is ready. If the auto dialer does not immediately respond to control B with READY, then the modem or associated terminal or CPU may have a problem. All user inputs except control B are echoed back to the DTE (displayed on the screen if the DTE is a terminal).

#### 3.4.2 Burst Mode

Burst mode is similar to interactive mode, but requires a control A (^A) to activate the dialing sequence. The only difference is that the initial READY response is not issued by the auto dialer as in interactive mode. All other response messages are identical to interactive mode, including subsequent READY conditions. Only the first READY response is omitted. This mode is typically used by a computer or intelligent terminal with memory store capability to save time. Without having to wait for the READY response the computer can operate more efficiently. Burst mode assumes that the auto dialer is ready and allows the computer or terminal to issue the telephone number to the auto dialer immediately following the control A. Also, in burst mode, all user inputs are not echoed back to the DTE (not displayed on the terminal).

### 3.4.3 Dial From Keyboard (Terminal Control)

to automatically originate a call using a terminal, perform the following procedure. This procedure emphasizes the use of control B because it is more commonly used when the modem is attached to a terminal. However, control A would work just as well, the only difference is that the auto dialer does not respond with the initial READY message. In fact, control A is recommended if the terminal has answerback capability such as the VT100 (see Section 3.4.5.1).

1. Verify that the TR and MR indicators are ON (unless the force DTP option is enabled) and ensure that all push-buttons (except the RS pushbutton, which is set to your specific speed) are in the OFF position. TR is asserted from an on-line, powered-up terminal or system.

*and the terminal  
does not support  
DTR.*

#### NOTE

For long form response messages, switch-pack S2, switch 5 must be set to the OFF position; for short form (abbreviated) set switch 5 ON.

2. Enter a control B (CTRL/B). The READY message appears on the terminal screen. Enter the number sequence followed by the \*.
3. If the call is answered within 30 seconds, the message "ATTACHED" appears at the originating terminal. If the call is not answered in 30 seconds, "NO ANSWER" is displayed.
4. When connection is established, verify that the following indicators are ON. Have someone verify the remote end.
  - a. ~~SR~~, MR and ON at transmit modem
  - b. ~~TR~~, MR and ~~CR~~ at receive modem

~~CR~~                      ~~SR~~

There will be a delay of several seconds while the modems establish communication. Proceed with normal communication functions.
5. To terminate a call, the user must take some action that will:
  - a. Result in turning TR OFF. Generally, this action depends on the hardware configuration. Some of the more common methods to turn TR OFF are:
    - i. Use the "Shift/Break" key to generate a long space disconnect.
    - ii. Switching modes between ON-LINE and LOCAL mode or

- b. Result in loss of carrier by placing the DATA/TALK (D/T) pushbutton to the TALK (TW) position.

Upon termination of a call at the local modem, the remote modem will disconnect due to loss of carrier, long spacing condition or inactivity time out if abort timer is enabled. These conditions are user selectable options that must be enabled for the disconnection to occur (see Chapter 5). The remote modem will also disconnect if it detects dial tone.

5. Verify that the MR and CD indicators go OFF.

#### 3.4.4 DIAL FROM COMPUTER (PROGRAM CONTROL)

When establishing a call, TR must be asserted and remain asserted throughout the auto dial ~~string~~ or the force DTR option must be enabled.

Response messages from the auto dialer can be set to long form (spelled out) or short form (abbreviated) by switchpack S2. To minimize computer overhead, the short form response message format is recommended. Both interactive or burst mode can be used in program control. To reduce computer overhead, burst mode is recommended.

Another programming consideration for using the auto dialer is the invisible (non-printable) characters that accompany each response message. Each response message is accompanied by special leading and trailing carriage return and line feed characters as shown below:

```
<cr lf>READY<cr lf>
```

The spaces in the example are used only as separators, they are not included in the response.

#### NOTE

These special characters are purposely omitted in Table 3-4 and in Examples 1 through 10 for clarity.

The leading cr/lf response from the auto dialer occurs on every response message except in two special cases involving the READY and ERROR messages where the leading carriage return and line feed are omitted. These special cases are typically associated with the use of control D. When a control D is entered to cancel a call, as in Example 1, the resulting READY message appears on the same line. The same holds true if an invalid character is entered in the telephone number string; the ERROR message response would not include the leading cr/lf. It would appear on the same line as the number and invalid character as shown in Example 2.

These same conditions also apply to the use of control A. However, under program control it is not likely that the computer

program will include an invalid character in the telephone number or cancel the call because of a wrong number. These two conditions simply should not exist in the program.

A variety of techniques and approaches can be used in designing a program for software control of the auto dialer. Designing a program is only limited by the programmer's imagination and knowledge of the fundamentals in the dialing sequence as detailed in this chapter.

### 3.4.5 Using the Autodialer

The autodialer can be used to:

1. Dial a number
2. Redial the Current Number
3. Store Numbers
4. Dial Stored Number
5. Cancel a Call

Each of these functions are described below. Examples of how to use each function are also provided.

#### 3.4.5.1 Dialing Numbers

Dialing a telephone number is done simply by entering the number at the ready condition for interactive mode (see Example 1), or immediately following control A in burst mode (see Example 2).

In Example 2, the answerback message feature of a VT100 terminal is used to demonstrate burst mode. This feature may differ on other video terminals. Be sure to refer to appropriate users guides for setting up the answerback message feature. For the VT100, the set up procedure is included in the example.

Both types of dialing codes (P or T) can be used within the same number string as shown in Example 3. The number string must be terminated by the # symbol; as shown in the examples, to start dialing. The last number dialed is always stored in the current number register for immediate redial. However, if a number is entered and just stored in one of the storage areas (not dialed) that number is now in the current number register. Appropriate system responses are given to indicate calling status (see Table 3-4).

### EXAMPLE 1: INTERACTIVE MODE DIALING

<E>

Enter control B; activates auto dialer.  
<Control B is not displayed (not echoed  
back to the DTE)>

READY

Dialer responds with the READY message.

TL=6035551212\*

Enter number followed by the start dialing  
symbol (#). In this example the number is  
being tone dialed. An access pause  
character is also used to wait for a  
second dial tone. Then the number,  
including area code is dialed and also  
stored in the current number register.  
There is a small delay while the number is  
dialed and connection made.

ATTACHED

Answer back tone is received from the  
remote modem and connection is made.  
When CD indicator comes ON, proceed with  
normal data transfer activity.

## EXAMPLE 2: BURST MODE DIALING - USING VT100 ANSWERBACK

**SET-UP 5** Press the SET-UP key, followed by the number 5 key to place the VT100 in SET-UP B mode.

**SHIFT A** Press the SHIFT and A key simultaneously to start loading the answerback message. The CAPS LOCKS key will not work.

**A=** The VT100 responds by displaying A= on the screen.

**A= Z** Enter any character except those listed in Table 3-3. This special character (called the delimiter) allows the user to clear the answerback message area and start over if a mistake is made. To correct an error, enter the delimiter again and return to SHIFT A. In the example the letter Z is selected.

**A= 2978\*0055551212#** Enter the desired telephone number to be stored. Control characters like control A for burst mode, are displayed as a diamond (◊). Also, remember that the start dialing symbol # needs to be included.

**A= 2978◊0055551212#Z** Enter the delimiter again to end the sequence. When it is entered, the number disappears from the screen.

**SHIFT S** Press the SHIFT and S key simultaneously to save the answerback message permanently so that it is not lost when the VT100 is turned OFF. Press the SET-UP key to return to normal video operation.

**<^BREAK>** Press the CONTROL and BREAK keys simultaneously to send the telephone number to the auto dialer in burst mode. The number is dialed and also stored in the current number register. (The Control Break function and the complete number sequence is not displayed but echoed back to the DTE.)

**ATTACHED** After a short delay, the answer back tone is received from the remote modem and connection is made. When CR indicator comes ON, proceed with normal data transfer activity.

### EXAMPLE 3: USING BOTH PULSE AND TONE DIALING CODES

<^B> Control B activates auto dialer. <Control B is not displayed (not echoed back to the DTE)>

READY System responds with READY message.

p9=t5551212# Enter number followed by the # start dialing symbol. Notice the P code for pulse dialing and T code for touch tone dialing. These codes can be either upper or lower case.

ATTACHED After a short delay, the answer back tone is received from the remote modem and connection is made. When the CD indicator comes ON, proceed with normal data transfer activity.

#### 3.4.5.2 Redial Current Number

Dialing the number stored in the current number register simply requires entering the # symbol at the ready condition in interactive mode or following control A in burst mode. To verify the number before dialing, use carriage return to display the number. Dialing codes (T or P) are always displayed as upper case when retrieved from storage. The # character is then used to start dialing (see Example 4). Remember, the current number register contains the last number to be entered into the auto dialer, not necessarily the last number dialed.

### EXAMPLE 4: REDIAL CURRENT NUMBER

<^T> Control B activates auto dialer. <Control B is not displayed (not echoed back to the DTE)>

READY System responds with READY message.

CR To verify current number, press carriage return. This step is optional. To dial without displaying current number, use # at the READY response or immediately following control A in burst mode.

9T=t5551212 When CR is entered at the READY response, the number in the current number register is displayed, including the dialing codes if they were originally entered.

READY The READY response is again displayed.

# # dials the number.

ATTACHED After a short delay, the answer back tone is received from the remote modem and connection is made. When the CD indicator comes ON, proceed with normal data transfer activity.

### 3.4.5.3 CANCELLING A CALL

The calling procedure can be canceled in one of the following ways.

1. By using control B before the start dialing symbol (\*).
2. By an invalid key (including control A) before the start dialing symbol (\*).
3. By any key after <sup>the number has been dialed</sup> ~~the start dialing symbol (\*)~~ is entered.

Before the number is dialed, a call sequence can be cancelled by pressing control B as shown in Example 5. Using control A causes an error as explained below.

A call can also be effectively cancelled when an invalid character (including control A) is entered in the telephone number string before it is dialed as shown in Example 6. In this case an ERROR message is issued, placing the auto dialer in the idle state which requires a control A or B to reactivate the auto dialer.

A call can also be cancelled after it is dialed by pressing any key, but this must be done before the remote modem answers; that is, a call can not be aborted during the dialing sequence (see Example 7). For touch tone applications, the dialing sequence happens almost immediately. For pulse dialing, the sequence is usually completed in 10 seconds. When the call is cancelled, the auto dialer responds with the NO ANSWER message, placing the auto dialer in the idle state which requires a control A or B to reactivate the auto dialer.

#### EXAMPLE 5: CANCELLING A CALL BEFORE DIALING

```
<B>          Control B activates auto dialer.
              <Control B is not echoed back to the DTE>

READY        Dialer responds with the READY message.

TS=555122<B>READY  If a wrong number is entered, the call can
                  be cancelled by using control B. As soon as
                  the control B is entered, the auto dialer
                  responds with the READY message. Notice that
                  it appears on the same line as the number,
                  immediately following the last digit
                  entered. <Control B is not echoed back to
                  the DTE>

TS=555122      Enter the corrected number followed by *.

ATTACHED     After a short delay, the answer back tone is
              received from the remote modem and
              connection is made. When the CD indicator
              comes ON, proceed with normal data transfer
              activity.
```

**EXAMPLE 6: ENTERING AN INVALID CHARACTER**

<^B>	CONTROL B activates auto dialer. <Control B is not echoed back to the DTE>
READY	Dialer responds with the READY message.
742=6175-ERROR	As soon as an invalid character is entered (hyphen in this case), the auto dialer responds with the ERROR message. Notice that it appears on the same line as the number, immediately following the invalid entry. Valid characters are listed in Table 3-2.
<^B>	Enter control B to reactivate the auto dialer.
READY	Dialer is again ready.
742*6175551312*	Enter the corrected number followed by the * (start dialing symbol).
ATTACHED	After a short delay, the answer back tone is received from the remote modem and connection is made. When the CD indicator comes ON, proceed with normal data transfer activity.

**EXAMPLE 7: CANCELLING A CALL AFTER DIALING**

<^E>	Control B activates auto dialer. <Control B is not echoed back to the DTE>
READY	Dialer responds with the READY message.
7122=456783<x>	Enter number followed by the # symbol and press any key. Pressing any key, in this example lower case "x", almost immediately cancels a touch tone dialed number. For pulse dialing, wait about 10 seconds before pressing any key. (Whatever key that is used is not displayed (not echoed back to the DTE))
NO ANSWER	Indicates that the call did not go through.

#### 3.4.5.4 Storing Numbers

The last number dialed is always stored for immediate redial. Whenever a new number is entered into the auto dialer, it replaces the number that was stored in the current number register.

Other storage areas identified as A, B, C or D are provided for storing up to 4 additional numbers. These numbers remain in storage until changed using the store number procedure in Example 8 or the modem is powered OFF. To store a number in either interactive or burst mode, simply enter one of the storage codes A, B, C or D immediately following the number. Also, if lower case dialing codes (t or p) are stored, they are displayed in upper case when retrieved from storage.

#### EXAMPLE 8: STORING NUMBERS

<^B>	Control B activates auto dialer. (Control B is not echoed back to the DTE)
READY	Indicates auto dialer is ready.
T2=1234567C	Enter desired number, including T or P dialing code followed by the desired storage area code. The example specifies storage area C.
READY	The number is stored in area C, as well as, in the current number register and the auto dialer is again ready. To store another number, enter number followed by storage area code.

### 3.4.5.5 Dialing Stored Numbers

At the ready condition, enter the desired number storage code (A, B, C OR D). This places the number in the current number register. Therefore that number is really stored in two places; 1) in the current number register and 2) in the letter coded area.

Entering the # symbol as shown in Example 9, dials the number retrieved from storage.

Example 10 shows that the remote modem did not answer the call and the call was made again at a later time using the redial feature.

#### EXAMPLE 9: DIAL STORED NUMBER - SUCCESSFUL

<B>	Control B activates auto dialer. <Control B is not echoed back to the DTE>
READY	Indicates auto dialer is ready to use.
	Enter storage code A, B, C or D; in this case storage area C.
CT2=1234567	Modem displays the stored number immediately following the storage code letter, including dial code (T or P) if originally stored. If the dial code is stored as lower case, it is displayed as upper case when retrieved from storage. The number is also placed in the current number register.
READY	Auto dialer again responds with READY.
#	# dials the number.
ATTACHED	After a short delay, the connect back tone is received from the remote modem and connection is made. When the CD indicator comes ON proceed with normal data transfer activity.

EXAMPLE 10: DIAL STORED NUMBER - UNSUCCESSFUL

<^B> control B activates auto dialer. <Control B is not echoed back to the DTE>

READY Indicates auto dialer is ready to use.

Enter storage code A, B, C or D; in this case storage area 6.

BF5=4445151

Modem displays the stored number immediately following the storage code letter, including dial code (T or P) if originally stored. If the dial code is stored as lower case, it is displayed as upper case when recalled from storage. The number is also placed in the current number register.

READY Auto dialer again responds with READY.

# B dials the number. There is a short delay while the modem dials the number.

NO ANSWER Answer back tone is not received from the remote modem and call did not go through.

<^B> Use control B to reactivate auto dialer.

READY Indicates auto dialer is ready to use.

# Press # key to redial the same number.

ATTACHED Answer back tone is received from the remote modem and connection is made. When the CD indicator comes ON, proceed with normal data transfer activity.

### 3.5 USING THE DF124 ON PRIVATE LINE

To operate the df124 on private line, two modem options must be set correctly.

These are:

1. PSTN/PLTN option (switchpack 2, switch 3) must be set to select PLTN (ON) and
2. Answer/Originate option (switchpack 1, switch 3) must be set to select a modem as either the ORIGINATE OR ANSWER modem in private line. One modem in the pair must be originate, the other must be answer.

See Chapter 5 for detailed instructions on these and other option selections.

#### 3.5.1 Normal Operation

To establish a private line connection, follow the procedure below.

1. Make sure that switchpacks are in correct positions.
2. Apply power to both modems and observe that the #\*, HS and CD indicators come ON. The RS indicator will also be ON, if high speed is selected. This indicates that the private line connection is established, allowing both modems to send and receive data (full-duplex operation). The position of the DATA/TALK pushbutton is not important, it can be in either position for private line data transfer. If the modem is also connected to a PSTN telephone line (dial backup feature, see Section 3.5.2) and the DATA/TALK pushbutton on both modems is in the TALK position, the telephone connected to the PSTN can be used for voice communication. The TR indicator may not come ON. This depends on the force DTR option and the DTR.

#### 3.5.2 Using the Dial Backup Feature

The dial backup feature requires that the modem be connected to both a private line (PLTN) and a dial-up line (PSTN). When configured to operate on a private line, if the signal quality becomes unacceptable, the dial-up line can be used as an alternative without having to change any option selections or any other special considerations.

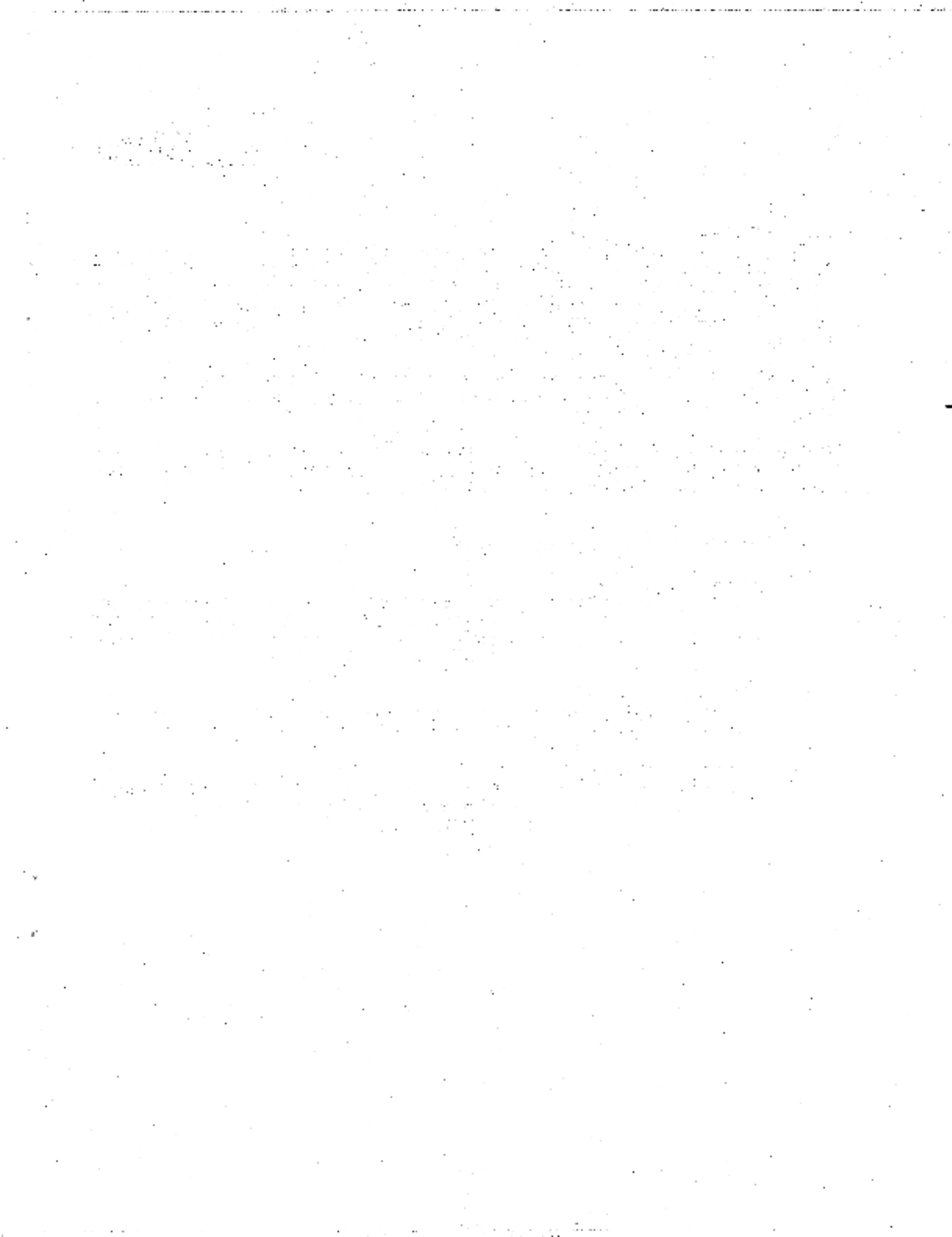
The procedure for using this feature is simple. If the private line is failing, lift the handset from the telephone with the modem's DATA/TALK switch in the DATA (OFF) position. The Carrier Detect indicator will go OFF, automatically switching the modem to PSTN mode. A call can now be placed manually by pressing the DATA/TALK switch to the TALK (ON) position and dialing the number. When the remote modem detects ringing with the loss of carrier

detect, it will also automatically switch to PSTN mode and answer the call, provided that the auto answer option (see Chapter 5) is set to AUTO. When the answer tone is heard, place the DATA/TALK switch to the DATA (OUT) position and hang up the handset. The call can also be made automatically by leaving the modem in the DATA position, hanging up the handset and using the auto dialer.

The PSTN connection will remain in effect until one of the users initiates a disconnect; then both modems will return to private line.

#### NOTE

When operating normally on private line, the telephone that is associated with the PSTN can still be used for voice conversation (not data) provided that the DATA/TALK switch is in the TALK (IN) position. Since the DATA/TALK switch can be in either position, data activity on the private line is not affected.



#### 4.1 GENERAL

This chapter provides modem testing procedures to help isolate data communications problems on the DE124 modem. All test functions include simplified diagrams representing the test features. In test features where a terminal is used, a computer system (interface) could be substituted. These tests are valid for both asynchronous and synchronous operation.

Some of the following tests use the manual originate mode to execute the test. These tests are basically for the standalone modem.

The correct procedure to test and verify a modem communications link is shown in Figure 4-1. The four modem test areas are listed below and discussed in the following text.

1. Test Area 1 --  
Local Terminal Test Tests the local terminal.
  
2. Test Area 2 --  
Local Loop Test Verifies that the local modem can transmit and receive data. Includes both Digital and Analog loopback tests.
  
3. Test Area 3 --  
Remote Digital Loop Test Verifies both the local and remote modems, and the telephone line.
  
4. Test Area 4 --  
End-to-End Selftest Verifies both local and remote modem, separating transmit and receive paths.

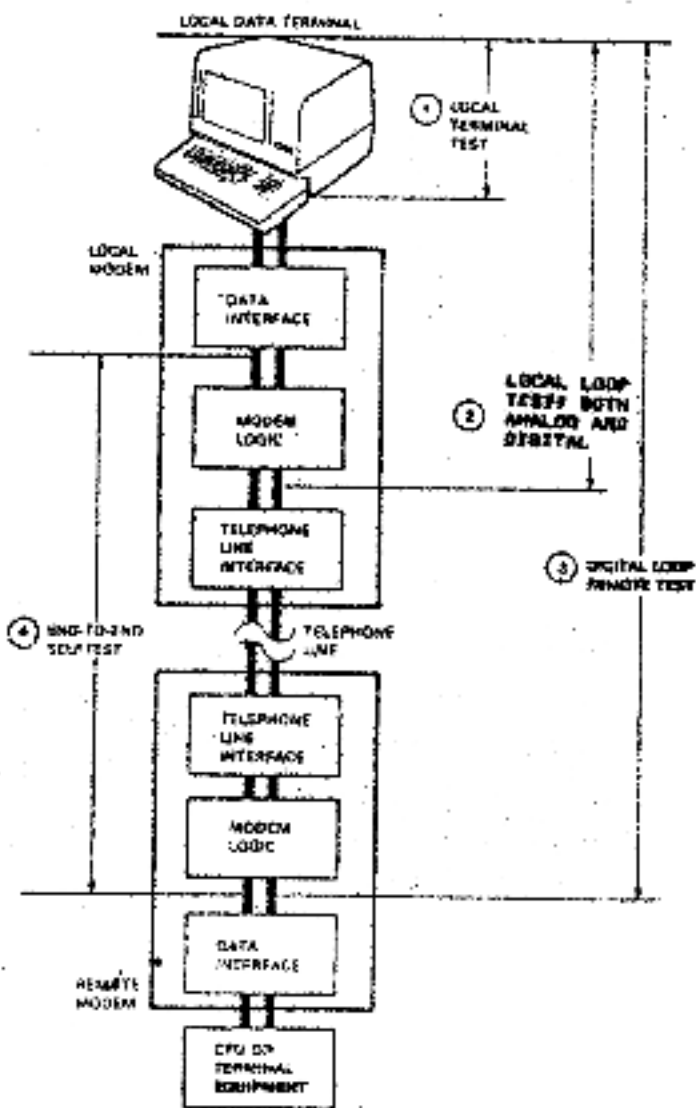


Figure 4-1 Data Path Test Diagram

#### 4.2 TEST AREA 1 -- LOCAL TERMINAL TEST (FIGURE 4-2)

These tests determine if the terminal or computer interface is working correctly. To verify the terminal or computer interface, perform the following.

##### o Terminal Test

- Set terminal to off-line local test and type test message. Verify that correct message is received.
- Set terminal to on-line and install the appropriate cable loopback connector at the end of the DTE cable that attaches to the modem. Repeat test message verification. This test verifies if the terminal or cable is the source of errors, rather than the modem.

##### o Computer Interface Test

- Execute a test message with the communication interface set to internal loopback mode and verify that correct message is received.
- Set the communication interface to normal mode and install the appropriate cable loopback connector at the end of the DTE cable that attaches to the modem. Send test message and verify.



Figure 4-2 Local Terminal Test

#### 4.3 TEST AREA 2 -- LOCAL LOOPBACK TEST

Test Area 2 provides both local Analog and Digital tests. Analog tests includes two separate tests: the analog loopback selftest (where the ST pushbutton is used to generate a test pattern for the test data) and the analog loopback (where the operator at the terminal, provides the test data). Both tests verify that the modem can transmit and receive data at the local modem with no errors. However, you need to execute only one of these tests to verify modem operation. The selftest feature is provided for configurations where a terminal is not available. Each test is discussed below.

Local digital testing does not include the selftest feature. The ST pushbutton is not functional in local digital loopback.

##### 4.3.1 Local Analog Loopback Selftest (Figure 4-3)

This test uses an internal test pattern generator for the transmitter and a test comparator on the receiver to detect errors. If errors occur, the Receive Data (RD) indicator flashes Q\* and Q\*\* once for each error after the test begins. The more RD flashes, the higher the rate of errors.

##### NOTE

Executing analog loopback terminates any current connection. It is not possible to establish a call while in analog loopback.

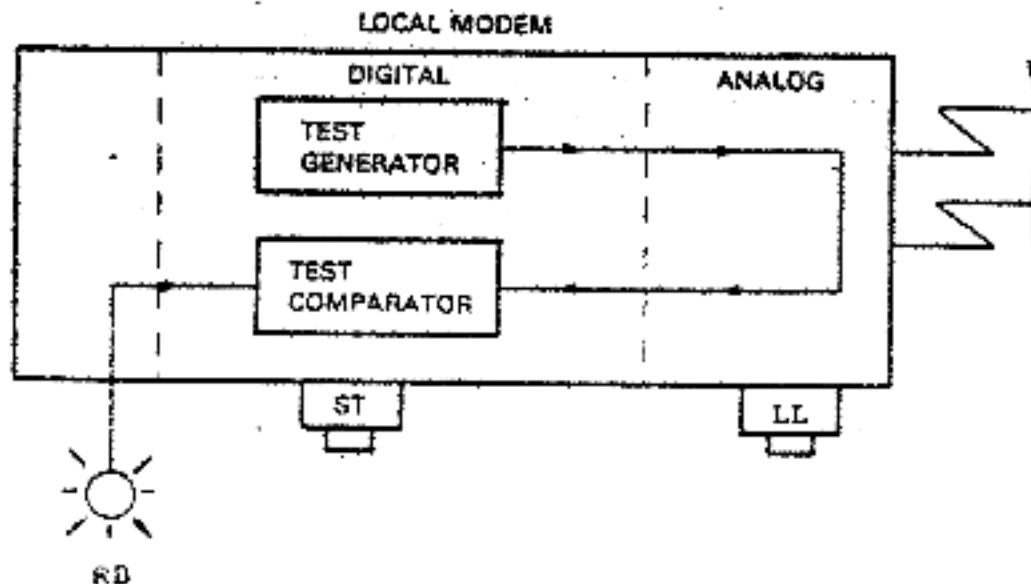


Figure 4-3 Local Analog Loopback Selftest

PROCEDURE:

1. Verify that the CD indicator is OFF and that ~~OR~~ and ~~TR~~ are ON.
2. Configure the switches as follows:
  - a. Set the LL switch to the IN position.
  - b. Set remaining switches to the OUT position.
3. Verify that the CD, ~~OR~~, HS and TR indicators come ON.
4. Set the ST switch to the IN position. *and the OR indicator if the "make busy" option is selected* Once the ST pushbutton is pressed IN, the test is started. Allow the test to run for about 1 minute. If RD does not flash after running for at least 1 minute, the modem can be assumed to be operating correctly. RD may flash when ST is first pressed IN, but that is normal.
5. Observe the RD indicator; if it flashes, the CE124 modem is defective.
6. Set the LL and ST switches to the OUT position to terminate the test.

NOTE

This procedure can be performed at the lower fallback speed of 1200 b/s by pressing the HS switch to the IN position followed by pressing and releasing LL to reset the modem. Repeat the procedure at the new speed.

4.3.2 Local Analog Loopback Test (Figure 4-4)

This test uses a data terminal or computer interface to generate the test message. The data is looped back through the analog circuits in the modem and the characters are returned to the terminal or computer. Either the operator or computer must verify that the received data is correct.

PROCEDURE:

1. Verify that the ~~DS~~ <sup>LS</sup> and HS indicators are ON.
2. Configure the switches as follows:
  - a. Set the LL switch to the IN position.
  - b. Set remaining switches to the OUT position.
3. Verify that the CD, CH, HS, and TM indicators are ON.
4. Type a test message at the terminal keyboard and verify that the same data is received. Incorrect data indicates that the modem is defective or the terminal is set to the wrong speed.
5. Set the LL switch to the OUT position to terminate the test.

NOTE

This procedure can be performed at the lower fallback speed of 1200 b/s by pressing the HS switch to the IN position followed by pressing and releasing LL to reset the modem. Repeat the procedure at the new speed.

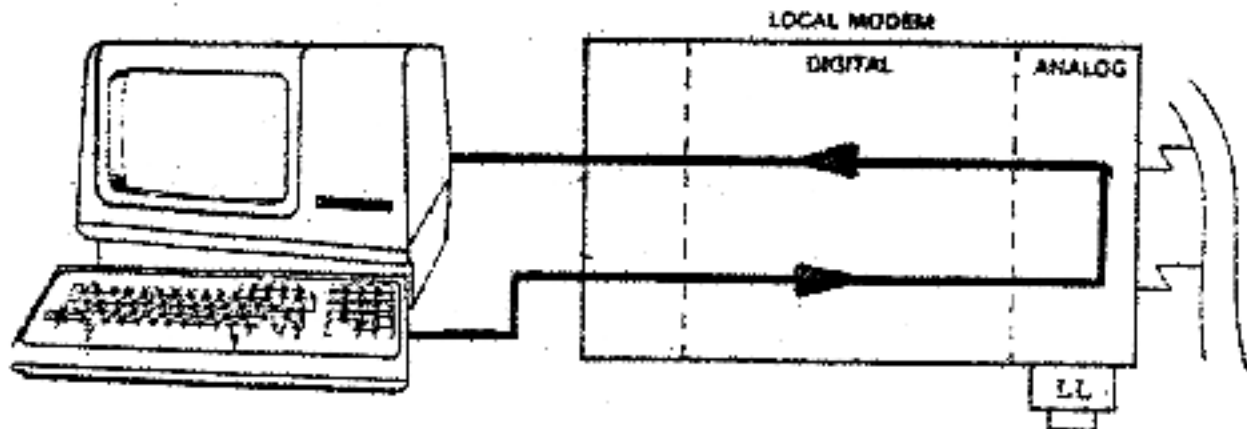


Figure 4-6 Local Analog Loopback Test

### 4.3.3 Local Digital Loopback Tests (Figure 4-5)

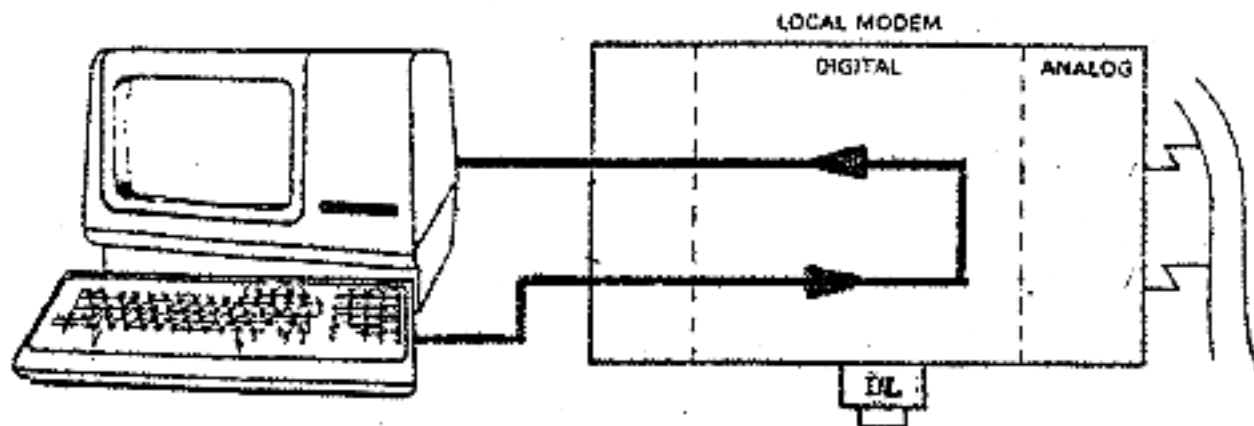


Figure 4-3 Local Digital Loopback

#### PROCEDURE:

1. Verify that the **CD** and **MD** indicators are OFF.
2. Configure the switches as follows:
  - a. Set the **DL** switch at the local modem to the **IN** position.
  - b. Set remaining switches to the **OUT** position.
3. Verify that the **DM** indicator comes ON.
4. Type a test message at the terminal keyboard and verify that the same data is received. Incorrect data indicates that the modem or terminal may be defective or the terminal is set to the wrong speed. To eliminate the terminal as a possible source of errors, run the local terminal test.
5. Set the **DL** switch to the **OUT** position to terminate the test. The **DM** indicator goes OFF.

#### NOTE

This procedure can be performed at the lower fallback speed of 1200 b/s by pressing the **MS** switch to the **IN** position followed by pressing and releasing **DL** to reset the modem. Repeat the procedure at the new speed.

#### 4.4 TEST AREA 3 -- REMOTE DIGITAL LOOPBACK TESTS (FIGURES 4-6 AND 4-7)

Test Area 3 provides separate tests that check remote digital loopback, with either selftest mode or terminal/computer to provide the test data. The remote digital loopback test allows the complete network to be checked. This test verifies the telephone line and the receive/transmit circuits of both the local and remote modems.

##### 4.4.1 Remote Digital Loopback (Figure 4-6)

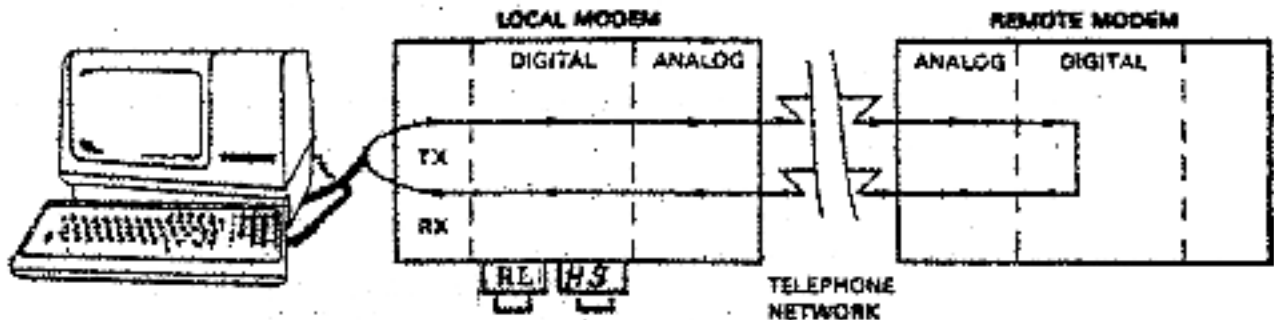


Figure 4-6 Remote Digital Loopback

#### NOTE

The RL function allows the local modem operator to force the remote modem to automatically switch to digital loopback. No operator is needed at the remote site.

#### PROCEDURE:

1. Verify that the TR and RR indicators are ON.
2. Configure the switches as follows:
  - a. Set DATA/TALK (D/T) switch to TALK position (TR).
  - b. Set remaining switches to the OUT position.
3. Remove telephone handset from cradle and dial remote modem. The RR indicator goes OFF.
4. Set the DATA/TALK (D/T) switch to the DATA position (RR) when answer tone is heard. Place the telephone handset back on the cradle.

5. Observe that the CD, MP and SW indicators are ON.
6. Set FL switch to IN position.
7. Observe that the TM indicator comes ON. A number of erroneous characters will appear on the terminal screen while the modem switch to remote loop mode. This is a normal occurrence and should not be interpreted as a fault condition.
8. Type a test message at the terminal keyboard and verify that the same data is received. Incorrect data indicates a problem with one of the modems or the telephone line. Run local loopback tests to determine which modem is defective.
9. Press the DATA/TALK (D/T) switch to TALK position (IN) to terminate the test.

**NOTE**

1. This test can be initiated from either end of the line. If initiated at the remote end, the remote is responsible for verifying the results.
2. This procedure can be performed at the lower fallback speed of 1200 b/s by disconnecting the present connection, pressing the HS switch to the IN position and redialing the remote modem. Repeat the procedure at the new speed. For private wire, omit Steps 2 through 4.

**4.4.2 Remote Digital Loopback Selftest (Figure 4-7)**

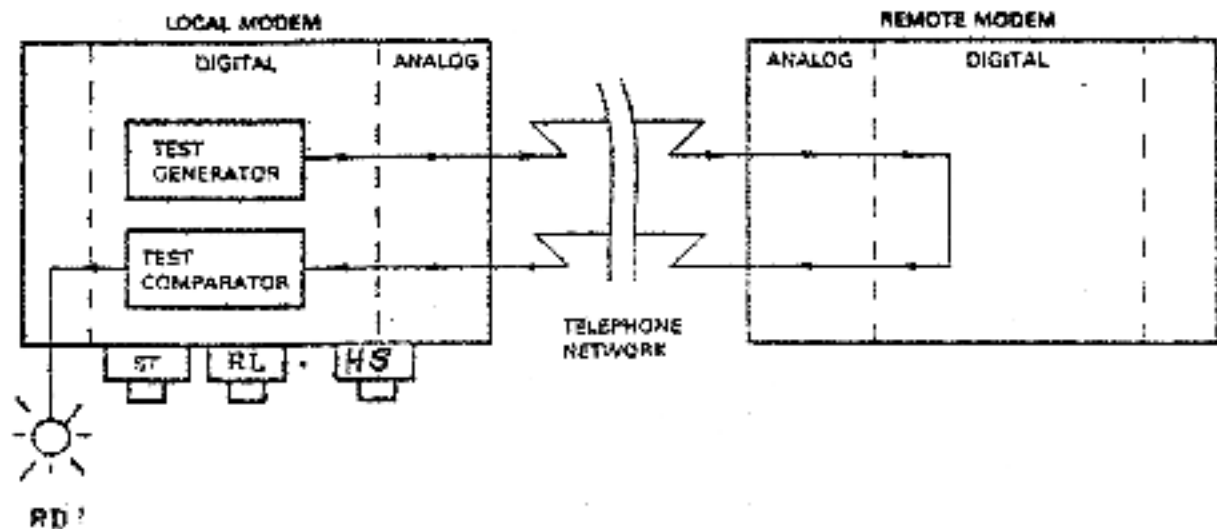


Figure 4-7 Remote Digital Loopback Selftest

#### PROCEDURE:

1. Verify that the ~~FR~~ and MR indicators are ON.
2. Configure the switches as follows:
  - a. Set DATA/TALK (D/T) switch to TALK position (IN).
  - b. Set remaining switches to the OUT position.
3. Remove telephone handset from cradle and dial remote modem. The MR indicator goes OFF.
4. Set the DATA/TALK (D/T) switch to the DATA (OUT) position when answer tone is heard. Place telephone handset back on the cradle.
5. Verify that the CD MR and CH indicators come ON.
6. Set RL switch to IN position and verify that the TM indicator comes ON.
7. Set the ST switch to the IN position. Once the ST pushbutton is pressed IN, the test is started. Allow the test to run for about 1 minute. If RD does not flash after running for at least 1 minute, the modems can be assumed to be operating correctly. RD may flash when ST is ~~pressed~~ pressed IN, this is normal. A number of erroneous characters may cause RD to flash while the modems switch to remote loop mode. This is a normal occurrence and should not be interpreted as a fault condition.
8. Observe the RD indicator. If RD flashes, one of the modems is detecting errors. Some errors can be expected, due to telephone line noise. If RD flashes vigorously or ON constantly, it is likely that one of the modems is faulty. Return to local modem testing or go to end-to-end selftest to isolate the problem.
9. Release the ST and RL switch and press the DATA/TALK (D/T) switch to the IN position to terminate the test.

#### NOTE

This procedure can be performed at the lower fallback speed of 1200 b/s by disconnecting the present connection, pressing the MS switch to the IN position and redialing the remote modem. Repeat the procedure at the new speed. In private line configurations, omit Steps 2 through 4.

#### 4.5 TEST AREA 4 -- END-TO-END SELFTEST

This test allows the local and remote modems to be verified over the telephone network. It separates the transmit and receive logic of both modems. This separation permits better problem isolation. Refer to Figure 4-8 for this test.

##### PROCEDURES:

1. Configure the following test switches at both modems.

##### NOTE

This procedure requires a second person at the remote site to set the same switches.

- a. Set DATA/TALK (D/T) switch at remote modem to the DATA position (OUT).
  - b. Set DATA/TALK (D/T) switch at local modem to TALK position (IN) to allow dialing remote modem.
  - c. Set remaining switches to the OUT position.
2. Remove telephone handset from cradle on local modem and dial the remote modem.
  3. Set the DATA/TALK (D/T) switch to the DATA position (OUT) when answer tone is heard. Place the telephone handset back on the cradle.
  4. Verify that the CD and MR indicators are ON at both modems.
  5. Set the ST switch to the IN position. Be sure to have the remote operator do the same. Any flashing of the RD indicator at either end means data errors are being detected. Some errors can be expected, due to telephone line noise. If RD flashes vigorously or ON constantly, it is likely that one of the modems is faulty.
  6. Release the ST switch and press the DATA/TALK (D/T) switch to the IN position at both modems to terminate the test.

##### NOTE

This procedure can be performed at the lower fallback speed of 1200 b/s by disconnecting the present connection, pressing the MS switch to the IN position and redialing the remote modem. Repeat the procedure at the new speed. In private line configurations, omit Steps 1 through 3.

#### 4.6 DF124 AUTO DIALER TESTING

Testing the DF124 auto dialer functions can be easily performed by doing any digital loopback test functions with the DATA/TALK switch in the DATA position (000), and dialing the remote modem by using the auto dial message format. If the call is initiated via a terminal and the call is completed, the message "ATTACHED" is displayed on the originating terminal.

A test message may then be sent and the received data verified. If the DF124 selftest mode is used with remote digital loopback, then the RD indicator must be observed. When the RD flashes, errors are being detected.

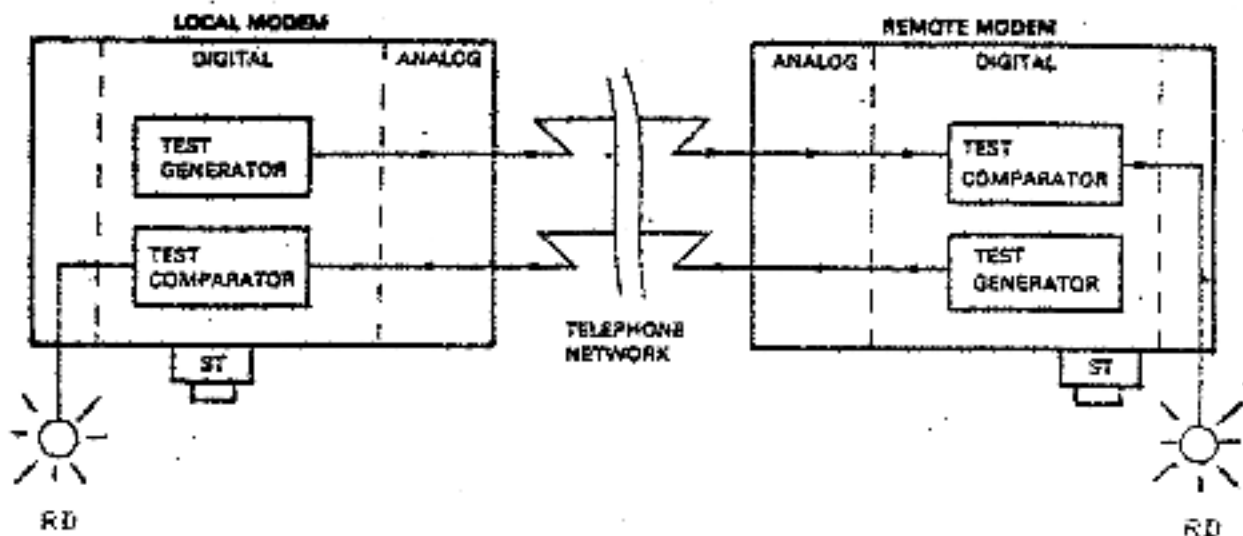


Figure 4-3 DF124 End-to-End Selftest

### 5.1 GENERAL

This chapter describes the many selectable options that are available on the DP124 Modem. As configured at the factory (standard configuration), these modems are compatible with most data communications equipment. However, these modems have selectable options to provide greater versatility. A detailed description of each modem option is provided in Table 5-1, while Table 5-2 provides a description of options associated with the auto dial feature.

To verify or change any of these options on the standalone modem, it is necessary to remove the front cover to access the DP124-MK module (see Section 5.2). For multiple modem enclosure configurations, simply remove the front door and retainer bar, and pull out the modem module to verify or change switchable options (see Section 5.3).

Table 5-1 Detailed Modem Option Descriptions

Option Function	Option Description	Factory Configuration
Long Space Disconnect	If a disconnect is initiated at the local end, the local modem sends 4 seconds of spacing then will disconnect. The remote modem will disconnect if more than 1.6 seconds of continuous spacing is detected.	Enabled
Loss of Carrier Disconnect	Causes the modem to disconnect if the carrier level falls below the selected signal detector threshold level for more than 300 milliseconds.	Enabled
Answer or Originate	This function applies only to private line (PLTY) configurations. One modem must be set to answer, the other to originate. If the PSTN option is selected, this option has no effect.	Answer
Slave Clock	This option has two selections; external or receive and is only required when master clock is set to external. When slave clock is set to receive, the transmit clock is derived from the receive clock. When set to external, transmit clock must be obtained from an external source (OTE). If master clock is set to internal, the setting of this option is not required.	External
Master Clock	Selects either internal or external clock. If external is selected, slave clock option must be specified by selecting either receive or external.	Internal
Remote Loopback	Selects remote loopback mode between V.22 and V.34.	V.22
Low Speed Mode	Selects either CCITT or 213A compatibility for 1200 b/s operation.	213A
Character Length	Selects data character length of 8, 9, 10 or 11 bits. Selection must include 1 start bit, 1 stop bit, and if the parity select option is enabled, 1 parity bit plus the data bits.	10 bits

Table 5-1 Detailed Modem Option Descriptions (cont)

Option Function	Option Description	Factory Configuration
Asyno Rate	Selects basic or extended mode. For overspeed data, the basic selection allows deletion of 1/8 of a stop bit. Extended mode allows deletion of 1/4 of a stop bit. This option has no effect in synchronous mode.	Extended
Mode Select	Selects asynchronous or synchronous operation. This option must be set to sync for synchronous operation. Any attempt to send asynchronous data on a modem that is set to synchronous mode will result in errors. This selection must be compatible with the DTE.	Asyno
MI	Normally there are two methods of connecting the modem to the line:  1) by placing the DATA/TALK switch to the data (out) position or  2) using the auto dial control C (^C) feature.  When exclusion key telephone service is used, the Mode Indicate (MI) option can be enabled to allow the exclusion key button to connect to the line rather than the DATA/TALK switch or ^C.	Disabled
Autoanswer or Manual	Selects operation in either manual mode or autoanswer mode.	Auto
RTN or PLIN	Selects the type of telephone service to which the modem is connected; switched dial-up (RTN) or private line (PLIN).	RTN
Signal Detector	Selects one of two threshold levels: <del>-40/-40</del> or <del>-37/-37</del> dBm. <del>-43/-43</del> or <del>-33/-33</del> dBm.	<del>AD/AD</del> RTN -43/-43
Retrain Inhibit	When enabled, the retrain sequence does not occur should signal quality decrease below accepted levels.	Enabled
Abort Time	When enabled, causes the modem to cancel a call if carrier is not detected within 15 seconds after connecting to the line. Option applies only to RTN and has no effect if disabled.	Enabled

Table 5-1 Detailed Modem Option Descriptions (cont)

Option Function	Option Description	Factory Configuration
Force DTR	This option is provided for DTEs that do not provide Terminal Ready. Selecting external allows the DTE to control DTR. Enabling this option does not force the TR indicator ON.	External
Force RTS	This is similar to the option above except that it applies to Request to Send.	Forced On
Interface Rate Select		
Guard Tone	Guard tone is a regulatory requirement and is country specific. This option does not apply to U.S. and Canadian installations, and must be disabled.	Disabled
Pulse Dialing Duty Cycle	This option is country specific and selects either a 60/40 or 57/33 duty cycle.	60/40 Duty Cycle
PSTN Xmit Level	This option is fixed at -12dBm for U.S. and Canadian installations, and cannot be changed by the user (switchpack is disabled). This option is <del>switchpack</del> for European use.	-12dBm
P/LTN Xmit Level	Selects private leased line transmit level from -2 to -17dBm in steps of 1 dBm. Selection must match the line characteristics. The factory setting is usually adequate. If there are any problems, contact the local telephone company for additional advice on this setting.	-9dBm
Interface LL Control	Enabled to allow the DTE to initiate analog loopback (in addition to the front panel LL switch) by placing a positive signal on Pin 10.	Enabled
Interface RDL Control	Enabled to allow the DTE to initiate remote digital loopback (in addition to the front panel RL switch) by placing a positive signal on Pin 21.	Enabled

Table 3-2, Detailed ACU Option Descriptions

Option Function	Option Description	Factory Configuration
Parity Select	This option enables or disables (no parity) auto dial parity feature. If this option is enabled, the parity bit must be considered in the character length selection (see Table 3-1).	No Parity
Parity Type	Selects either odd or even parity. This option has no effect if parity select is disabled.	Even
Local Echo	Selects whether or not auto call functions are echoed back to the DTE.	Enabled
Response Message	Selects whether the auto dial response messages are abbreviated (short) or are spelled out (long).	Long

34200

## 5.2 STANDALONE MODEM DISASSEMBLY

Disassembly procedures for the standalone modem are simple. Before disassembly, be sure to unplug the power cord from the wall outlet.

To remove the DF124-AM module from the DF100-0T enclosure, simply remove the two slotted screws (from the bottom) closest to the front cover and remove the cover from the enclosure. The module can then be unplugged from the rear connector by pulling the module forward, sliding it out from the card guide (see Figure 5-1).

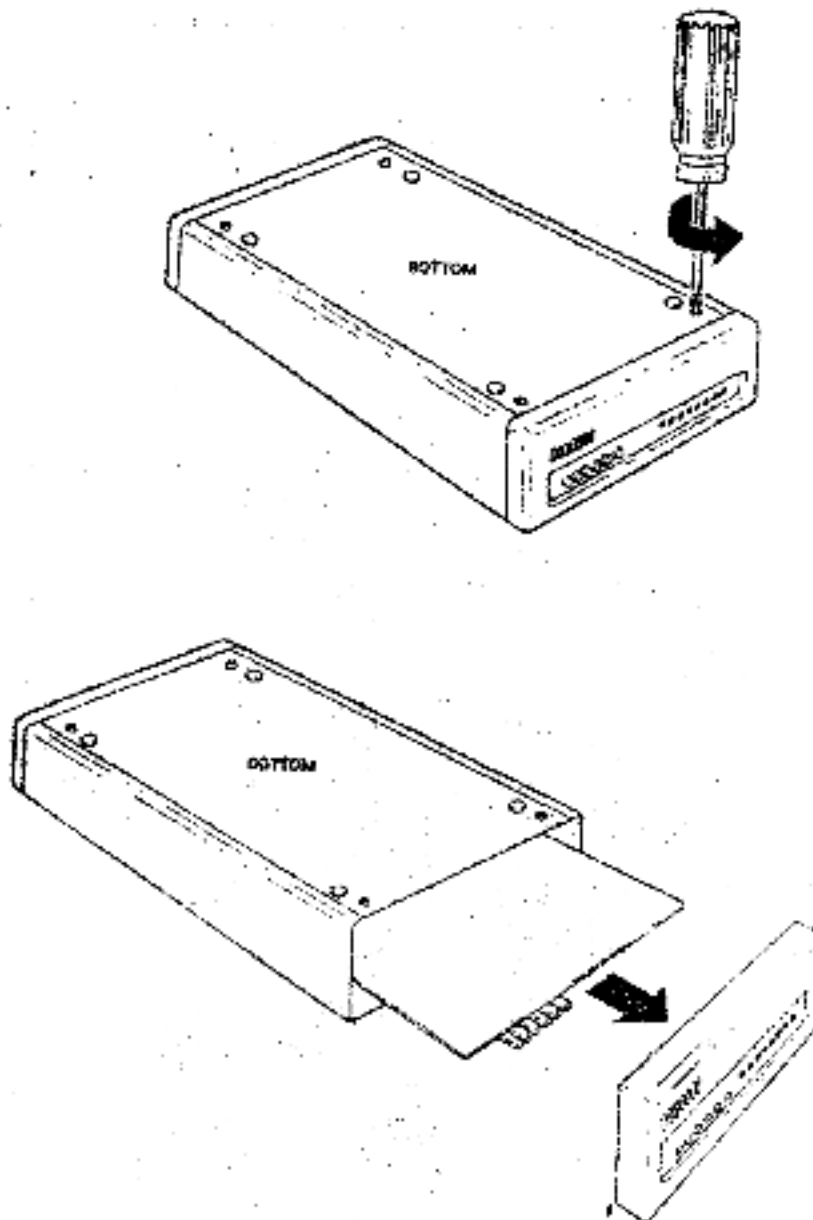


Figure 5-1 Standalone Modem Disassembly

### 5.3 MULTIPLE MODEM ENCLOSURE DISASSEMBLY

Disassembly of the multiple modem enclosure is accomplished by removing the front door and retainer bar to access the DE124-AM to either change modules or verify switchpack settings. To remove and/or replace the DE124-AM modules, it is not necessary to disconnect any of the system cabling. Figure 5-2 illustrates the procedure for removing the front panel and retainer bar.

If a modem module removed for replacement or to change switch options, it is not necessary to turn off power to the enclosure. Modules can be removed and inserted without disrupting the operations of other modules in the enclosure.

- ① Grasp spring latch handles and push in the direction of the arrows. Lift handles to lock into the detent position. Remove the door.
- ② Remove the screw holding the retainer bar and remove the bar.
- ③ Remove or insert modem modules as required. Remember, all slots must be filled with either modem modules or filler cards.

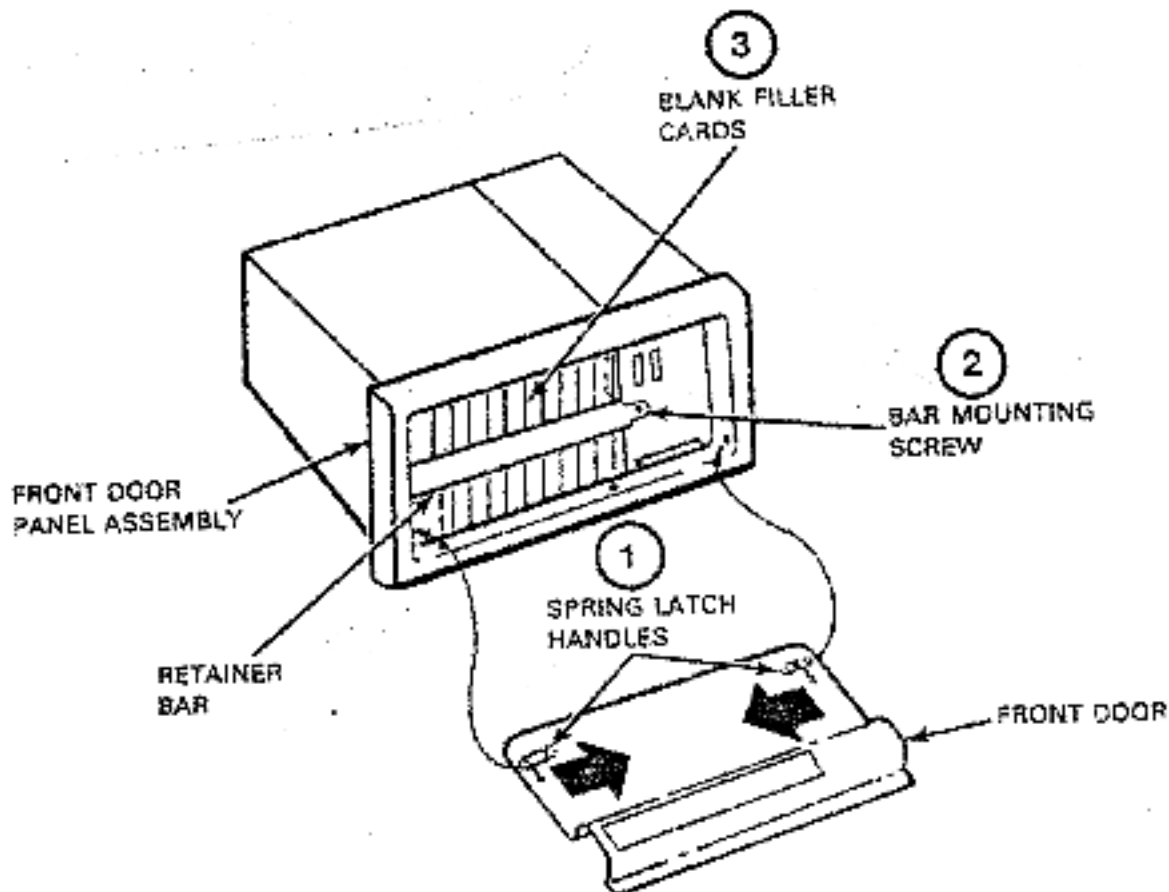


Figure 5-2 Multiple Modem Enclosure Disassembly

#### 5.4 SELECTING SWITCHPACK OPTIONS

The DF124-AM modem module includes a variety of configuration options that are selected by switchpacks.

Modem modules may be equipped with any of three switchpack types shown in Figure 5-3.

##### 5.4.1 DF124-AM Modem Module Assembly

Figure 5-4 shows the general layout of the DF124-AM module, which details placement of pushbutton switches, LED indicators, dc power fuses, special country specific jumpers and regulatory labels. The location and description of switchpacks and option selections are presented in Section 5.4.2.

Detailed explanations of pushbuttons and indicators have already been presented in Chapter 3.

The DF124-AM module includes 15 special jumpers (W1 - W15), which are provided solely for manufacturing and field service use. These should not be touched by the user. They are mentioned here for information only. Jumper descriptions are provided in Table 5-3, while Table 5-4 lists the factory selections based on country destinations.

Wid dc fuses are not field replaceable; they are identified here for information only. However, in cases where faulty operation may indicate a power problem, it may be a good idea to verify that the fuses are not the cause.

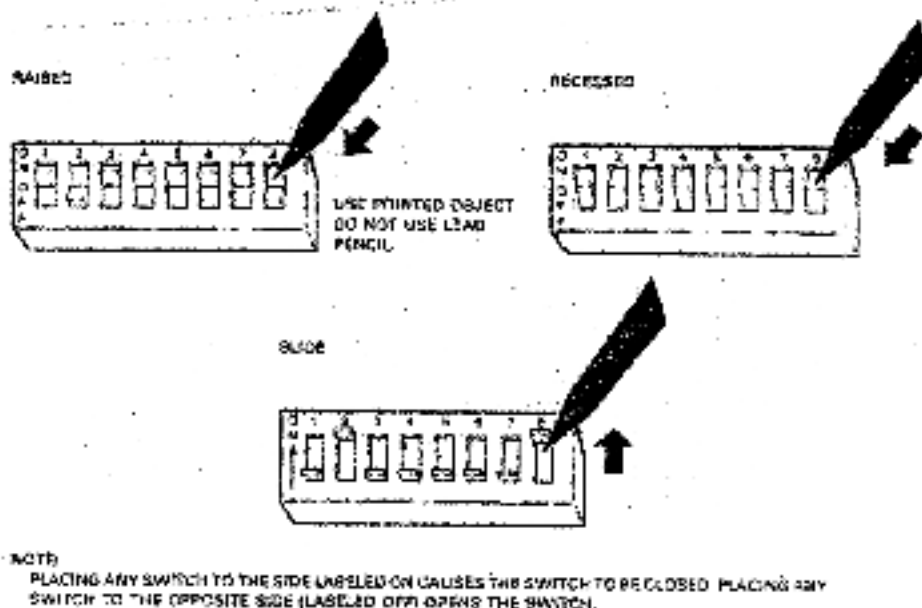


Figure 5-2 Switchpack Variations

Table 5-3 Country Specific Jumper Descriptions

Jumpers	Description
W1	Two dial tone timeout periods are available; 40 Seconds for European use (jumper CUT) and 15 Seconds for US/Canadian use (jumper IN).
W2, W3, W4 & W5	These are used to preset the PSTN transmit level at a fixed - 12 dBm for US and Canada. For Europe, these are configured so that transmit level selection is controlled by switches on switchpack S4.
W6	Used for special factory test only. Not to be remove for any geographic location. Must always be IN. In REV C modules and higher, W6 is omitted.
W7 & W8	Reserved
W9	Telephone line current limiter
W10 & W11	Used to accommodate programmed telephone service (RJ410/4245P) in the US and Canada.
W12	Used to generate OFF HOOK (make busy) condition when the Digital Loop switch is IN. This feature is used to support hunt chain equipment in the US and Canada.
W13	Selects ring sensitivity threshold.
W14	Compensates for different answerback tone levels which vary due to geographic locations.
W15 & W192	Used to support exclusion key telephone service in the US and Canada.

NOTE

Jumpers W1 through W15 are factory installed for country specific destinations. Changing any of these jumpers is a violation of certain regulatory agencies. If any change is necessary, it must be performed by an authorized Digital Field Service representative.

W16 *compensates for different tone level requirements in different countries*

W19 *When set, raises transmit level by 2 dB as allowed in US 300 powerline mode*

Table 5-4 Jumper Selections

Jumper	US/Canada	Europe	Function
W1	IN	OUT	Dial Tone Timeout
W2	OUT	IN	Fixed PSTN Transmit Level
W3	IN	OUT	Fixed PSTN Transmit Level
W4	OUT	IN	Fixed PSTN Transmit Level
W5	IN	OUT	Fixed PSTN Transmit Level
W6	IN	IN	Always Installed
W7	OUT	OUT	Reserved
W8	IN	IN	Reserved
W9	IN	IN	Telephone Line Current Limit
W10	IN	OUT	Enable Programmed (RJ418/RJ458) Telephone Service
W11	IN	OUT	Enable Programmed (RJ418/RJ458) Telephone Service
W12	IN	OUT	Make Busy
W13	OUT	IN	Ring Threshold
W14	IN	OUT	Answerback Level Compensation
W15	IN	OUT	Enable Exclusion Key Telephone Service
W198 10K Ohms	IN	OUT	Enable Exclusion Key Telephone Service

NOTE

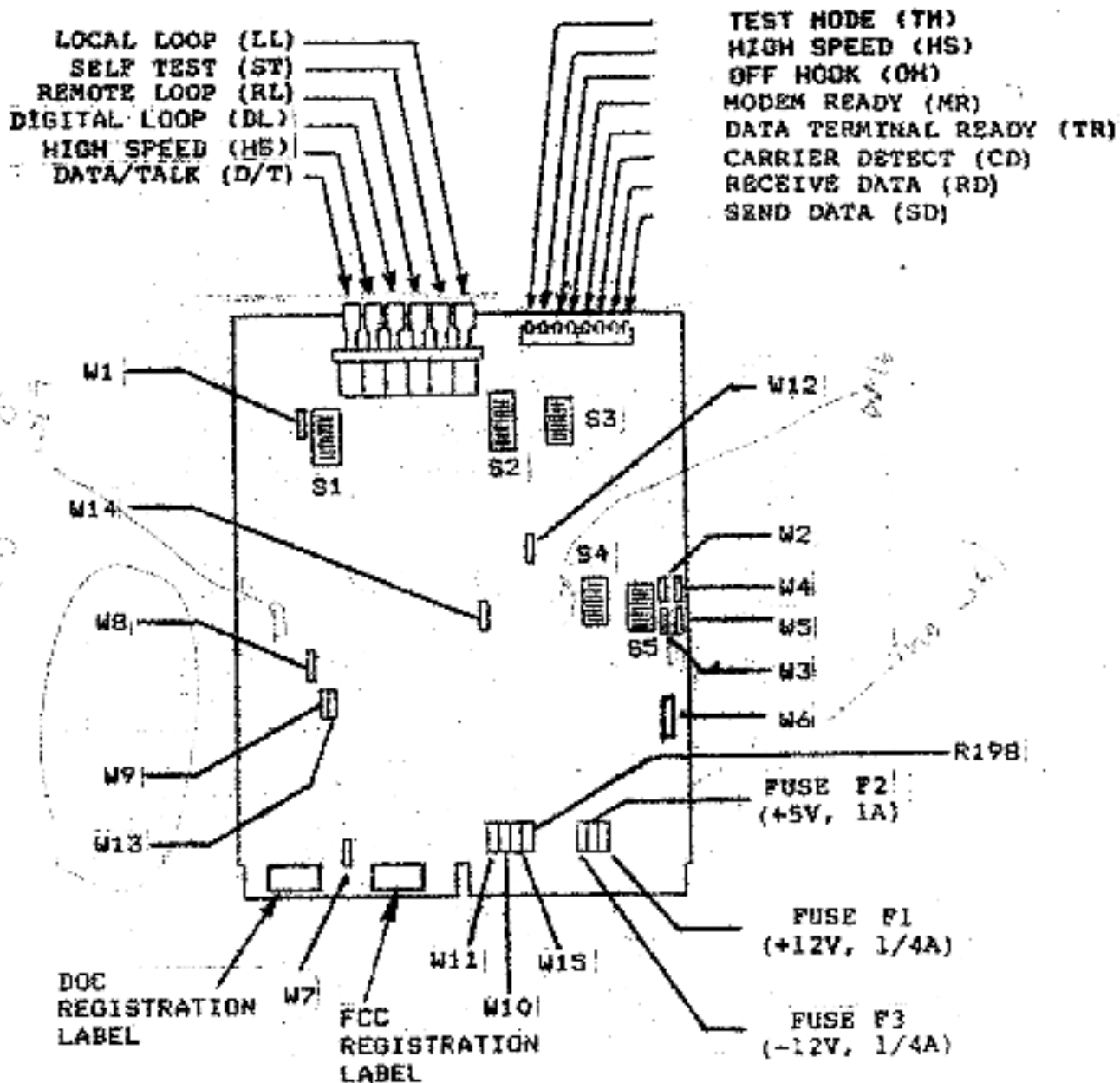
Jumpers W1 through W15 are factory set for country specific destinations. If any change is necessary, it must be performed by an authorized Digital Field Service representative.

W16     OUT     IN     Tone Level control  
W19     OUT     OUT     IN for US permission mode

#### 5.4.2 DF124-AM Modem Options

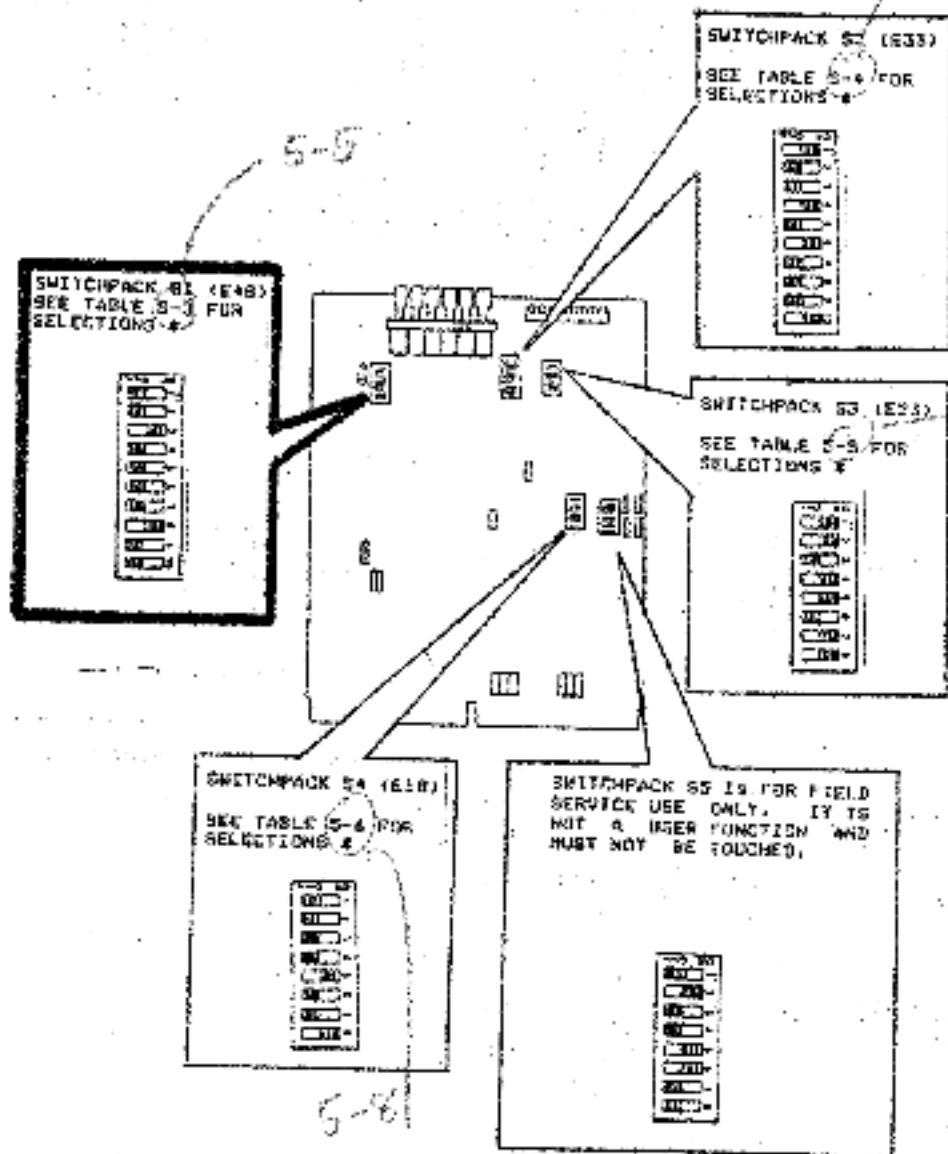
The DF124-AM modem module contains four switchpacks (S1 through S4) as shown in Figure 5-5, to select a variety of user options. Tables 5-5 through 5-8 lists each of the switches and the option that is selected. Each module is shipped from the factory with these options preset to select the most popular configurations. In these tables, factory settings are printed in blue for easy reference.

The DF124-AM module also includes one additional switchpack (S5) which is provided solely for manufacturing and field service use. These switches should not be touched by the user. They are mentioned here for information only.



NOTE: JUMPERS W1 THROUGH W15 ARE FACTORY INSTALLED FOR COUNTRY SPECIFIC DESTINATIONS. CHANGING ANY OF THESE JUMPERS IS A VIOLATION OF CERTAIN REGULATORY AGENCIES.

Figure 5-4 DF124-AM Module Layout



\* FACTORY SELECTIONS ARE SHOWN

Figure 5-5 DF124-AM Switchpack Locations (sheet 1 of 4)

Table 5-5 DF124-AM Switchpack 1 Selections

Option	Selection	Switch									
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Long Space Disconnect	Enabled	OFF									
	Disabled	ON									
Loss of Carrier Disconnect	Enabled		OFF								
	Disabled		ON								
Answer or Originate	Ans			OFF							
	Orig			ON							
Slave Clock	Receive				ON						
	External				OFF						
Master Clock	Internal					OFF					
	External					ON					
Remote Loopback	V.54						OFF				
	V.22						ON				
Parity Select	Parity							ON			
	No Parity							OFF			
Local Echo	Enabled								ON		
	Disabled								OFF		
Parity Type	Odd									ON	
	Even									OFF	
Low Speed Mode	CCITT										ON
	BELL										OFF



Table 5-6 DF124-AM Switchpack 2 Selections

Option	Selection	Switch										
		S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	
Character Length	8 Bits	ON		ON								
	9 Bits	OFF		ON								
	10 Bits	ON		OFF								
	11 Bits	OFF		OFF								
Async Rate	Basic		ON									
	Extended		OFF									
Mode Select	Sync				OFF							
	Async				ON							
Response Message	Long					OFF						
	Short					ON						
MC	Enabled						OFF					
	Disabled						ON					
Auto Answer	Manual							ON				
	Auto							OFF				
PSTN or PLTN	PSTN								OFF			
	PLTN								ON			
Signal Detector Threshold	-49dBm										OFF	
	-37dBm										ON	
Retrain	Enabled											ON
	Disabled											OFF

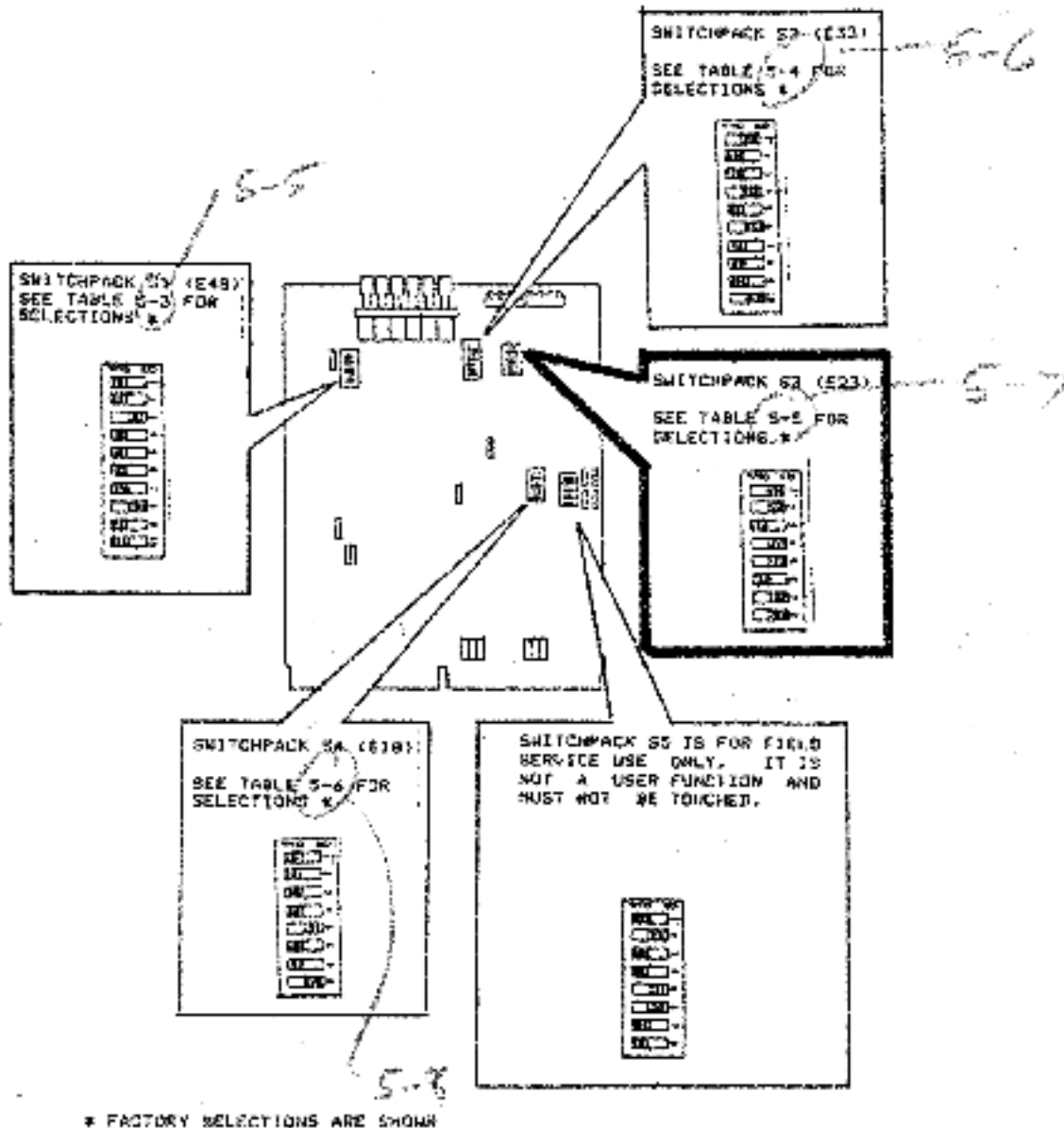


Figure 5-5 DF124-AM Switchpack Locations (sheet 3 of 4)

Table 5-7 DF124-AM Switchpack 3 Selections

Option	Selection	Switch							
		S1	S2	S3	S4	S5	S6	S7	S8
Abort Timer	Enabled	ON							
	Disabled	OFF							
DTR	External		ON						
	Forced ON		OFF						
RTS	External			ON					
	Forced ON			OFF					
Interface Rate Select Control	Enabled				ON				
	Disabled				OFF				
Guard Tone Select	Enabled					OFF			
	Disabled					ON			
Pulse Dialing Duty Cycle	60%						OFF		
	67%						ON		
Interface Local Loop Control	Enabled							ON	
	Disabled							OFF	
Interface Remote Digital Loop Control	Enabled								ON
	Disabled								OFF

*Default*

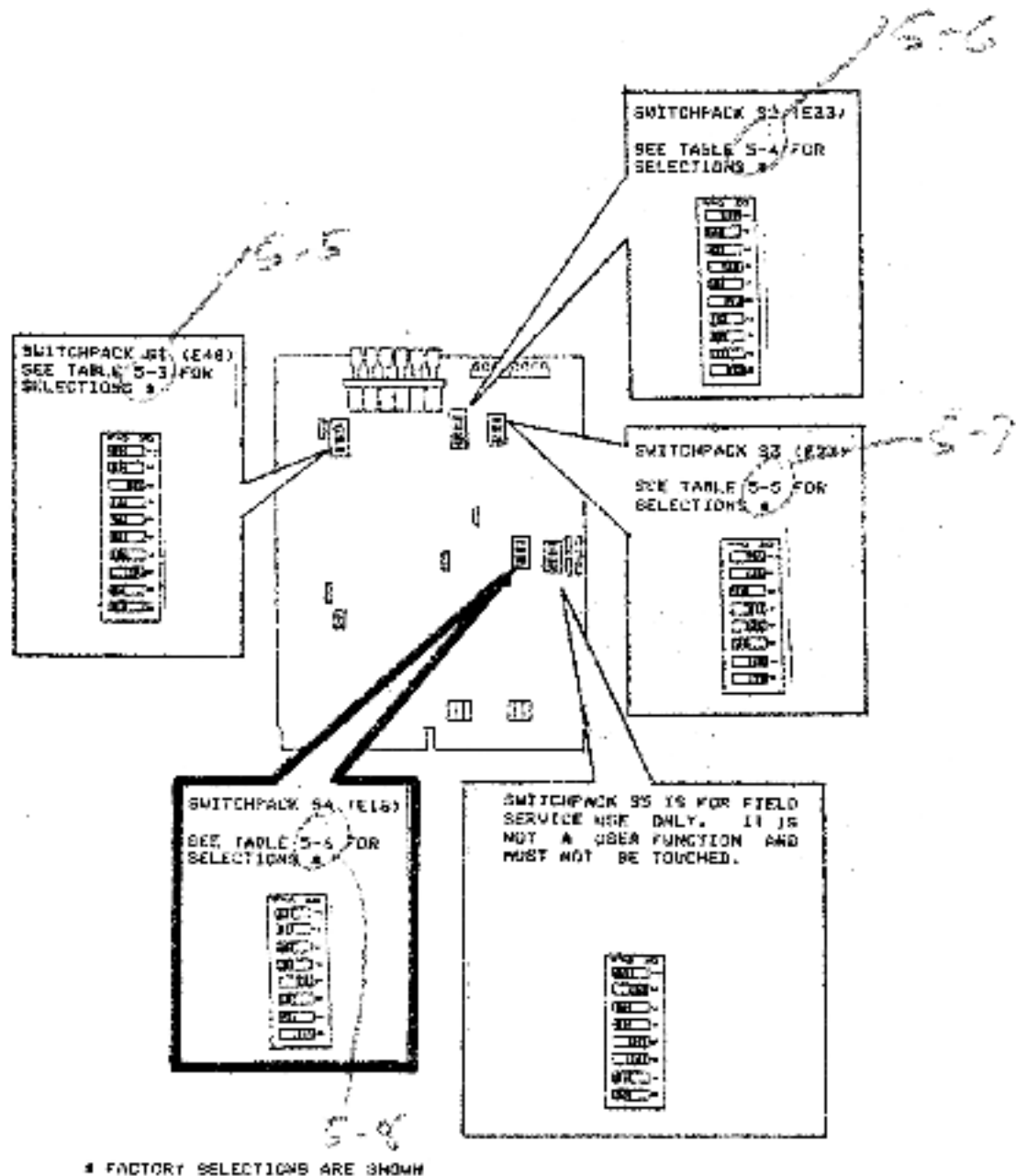


Figure 5-3 DF124-AM Switchpack Locations (sheet 4 of 4)

Table 5-8 DF124-AM Switchpack 4 Selections

Option	Selection	Switch							
		S1	S2	S3	S4	S5	S6	S7	S8
PSTN Xmit Level	- 2dB	These switches are disabled for U.S. and Canadian installations. The option is hard wired to select -12dBm.							
	- 3dB								
	- 4dB								
	- 5dB								
	- 6dB								
	- 7dB								
	- 8dB								
	- 9dB								
	-10dB								
	-11dB								
	-12dB								
	-13dB								
	-14dB								
	-15dB								
	-16dB								
	-17dB								
PL Xmit Level	- 2dB	OFF	OFF	OFF	OFF	OFF	OFF	OFF	
	- 3dB	ON	OFF	OFF	OFF	OFF	OFF	OFF	
	- 4dB	OFF	ON	OFF	OFF	OFF	OFF	OFF	
	- 5dB	ON	ON	OFF	OFF	OFF	OFF	OFF	
	- 6dB	OFF	OFF	ON	OFF	OFF	OFF	OFF	
	- 7dB	ON	OFF	ON	OFF	OFF	OFF	OFF	
	- 8dB	OFF	ON	ON	OFF	OFF	OFF	OFF	
	- 9dB	ON	ON	ON	OFF	OFF	OFF	OFF	
	-10dB	OFF	OFF	OFF	OFF	ON	ON	ON	
	-11dB	ON	OFF	OFF	OFF	ON	ON	ON	
	-12dB	OFF	ON	OFF	OFF	ON	ON	ON	
	-13dB	ON	ON	OFF	OFF	ON	ON	ON	
	-14dB	OFF	OFF	ON	OFF	ON	ON	ON	
	-15dB	ON	OFF	ON	OFF	ON	ON	ON	
	-16dB	OFF	ON	ON	OFF	ON	ON	ON	
	-17dB	ON	ON	ON	OFF	ON	ON	ON	

## 5.5 DF124 REASSEMBLY

### 5.5.1 Standalone Modem Reassembly

Reassembly procedures for the DF124-4A are simple; just reverse the disassembly procedures (see Figure 5-6). Things to consider:

1. Be sure correct module is being inserted. Several different types of DIGITAL modem modules can mount in the DF100-07 enclosure.
2. If replacement module is being installed, are the option selections correct?
3. Be sure to push module firmly into the mating connector until it snaps into position.
4. When completely reassembled, run loopback tests to verify that modem is operational (see Chapter 4).

### 5.5.2 Multiple Modem Enclosure Reassembly

After inserting modem modules and/or filler cards, or verifying switchpacks, reassemble the enclosure as specified in Figure 5-7.

- 1 With the enclosure up-side-down, insert module (components facing down), into the card guides and push the module into the enclosure until it touches the backplane. Then press firmly until the module edge connector snaps into the mating connector.
- 2 Replace the front cover using the two slotted screws removed earlier.

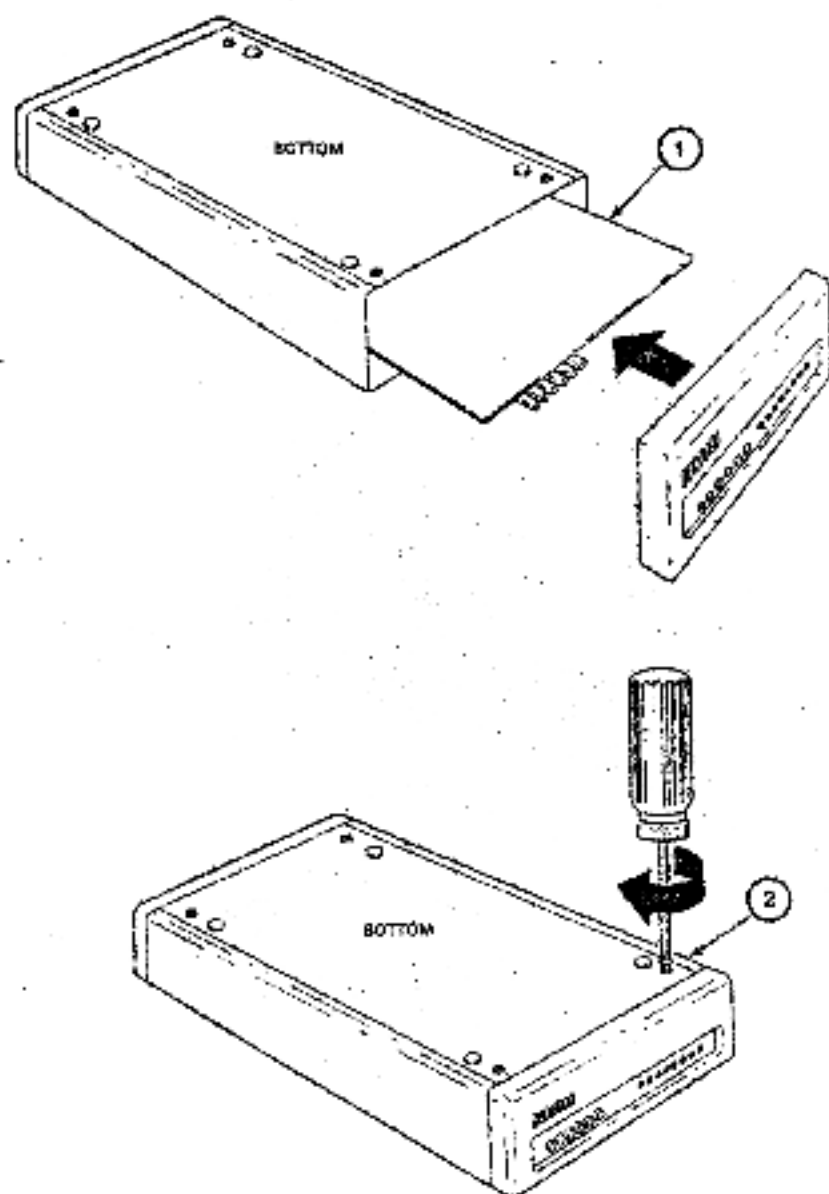


Figure 5-6 Standalone Modem Reassembly

- ① Insert modem modules (components facing the power supply), into the selected slot. All slots must be occupied with either modem modules or filler cards, before the retainer bar is replaced.
- ② Replace the retainer bar and secure with the holding screw removed earlier.
- ③ Place the front door into position and release the spring latch handles into the pivot holes on both sides of the door panel assembly.



MK784-0875

Figure 5-B Multiple Modem Enclosure Reassembly

### 6.1 GENERAL

The DF124 Modem family is registered with the Federal Communications Commission for direct connection to the telephone network. The regulations require that all major repairs on the DF124 other than board replacement, be performed by Digital Equipment Corporation or its authorized agent. Module replacement however, can be performed by anyone.

### 6.2 DF124 SERVICE

Digital offers a wide variety of maintenance plans which may include on-site or off-site variations to satisfy almost every need. Some of these plans however, are not offered in certain geographic areas. If you cannot recall which plan, if any, was selected for your system, contact a DIGITAL Field Service representative for information about system service.

### 6.3 TELEPHONE COMPANY SERVICE OR EQUIPMENT PROBLEMS

Problems encountered with the telephone company equipment or service must be reported immediately to the telephone company. It is important, however, to first make certain that the problem is with the telephone company equipment and not with your equipment.





