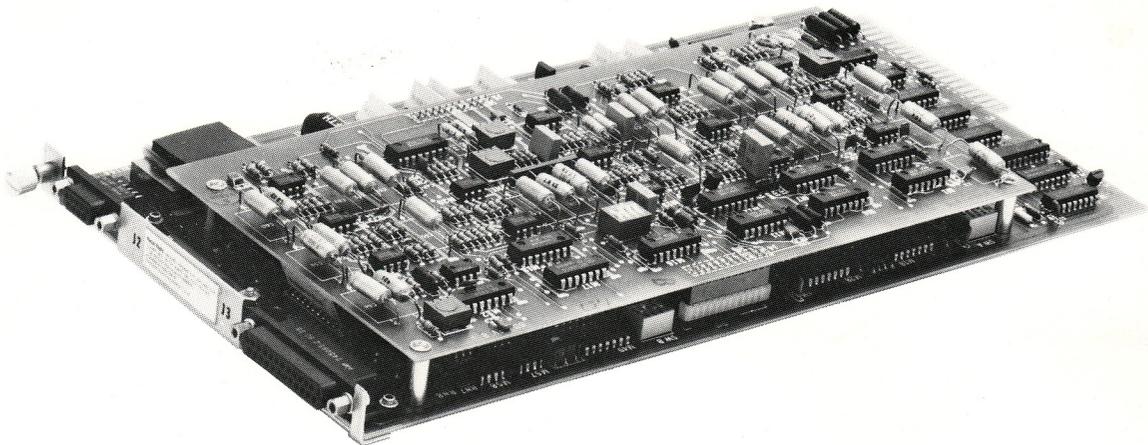


Racal-Vadic

VA2440,45 P/S/G/X MODEM INSTALLATION/OPERATION MANUAL



RACAL

**Addendum to The VA2440
Installation and Operation Manual**

Use this addendum with The VA2440,45 P/S/G/X
Installation and Operation Manual, publication
number 18008-067.

The VA2440 modem has been enhanced to include
4-wire leased-line operation formerly available in
the VA2430 modem. The new model is identified as
the VA2440K. This addendum provides information
required for 4-wire operation. However, note that
switch C2 has been changed which will affect
2-wire operation.

This page is an addition to page 2-10:

Installation

For 4-wire operation with the 15044-XXX cable, the 4 spade lug connections are identified as follows:

White = Receive Tip
Black = Receive Ring
Green = Transmit Tip
Red = Transmit Ring

The following is an addition to page 4-1:

Testing

In the 4-wire leased-line configuration, no tests are available.

This page replaces Table 5-1 on page 5-2:

Table 5-1. VA2440 Factory-Set Options

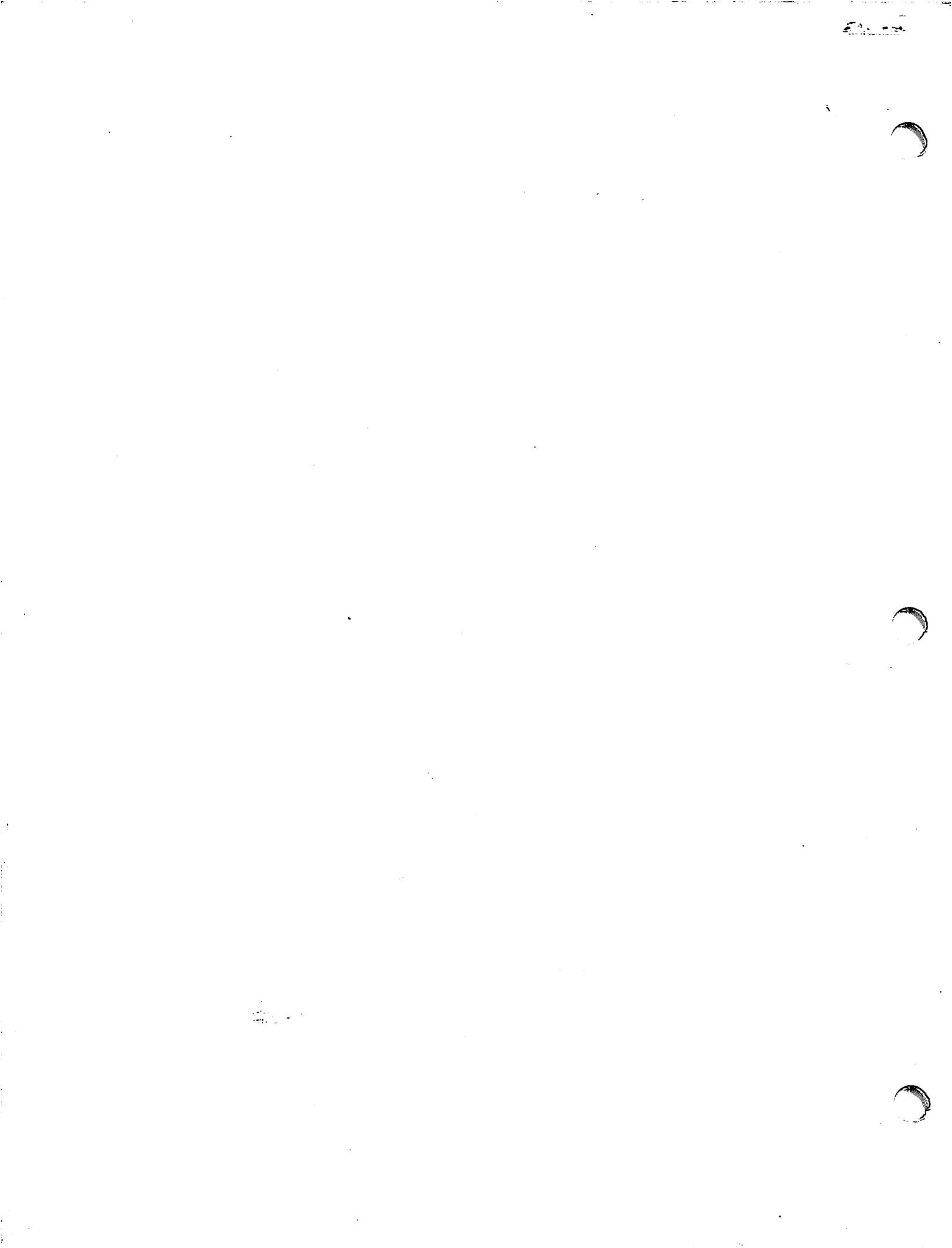
Switch/ Strap	Standard Setting			Option Selected
	P/S/X	G	K	
A1	OFF	OFF	OFF	Local Copy disabled
A2	ON	ON	OFF	105 ms Turnaround Delay. Disabled for K model
A3	OFF	OFF	OFF	106 ms Clear To Send (CTS) delay
A4	OFF	ON	ON	P/S/X Models--Data Terminal Ready (DTR) controlled by the terminal equipment G and K Models--DTR forced ON
B1	ON	ON	ON	Attended disconnect operation
B2	ON	ON	ON	Terminal control of fall back (1200 bps operation) disabled
B3	OFF	OFF	OFF	Data Set Ready (DSR) OFF in test mode
B4	ON	ON	ON	Internal clock selected
C1	OFF	ON	ON	P/S/X Models--Receiver sensitivity set to -50 dBm G and K Models--Receiver sensitivity set to -35 dBm
C2	ON	ON	OFF	Constant carrier with forced RTS
C3	OFF	OFF	OFF	Constant carrier without RTS
C4	OFF	OFF	OFF	Receiver equalizer disabled
a	IN	IN	IN	Answer tone frequency set to 2025 Hz
b	*	*	*	Bell 201B/C (V.26B) encoding (* strap b replaced with 1 kohm resistor)
c	IN	OUT	OUT	P/S/X Models--Chassis DLB switch forces answer tone G and K Models--DLB switch turns on transmitter for remote test
d	IN	IN	IN	Analog loopback (ALB) test controlled from chassis front-panel switch only
e	OUT	IN	IN	P/S/X Models--Line current disconnect enabled G and K Models--Line current disconnect disabled
W1	a	a	b	2-wire and 4-wire operation
W2	a	a	b	

The following are additional options for Table 5-3 on pages 5-5 and 5-6:

Table 5-3. VA2440,45 Option Descriptions (Main Board) (cont'd)

Option	Switch/ Strap	Description
Constant Carrier with Forced RTS	C2	If OFF forces RTS ON, creating constant carrier operation, CTS is always ON and the modem is always ready to transmit data presented to its transmitter. This option is used for 4-wire full-duplex operation, not requiring half-duplex protocols. RTS is not displayed on front panel. If ON provides controlled carrier for half duplex.
Constant Carrier without RTS Control	C3	If ON allows full-duplex operation with half-duplex protocols. Internally, the transmitter is kept unquelled, and is not under RTS control. When RTS comes on, data is transmitted after CTS comes on; CTS comes on with RTS overriding the setting of CTS delay. If OFF allows half-duplex, controlled carrier operation.
2-wire/4-wire operation	W1	Strap in "a" position for 2-wire operation
	W2	Strap in "b" position for 4-wire operation

*eot



VA2440,45 P/S/G/X MODEM
INSTALLATION/OPERATION
MANUAL

THIRD EDITION
THIRD PRINTING
MAY 1985

Please address comments about this manual to:

Racal-Vadic
Corporate Communications
1525 McCarthy Boulevard
Milpitas, CA 95035

Call the number below for technical assistance or before shipping
any equipment in for repair.

(408) 747-4500

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CANADIAN DEPARTMENT OF COMMUNICATIONS REQUIREMENTS FOR END USERS Racal-Vadic Model VA2440,45 P/S/G/X

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

Before installing this equipment, users should ensure that connection to the line is allowed by the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a telephone extension cord. Compliance with the above conditions may not prevent degradation of service in certain situations.

Equipment repairs should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alterations made by the user, may cause the telecommunications company to request disconnection.

The electrical ground connections of the power utility, telephone lines, and internal metallic water pipe system, if present, should be 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 electrical inspection authority, or electrician as appropriate.

The Load Number (LN) assigned to each terminal device indicates the total load percentage that can be connected to a telephone loop. The termination on a loop may consist of any combination of devices. However, the total LN of all the devices must not exceed 100.

The load number, Canadian certification number, and DOC connector codes are listed on the modem label. For internal modems where the agency information label cannot be seen when the modem is installed, a second agency label will be provided. The customer must attach the label to the exterior of the cabinet where the modem is installed.

Repairs

Inquiries regarding Canadian repair centers should be addressed to:

Racal-Vadic

Customer Service
222 Caspian Drive
Sunnyvale, CA 94089 USA

FCC PART 68: REQUIREMENTS FOR END USERS

Racal-Vadic VA2440,45 (P/S/G/X) Modem

Type of Service

Your VA2440,45 (P/S/G/X) modem can be used on standard telephone lines. The VA2440,45 (P/S/G/X) connects to the telephone line with a standard USOC RJ11C, RJ41S, or RJ45S jack. Connection to pay telephones is prohibited. Connection to party lines service is subject to state tariffs.

Telephone Company Procedures

The telephone company may occasionally make changes in their equipment, operations, or procedures. They will give you prior notice in writing, so you can make any necessary changes to maintain uninterrupted service. If you have any questions about your telephone line, call the telephone company.

In certain circumstances, the telephone company may request information concerning the equipment which you have connected to your telephone line. Upon their request, provide the FCC registration number and the ringer equivalence number (REN) of the modem. Both of these items are listed on the equipment label. The sum of all of the RENs on your telephone line should be less than five to assure proper service from the telephone company. In some cases, an REN sum of five may not be usable on a given line.

When the modem is enclosed in a cabinet, a label listing the unit's registration number and ringer equivalence number must be visible from the outside of the cabinet or other enclosure, in addition to the label required on the registered device itself. Additionally, OEMs must provide end users of their equipment with the attached warnings.

If Problems Arise

If your telephone equipment is not operating properly, immediately remove it from your telephone line, as it may cause harm to the telephone network. If the telephone company notes a problem, they may temporarily discontinue service. When you are notified, you will be given the opportunity to correct the problem, and will be informed of your right to file a complaint with the FCC.

All repairs on your VA2440,45 (P/S/G/X) modem should be performed by **Racal-Vadic** or an authorized representative of **Racal-Vadic**. For information contact:

Racal-Vadic

Customer Service
222 Caspian Drive
Sunnyvale, CA 94089

FCC PART 15: RADIO/TV INTERFERENCE

This equipment generates and uses radio frequency energy and, if not installed and used properly (in strict accordance with the manufacturer's instructions), may cause interference to radio and television reception. It has been type-tested and found to comply with the limits for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of the FCC Rules, which are designed to provide reasonable protection against interference in a residential installation. If this equipment does cause interference to radio or television reception, which can be determined by turning the equipment on and off, try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna
- Relocate the modem with respect to the receiver
- Move the modem away from the receiver
- Plug the modem into a different outlet so that modem and receiver are on different branch circuits.

If necessary, consult the dealer or an experienced radio/television technician for additional suggestions. You might find the following booklet prepared by the Federal Communications Commission helpful:

"How to Identify and Resolve Radio/TV Interference Problems"

This booklet is available from the U.S. Government Printing Office, Washington, D.C. 20402, Stock No. 004-000-00345-4.

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Section 1

GENERAL INFORMATION

INTRODUCTION

The VA2440,45P/S/G/X modem is a Bell 201B/C-compatible unit that provides half-duplex synchronous operation at 2400 bps, with fallback to 1200 bps. The VA2445 model includes an asynchronous 0 to 75 or 0 to 150 bps secondary channel that may be used as either an auxiliary or reverse channel. The VA2440,45 P, S, and X versions are registered for direct connection to the switched-telephone network under Part 68 of the FCC Rules and Regulations; the VA2440,45G version is designed for 2-wire leased-line operation.

FEATURES

The VA2440,45 modem provides many standard and optional features that allow custom tailoring to fit the needs of a particular installation. Features available on this series of modems include:

- Half-duplex, 2400 bps synchronous operation, with optional fallback to 1200 bps
- Manual originate/manual and automatic answer capability
- Auto originate capability when used with RACAL-VADIC Multiline Automatic Calling System (MACS) or VA810-series single-line dialer
- Attended and unattended disconnect operation
- Local copy and delayed busy-out options
- Local and remote test capability
- Extensive RS232C diagnostic display
- FCC-registered, direct connect
- TAP and CSA Certified

PHYSICAL DESCRIPTION

The VA2440 consists of a single-width printed circuit board (PCB) assembly that occupies one card slot in a RACAL-VADIC VA1601-, VA1616-, or VA1680-series chassis. The VA2445 includes a plug-in secondary channel PCB and a dual-width rear panel and requires two card slots. The modem accepts dc power and interfaces to the chassis controls and indicators via the standard card-edge connector located at one end of the PCB. A 25-pin female connector mounted on the rear panel of the modem provides an EIA RS232C connection to the terminal equipment and a rear-mounted 9-pin analog connector mates with the direct-connect telephone interface cable supplied with each modem.

DIAGNOSTICS

The VA2440,45 implements all standard RACAL-VADIC diagnostics for half-duplex modems and displays the status of eight primary terminal interface signals via an LED display located on the front of each chassis. This display, together with built-in Analog Loopback and on-line test capability, provides a simple, effective operational check of the modem.

MODEL SUMMARY

The VA2440,45 modem series includes the following models:

- VA2440P—single-width, 2400 bps synchronous, primary channel-only version designed for permissive direct connection (voice or data jack connection).
- VA2445P—dual-width, 2400 bps synchronous, primary channel and 0 to 75 or 0 to 150 bps asynchronous secondary channel version, designed for permissive direct connection (voice or data jack connection).
- VA2440S—single-width, 2400 bps synchronous, primary channel-only version designed for programmable direct connection (data jack connection only).
- VA2445S—dual-width, 2400 bps synchronous, primary channel and 0 to 75 or 0 to 150 bps asynchronous secondary channel version, designed for programmable direct connection (data jack connection only).
- VA2440X—single-width, 2400 bps synchronous, primary channel-only version, designed for multiple programmable direct connection using a 50-position ribbon jack supplied by the telephone company.
- VA2445X—dual-width, 2400 bps synchronous, primary channel and 0 to 75 or 0 to 150 bps asynchronous secondary channel version, designed for multiple programmable direct connection using a 50-position ribbon jack supplied by the telephone company.
- VA2440G—single-width, 2400 bps synchronous, primary channel-only version, designed for 2-wire leased-line operation.
- VA2445G—dual-width, 2400 bps synchronous, primary channel and 0 to 75 or 0 to 150 bps asynchronous secondary channel version, designed for 2-wire leased-line operation.

Section 2

INSTALLATION

INTRODUCTION

This section provides installation procedures for VA2440,45-series modems. In case of difficulty during any of the following procedures, contact the nearest RACAL-VADIC Regional Service Center listed at the front of this manual.

CAUTION

Procedures in this section should be performed in the sequence and manner specified. Any deviation may damage the equipment.

PRELIMINARY PROCEDURES

Unpacking and Inspection

Inspect shipping carton immediately upon receipt. If the carton has been damaged, request that the carrier's agent be present during unpacking. Inspect contents for physical damage and/or missing parts. If contents have been damaged or parts are missing, immediately notify the nearest RACAL-VADIC sales office.

Equipment Supplied

The VA2440,45 modem is supplied as a plug-in printed circuit board (PCB) assembly and a separate telephone interface cable. Table 2-1 itemizes the RACAL-VADIC assembly part numbers for each version of the modem.

Table 2-1. VA2440,45 Part Numbers

Model No.	Part No.	Cable No.
VA2440P	81144-011	15027-xxx
VA2440S	81144-011	15019-xxx
VA2440G	81144-011	15022-xxx
VA2440X	81144-011	*
VA2445P	81144-012	15027-xxx
VA2445S	81144-012	15019-xxx
VA2445G	81144-012	15022-xxx
VA2445X	81144-012	*

* This version requires one multiconductor cable, RACAL-VADIC model No. VA885 (part No. 15033-001 or 15033-003) for each set of eight modems.

NOTE: Cables ending in -xxx may be ordered in one of three lengths as follows:

- 001—24 in.
- 002—48 in.
- 003—12 ft.

**Additional
Equipment
Required**

The following items are required for installation:

1. RACAL-VADIC VA1601, VA1616, or VA1680 chassis.
2. Data terminal equipment (RS232C) interface cable—terminated with a 25-pin male D-type connector (Cinch or Cannon DB-19604-432).
3. Telephone line jack as specified in Table 2-2.
4. An optional voice/data telephone set (RACAL-VADIC VA871 VADIC-phone or TelCo 503C or 2503C Data-Phone) if manual operation is desired. See Table 2-3 for VA871 models, or see Table 2-4 for 503C and 2503C options. (Note that the VA871 can be used with the VA2440,45P version only.)

Table 2-2. Telephone Equipment Required

Model No.	USOC*	Description	Connection
VA2440,45P	RJ11C	Voice jack	Permissive (6-position plug)
	RJ41S	Universal data jack	
	RJ45S	Programmed data jack	
VA2440,45S	RJ41S	Universal data jack	Programmable (8-position plug)
	RJ45S	Programmed data jack	
VA2440,45G	N/A	Leased-line jack	Leased-line (2-wire)
VA2440,45X	RJ26X	Universal ribbon jack	Programmable (50-position plug)
	RJ27X	Programmed ribbon jack	

* TelCo ordering code

Table 2-3. VA871 Options (Model Summary)

Model	Description
VA871AA	Dataset Control, Rotary Dial
VA871BA	Dataset Control, Touch-Tone® Dial
VA871AM	Telset Control, Rotary Dial
VA871BM	Telset Control, Touch-Tone® Dial

Table 2-4. Telephone Options (503C, 2503C)

Option	Description
A 1	Telset Controls Line*
	Dataset Controls Line**
B 3	Aural Monitoring Not Provided
	Aural Monitoring Provided
C 5	Touch-Tone® Dial
	Rotary (Pulse) Dial
D 7	Switch Hook Indication***
	Mode Indication

* Manual Answer only
 ** Auto Answer only
 *** Required by modem

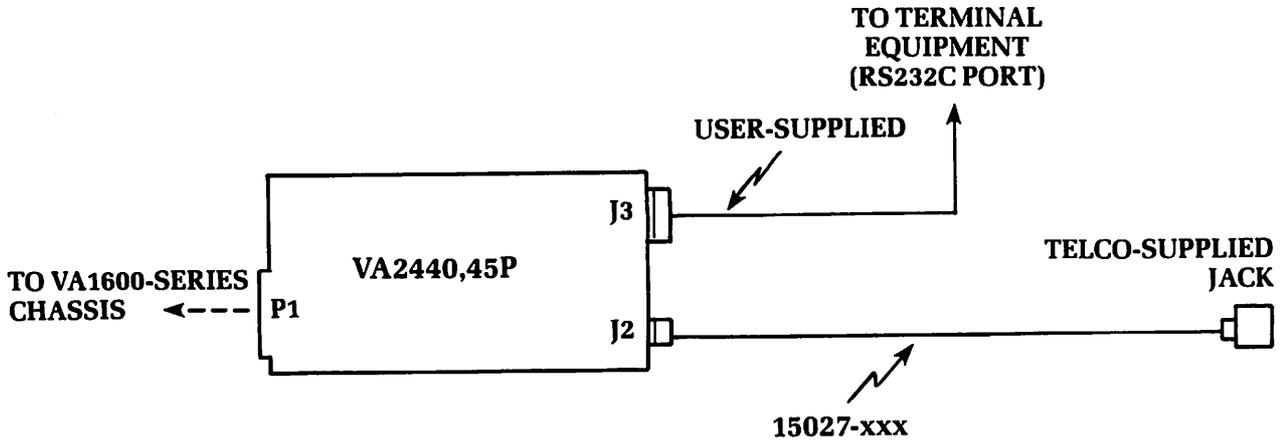
EQUIPMENT CONNECTIONS

VA2440,45P Connections

The P-series modem is designed for permissive connection to the switched-telephone network. This modem may be installed in the following configurations:

No Phone Connection—Figure 2-1 shows the modem connected without a telephone for automatic originate/automatic answer application.

NOTE: The automatic originate mode of operation requires an automatic dialer.

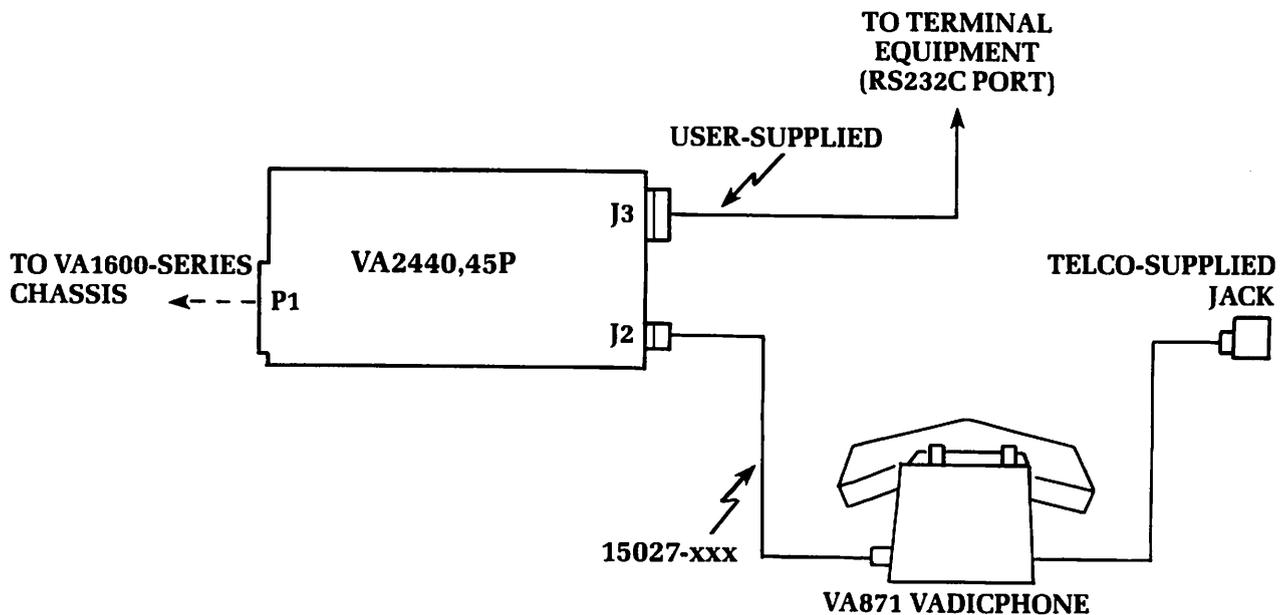


MDS-001

Figure 2-1. P-Series Modem without Telephone

VADICphone Connection—Figure 2-2 shows modem connections when used with the optional VA871 VADICphone. If the VADICphone is connected for telset control (VA871AM,BM), the modem will operate in manual originate/manual answer modes with attended disconnect only; if the VADICphone is connected for dataset control (VA871AA,BA), the modem will operate in manual or automatic originate/automatic answer modes with either attended or unattended disconnect. See Table 2-3 for VA871 model summary.

NOTE: The automatic originate mode of operation requires an automatic dialer.

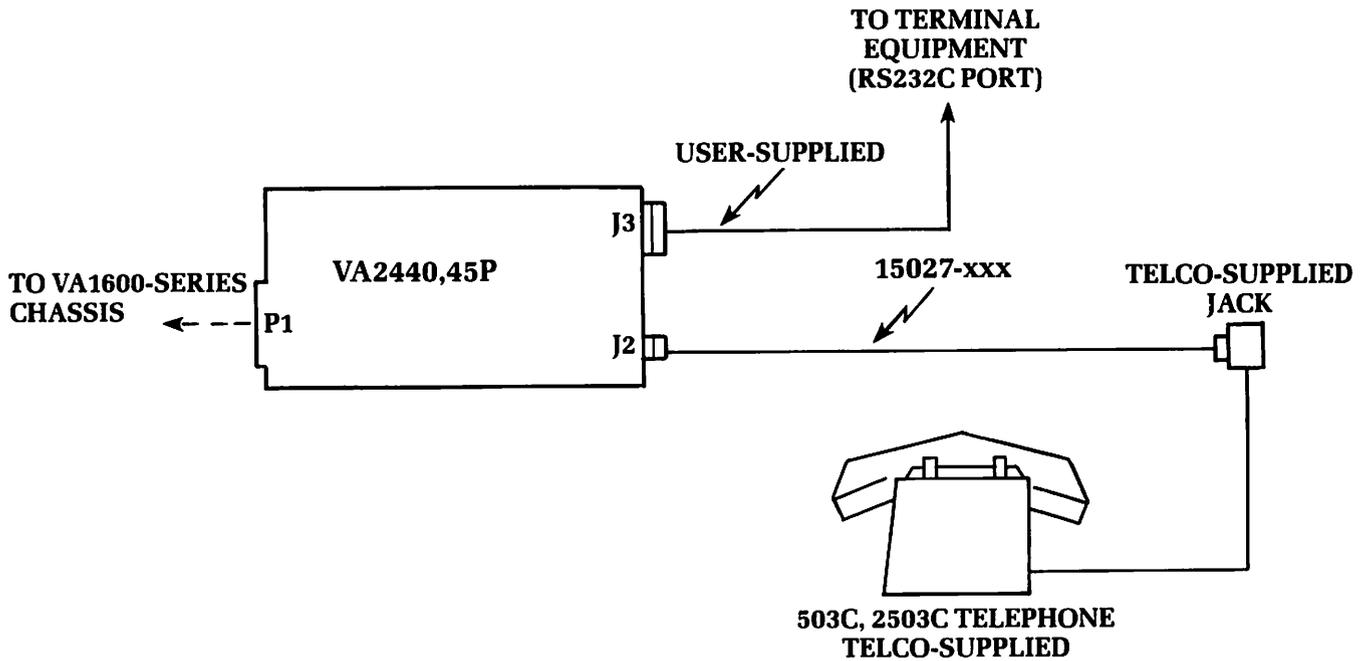


MDS-002

Figure 2-2. P-Series Modem with VA871 VADICphone

Data-Phone Connection—Figure 2-3 shows modem connections when used with a TelCo-supplied Data-Phone (503C/2503C). If the telephone is connected for telset control, the modem will operate in manual originate/manual answer modes with attended disconnect only; if the telephone is connected for dataset control, the modem will operate in manual or automatic originate/automatic answer modes with either attended or unattended disconnect. See Table 2-4 for telephone options.

NOTE: The automatic originate mode of operation requires an automatic dialer.



MDS-003

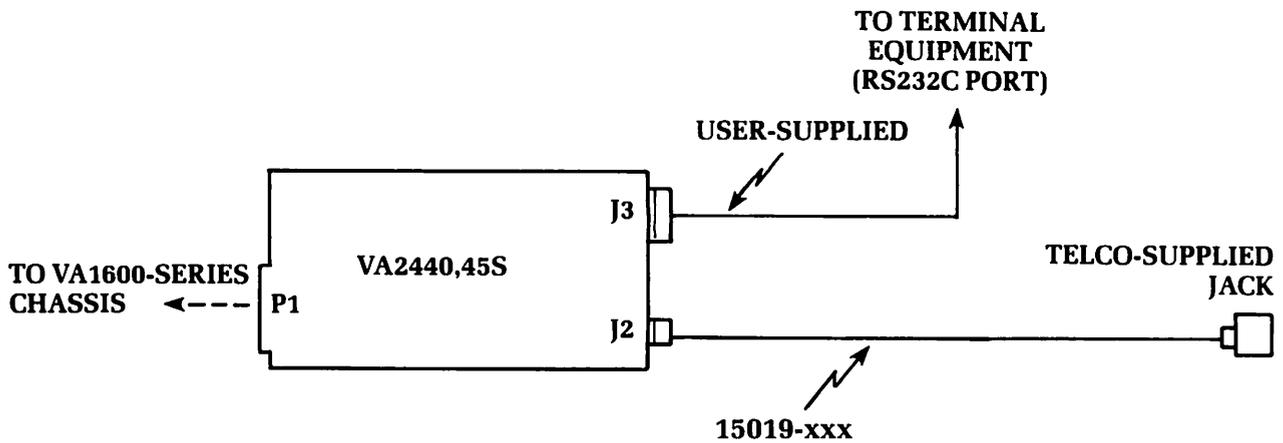
Figure 2-3. P-Series Modem with 503C or 2503C Telephone

NOTE: The P-series modem may be field converted to a G-series 2-wire leased-line modem by adding a VA881 adapter and making appropriate option changes (see Section 5). See VA2440,45G Connections for connection details.

VA2440,45S Connections

The S-series modem is designed for programmable direct connection to the switched-telephone network. This modem is used normally in a multiple dataset installation without a telephone as shown in Figure 2-4. In this configuration, the modem will operate in automatic originate/automatic answer modes.

NOTE: The automatic originate mode of operation requires an automatic dialer.

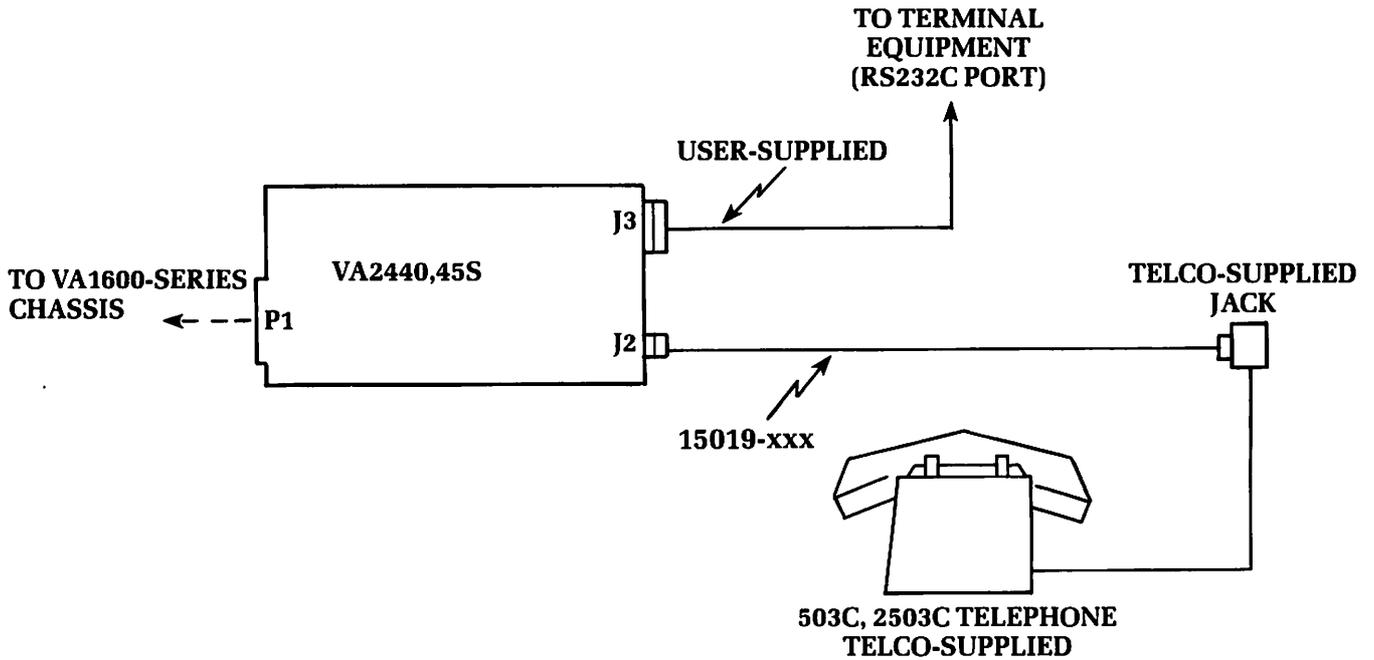


MDS-001

Figure 2-4. S-Series Modem without Telephone

Data-Phone Connection—The modem may also be used with a TelCo-supplied Data-Phone (503C/2503C) as shown in Figure 2-5. If the phone is connected for telset control, the modem will operate only in manual originate/manual answer modes with attended disconnect; if the phone is connected for dataset control, the modem will operate in manual or automatic originate/automatic answer modes with either attended or unattended disconnect. See Table 2-4 for telephone options.

NOTE: The automatic originate mode of operation requires an automatic dialer.

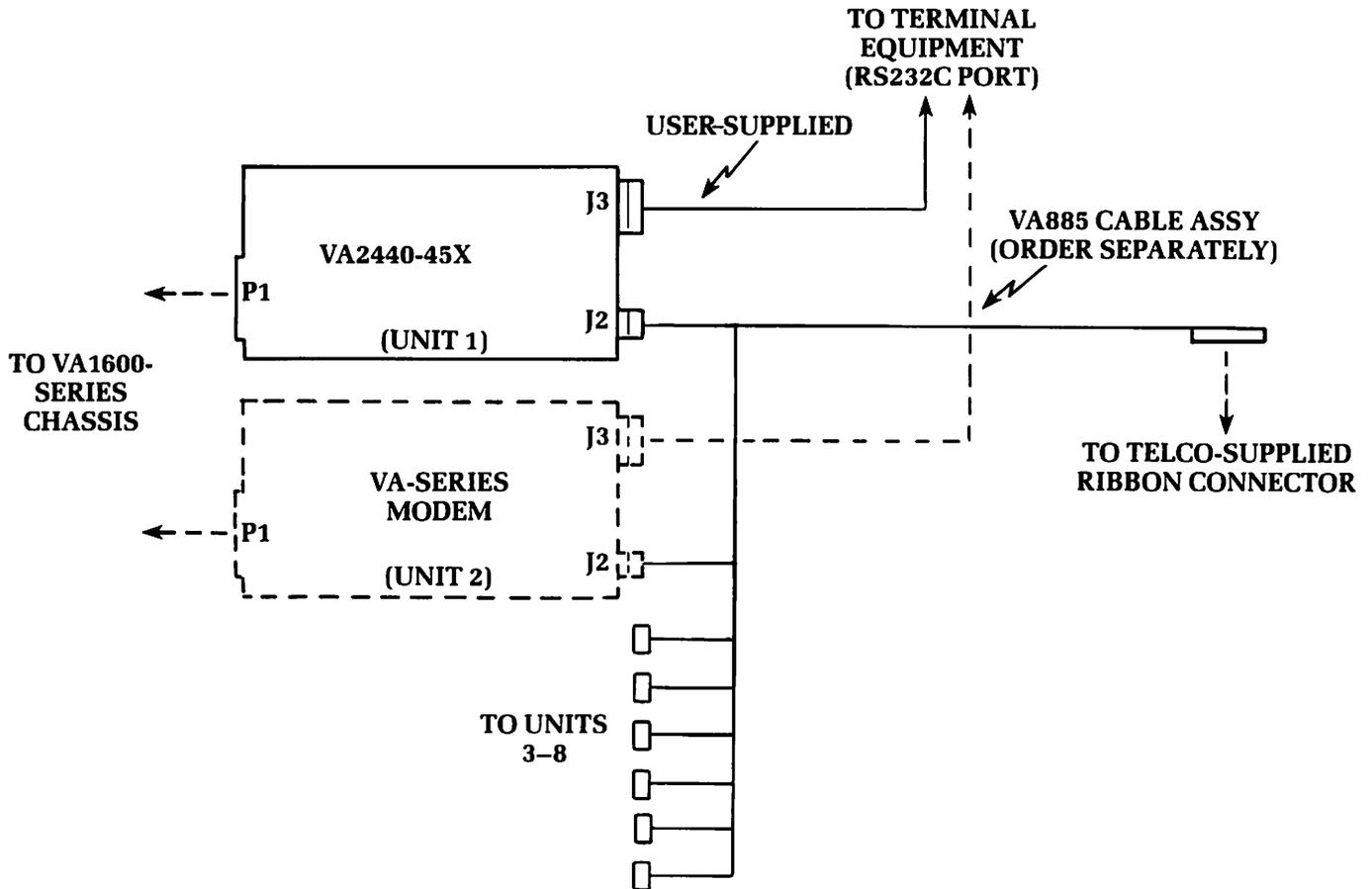


MDS-003

Figure 2-5. S-Series Modem with 503C or 2503C Telephone

**VA2440,45X
Connections**

The X-series modem is designed for programmable direct connection to the switched-telephone network in central-site, multiple dataset installations as shown in Figure 2-6. If used with an optional automatic dialer, the modem will operate in automatic originate/automatic answer modes; if a dialer is not used, the modem will operate only in automatic answer mode.

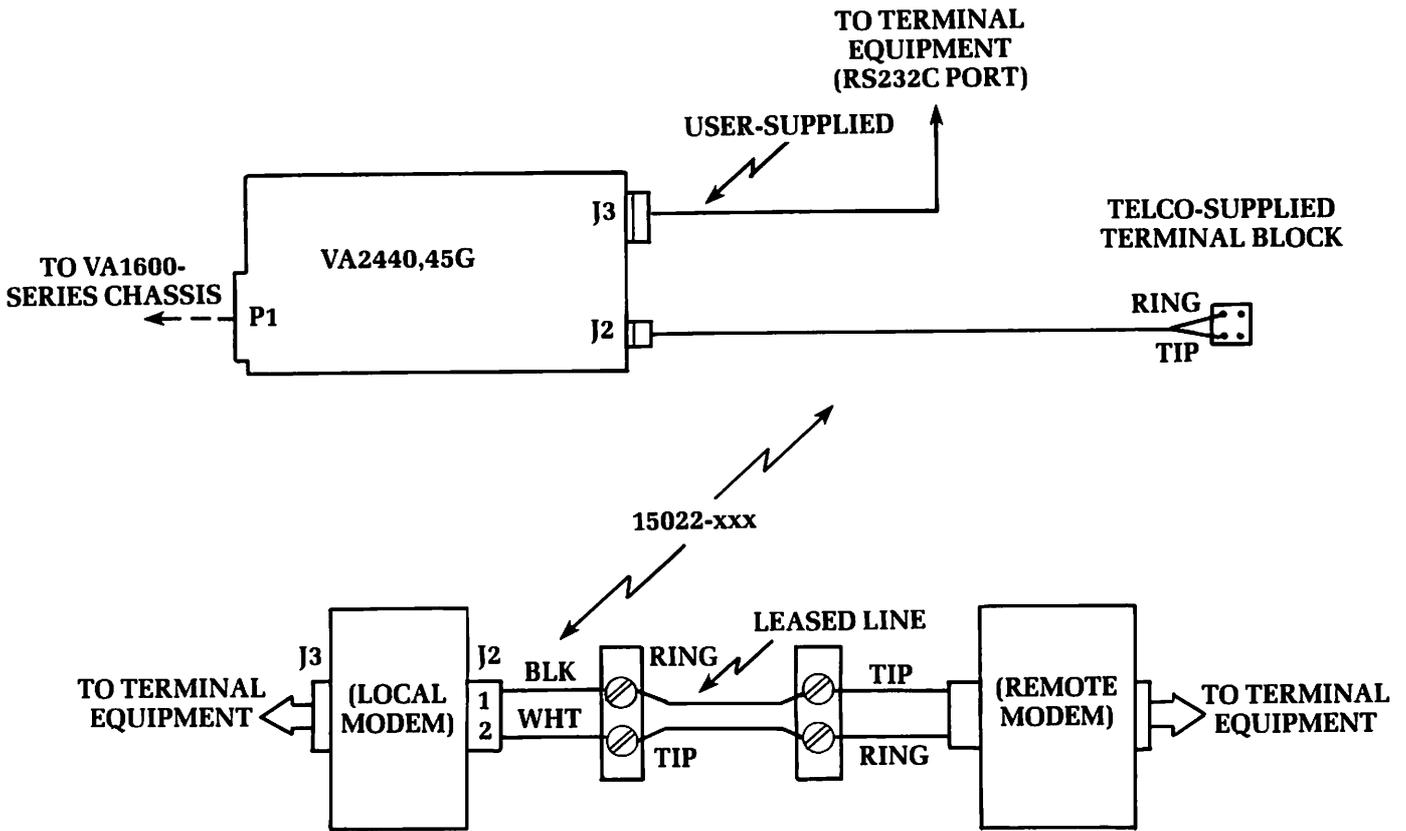


MDS-004

Figure 2-6. X-Series Modem Connections

**VA2440,45G
Connections**

The G-series modem is designed for 2-wire leased-line operation. This modem connects to the TelCo-supplied leased-line terminal block with the 2-wire cable as shown in Figure 2-7.



MDS-005

Figure 2-7. G-Series Modem Connections (Leased Line)

PREINSTALLATION CHECKS

Before installing modem, check the following:

- Refer to Section 5 and verify that correct switch and strap options have been selected.
- Refer to Table 2-2 and verify that proper TelCo equipment has been provided.

INSTALLATION PROCEDURE

To install the modem, proceed as follows:

1. Disconnect power supply from chassis.
2. Carefully insert modem in desired slot and ensure that printed circuit board is properly seated in edge connector, then tighten retaining thumbscrew on lower edge of modem backplate.
3. Connect RS232C interface cable from terminal equipment (DTE) to 25-pin EIA connector on rear of modem.
4. Connect telephone interface cable between 9-pin connector on modem backplate and TelCo connection jack.

NOTE

Prior to connecting any device to the switched-telephone network, Federal Communications Commission (FCC) regulations specify that the customer must provide the telephone company with the name of the manufacturer, equipment model numbers, FCC registration numbers, and ringer equivalence numbers of the devices to be used. This information is listed at the front of this manual.

4. Apply power to chassis and verify that power indicator on chassis front panel illuminates.
5. See next section for location of controls and indicators, then perform test procedures described in Section 4.



Section 3

OPERATION

CONTROLS AND INDICATORS

The VA2440,45-series modems interface to the standard set of controls and indicators located on the front panel of all RACAL-VADIC chassis. The standard controls found on the front panel typically include a channel select switch, a local test (ALB) switch, a remote test (DLB) switch, and a Transmit Reversals (TXR) switch. When the modem card slot is addressed by the channel select switch, the chassis diagnostic indicators display the status of the primary terminal interface (RS232C) signals connected to the modem. Figure 3-1 shows the standard set of diagnostic indicators used on RACAL-VADIC chassis and Table 3-1 defines the function of each control and indicator. Further information on the controls and indicators is presented in the associated chassis manual.



MDS-007

Figure 3-1. Chassis Diagnostic Indicators

Table 3-1. Chassis Controls and Indicators

Indicator	Description
TXD	<u>Transmit Data</u> —Serial data from DTE (data terminal equipment) to input of modem transmitter. ON = SPACE.
RXD	<u>Receive Data</u> —Demodulated serial data from output of modem receiver to DTE. ON = SPACE.
RTS	<u>Request To Send</u> —Control signal from DTE to modem. Turns transmitter ON.
CTS	<u>Clear To Send</u> —Control signal from modem to DTE. Indicates modem is ready to transmit.
DSR	<u>Data Set Ready</u> —Control signal from modem to DTE. Indicates modem is connected to telephone line.
DTR	<u>Data Terminal Ready</u> —Control signal from DTE to modem. Enables line-connection sequence in auto answer mode.
RI	<u>Ring Indicator</u> —Control signal from modem to DTE. Indicates modem has detected ring voltage on telephone line.
CXR	<u>Carrier Detect</u> —Control signal from modem to DTE. Indicates modem receiver is unquelled and receiving a valid carrier.
SI*	<u>Status Indicator</u> —Flashes in test mode and during ring. ON when modem is off hook.
Test Switches	Description
Channel Select*	Selects desired slot address from front panel and enables diagnostic display for that slot.
Local Test (ALB)*	Selects Analog Loopback (ALB) test mode.
Remote Test (DLB)*	Turns on answer tone if Manual Control of Answer Tone option is enabled; otherwise, forces transmitter on for on-line testing.
Transmit Reversals*	Modulates transmitter with alternate MARK/SPACE pattern at 2 Hz rate.

* Not shown in Figure 3-1

OPERATING MODES

The VA2440,45P/S can operate in manual or automatic originate and manual or automatic answer modes, depending on the modem hardware options selected (described in Section 5) and the optional accessories used. The various operating modes are summarized below and a step-by-step procedure for each mode of operation is provided later in this section.

Automatic Originate/ Automatic Answer

For this mode of operation, the modem typically is connected directly to the telephone line without a telephone (if a telephone is used on the same line for voice communication, it must be a dataset-control telephone). An automatic dialer is necessary to originate calls, and DTR must be on for automatic operation. No operator action is required to originate or answer calls, and the modem will automatically disconnect at the end of data communication when the remote modem disconnects (if the line-current disconnect option is selected) or when DTR is turned off by the terminal equipment.

Manual Originate/ Automatic Answer

For this mode of operation, the unattended disconnect option and a dataset-control telephone are required, and Data Terminal Ready (DTR) must be turned on from the terminal equipment or forced on within the modem.

To originate a call, the operator picks up the telephone handset and lifts the exclusion key, then dials the number of the remote installation. When answer tone is detected, the operator simply hangs up the telephone and the modem automatically disconnects when the remote modem disconnects (if the line-current disconnect option is selected) or when DTR is turned off by the terminal equipment.

To answer a call, no operator action is required: with a dataset-control telephone, the modem is connected to the telephone line when the telephone handset is in its cradle (i.e., hung up), and the modem will automatically answer an incoming call provided that DTR is on.

Automatic Originate/ Manual Answer

This mode of operation is available when using a dataset-control telephone and an automatic dialer, but DTR must be held off by the terminal equipment until after a call has been manually answered (or when originating a call) to disable automatic answer mode.

To originate a call in this mode, no operator action is necessary, but the terminal equipment must turn on DTR before dialing and turn off DTR at the end of data communication.

To answer a call in this mode, DTR must be held off until the operator picks up the handset and lifts the telephone exclusion key. To enable modem line connection after voice contact has been established, the operator turns on DTR from the terminal equipment and replaces the telephone handset. If answer tone is required, the operator selects the modem address on the chassis front panel and turns on the DLB switch for approximately 3 seconds. To disconnect the modem at the end of data communication and to inhibit automatic answering of subsequent calls, DTR must be turned off from the terminal equipment.

**Manual Originate/
Manual Answer**

For this mode of operation, the attended disconnect option and a voice/data telephone configured for telset-control are recommended.

To originate a call to a remote installation, the operator lifts the telephone handset and dials the phone number of the remote installation. If the remote modem is configured for automatic answer, a high-pitched answer tone will be heard when the modem connects to line. At this point, the operator lifts the telephone exclusion key and places the handset beside the telephone. If the remote modem is configured for manual answer, the operator first establishes voice contact with the remote installation and asks the remote operator to connect the modem to line, then follows the same procedure. In either case, the local operator must return the telephone handset to its cradle when data communication is complete.

To answer a call, the operator lifts the telephone handset in response to an incoming call and establishes voice contact. To connect the modem to line, the operator lifts the telephone exclusion key, then places the handset beside the telephone. If answer tone is required, the operator selects the modem address on the chassis front panel and turns on the DLB switch for approximately 3 seconds. At the end of data communication, the operator returns the telephone handset to its cradle.

**OPERATING
PROCEDURES**

When shipped from the factory, modem switch and strap options are configured as specified in Table 5-1 (Section 5). In this configuration, the modem will operate in the manual originate/manual/automatic answer modes with attended disconnect. The following procedures apply when the modem has factory-set options selected and a telset-control telephone is used unless otherwise specified. Chassis front-panel displays included in the procedures use the following convention to show the status of the indicators:

● = ON, ○ = OFF, ◐ = FLASHING/BLINKING

VA2440.45-18

**Manual
Originate**

To originate a call, proceed as follows:

1. Lift handset and verify that front-panel indicators display the following:



VA2440.45-01

2. Listen for dial tone and dial phone number of remote modem.
3. Listen for high-pitched tone generated when remote modem answers, then set exclusion key to DATA mode.
4. Data communication can now proceed as follows:
 - a. While modem is transmitting data, front-panel indicators will display the following:



VA2440.45-02

- b. While modem is receiving data, front-panel indicators will display the following:



VA2440.45-03

5. When data communication is complete, replace handset in cradle.

NOTE
When modem is configured for unattended disconnect (not a standard factory setting) and a dataset-control telephone is used, place handset in cradle during data communication.

**Manual
Answer**

To answer a call, proceed as follows:

1. When telephone rings, lift handset and establish voice communication. Front-panel indicators will display the following when handset is lifted.



VA2440.45-04

2. Set exclusion key to DATA mode and turn on DLB switch for 3 seconds to transmit answer tone. (Note: strap c must be in to free answer tone with DLB switch.) When DLB switch is turned off, modem will enter data communication mode and operate as follows:
 - a. While modem is transmitting data, front-panel indicators will display the following:



VA2440.45-05

- b. While modem is receiving data, front-panel indicators will display the following:



VA2440.45-06

3. When data communication is complete, return handset to cradle.

**Automatic
Answer**

No operator intervention is required in this mode. To automatically answer, the modem must be configured as follows:

DTR (from terminal) ON

Telephone (if used) must be dataset control.

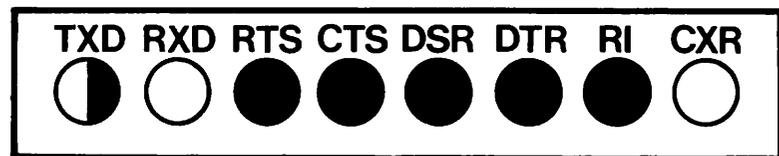
1. When modem is configured for automatic answer, front-panel indicators will display the following:



VA2440.45-07

2. When a call is received, RI (Ring Indicator) on front panel will flash and modem will answer automatically and data communication can proceed as follows:

- a. While modem is transmitting data, front-panel indicators will display the following:



VA2440.45-08

- b. While modem is receiving data, front-panel indicators will display the following:



VA2440.45-09

**Leased
Line**

No operator intervention is required for leased-line operation. When modems are properly connected, front-panel indicators will display the following:



VA2440.45-10

Section 4

TESTING

GENERAL

Two levels of testing are available on the VA2440,45-series modems. These are:

- Local Test (also referred to as Analog Loopback), which checks operation of the local modem and terminal.
- On-Line Test, which checks operation of the local modem transmitter, the remote mode receiver, and the communication link (TelCo lines) between them.

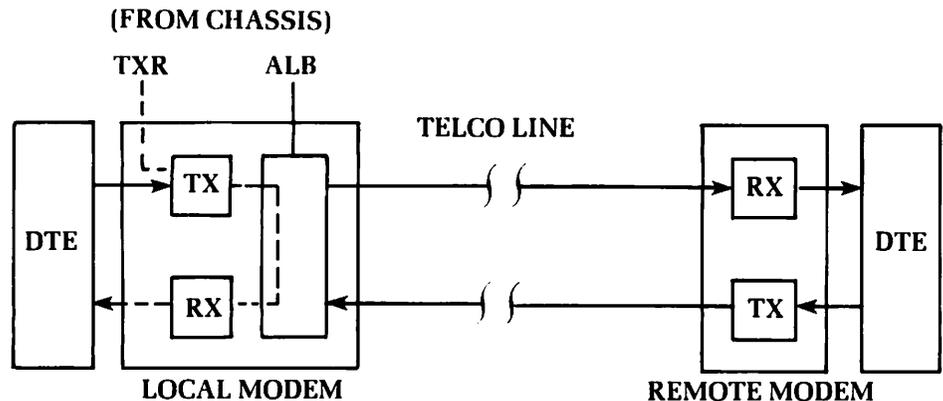
Either test can be initiated manually with the LOCAL TEST (ALB) and REMOTE TEST (DLB) switches on the chassis front panel. Optionally, Local Test can be initiated under terminal control as described in the following subsection.

LOCAL TEST DESCRIPTION

When the LOCAL TEST (ALB) switch on the chassis is enabled, the modem is disconnected from the telephone line and the transmitter output is looped back into the receiver (Figure 4-1). Characters sent from the terminal equipment (DTE) are modulated by the transmitter, looped back to the receiver, demodulated, and returned to the terminal. Successful loopback verifies proper operation of the terminal and local modem.

Transmit Reversals

Optionally, a 2 Hz square wave (alternate MARK/SPACE) may be connected internally to the transmitter during test by enabling the TXR (Transmit Reversals) switch on the chassis front panel. In this case, the TXD (Transmit Data) and RXD (Receive Data) indicators will flash in unison, providing a simple visual indication that the modem is operational.



MDS-008

Figure 4-1. Local Test Diagram

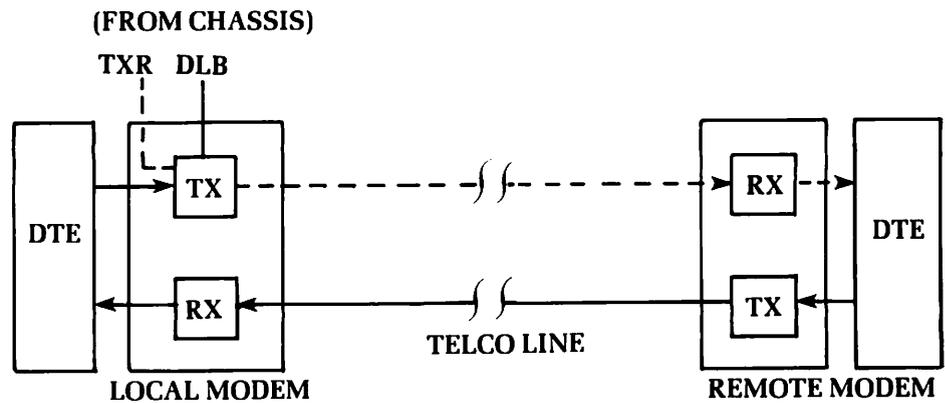
Terminal Control of Local Test

Terminal control of Local Test is provided via pin 25 of the terminal interface connector when option switch d is OUT (not a standard factory setting). With this switch ON, Local Test can be initiated by turning on pin 25 from the terminal, and operation of the modem will be identical to that described previously.

ON-LINE TEST DESCRIPTION

When the modem is addressed from the front panel CHANNEL SELECT switch and the chassis REMOTE TEST switch is enabled, the modem transmitter is forced on the test data applied to the transmitter is modulated, sent over the telephone line, demodulated by the remote receiver, and sent to the remote terminal equipment (provided, of course, that line connection to the remote modem was made previously). As indicated by Figure 4-2, successful reception of data by the remote modem verifies operation of the local transmitter, the remote receiver, and the telephone link between them.

Optionally, the chassis TXR switch can be used to apply a 2 Hz square wave to the local transmitter as described previously under Local Test. In this case, the TXD indicator on the local modem will flash at a 2 Hz rate and, if the diagnostic display for the remote modem is selected, the RXD indicator at the remote end of the link will flash at the same rate.



MDS-009

Figure 4-2. On-Line Test Diagram

TEST PROCEDURES

Local Test Procedure

The following procedures assume that a RACAL-VADIC VA1616-series chassis is used and standard factory-set options are selected unless otherwise specified.

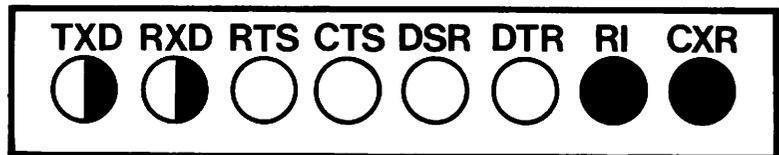
Perform Local Test as follows:

1. Set LOCAL TEST/OFF switch on the chassis front panel to LOCAL TEST. (If a VA1601 chassis is used, the LOCAL TEST switch is labeled ALB, and the appropriate modem channel must be addressed with the CHANNEL SELECT switch.) Verify that the CHANNEL STATUS indicator associated with the modem begins to flash at this point and that the chassis diagnostic indicators display the following:



VA2440.45-11

2. Set TXR/OFF switch to TXR. Verify the diagnostic indicators display the following:



VA2440.45-12

3. To terminate test, return all switches to OFF position.

NOTE: If modem display is correct, the modem is working properly. If display is incorrect, see SERVICE CENTERS at the end of this section.

On-Line Test Procedure

Perform On-Line Test as follows:

1. Establish line connection with remote modem as specified under Operating Procedures (Section 3).

2. Ensure that LOCAL TEST and TXR (Transmit Reversals) switches on chassis front panel are OFF, then select modem address with CHANNEL SELECT switch and set REMOTE TEST/OFF switch to REMOTE TEST. Verify that CHANNEL STATUS indicator associated with modem begins to flash at this point and that diagnostic indicators display the following:



VA2440.45-13

3. Set TXR/OFF switch to TXR (Transmit Reversals) and verify that diagnostic indicators display the following:



VA2440.45-14

4. Ask remote operator to monitor diagnostic display on remote modem and verify that RXD indicator flashes.
5. To terminate test, set switches to OFF position.

NOTE: If displays are correct, the local modem is transmitting properly and the remote modem is demodulating the signal properly. If local modem display is incorrect, perform Local Test to check operation of modem and refer to Service Centers at the end of this section.

SERVICE CENTERS

If the modem appears to be faulty or the problem cannot be isolated, contact the nearest RACAL-VADIC Regional Service Center listed at the front of this manual. Do not attempt to repair the modem in the field. This action may violate FCC regulations and/or invalidate the warranty on the modem. Warranty and shipping instructions are provided on the inside back cover of this manual.

Section 5

OPTIONS

INTRODUCTION

This section describes the switch and strap options available on VA2440,45-series modems. Tables 5-1 and 5-2 list the standard options selected at the factory for each model in the series, Figure 5-1 shows the location of each switch and strap, and Tables 5-3 and 5-4 present a brief description of each option.

Prior to shipment, the modem is normally configured to operate in the manual originate/manual/automatic answer modes as indicated in Table 5-1. After determining the specific requirements of the installation, verify or change the option settings as follows:

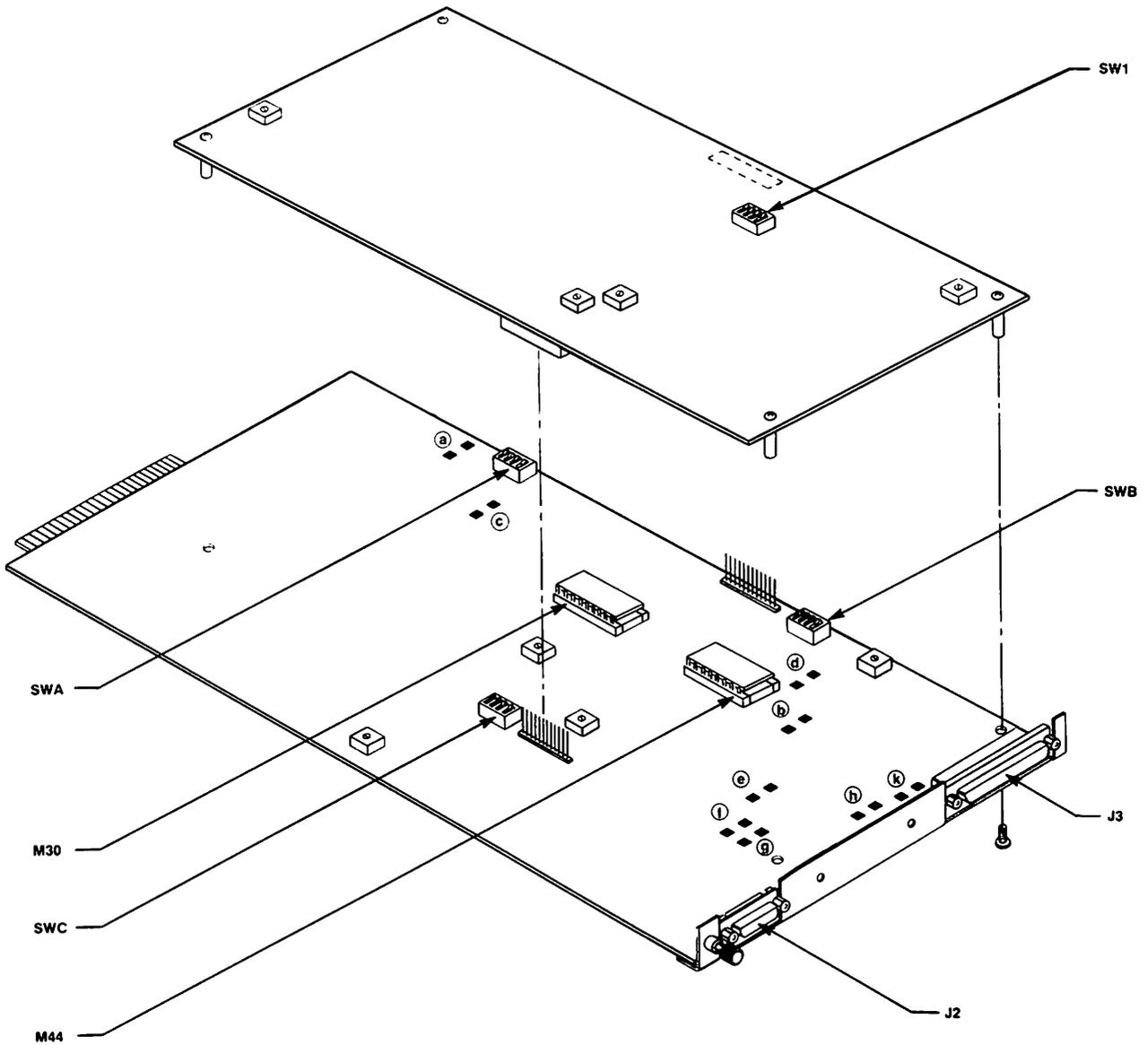
1. Disconnect power and interface cables, then remove modem from chassis.
2. Locate model number in Table 5-1 (and Table 5-2 for VA2445 model) and verify standard settings from appropriate column. If changes are necessary, refer to option descriptions in Tables 5-3 and 5-4 for further information on the operation of each switch and strap.

Table 5-1. VA2440,45 Factory-Set Options (Main Board)

Switch/ Strap	Standard Setting		Option Selected
	P/S/X	G	
A1	OFF	OFF	Local Copy disabled
A2	ON	ON	105 ms Turnaround Delay
A3	OFF	OFF	106 ms Clear To Send (CTS) delay
A4	OFF	ON	P/S/X Models—Data Terminal Ready (DTR) controlled by the terminal equipment G Models—DTR forced ON
B1	ON	ON	Attended disconnect operation
B2	ON	ON	Terminal control of fallback (1200 bps operation) disabled
B3	OFF	OFF	Data Set Ready (DSR) OFF in test mode
B4	ON	ON	Internal clock selected
C1	OFF	ON	P/S/X Models—Receiver sensitivity set to - 50 dBm G Models—Receiver sensitivity set to - 35 dBm
C2	OFF	OFF	Not used
C3	OFF	OFF	Not used
C4	OFF	OFF	Receiver equalizer disabled
a	IN	IN	Answer tone frequency set to 2025 Hz
b	*	*	Bell 201B/C (V.26B) encoding (* strap b replaced with 1 kohm resistor)
c	IN	OUT	P/S/X Models—Chassis DLB switch forces answer tone G Models—DLB switch turns on transmitter for remote test
d	IN	IN	Analog Loopback (ALB) test controlled from chassis front-panel switch only
e	OUT	IN	P/S/X Models—Line-current disconnect enabled G Models—Line-current disconnect disabled

Table 5-2. VA2445 Factory-Set Options (Secondary Channel Board)

Switch/ Strap	Standard Setting		Option Selected
	P/S/X	G	
f	*	IN	P/S/X Models—Line interface configured for switched-network operation (* strap f replaced with 1 kohm resistor on revision F board) G Models—Line interface configured for leased-line operation
g	OUT	IN	
h	OUT	IN	
k	OUT	OUT	Signal common isolated from chassis ground
SW-1	ON	OFF	P/S/X Models—Secondary channel receiver sensitivity set for switched-network operation G Models—Secondary channel receiver sensitivity set for leased-line operation
SW-2	OFF	OFF	Secondary channel transmitter output set to - 5 dBm below primary channel
SW-3	ON	ON	Secondary channel local copy disabled
SW-4	ON	ON	Secondary channel data rate set for 0 to 150 bps



VA2440.45-15

Figure 5-1. VA2440,45 Switch and Strap Locations

Table 5-3. VA2440,45 Option Descriptions (Main Board)

Option	Switch/ Strap	Description
Local Copy Select	A1	If ON, transmit data is echoed back through the receiver, providing local monitoring of transmitted data. If OFF, Local Copy is disabled.
Turnaround Delay Select	A2	If OFF, the local receiver is squelched for 105 ms at the end of data transmission to prevent modem from receiving echo of its own transmitted signal. If ON, turnaround delay is disabled.
Clear To Send (CTS) Delay Timing	A3	If OFF, the modem holds CTS OFF and transmits continuous MARK for 106 ms after Request To Send (RTS) from the terminal equipment is turned ON. This delay allows the remote receiver time to detect carrier before data is transmitted. At the end of the delay period, CTS is turned ON, indicating that the modem is ready to transmit data. If ON, CTS delay period is set to 7.1 ms.
Data Terminal Ready (DTR) Control	A4	If OFF, DTR is controlled by the data terminal equipment interface (J3/20). If ON, DTR is forced on continuously.
Attended or Unattended Disconnect Select	B1	If ON, attended disconnect operation is selected. In this case, the modem will connect to line when the telephone handset is lifted and disconnect from line when the handset is returned to its cradle. If OFF, unattended disconnect operation is selected. In this case, the modem will connect to line when the telephone handset is returned to its cradle (dataset-control telephone required) if DTR is ON. With unattended disconnect, the modem will also automatically answer when ring voltage is received if DTR is ON. The modem disconnects from line when DTR is turned OFF or when the remote modem disconnects if Line Current Disconnect option is selected.
Terminal Control of Fallback Mode	B2	If OFF, the primary channel data rate can be switched to 1200 bps operation by asserting a logic LOW on J3/23 (CCITT V.26 option). If ON, the modem operates only at 2400 bps.
Data Set Ready (DSR) in Test	B3	If ON, DSR is turned ON during test mode. If OFF, DSR is turned OFF during test mode.
Transmit Clock Select	B4	If ON, the modem transmitter is clocked internally. If OFF, an external transmit clock (SCTE) must be supplied on the terminal equipment interface (J3/24).

Table 5-3. VA2440,45 Option Descriptions (Main Board) (cont'd)

Option	Switch/ Strap	Description
Receiver Sensitivity	C1	If ON, receiver sensitivity is set to -35 dBm (leased-line operation). If OFF, receiver sensitivity is set to -50 dBm (switched-network operation).
Receiver Equalizer	C4	If ON, amplitude and group delay equalization is included in the receiver to compensate for poor-quality telephone lines. If OFF, the receiver equalizer is disabled.
Answer Tone Frequency Select	a	If IN, U.S. answer tone frequency (2025 Hz) is selected. If OUT, international answer tone frequency (2100 Hz) is selected.
Modulation Select	b	If IN, Bell 201B/C (V.26B) dibit encoding is used by the modem. (Note: strap b is replaced with a 1 kohm resistor.) If OUT, V.26A encoding is selected.
Manual Control of Answer Tone	c	If IN, the chassis DLB switch forces answer tone when turned ON. This option is required for manual answer applications where the operator must control answer tone. If OUT, the DLB switch forces Request To Send (RTS) when turned ON. In applications where manual control of answer tone is not required, this option may be used to unsquelch the transmitter for on-line test.
Analog Loopback (ALB) Test Control	d	If OUT, ALB test can be initiated from the chassis front-panel switch or the terminal equipment interface (by asserting a logic HIGH on J3/25). If IN, terminal control of ALB is disabled and the test can be initiated from the chassis front-panel switch only.
Line Current Disconnect	e	If OUT, the modem will automatically disconnect from line by detecting the current reversal generated in the telephone line when the remote modem disconnects. If IN, the modem will disconnect from line only when DTR is turned OFF (unattended operation) or when the telephone handset is returned to its cradle (attended operation).
Line Interface Select	f,g,h	If OUT, switched-network operation is selected (strap f is replaced with a 1 kohm resistor on revision F board). If IN, leased-line operation is selected.
Signal Common Ground Reference	k	If IN, signal common is connected to chassis ground. If OUT, signal common is isolated from chassis ground.

Table 5-4. VA2445 Option Descriptions (Secondary Channel Board)

Option	Switch	Description
SC Receiver Sensitivity	SW-1	If ON, secondary channel receiver sensitivity is set to -35 dBm (switched-network operation). If OFF, receiver sensitivity is set to -50 dBm (leased-line operation).
SC Transmit Level	SW-2	If ON, secondary channel transmit level is set to same level as the primary channel (0 dBm attenuation). This setting is used for reverse channel operation. If OFF, secondary channel transmit level is set for -5 dBm below the primary channel (5 dBm attenuation). This setting is used for forward or side channel operation.
SC Local Copy	SW-3	If OFF, secondary channel transmit data is echoed through the secondary channel receiver, providing local monitoring of the transmitted data. If ON, secondary channel local copy is disabled.
SC Data Rate	SW-4	If ON, secondary channel data rate is set for 0 to 150 bps operation. If OFF, secondary channel data rate is set for 0 to 75 bps operation.

Section 6

SUPPLEMENTAL INFORMATION

EQUIPMENT INTERFACES

Data Terminal Equipment (DTE) Interface

The data terminal equipment (DTE) interface consists of a 25-pin D-type connector (J3) located on the modem backplate. This connector provides an RS232C signal interface between the modem and the terminal equipment. Table 6-1 lists pin assignments for the interface connector and each signal is described below by pin number. Eight of these signals are displayed on the chassis front panel for diagnostic use when the modem card-slot is addressed via the Channel Select switch. These eight signals are identified by asterisks in the following list:

1. Chassis Ground—Common return to ac protective ground.
2. Transmitted Data*—Serial data from DTE to modem transmitter. MARK = -5 to -15 V; SPACE = +5 to +15 V.
3. Received Data*—Demodulated serial data from modem receiver to DTE. Held in MARK condition in absence of Carrier Detect.
4. Request To Send*—Control signal from DTE to modem indicating that DTE has data to transmit. Unsquels modem transmitter (and squels receiver in half-duplex modems).
5. Clear To Send*—Control signal from modem to DTE indicating that modem is ready to transmit data.
6. Data Set Ready*—Control signal from modem to DTE indicating that modem is off hook (connected to the TelCo line) and not in test mode.
7. Signal Common—Common ground reference point for all interface circuits except Chassis Ground.
8. Carrier Detect*—Control signal from modem to DTE indicating that the modem is receiving valid energy suitable for demodulation. Also called Receive Line Signal Detector.
9. + 12 V Test—Positive dc test voltage, 1.5 kohm, nominal.
10. - 12 V Test—Negative dc test voltage, 1.5 kohm, nominal.
11. Not used.
12. Secondary Carrier Detect—VA2445 only. See pin 8.
13. Secondary Clear To Send—VA2445 only. See pin 5.
14. Secondary Transmitted Data—VA2445 only. See pin 2.

15. Serial Clock Transmit—Clock signal from modem transmitter to DTE. Used during synchronous operation only.
16. Secondary Received Data—VA2445 only. See pin 3.
17. Serial Clock Received—Clock signal from modem receiver to DTE. Used during synchronous operation only.
18. Not used.
19. Secondary Request To Send—VA2445 only. See pin 4.
20. Data Terminal Ready*—Control signal from DTE to modem indicating that DTE is ready for data communication. Prepares modem for connection to the telephone line and maintains connection once established. In automatic answering application, the modem will connect to line upon receipt of the trailing edge of the ring signal (RI) if this signal is ON.
21. Not used.
22. Ring Indicator*—Control signal from modem to DTE indicating that a ring signal has been detected (i.e., a call is being received).
23. Data Rate Select—If option switch B2 is OFF, a logic LOW on this pin will force 1200 bps operation.
24. External Serial Clock Transmit—Clock signal from DTE to modem to synchronize transmitter. Used during synchronous operation only.
25. Test/Busy Out—Optional control signal from DTE to modem that provides terminal control of local test (ALB) if hardware option is selected (refer to Sections 4 and 5). Can also be used to busy-out the modem from terminal. This is a RACAL-VADIC feature only and is not defined by either EIA RS232C or CCITT V.24.

Table 6-1. RS232C (DTE) Interface Connector (J3)

Pin	VADIC Designation	EIA Designation	CCITT Designation	Function	Active State*
1	FG	AA	101	Chassis Ground	—
2	TXD	BA	103	Transmitted Data	E
3	RXD	BB	104	Received Data	E
4	RTS	CA	105	Request To Send	PL
5	CTS	CB	106	Clear To Send	PL
6	DSR	CC	107	Data Set Ready	PL
7	SG	AB	102	Signal Common	—
8	CXR	CF	109	Carrier Detect	PL
9	+V	—	—	+ 12 Vdc through 1.5 kohm (test)	—
10	-V	—	—	- 12 Vdc through 1.5 kohm (test)	—
11	—	—	—	Not used	—
12	SCXR	SCF	122	Secondary Carrier Detect	PL
13	SCTS	SCB	121	Secondary Clear To Send	PL
14	STXD	SBA	118	Secondary Transmitted Data	E
15	SCT	—	114	Serial Clock Transmit	E
16	SRXD	SBB	119	Secondary Received Data	E
17	SCR	DD	115	Serial Clock Receive	E
18	—	—	—	Not used	—
19	SRTS	SCA	120	Secondary Request To Send	PL
20	DTR	CD	108.2	Data Terminal Ready	PL
21	—	—	—	Not used	—
22	RI	CE	125	Ring Indicator	PL
23	-FB	CH/CI	111/112	Data Rate Selector	NL
24	XSCT	DA	113	External Transmit Clock	E
25	BO	—	—	Test/Busy	PL

* PL = Positive TRUE logic
 NL = Negative TRUE logic
 E = Either state

TelCo Line Interface

The VA2440,45 modem is supplied with a telephone interface cable terminated at one end with a 9-pin analog connector (J2) that attaches to the modem backplate and at the other end with a miniature telephone connector that mates with standard jacks supplied by the telephone company. Pin assignments for standard telephone jacks are listed in Tables 6-2 and 6-3 and pin assignments for the 9-pin analog connector are listed in Table 6-4. Signal mnemonics used on the TelCo interface are defined in Table 6-5.

VA2440,45P Interface

The VA2440,45P cable is terminated in a 6-position connector that mates with a USOC RJ11C voice jack (or a RJ41S universal data jack) to form a permissive connection as defined by Part 68 of the FCC Rules and Regulations. Tables 6-2 and 6-3 list pin assignments for the RJ11C and RJ41S connectors, respectively.

VA2440,45S Interface

The VA2440,45S cable is terminated in an 8-position connector that mates with a USOC RJ41S or RJ45S data jack to form a programmed connection as defined by Part 68 of the FCC Rules and Regulations. Table 6-3 lists pin assignments for the RJ41S,45S TelCo interface connectors.

VA2440,45G Interface

The VA2440,45G model connects to a TelCo-supplied leased-line connection block with the two-wire cable supplied with the modem. The cable terminates in spade lugs that connect to the telephone line as follows:

- Black—One side of telephone line (Ring)
- White—Other side of telephone line (Tip)

VA2440,45X Interfaces

The VA2440,45X modem interfaces to a USOC RJ26X or RJ27X data jack via a multiple cable (RACAL-VADIC model No. VA885) that must be ordered separately. The VA885 cable accommodates up to eight modems and forms a programmed connection as defined by Part 68 of the FCC Rules and Regulations.

Table 6-2. RJ11C Connector Pin Assignments

Pin	Mnemonic	Function
1	—	Not used
2	MI	Mode Indicator
3	R	Ring
4	T	Tip
5	MIC	Mode Indicator Common
6	—	Not used

Table 6-3. RJ41S,45S Connector Pin Assignments

Pin	Mnemonic	Function
1	—	*
2	—	*
3	MI	Mode Indicator
4	R	Ring
5	T	Tip
6	MIC	Mode Indicator Common
7	PR	Programming Resistor
8	PRC	Programming Resistor Common

* Pins 1 and 2 are Ring and Tip for Fixed-Loss Loop (FLL) connections and are not used in RACAL-VADIC modems.

Table 6-4. Analog Connector Pin Assignments (J2)

Pin	Mnemonic	Function
1	MIC/PRC	MI/PR Common Return
2	MI	Mode Indicator
3	—	Not used
4	—	Not used
5	T	Tip
6	PR	Programming Resistor
7	—	Not used
8	—	Not used
9	R	Ring

Table 6-5. TelCo Interface Signal Definitions

Mnemonic	Signal Name	Function
R	Ring	Connection to one side of telephone line.
T	Tip	Connection to other side of telephone line.
MI	Mode Indicator	Mode indication from voice/data telephone (if used). When closed to MIC, indicates that telephone is off hook and in DATA mode.
PR	Programming Resistor	Connection to resistor in TelCo data jack that sets modem gain for programmable connection (VA2440,45S version only).
MIC/PRC	MI/PR Common	Common return for Mode Indicator and Programming Resistor signals.

Chassis Interface

The modem interfaces to the standard controls and indicators used on RACAL-VADIC chassis through a 36-pin card-edge connector (P1) located at one end of the PC board. An optional automatic dialer (if used) also communicates with the modem through this connector. Pin assignments for the edge connector are listed in Table 6-6. Further information on these signals can be found in the associated chassis manual.

Table 6-6. Edge Connector Pin Assignments (P1)

Pin	Mnemonic	Function	Signal Type*
A	—	Busy/Local Test	NL
1	SI	Status Display	NL
B	DTXD	Transmit Data Display	NL
2	DRXD	Receive Data Display	NL
C	DRTS	Request To Send Display	NL
3	DCTS	Clear To Send Display	NL
D	DDSR	Data Set Ready Display	NL
4	DDTR	Data Terminal Ready Display	NL
E	DRI	Ring Indicator Display	NL
5	DCXR	Carrier Detect Display	NL
F	—	DLB (Remote Test) Switch	NL
6	TXR	Transmit Reversals Switch	NL
H	—	Flash Input	NL
7	DOH	Dialer Off Hook	PL
J	DDA	Dialer Data Access	PL
8	XFER	Dialer Transfer	PL
K	—	Dialer (TelCo) Ring	A
9	—	Dialer (TelCo) Tip	A
L	—	Not used	—
10	A8	Address Bit 4	NL
M	A4	Address Bit 3	NL
11	A2	Address Bit 2	NL
N	A1	Address Bit 1	NL
12	STRB	Dialer Strobe	NL
P	C8	Compare Bit 4	PL
13	C4	Compare Bit 3	PL
R	C2	Compare Bit 2	PL
14	C1	Compare Bit 1	PL
S	—	Signal Common	—
15	—	Signal Common	—
T	—	+ 5 V Power	—
16	—	+ 5 V Power	—
U	—	+ 12 V Power	—
17	—	+ 12 V Power	—
V	—	- 12 V Power	—
18	—	- 12 V Power	—

* PL = Positive TRUE logic
 NL = Negative TRUE logic
 A = Analog signal

OPERATIONAL OVERVIEW

The VA2440,45P/S-series modems are designed for switched-network operation and perform three primary functions: (1) connecting to line, (2) transmitting and receiving data (data transfer), and (3) disconnecting from line. (The VA2440,45G operates in leased-line mode and only the data-transfer discussion applies to this unit.) Figure 6-1 shows the basic organization and primary interfaces to the modem, and a general discussion of the line connection, data transfer, and line-disconnect sequences is presented in the following paragraphs.

Line Connection

Manual Operation—For manual line connection, an external voice/data telephone is required, and modem Tip, Ring, Mode Indicator, and Mode Indicator Common lines (T-J2/5, R-J2/9, MI-J2/2, and MIC-J2-1) are controlled by selecting VOICE or DATA mode with the telephone exclusion key. When VOICE mode is selected, the telephone handset is connected to the telephone line, modem T and R are isolated from the line, and MI/MIC are open. When DATA mode is selected, the opposite is true: the telephone handset is disconnected, modem T and R are connected to the telephone line, and MI/MIC are shorted together through the telephone.

NOTE: If the telephone is configured for telset control, the VOICE mode is automatically selected when the handset is lifted and the DATA mode is selected by lifting the exclusion key; if the telephone is configured for dataset control, the opposite is true, and modem T and R are always connected to line except when the exclusion key is lifted.

If the attended disconnect option has been selected (refer to Section 5), the modem will go off hook whenever the telephone goes off hook and DATA mode is selected (i.e., MI/MIC are shorted and modem T and R are connected to line); if the unattended disconnect option has been selected instead, the modem will go off hook only after the telephone has been taken off hook and switched first to VOICE, then to DATA mode (this allows the telephone handset to be hung up if a dataset-control telephone is used).

During manual originate operation, the modem takes Data Set Ready (DSR-J3/6) HIGH when the telephone is switched to DATA mode, indicating that the modem is connected to line.

For manual answer operation, the force answer tone option must be selected to provide manual control of answer tone with the chassis REMOTE TEST (DLB) switch. In this case, answer tone is manually forced on for approximately 3 seconds by selecting REMOTE TEST immediately after the modem goes off hook. At the end of answer tone (i.e., when the switch is returned to OFF position), the modem turns on Data Set Ready (DSR-J3/6), indicating the end of the connect sequence.

Automatic Operation—For automatic line connection, modem Tip and Ring (T-J2/5 and R-J2/9) must be connected to the telephone line during normal operation (i.e., if a voice/data telephone is used on the same line, it must be configured for dataset control), and Data Terminal Ready (DTR-J3/20) must be turned on by the terminal equipment (DTE) or the force DTR option must be selected.

During automatic originate operation, the automatic dialer addresses the modem through the chassis interface and inhibits modem operation, then dials out through the modem TelCo interface. If Data Terminal Ready (DTR-J3/20) is on at the end of the dial sequence, the dialer transfers control to the modem and the modem automatically connects to line. At this point, the modem turns on Data Set Ready (DSR-J3/6), indicating the end of the connect sequence.

During automatic answer operation, ring voltage applied to T and R during an incoming call is detected by the modem and sent to the terminal equipment (DTE) as Ring Indicator (RI-J3/33). Depending on the local system software, the DTE will either turn on Data Terminal Ready (DTR-J3/20) in response to RI or DTR will have been turned on previously to enable automatic answer operation. In either case, the modem goes off hook when it detects the training edge of RI and transmits an answer tone for three seconds. At the end of answer tone, the modem turns on Data Set Ready (DSR-J3/6), indicating the end of the connect sequence.

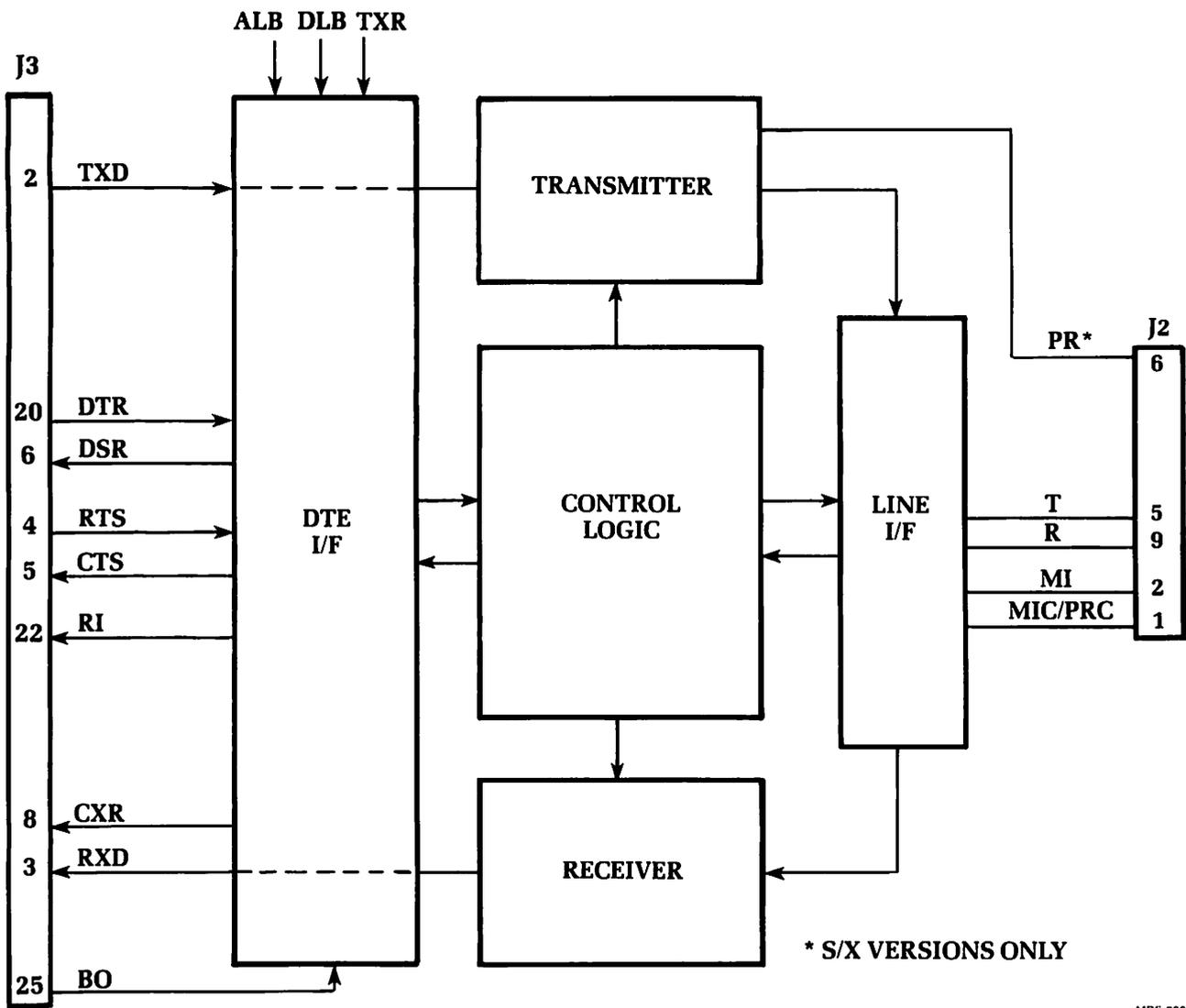
Data Transfer

After the modem is connected to line, the direction of data transfer is controlled by Request To Send (RTS-J3/4) from the terminal equipment (DTE). When RTS is turned on, the modem receiver is squelched and the modem transmits continuous MARK during the RTS/CTS delay period (refer to option descriptions in Section 5). At the end of the delay period, the modem turns on Clear To Send (CTS-J3/5) and accepts data for transmission on the Transmit Data (TXD-J3/2) input from the DTE. When RTS from the DTE is turned off, the transmitter is squelched immediately and the receiver is unsquelched after the turnaround delay (TAD) period (see Section 5). Provided that a valid signal is being received at this point, the modem turns on Carrier Detect (CXR-J3/8) to the DTE, indicating that valid receive data is available on the Receive Data (RXD-J3/3) output.

Line Disconnect

Line disconnect is accomplished in one of three ways, depending upon the options selected:

- If the attended disconnect option is enabled (and the modem is manually connected to line by MI/MIC closure), the modem will disconnect from line whenever the telephone handset is returned to the cradle (i.e., MI/MIC contact opens).
- If the unattended disconnect option is selected instead, modem line connection is controlled by Data Terminal Ready (DTR-J3/20) from the terminal (as described under automatic line connection discussed previously) and the modem may be disconnected from line by turning off DTR.
- If the line-current disconnect option is selected (and the unattended disconnect option is also selected), the modem will disconnect from line when the remote modem disconnects. Refer to Section 5 for detailed descriptions of these options.



MDS-006

Figure 6-1. VA2440,45 Block Diagram

SPECIFICATIONS

OPERATING CHARACTERISTICS (Primary Channel)	
Operating Modes	VA2440,45P/S/X: Manual originate, manual answer, automatic answer (automatic originate with optional dialer) VA2440,45G: Originate/answer, constant or controlled carrier
Data Transfer Rate	2400 bps \pm 0.05%, half-duplex (V.26 bis fallback to 1200 bps)
Data Format	Synchronous, serial, binary
Modulation	Differentially coherent phase-shift keyed (DPSK)
Carrier Frequency	1800 Hz \pm 0.01%
Answer Tone Frequency	2025 or 2100 Hz \pm 0.5%, strap selectable
Transmitter Output Level	VA2440,45P — -10 dBm \pm 1 dB VA2440,45S — 0 to -12 dBm \pm 1 dB (via R88) VA2440,45G — 0 dBm \pm 1 dB
Receiver Dynamic Range	VA2440,45P/S/G/X—0 to -51 dBm

OPERATING CHARACTERISTICS (Secondary Channel)										
Data Transfer Rate	0 to 75 or 0 to 150 bps, switch selectable									
Data Format	Asynchronous, serial, binary									
Modulation	Phase coherent frequency-shift keyed (FSK)									
Operating Frequencies	<table style="width: 100%; border: none;"> <thead> <tr> <th></th> <th style="text-align: center;">MARK</th> <th style="text-align: center;">SPACE</th> </tr> </thead> <tbody> <tr> <td>0 to 75 bps:</td> <td style="text-align: center;">390 \pm 3 Hz</td> <td style="text-align: center;">450 \pm 3 Hz</td> </tr> <tr> <td>0 to 150 bps:</td> <td style="text-align: center;">370 \pm 3 Hz</td> <td style="text-align: center;">470 \pm 3 Hz</td> </tr> </tbody> </table>		MARK	SPACE	0 to 75 bps:	390 \pm 3 Hz	450 \pm 3 Hz	0 to 150 bps:	370 \pm 3 Hz	470 \pm 3 Hz
	MARK	SPACE								
0 to 75 bps:	390 \pm 3 Hz	450 \pm 3 Hz								
0 to 150 bps:	370 \pm 3 Hz	470 \pm 3 Hz								

INTERFACES	
Terminal (DTE)	Per EIA RS232C, V.24, and V.28
Line (TelCo)	VA2440,45P: Permissive direct-connect per FCC Rules, Part 68
Interface	VA2440,45S/X: Programmable direct-connect per FCC Rules, Part 68 VA2440,45G: 2-wire leased-line

LINE-CONTROL FUNCTIONS			
Carrier Detect		Primary Channel	Secondary Channel
(CXR) Delay	Off to On:	10 ± 1 ms	60 ± 15 ms
	On to Off:	7.1 ms	50 ± 15 ms
Clear To Send Delay		7.1 ± 1 ms	120 ± 20 ms
		or	
		106 ± 5 ms	
Turnaround Delay	105 ± 5 ms, or none		
Line Current Disconnect	Enabled 7 ± 1.0 seconds after off hook Disabled by switch hook		

POWER REQUIREMENTS			
Volt/Amps		VA2440	VA2445
	+ 12 Vdc @	125 mA	250 mA
	- 12 Vdc @	125 mA	250 mA
	+ 5 Vdc @	270 mA	270 mA

ENVIRONMENTAL REQUIREMENTS		
Temperature	Operating	0° to 50° C
	Nonoperating:	- 20° to 70° C
Humidity	Up to 90% relative humidity, without condensation	

PHYSICAL CHARACTERISTICS			
Height	VA2440:	0.68 in. (1.7 cm)	
	VA2445:	1.44 in. (3.6 cm)	
Width	6.4 in. (16 cm)		
Depth	12.75 in (32 cm)		
Shipping Weight	VA2440:	2 lb. (.91 kg)	
	VA2445:	2.25 lb. (1.02 kg)	

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