EK-CMIV1-RM-005

Networks . Communications

Communications Options Minireference Manual

Volume 1 **General Information and Communications Options**

DIGITAL INTERNAL USE ONLY

Digital Equipment Corporation

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- Class A Computing Devices:

Notice: This equipment generates, uses, and may emit radio frequency energy. The equipment has been type tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such radio frequency interference when operated in a commercial environment. Operation of this equipment in a residential area may cause interference in which case the user at his own expense may be required to take measures to correct the interference.

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	Professional	VMS
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		Work Processor

CHAPTER 1
INTRODUCTION

The Communications Options Minireference series of manuals provide Field Service personnel (trained in Digital Equipment Corporation's communications options, DEC modem products, and Ethernet products) with easy-to-use references that focus on essential installation and maintenance procedures.

This series of manuals is a replacement for and supersedes the *Communications Options Minireference Manual* (EK-CMINI-RM). All of the information contained in the *Communications Options Minireference Manual* is included. Information concerning most of Digital Equipment Corporation's new communication options, modem products, and Ethernet products has also been included. These manuals will be updated as new communications options, modem products, and Ethernet products are produced.

To effectively use these reference manuals and to quickly locate the desired information, it is important that the user be aware of the organization and content of the various manuals.

- Volume 1 contains generic communications information such as: cables, test connectors and terminators, special test programs, and special tools and equipment. Volume 1 also contains information concerning installation and maintenance of some of the communications options.
- Volume 2 contains only communications options. Communications options are presented in alphanumerical order beginning in Volume 1 and continuing into Volume 2.
- Volumes 3 and 4 contain information concerning Digital Equipment Corporation's modem products.
- Volumes 5, 6, and 7 contain information concerning installation and maintenance of Ethernet products. Chapters include Ethernet Devices, Cables, Special Tools and Test Equipment, Network Troubleshooting, and Ethernet Configuration. Provisions are made for adding information as it becomes available.

Option-specific data is located alphanumerically by option designation.

CHAPTER 2
FLOATING DEVICE ADDRESSES AND VECTORS AND DIAGNOSTIC SUMMARY CHARTS

2.1 FLOATING DEVICE ADDRESSES

UNIBUS addresses 760010 (160010) through 763776 (163776) are designated as floating device addresses (see the following figure). These are used as register addresses for communications devices and other devices interfacing with the PDP-11, LSI-11, and VAX-11 systems.

NOTE

Some devices are not supported by LSI-11 and VAX-11 systems; however, the same scheme applies (that is, gaps are provided as appropriate). The convention for assigning these addresses is as follows:

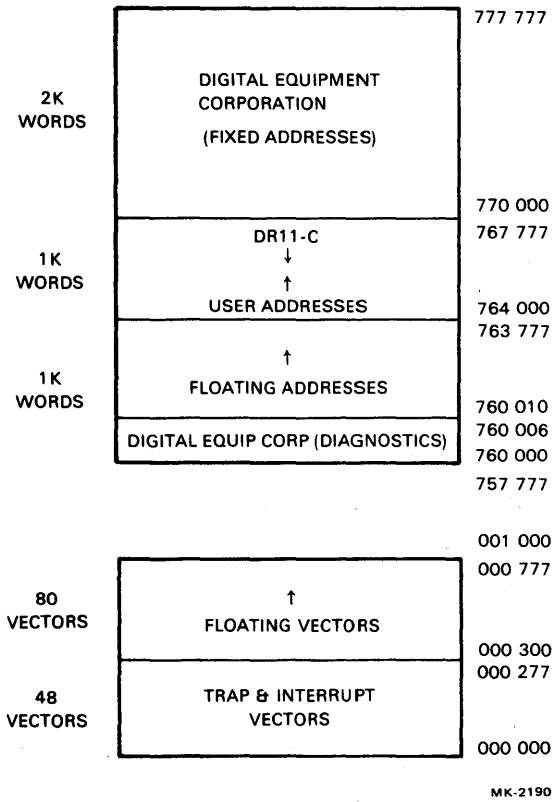


Figure 2-1 Floating Device Addresses

A gap of 10_8 must be left between the last address of one device type and the first address of the next device type. The first address of the next device type must start on a module 10_8 boundary. The gap of 10_8 must also be left for devices that are not installed but are skipped over in the priority ranking list. Multiple devices of the same type must be assigned contiguous addresses. Reassignment of device types already in the system may be required to make room for additional ones.

Table 2-1 Floating CSR Address Devices

Rank	UNIBUS Option	LSI-11 Option	Decimal Size	Octal Modulus
1	DJ11		4	10
2	DH11		8	20
3	DQ11		4	10
4	DU11	DUV11	4	10
5	DUP11		4	10
6	LK11A		4	10
7	DMC11/DMR11*		4	10
8	DZ11†	DZV11	4	10 (DZ11 Before DZ32)
	DZ32, DZS11	DZQ11		
9	KMC11		4	10
10	LPP11		4	10
11	VMV21		4	10
12	VMV31		8	20
13	DWR70		4	10
14	RL11	RLV11	4	10‡
15	LPA11-K		8	20‡
16	KW11-C		4	10
17	Reserved		4	10
18	RX11/RX211	RXV11	4	10‡
		RXV211		
19	DR11-W		4	10
20	DR11-B		4	10**
21	DMP11		4	10
22		DPV11	4	10
23	ISB11		4	10
24		DMV11	8	20
25	DEUNA		4	10
26	UDA50		2	4
27	DMF32		16	40
28	KMS11 (DMS)		6	20
29	VS100		8	20
30	TU81		2	4
31	KMV11		8	20
32	DHU11	DHV11/DHQ11	8	20
33	DMZ32		16	40
34	CPI32		16	40
35		DSV11	4	10

* DMC11 before DMR11.
** After second device.
† DZ11E and DZ11F are dual DZ11 options and are treated by the algorithm as two DZ11s.
‡ Extra devices only.

2.2 FLOATING VECTOR ADDRESSES

Vector addresses 300 through 777 are designated as floating vectors. They are used for communications and other devices that interface with the PDP-11, LSI-11, and VAX-11 systems. The LSI-11 floating vector area is limited to a starting address of 300 through 376. The area from 400 to 450 is reserved for LSI-11 devices ADV11-A, IBV11-A, and KWV11-A with additional space available from 450 to 777.

NOTE

Some devices are not supported by LSI-11 and VAX-11 systems; however, the same scheme applies. Vector size is detemined by the device type.

There are no gaps in floating vectors unless required by physical hardware restrictions (in data communications devices, the receive vector must be on a zero boundary and the transmit vector must be on a 4_8 boundary).

Multiple devices of the same type would be assigned vectors sequentially. Table 2-2 shows the assignment sequence.

Table 2-2 Floating Interrupt Vector Devices

Rank	UNIBUS Option	LSI-11 Bus Option	Decimal Size	Octal Modulus
1	DC11		4	10
1	TU58**		4	10
2	KL11 (extra)		4	10*
2	DL11-A (extra)	DLV11-F	4	10*
2	DL11-B (extra)		4	10
2		DLV11-J	16	10
3	DP11		4	10
4	DM11-A		4	10*
5	DN11		2	4
6	DM11-BB/BA		2	4
7	DH11 modem control		2	4
8	DR11-A	DRV11-B	4	10*
9	DR11-C	DRV11	4	10*
10	PA611 (reader)		8	10*
10	PA611 (punch)		8	10*
11	LPD11		4	10
12	DT07		4	10*
13	DX11		4	10*
14	DL11-C		4	10*
14	DL11-D		4	10*
14	DL11-E	DLV11-E	4	10*
15	DJ11		4	10*

* The vector for the device of this type must always be on a 10_8 boundary.

** There is no standard configuration for systems with both DC11 and TU58.

Table 2-2 Floating Interrupt Vector Devices (Cont)

Rank	UNIBUS Option	LSI-11 Option	Decimal Size	Octal Modulus
16	DH11		4	10†
17	GT40		8	10
17	VSV11		8	10
18	LPS11		12	10*
19	DQ11		4	10†
20	KW11-W	KWV11	4	10
21	DU11	DUV11	4	10*
22	DUP11		4	10*
23	DV11		4	10*
23	DV modem control		6	10
24	LK11-A		4	10
25	DWUN		4	10
26	DMC11/DMR11		4	10*
27	DZ11	DZV11	4	10*
	DZS11	DZQ11		‡
	DZ32			
28	KMC11		4	10
29	LPP11		4	10
30	VMV21		4	10
31	VMV31		4	10
32	VTV01		4	10
33	DWR70		4	10*
34	RL11	RLV11	2	4**
35	TS11, TU80		2	4**
36	LPA11-K		4	10
37	IP11/IP300		2	4
38	KW11-C		4	10
39	RX11/RX211	RXV11	2	4**
		RXV211		
40	DR11-W		2	4
41	DR11-B		2	4**
42	DMP11		4	10
43		DPV11	4	10
44	ML11		2	4#
45	ISB11		4	10
46		DMV11	4	10
47	DEUNA		2	4**
48	UDA50		2	4**

* The vector for the device of this type must always be on a 10_8 boundary.
** After the first.
† These devices can have either an M7820 or M7821 interrupt control module. However, it should always be on a 10_8 boundary.
‡ DZ11 before DZ32
\# MASSBUS device.

Table 2-2 Floating Interrupt Vector Devices (Cont)

Rank	UNIBUS Option	LSI-11 Option	Decimal Size	Octal Modulus
49	DMF32		16	4
50	KMS11		6	10
51	PCL11-13		4	10
52	VS100		2	4
53	TU81		2	4
54	KMV11		4	10
55	KCT32		4	10
56	IEX		4	10
57	DHU11	DHQ11/DHV11	4	10
58	DMZ32		12	4
59	CPI32		12	4
60		DSV11	2	4

Table 2-3 Link Test/DEC/X11 Diagnostic Index

Device Option	DCLT PDP-11	DCLT VAX-11	ITEP Overlay	DEC/X11
DH11	N/A	N/A	DZDHL	CXDHA
DHU11	N/A	N/A	N/A	CXDU
DHV11	N/A	N/A	N/A	CXDHV
DL11-E	N/A	N/A	N/A	CXDLA
DL11-W	N/A	N/A	N/A	CXDLA
DLV11	N/A	N/A	N/A	CXDLA
DMC11	CZCLK	EVDMC	DZDMO	CXDMC
DMF32	NONE	EVDLF	NONE	NONE
DMP11	CZCLM	EVDMD	N/A	CXDMD, CMDME
DMR11	CZCLK	EVDMC	DZDMO	CXDMR
DMV11	CZCLM	N/A	N/A	CXDMD, CXDME
DMZ32	NONE	NONE	NONE	NONE
DPV11	CZCLH	N/A	N/A	CXDPV
DQ11	N/A	N/A	DZDQO	CXDQA
DU11	N/A	N/A	DZDUO	CXDUA
DUP11	CZDCL	N/A	DZDPF	CXDPB
DUV11	N/A	N/A	N/A	N/A
DV11	N/A	N/A	DZDVO	CXDVA
DZ11	N/A	N/A	DZDZB	CXDZA
DZ11-X	N/A	N/A	DZDZB	CXDZA
DZ32	N/A	N/A	N/A	N/A
DZQ11	N/A	N/A	DVDZD	CXDZB
DZV11	N/A	N/A	DVDZD	CXDZB

N/A = Not available

Table 2-4 General Purpose/Functional Diagnostic Index

Option	PDP-11 Systems	VAX-11 Systems	Level
DH11	CZDHM,CZDHN,DZDHK	None	
DHU11	CZDHU,CZDHV,CZDHW	EVDAH	2R
	CZDHX	EVDAI	3
DHV11	CVDHA,CVDHB,CVDHC	NONE	
DL11-E	DZDLA	NONE	
DL11-W	DZDLA,DZDLD	NONE	
DLV11	DVDVA,DVDVC	NONE	
DMC11	CZDMC	EVDXA	3
	CZDME	EVDBA	3
	CZDMH	EVDBB	3
		EVDCA	2R
		EVDMC	2
DMF32	NONE	EVDLA	2R
		EVDLB	3
		EVDLC	3
		EVDLD	3
DMP11	CZDMP	EVDXA	3
	CZDMT	EVDMA	3
		EVDMB	2R
DMR11	CZDMP.	EVDXA	3
	CZDMS	EVDCA	2R
	CZDMI	EVDMC	2
		EVDMA	3
DMV11	CVDMA,CVDME,CVDMT	NONE	
DMZ32	NONE	EVDAE	3
		EVDAF	2R
DPV11	CVDPV	NONE	
DQ11	DZDQA,DZDQF	NONE	
DU11	DZDUA,DZDUF	NONE	
DUP11	DZDPB	EVDCA	2R
	DZDPF	EVDUP	3
		EVDUQ	3
DUV11	DZDUQ-DZDUV	NONE	
DV11	DZDVA	EVDEA	2
	DZDVF	EVDEB	3
		EVDEC	3
		EVDED	3
		EVDEE	3
		EVDEF	3
		EVDEG	3
DZ11,	DZDZA	EVDAA	3
DZ11-X		EVTAA	2R
		EVTBA	2R
DZ32	NONE	EVDAB	3
DZQ11	DVDZA,DVDZB,DVDZC	NONE	2R
DZV11	DVDZA,DVDZB,DVDZC	NONE	

CHAPTER 3
CABLES

3.1 CABLES

This chapter contains a line drawing of each cable needed to configure any of the device options contained in Volumes 1 and 2 of this manual.

Table 3-1 can be used to quickly identify which cables are used with each option.

Cables are placed in alphanumeric order for speedy reference.

Table 3-1 Communication Options Cables

CABLES	OPTIONS	DH11	DHU11	DHV11	DL11E	DL11W	DLV11	DMC11	DMF32	DMP11	DMR11	DMV11	DZV11	DZQ11	DHQ11		
BC01R-XX		X															
BC03M-XX								X									
BC03N-XX								X									
BC05C-XX		X			X	X	X	X									
BC05D-XX		X								X	X	X					
BC05L-XX			X	X									X	X	X		
BC05M-XX							X										
BC05Z-XX								X		X	X	X					
BC06R-XX									X								
BC08R-XX		X															
BC08S-XX		X						X		X	X	X					
BC17E										X		X					
BC55A-XX										X	X	X					
BC55B-XX										X	X	X					
BC55C-XX										X	X	X					
BC55D-XX										X	X	X					
BC55F												X					
BC55H												X					
BC55J										X							
BC55M-XX								X		X	X	X					
BC55N-XX								X		X	X	X					
BC55R-XX										X	X						
7008360					X	X											
7008519					X	X											
BC16C				X											X		
70-18250												X					
70-20861												X					

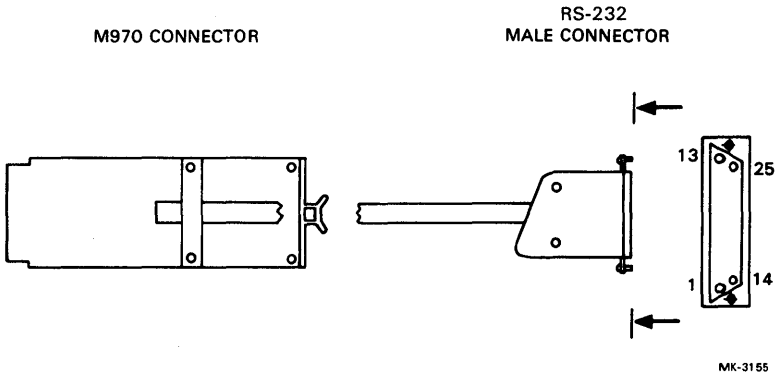
MKV87-1300

Table 3-1 Communication Options Cables (Cont)

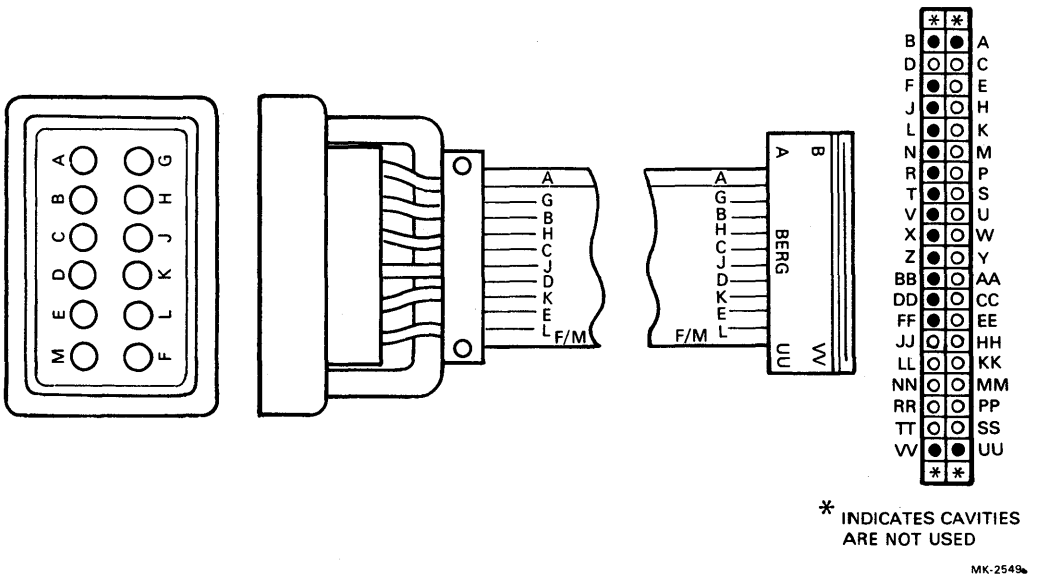
CABLES / OPTIONS	DMZ32	DPV11	DQ11	DU11	DUP11	DUV11	DV11	DZ11	DZ11-X	DZ32	DZV11	DZQ11	DMB32	DSV11		
BC01R-XX			X													
BC01W-XX			X	X												
BC02C-XX					X											
BC02D-XX					X											
BC03M-XX								X		X						
BC03P-XX								X								
BC04R-XX								X								
BC05C-XX		X	X	X	X	X										
BC05D-XX							X	X		X						
BC05W-XX								X		X						
BC06K-XX								X								
BC06L-XX								X		X						
BC08R-XX							X									
BC08S-XX			X		X		X	X								
BC11U-XX											X	X				
BC18L-XX	X															
BC18M-XX	X															
BC20R-XX									X							
BC20S-XX									X							
BC22N-XX	X															
BC26L-XX		X														
7016428									X							
7018209		X														
70-18194						X										
BC19B												X	X			
BC19D												X	X			
BC19E												X	X			
BC19F												X	X			
17-00740-XX												X				

MKV87-1301

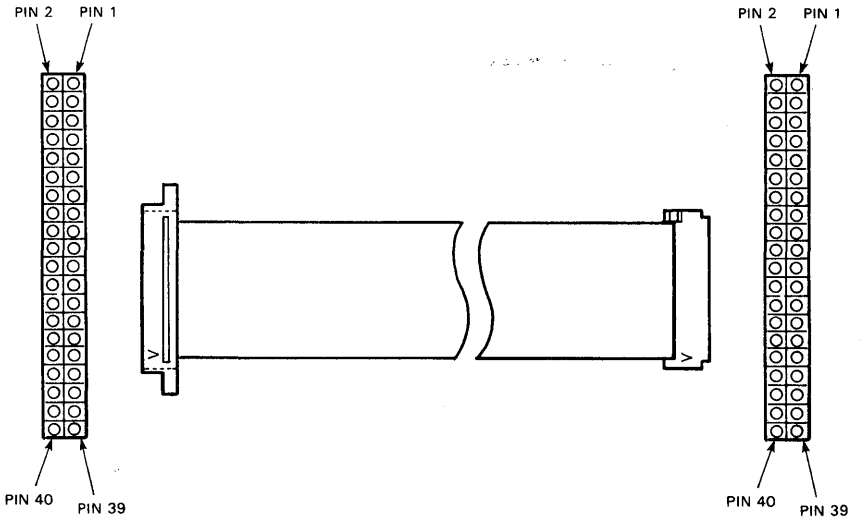
BC01R


M970 CONNECTOR
RS-232
MALE CONNECTOR
13
25
1
14
MK-3155

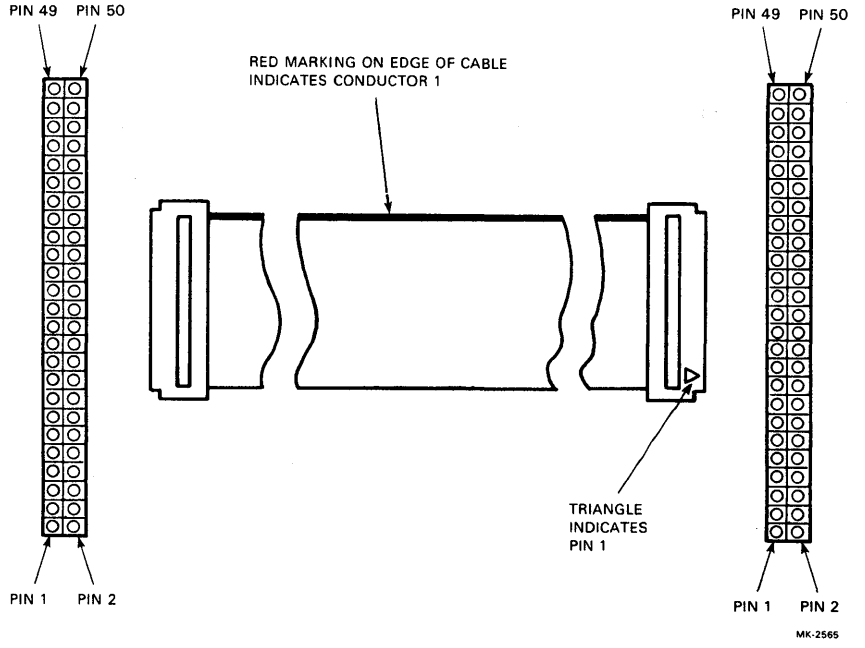
BC01W


M E D C B A
F L K J H G
A G B H C J D K E L F/M
A G B H C J D K E F/M L
A B
BERG
UU VV
B A
D C
F E
J H
L K
N M
R P
T S
V U
X W
Z Y
BB AA
DD CC
FF EE
JJ HH
LL KK
NN MM
RR PP
TT SS
VV UU
* INDICATES CAVITIES ARE NOT USED
MK-2549

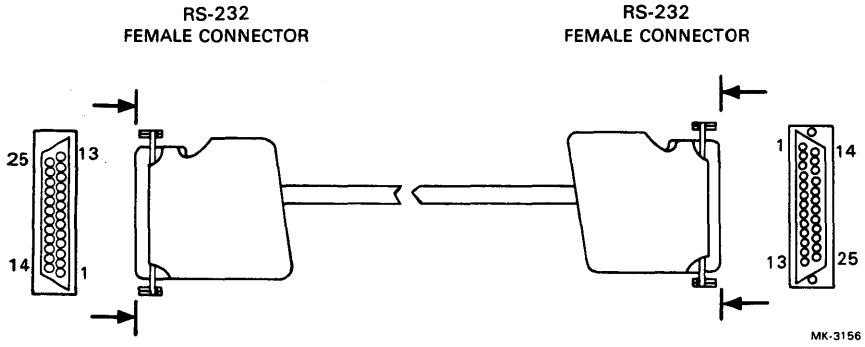
BC02C


PIN 2
PIN 1
PIN 40
PIN 39
PIN 2
PIN 1
PIN 40
PIN 39
MK-2554

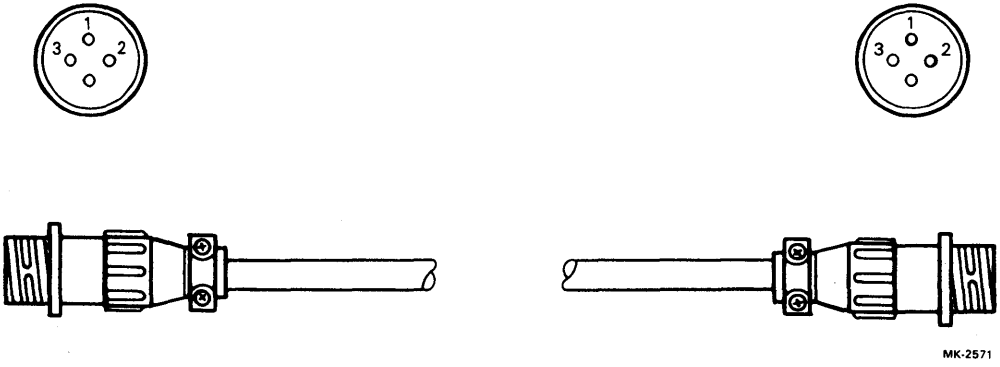
BC02D


PIN 49
PIN 50
RED MARKING ON EDGE OF CABLE
INDICATES CONDUCTOR 1
TRIANGLE
INDICATES
PIN 1
PIN 1
PIN 2
PIN 49
PIN 50
PIN 1
PIN 2
MK-2565

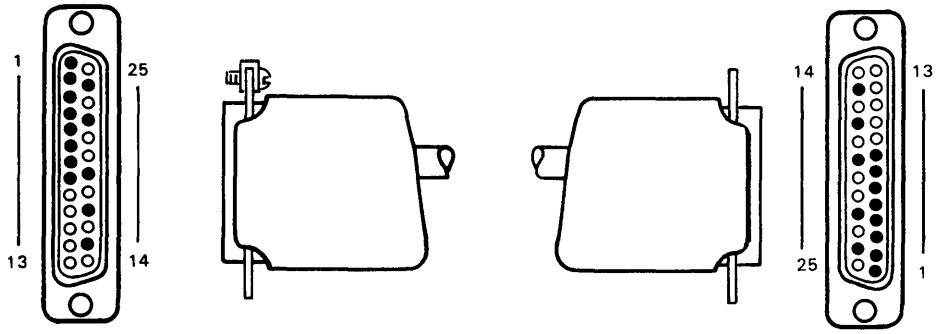
BC03M


RS-232
FEMALE CONNECTOR
RS-232
FEMALE CONNECTOR
25
13
14
1
1
14
13
25
MK-3156

BC03N

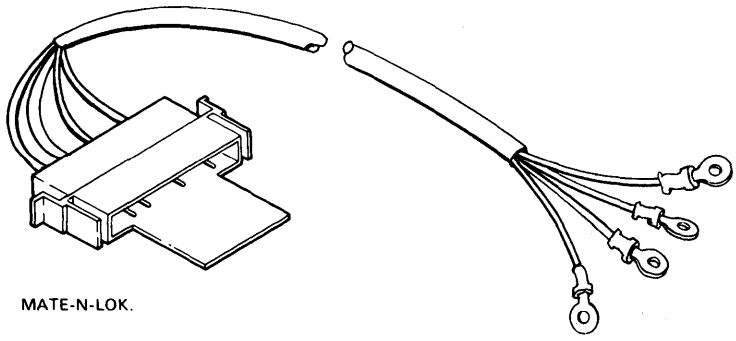

1
3
2
1
3
2
MK-2571

BC03P



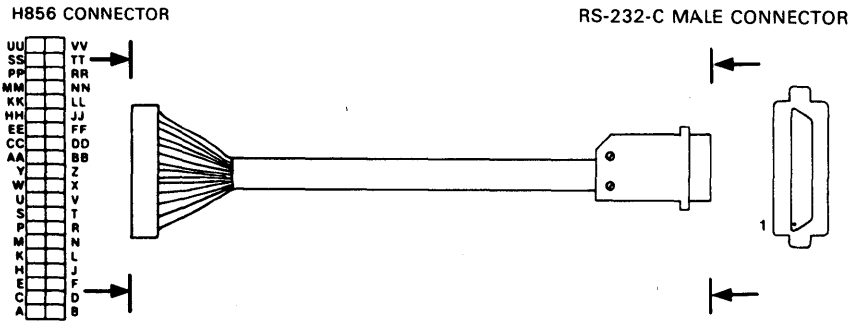
MK-2555

BC04R



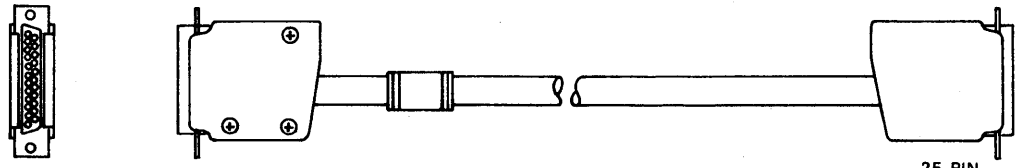
MK-2842

BC05C

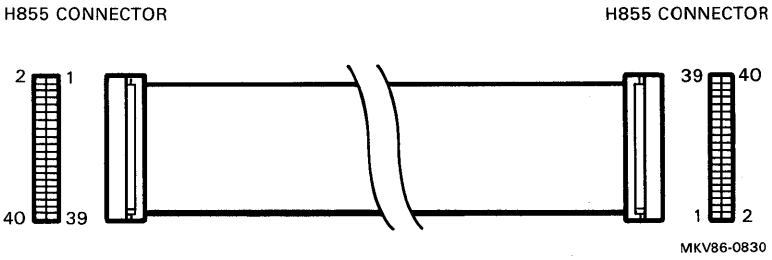


MKV84-1617

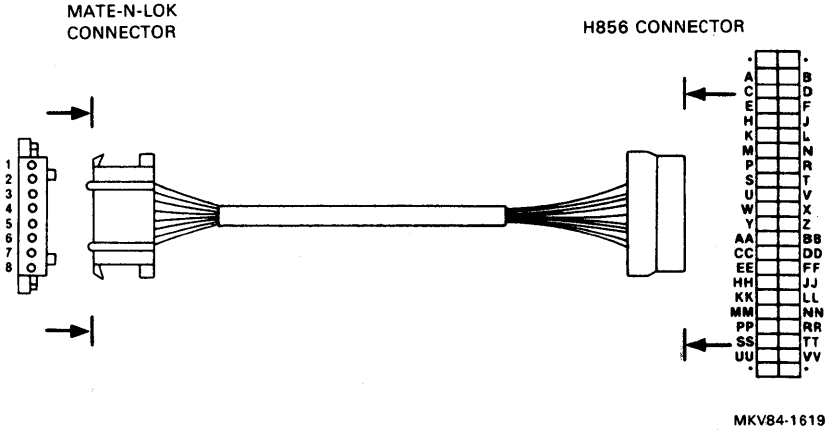
BC05D



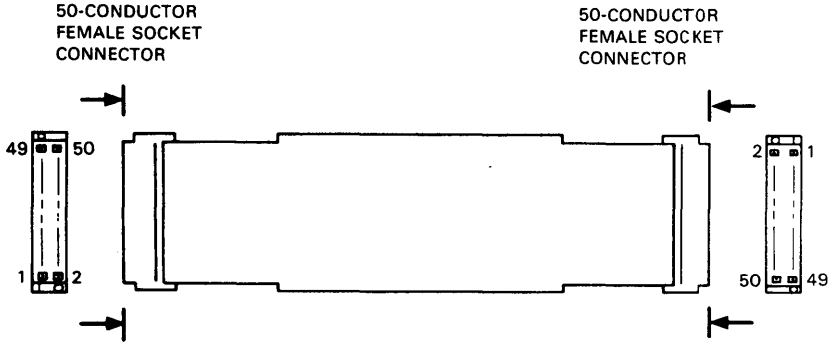
BC05L



BC05M

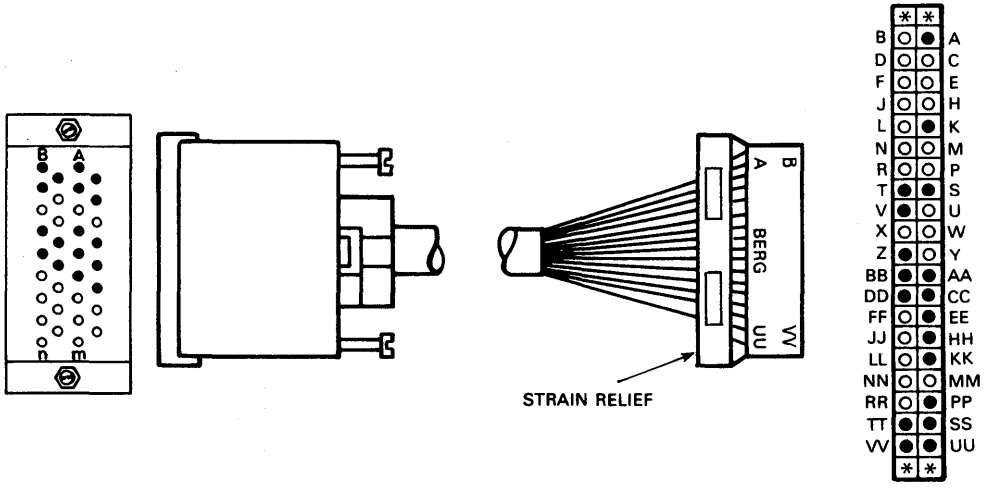


BC05W



MKV84-1620

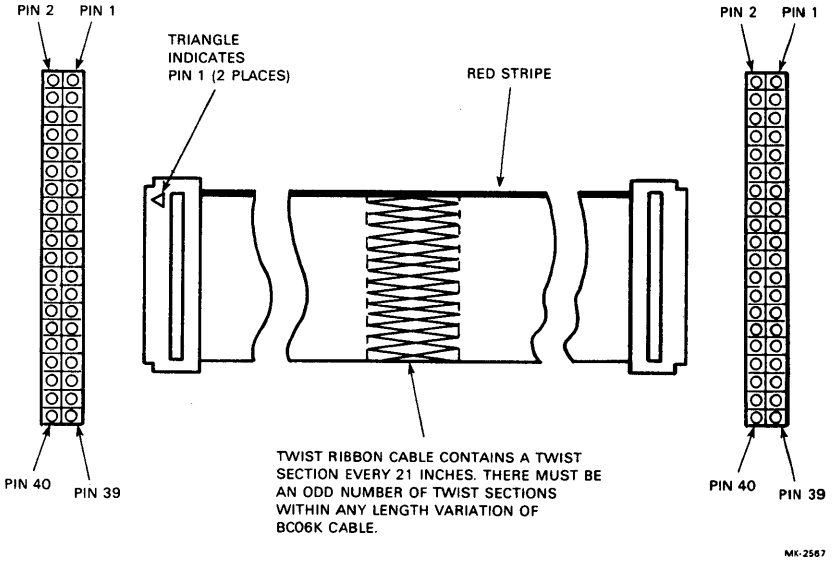
BC05Z



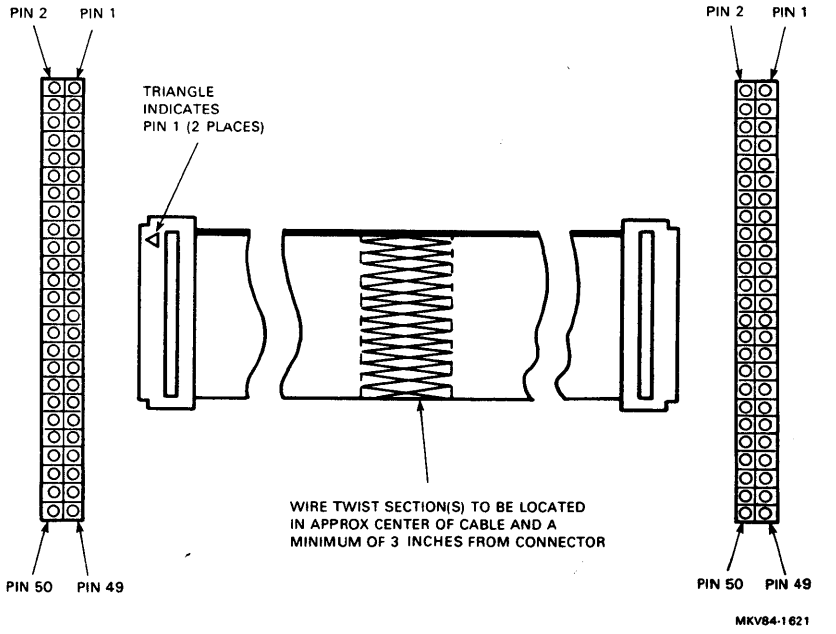
* INDICATES CAVITIES USED TO MOUNT STRAIN RELIEF

MK-2550

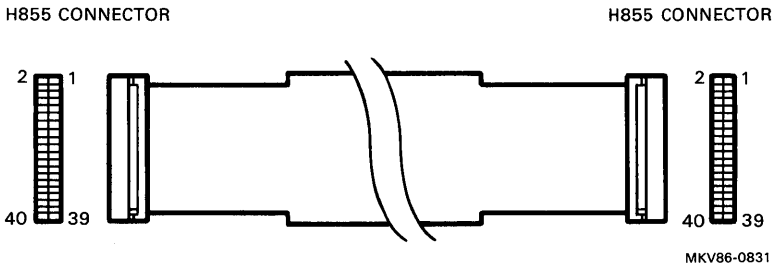
BC06K


PIN 2
PIN 1
TRIANGLE INDICATES PIN 1 (2 PLACES)
RED STRIPE
PIN 2
PIN 1
PIN 40
PIN 39
TWIST RIBBON CABLE CONTAINS A TWIST SECTION EVERY 21 INCHES. THERE MUST BE AN ODD NUMBER OF TWIST SECTIONS WITHIN ANY LENGTH VARIATION OF BC06K CABLE.
PIN 40
PIN 39
MK-2567

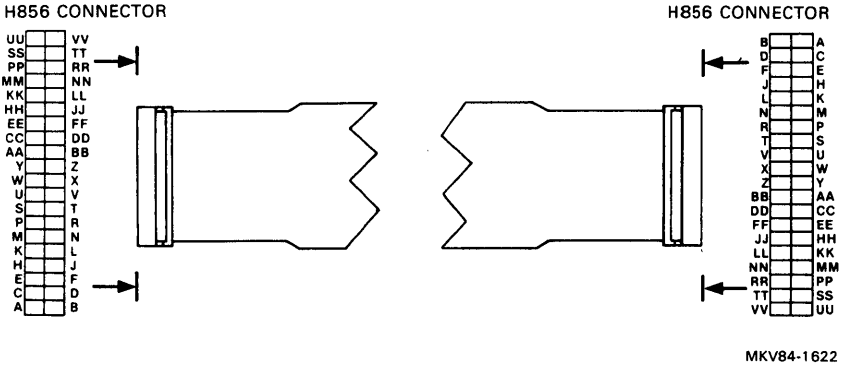
BC06L


PIN 2
PIN 1
TRIANGLE INDICATES PIN 1 (2 PLACES)
PIN 2
PIN 1
WIRE TWIST SECTION(S) TO BE LOCATED IN APPROX CENTER OF CABLE AND A MINIMUM OF 3 INCHES FROM CONNECTOR
PIN 50
PIN 49
PIN 50
PIN 49
MKV84-1621

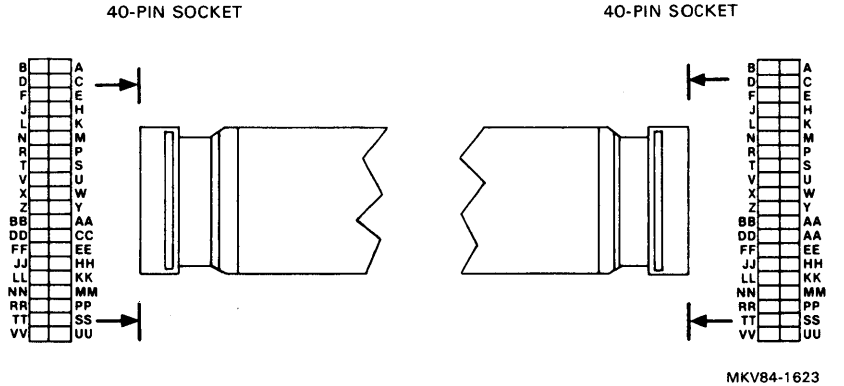
BC06R



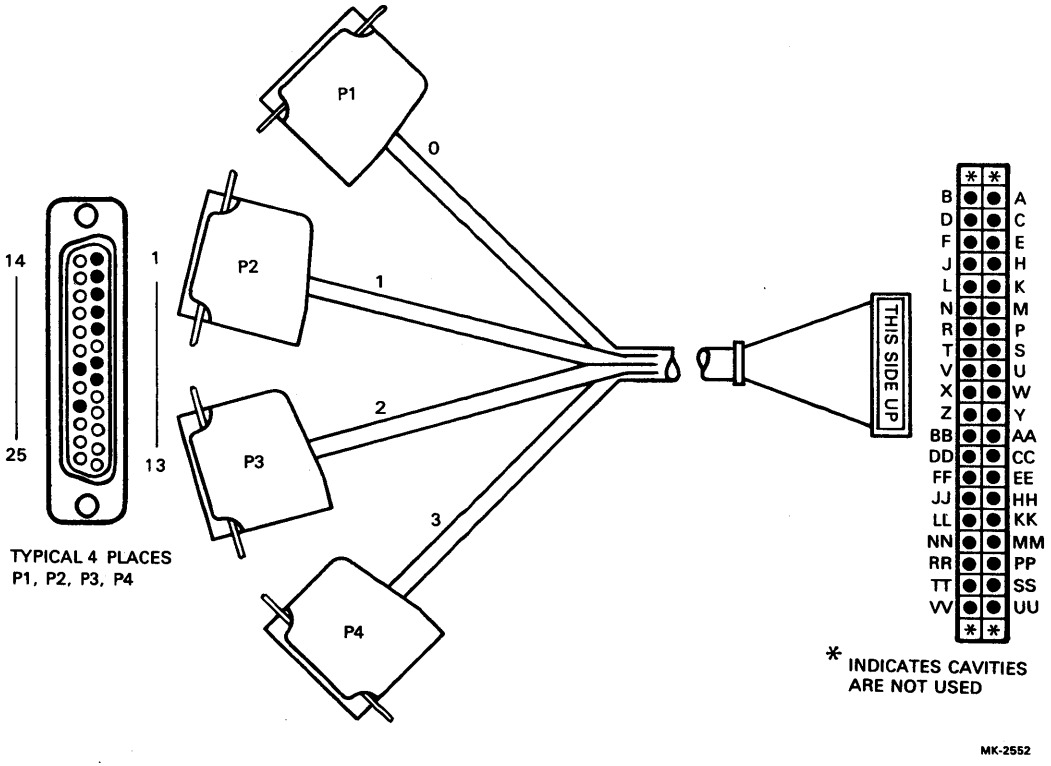
BC08R



BC08S

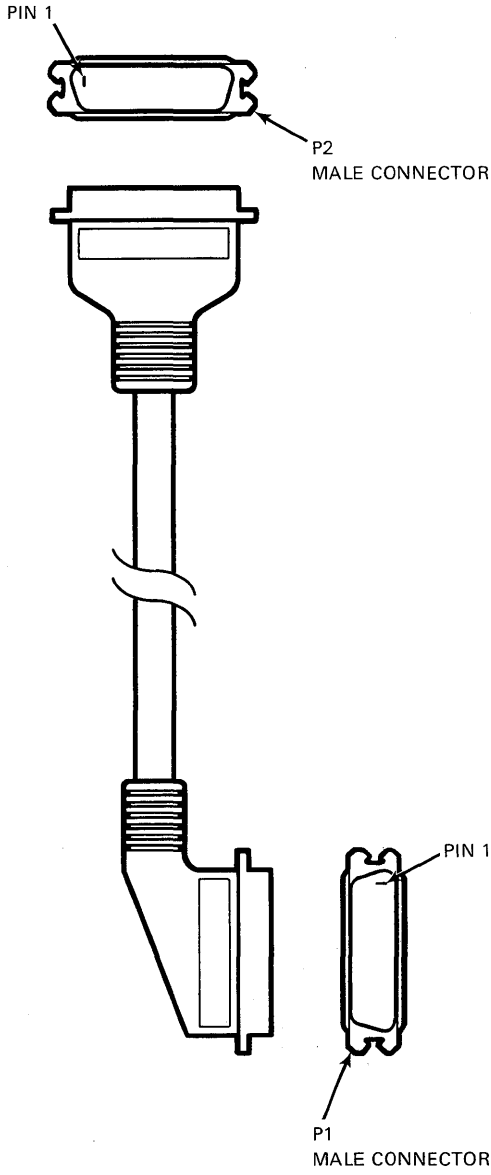


BC11U


P1
P2
P3
P4
0
1
2
3
14
25
1
13
TYPICAL 4 PLACES
P1, P2, P3, P4
THIS SIDE UP
B A
D C
F E
J H
L K
N M
R P
T S
V U
X W
Z Y
BB AA
DD CC
FF EE
JJ HH
LL KK
NN MM
RR PP
TT SS
VV UU
* INDICATES CAVITIES
ARE NOT USED
MK-2552

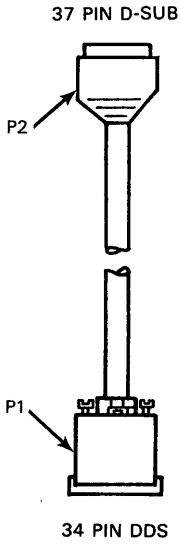
BC16C

FROM CONN	TO CONN
P1-1	P2-1
P1-19	P2-19
P1-2	P2-2
P1-20	P2-20
P1-3	P2-3
P1-21	P2-21
P1-4	P2-4
P1-22	P2-22
P1-5	P2-5
P1-23	P2-23
P1-6	P2-6
P1-24	P2-24
P1-7	P2-7
P1-25	P2-25
P1-8	P2-8
P1-26	P2-26
P1-9	P2-9
P1-27	P2-27
P1-10	P2-10
P1-28	P2-28
P1-11	P2-11
P1-29	P2-29
P1-12	P2-12
P1-30	P2-30
P1-13	P2-13
P1-31	P2-31
P1-14	P2-14
P1-32	P2-32
P1-15	P2-15
P1-33	P2-33
P1-16	P2-16
P1-34	P2-34
P1-17	P2-17
P1-35	P2-35
P1-18	P2-18
P1-36	P2-36



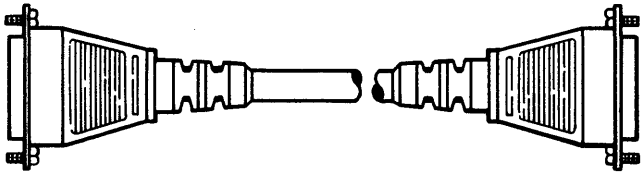
BC17E

FROM CONN	TO CONN
P1-V	P2-8
P1-X	P2-26
P1-R	P2-6
P1-T	P2-24
P1-Y	P2-5
P1-A	P2-23
P1-P	P2-4
P1-S	P2-22
P1-U	P2-17
P1-W	P2-35
P1-D	P2-9
P1-B	P2-19
P1-C	P2-7
P1-B	P2-19
P1-F	P2-13
P1-B	P2-19
P1-E	P2-11
P1-B	P2-19
P1-J	P2-15
P1-B	P2-19
P1-H	P2-12
P1-B	P2-19
P1-K	P2-10
P1-B	P2-19
P1-A	P2-1
P1-A	P2-1
P1-B	P2-19



MKV86-0827

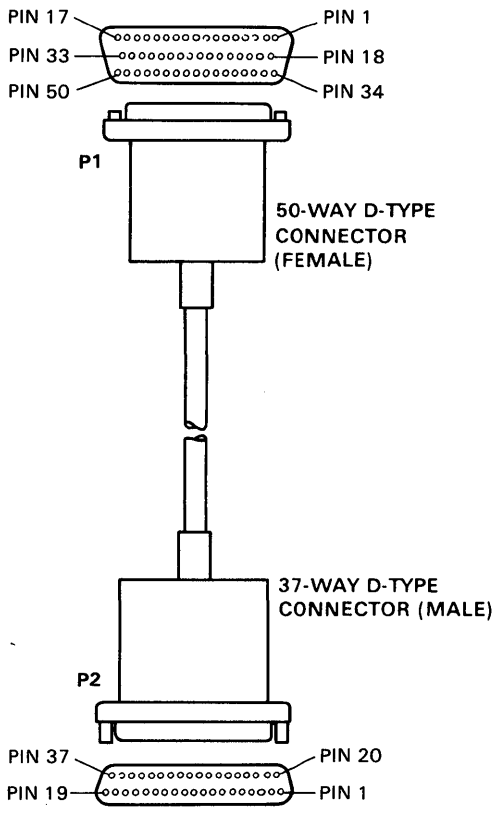
BC18L/M



MKV84-0787

BC19B

50-WAY PINS	SIGNAL NAME	37-WAY PINS
1	CODE GROUND	*
2	CODE 0	
3	CODE 1	
4	CODE 2	*
5	CODE 3	
6	TX DATA (A)	4
7	TX DATA (B)	22
9	RTS/C (A)	7
10	RTS/C (B)	25
11	RX DATA (A)	6
12	RX DATA (B)	24
13	LOCAL LOOP	10
15	TEST 1	18
16	REM.LOOP	14
17	R1	15
18	RX CLOCK (A)	8
19	RX CLOCK (B)	26
20	TX CLOCK (A)	5
21	TX CLOCK (B)	23
34	DSR (A)	11
35	DSR (B)	29
37	DCD/I (A)	13
38	DCD/I (B)	31
39	CTS (A)	9
40	CTS (B)	27
41	DCE GROUND	20
44	DTE GROUND	19, 37
45	DTR (A)	12
46	DTR (B)	30
47	CLOCK (A)	17
48	CLOCK (B)	35
50	SPEED	16



* – CONNECTED TOGETHER

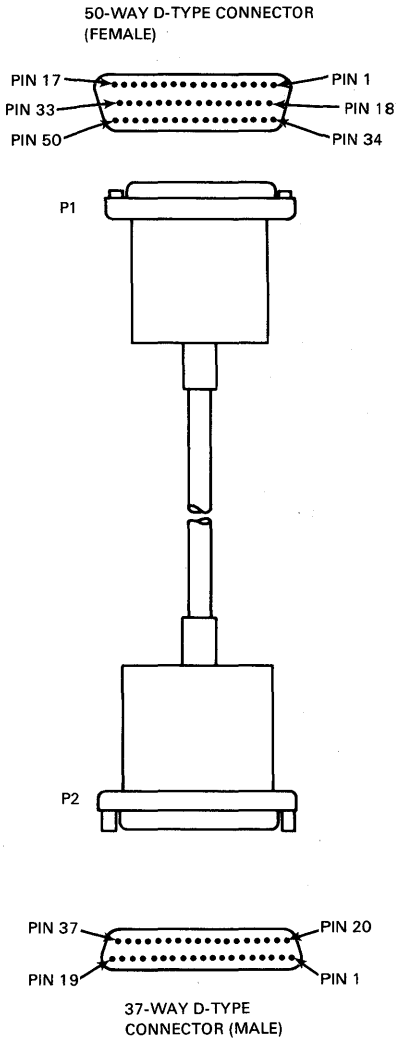
(A),(B) – WIRES A AND B OF A TWISTED PAIR

MKV87-1298

BC19B-02

FROM CONNECTION (P1)	TO CONNECTION (P2)
P1–1,4 (SEE NOTE 1)	
P1–6 P1–7	P2–4 P2–22
P1–9 P1–10	P2–7 P2–25
P1–11 P1–12 (SEE NOTE 2)	P2–6 P–24
P1–13	P2–10
P1–14	P2–2
P1–15	P2–18
P1–16	P2–14
P1–17	P2–15
P1–18 P1–19 (SEE NOTE 2)	P2–8 P2–26
P1–20 P1–21 (SEE NOTE 2)	P2–5 P2–23
P1–34 P1–35	P2–11 P2–29
P1–37 P1–38	P2–13 P2–31
P1–39 P1–40	P2–9 P2–27
P1–41	P2–20
P1–44	P2–19, 37
P1–45 P1–46	P2–12 P2–30
P1–47 P1–48	P2–17 P2–35
P1–50	P2–16
P1–SHELL	P2–SHELL

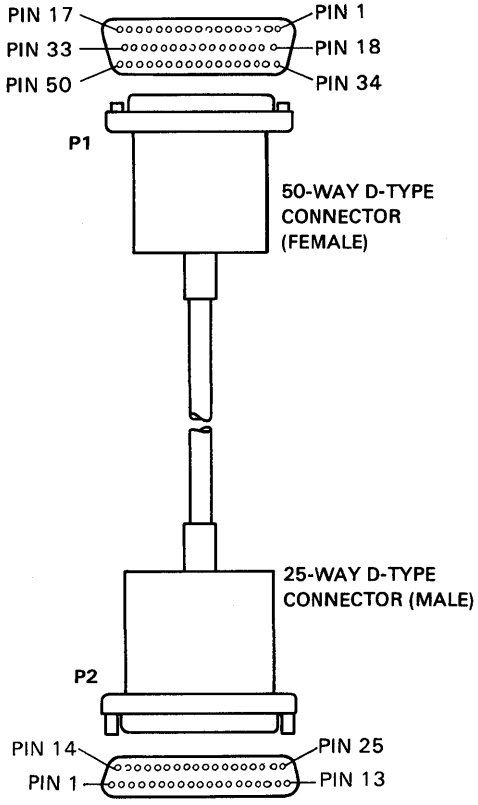
NOTES
1. CONTACTS TIED TOGETHER
2. 120 OHM RESISTER, 1/2W, BETWEEN PINS 11 AND 12, 18 AND 19, 20 AND 21.



MKV87-1059

BC19D

50-WAY PINS	SIGNAL NAME	25-WAY PINS
1	CODE GROUND	*
2	CODE 0	
3	CODE 1	*
4	CODE 2	
5	CODE 3	
8	TX DATA	2
11	RX DATA (A)	3
12	RX DATA (B)	#
13	LOCAL LOOP	18
15	TEST 1	25
16	REM.LOOP	21
17	RI	22
18	RX CLOCK (A)	17
19	RX CLOCK (B)	#
20	TX CLOCK (A)	15
21	TX CLOCK (B)	#
22	CLOCK	24
33	DTR	20
34	DSR (A)	6
35	DSR (B)	#
36	RTS	4
37	DCD/I (A)	8
38	DCD/I (B)	#
39	CTS (A)	5
40	CTS (B)	#
41	DCE GROUND	#
44	DTE GROUND	7,#
50	SPEED	23



* – CONNECTED TOGETHER

– CONNECTED TO DCE GROUND

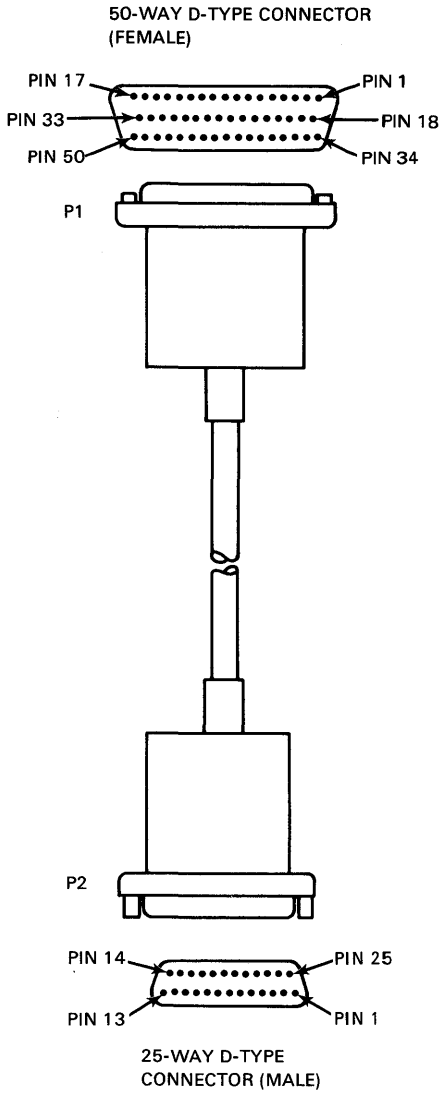
(A),(B) – WIRES A AND B OF A TWISTED PAIR

MKV87-1296

BC19D-02

FROM CONNECTION (P1)	TO CONNECTION (P2)
P1–13 (SEE NOTE)	
P1–8	P2–2
P1–11	P2–3
P1–13	P2–18
P1–15	P2–25
P1–16	P2–21
P1–17	P2–22
P1–18	P2–17
P1–20	P2–15
P1–22	P2–24
P1–33	P2–20
P1–34	P2–6
P1–36	P2–4
P1–37	P2–8
P1–39	P2–5
P1–41, 12, 19, 21, 35, 38, 40, 44 (SEE NOTE)	P2–7
P1–50	P2–23
P1–SHELL	P2–SHELL

NOTE: CONTACTS TIED TOGETHER



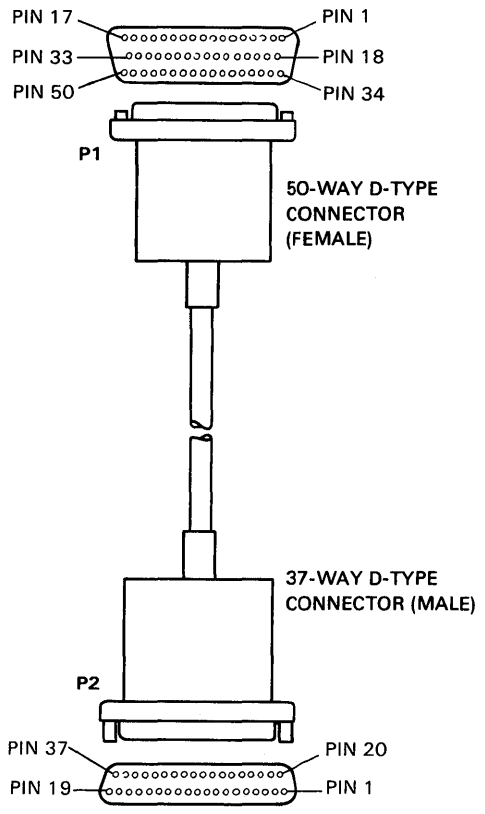
MKV87-1061

BC19E

50-WAY PINS	SIGNAL NAME	37-WAY PINS
1	CODE GROUND	*
2	CODE 0	
3	CODE 1	*
4	CODE 2	
5	CODE 3	
8	TX DATA	4
11	RX DATA (A)	6
12	RX DATA (B)	24
13	LOCAL LOOP	10
15	TEST 1	18
16	REM.LOOP	14
17	RI	15
18	RX CLOCK (A)	8
19	RX CLOCK (B)	26
20	TX CLOCK (A)	5
21	TX CLOCK (B)	23
22	CLOCK	17
33	DTR	12
34	DSR (A)	11
35	DSR (B)	29
36	RTS	7
37	DCD/I (A)	23
38	DCD/I (B)	32
39	CTS (A)	9
40	CTS (B)	27
41	DCE GROUND	20
44	DTE GROUND	19, 22, 25, 30, 35, 37
50	SPEED	16

* – CONNECTED TOGETHER

(A), (B) – WIRES A AND B OF A TWISTED PAIR

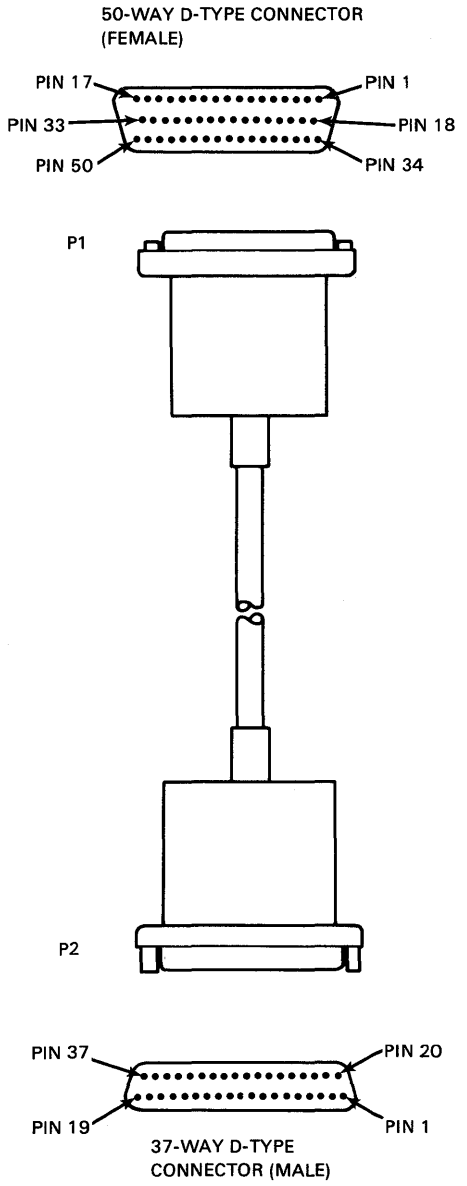


MKV87-1299

BC19E-02

FROM CONNECTION (P1)	TO CONNECTION (P2)
P1–1, 3 (SEE NOTE)	
P1–8	P2–4
P1–11 P1–12	P2–6 P2–24
P1–13	P2–10
P1–14	P2–2
P1–15	P2–18
P1–16	P2–14
P1–17	P2–15
P1–18 P1–19	P2–8 P2–26
P1–20 P1–21	P2–5 P2–23
P1–22	P2–17
P1–33	P2–12
P1–34 P1–35	P2–11 P2–29
P1–36	P2–7
P1–37 P1–38	P2–13 P2–31
P1–39 P1–40	P2–9 P2–27
P1–41	P2–20
P1–44	P2–19, 22, 25 30, 35, 37 (SEE NOTE)
P1–50	P2–16
P1–SHELL	P2–SHELL

NOTE: CONTACTS TIED TOGETHER



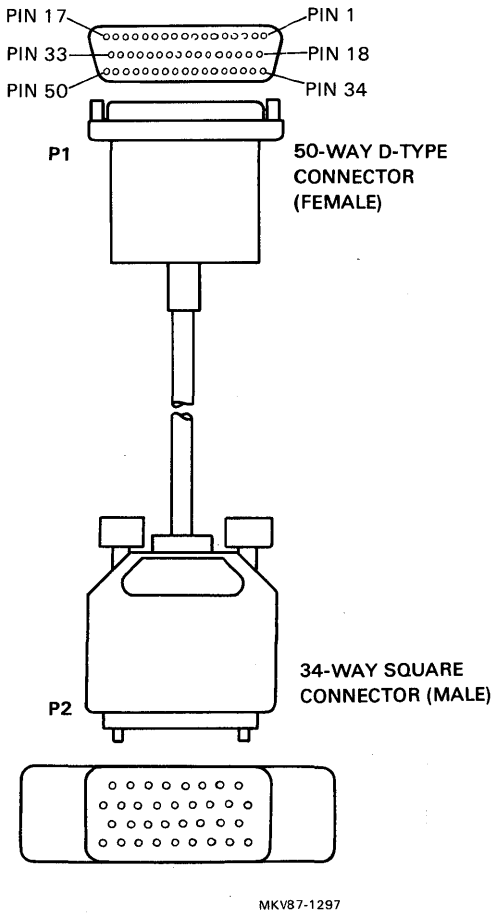
MKV87-1060

50-WAY PINS	SIGNAL NAME	34-WAY PINS
1	CODE GROUND	*
2	CODE 0	*
3	CODE 1	
4	CODE 2	
5	CODE 3	
17	RI	J
23	V.35 TX CLOCK (A)	Y
24	V.35 TX CLOCK (B)	a
25	V.35 CLOCK (A)	U
26	V.35 CLOCK (B)	W
27	V.35 RX DATA (A)	R
28	V.35 RX DATA (B)	T
29	V.35 TX DATA (A)	P
30	V.35 TX DATA (B)	S
31	V.35 RX CLOCK (A)	V
32	V.35 RX CLOCK (B)	X
33	DTR	H
34	DSR (A)	E
35	DSR (B)	#
36	RTS	C
37	DCD/I (A)	F
38	DCD/I (B)	#
39	CTS (A)	D
40	CTS (B)	#
41	DCE GROUND	#
44	DTE GROUND	B,#

* CONNECTED TOGETHER

CONNECTED TO DCE GROUND

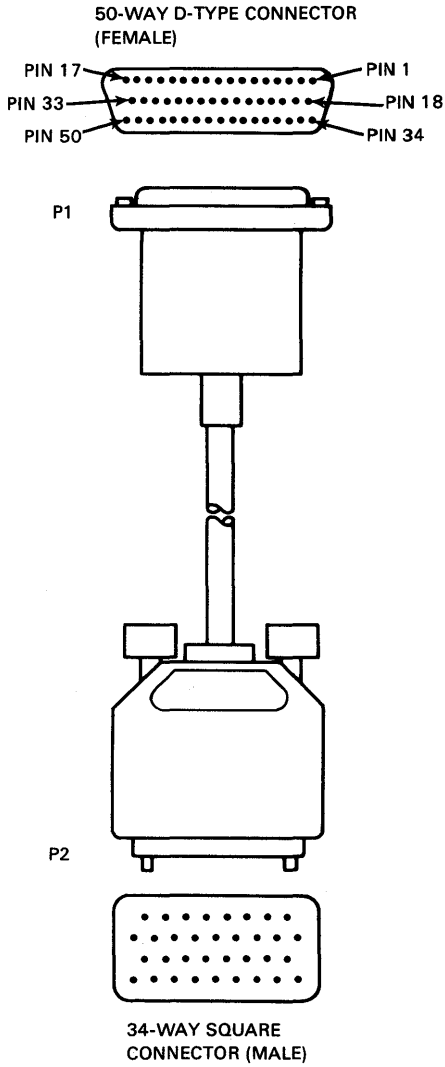
(A), (B) – WIRES A AND B OF A TWISTED PAIR



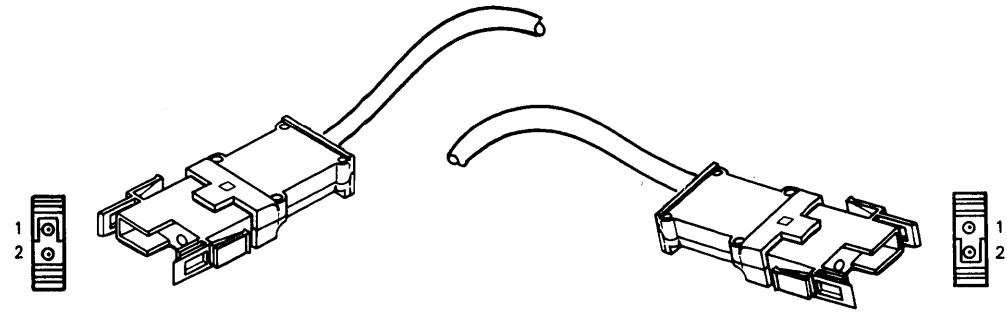
BC19F-02

FROM CONNECTION (P1)	TO CONNECTION (P2)
P1–1, 2 (SEE NOTE)	
P1–17	P2–J
P1–23 P1–24	P2–Y P2–A
P1–25 P1–26	P2–U P2–W
P1–27 P1–28	P2–R P2–T
P1–29 P1–30	P2–P P2–S
P1–31 P1–32	P2–V P2–X
P1–33	P2–H
P1–34	P2–E
P1–36	P2–C
P1–37	P2–F
P1–39	P2–D
P1–41, 35, 38 40, 44 (SEE NOTE)	
P1–44	P2–B
P1–SHELL	P2–BRAID

NOTE: CONTACTS TIED TOGETHER

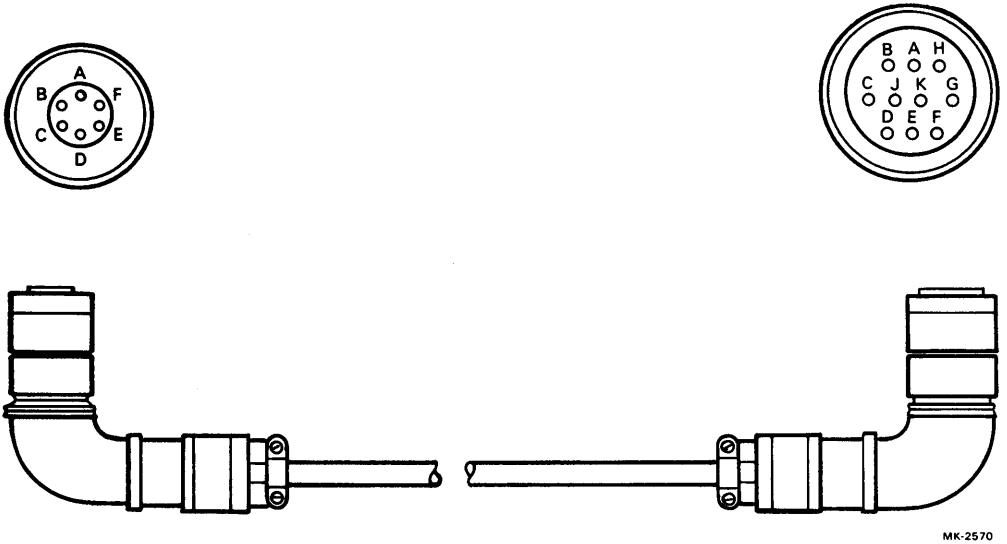


BC20R



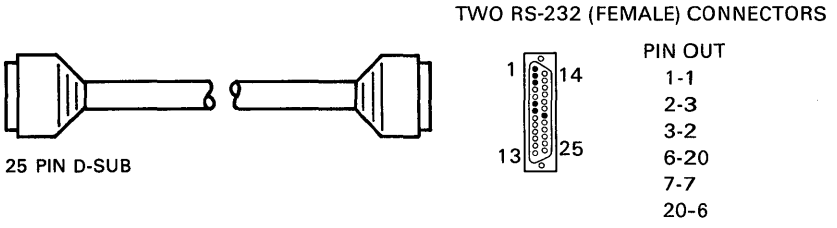
MK-2577

BC20S

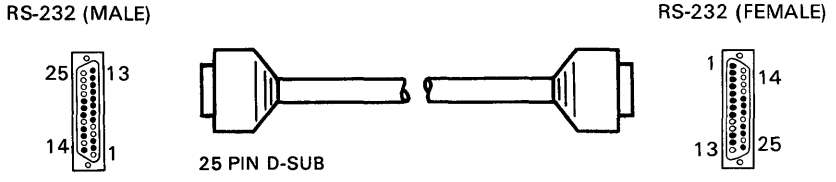


MK-2570

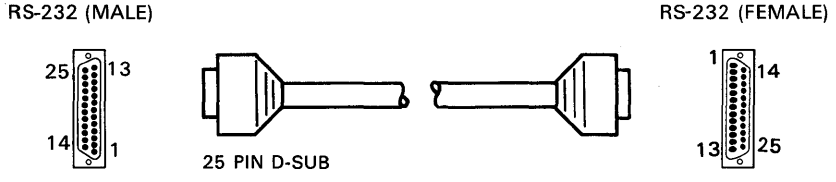
BC22D-**



BC22E-**

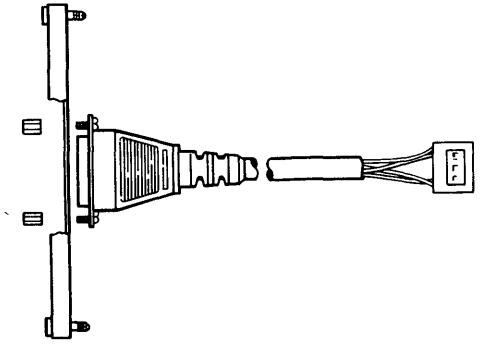


BC22F-**



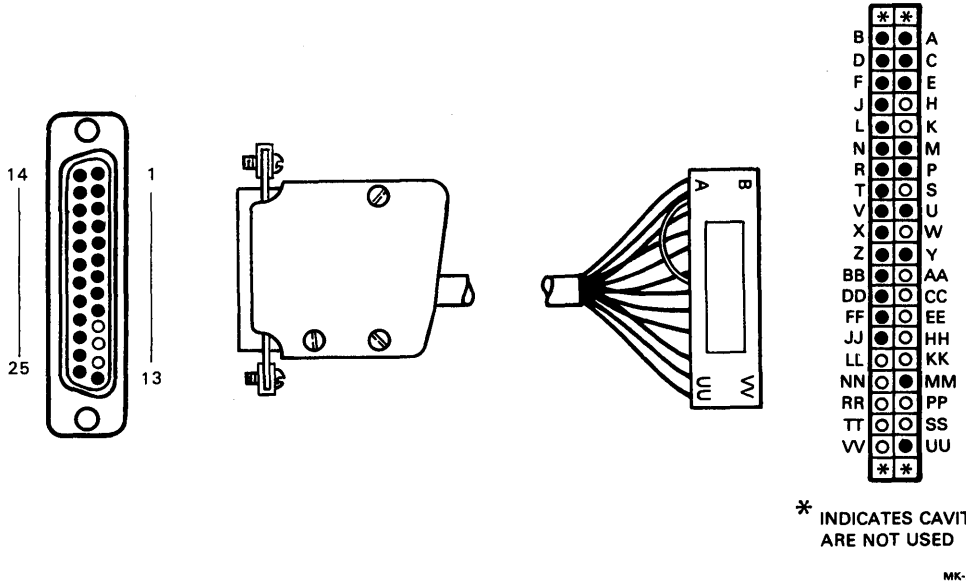
MKV86-0828

BC22N-**



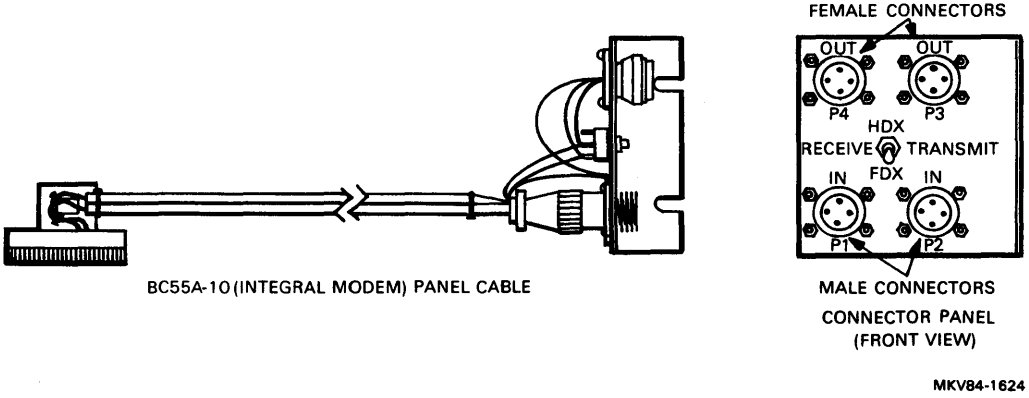
MKV84-0797

BC26L

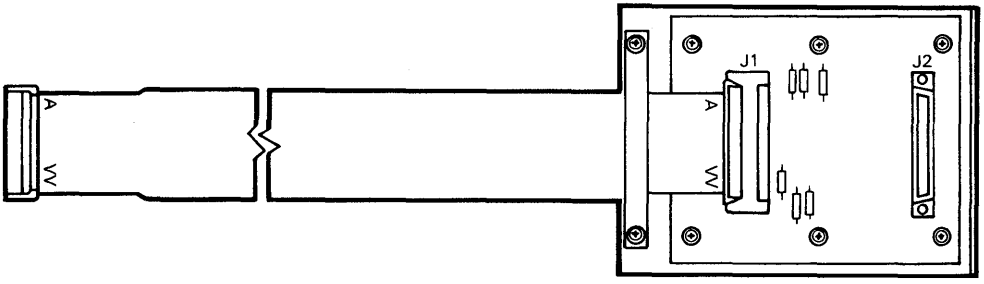


BC55A

Appropriate terminator connectors H3257 or H3258 must be used.



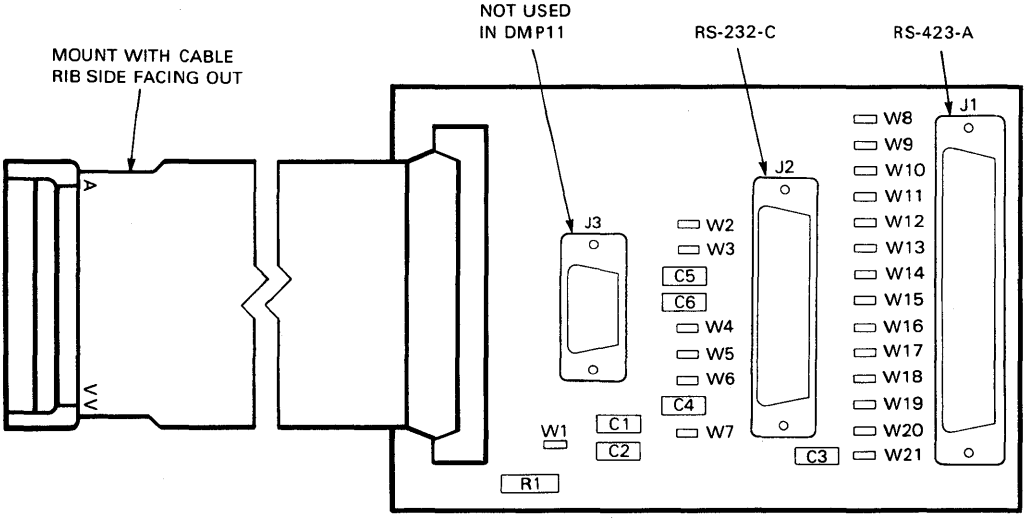
BC55B



BC55B-10 (RS-422-A INTERFACE) PANEL CABLE

MKV84-1625

BC55C



BC55C-10 (RS-232-C/RS-423-A) INTERFACE PANEL CABLE

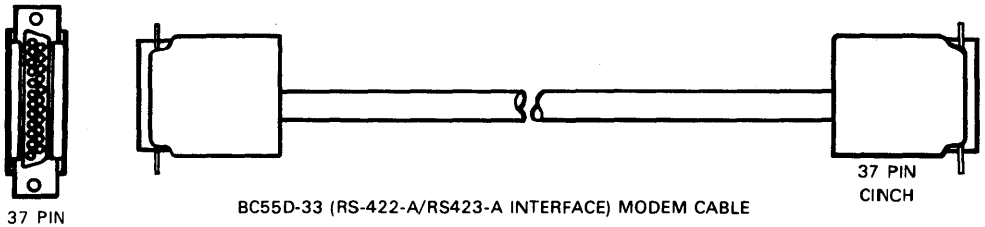
MKV84-1626

Table 3-2 Modem Option Jumper Functions

J2 PIN	JUMPER	RS-232-C	BELL 208B	BELL 209	DATA 2400	DATEL 4800	CCITT V.23	CCITT V.26 BIS	CCITT V.27 TER	ISO 2110-1972 FUTURE D		EIA RS-232	EIA RS-449	CCITT V.24
1	W1	IN	IN	IN	IN	IN				IN		AA		101
	W7													
2												BA	SD	103
3												BB	RD	104
4	W19	IN	IN	IN	IN	IN	IN	IN	IN	IN		CA	RS	105
5												CB	CS	106
6												CC	DM	107
7												AB	SG	102
8												CF	RR	109
9														
10														
11	W14									IN			SF	126
12	W3	IN			IN	IN	IN	IN	IN	IN		SCF	SRR	122
13	W2	IN			IN		IN	IN	IN	IN		SCB	SCS	121
14	W6	IN			IN	IN	IN	IN	IN	IN		SBA	SSD	110
15	W20	IN	IN	IN	IN	IN	IN	IN	IN	IN		DB	ST	114
16	W5	IN			IN	IN	IN	IN	IN	IN		SBB	SRD	119
17	W18	IN	IN	IN	IN	IN	IN	IN	IN	IN		DD	RT	115
18	W17												LL	141
19	W4	IN			IN	IN	IN	IN	IN	IN		SCA	SRS	120
20												CD	TR	108
21	W16	IN		IN								CG	SQ	110
	W13												RL	140
22												CE	IC	125
23	W21	IN			IN	IN	IN	IN	IN	IN		CH	SR	111
	W12											CI	SF	112
24	W15				IN								SS	116
	W10	IN	IN	IN		IN		IN	IN			DA	TT	113
25	W11				IN								SB	117
	W9												TM	142
	W8											MAKE BUSY		

MKV84-0789

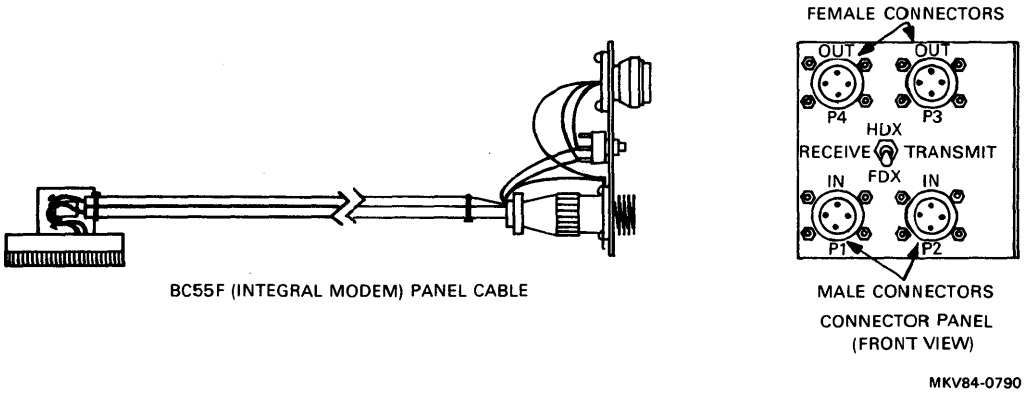
BC55D



BC55D-33 (RS-422-A/RS423-A INTERFACE) MODEM CABLE

MKV84-1627

BC55F



BC55F (INTEGRAL MODEM) PANEL CABLE

MALE CONNECTORS

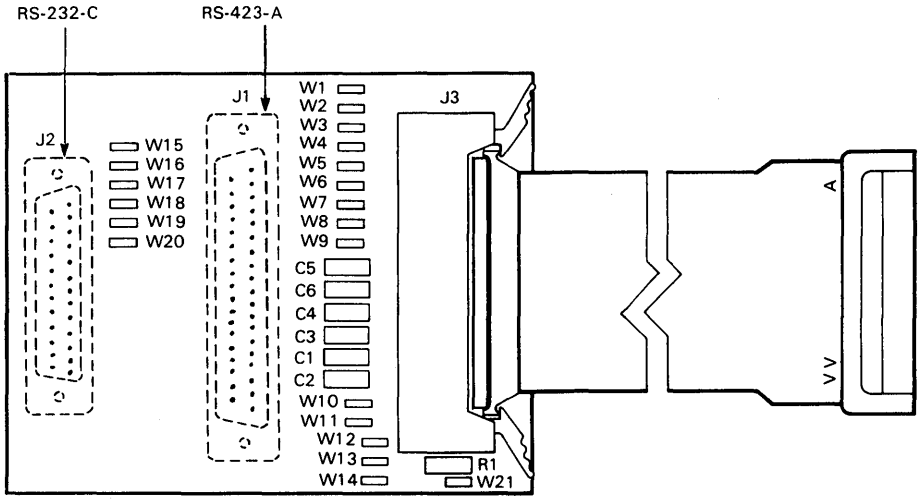
CONNECTOR PANEL
(FRONT VIEW)

MKV84-0790

NOTE

The BC55F cable is very similar to the BC55A. The only difference is in the connector panel configuration (see BC55A).

BC55H



BC55H-3 (RS-232-C/RS-423-A) INTERFACE PANEL CABLE

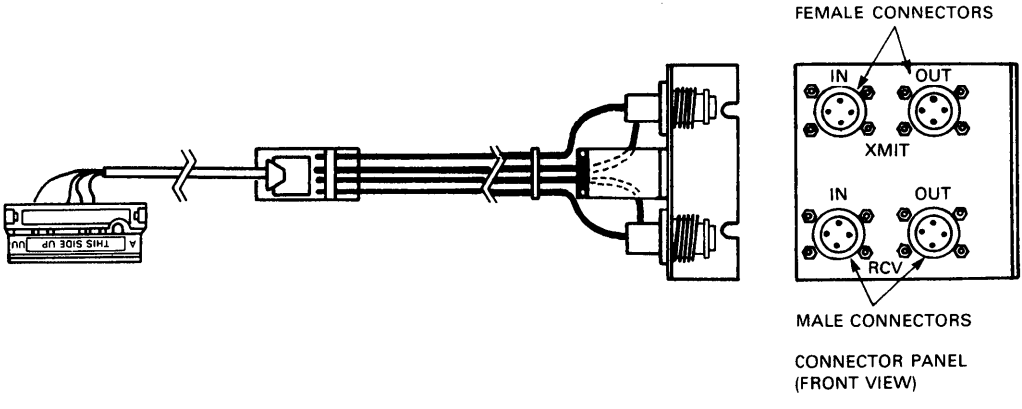
MKV84-1628

Table 3-3 BC55H Modem Option Jumper Functions

J2 PIN	JUMPER	RS-232-C	BELL 103J	BELL 208B	BELL 209	DATEL 200	DATEL 600	DATEL 2400	DATEL 4800	CCITT V.21	CCITT V.23	CCITT V.26B	CCITT V.27T	ISO2110-1972 (FUTURE D)	ISO2110.2 (X.21BIS)	EIA RS-232-C (X.20 BIS)	EIA RS-449	CCITT V.24
23	W1	IN					IN	IN	IN							CH	SR	111
21	W2	IN														CG	SQ	110
11	W3					IN				IN							SF	126
23	W4															CI	SR	112
16	W5	IN					IN	IN	IN							SBB	SRD	119
14	W6	IN					IN	IN	IN							SBA	SSD	118
12	W7	IN					IN	IN	IN							SCF	SRR	122
21	W8									IN	IN	IN	IN		IN		RL	140
4	W9	IN		IN	IN	IN	IN	IN	IN	IN	IN	IN	IN	IN	IN	CA	RS	105
15	W10	IN		IN	IN			IN	IN		IN	IN	IN	IN	IN	DB	ST	114
17	W11	IN		IN	IN			IN	IN		IN	IN	IN	IN	IN	DD	RT	115
18	W12									IN	IN	IN	IN		IN		LL	141
19	W13	IN					IN	IN	IN		IN	IN	IN	IN	IN	SCA	SRS	121
	W14	NOT NORMALLY INSTALLED																
25	W15									IN	IN	IN	IN		IN		TM	142
24	W16	IN		IN	IN				IN						IN	DA	TT	113
25	W17							IN									SB	117
24	W18							IN									SS	116
13	W19	IN					IN	IN	IN							SCB	SCS	121
25	W20															MAKE BUSY		
1	W21	IN	IN	IN	IN	IN	IN	IN	IN				IN			AA		101
2																BA	SD	103
3																BB	RD	104
5																CB	CS	106
6																CC	DM	107
7																AB	SG	102
8																CF	RR	109
20																CD	TR	108
22																CE	IC	125

MKV86-0833

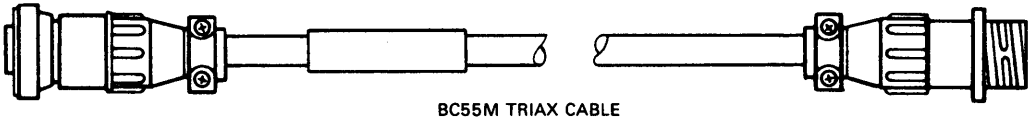
BC55J



BC55M

Cable is used for the same purpose as the BC55N, but for data rates above 56K bits/s.

USES: BELDEN 8232 – UP TO 4.3 KM (14K FEET)*
BELDEN 8233 – UP TO 6.0 KM (18K FEET)*



BC55M TRIAX CABLE

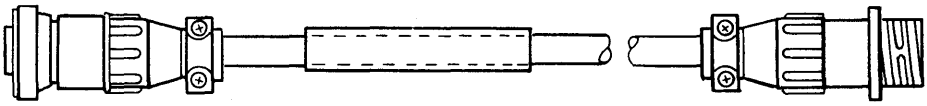
*MAXIMUM DISTANCE IS DEPENDENT ON SPEED.
REFER TO M8203 TECHNICAL MANUAL, EK-M8203-TM FOR DETAILS.

MK-3605

BC55N

Cable is used to interconnect local (integral) configurations for a selected data rate of 56K bits/s.

USES: BELDEN 9272



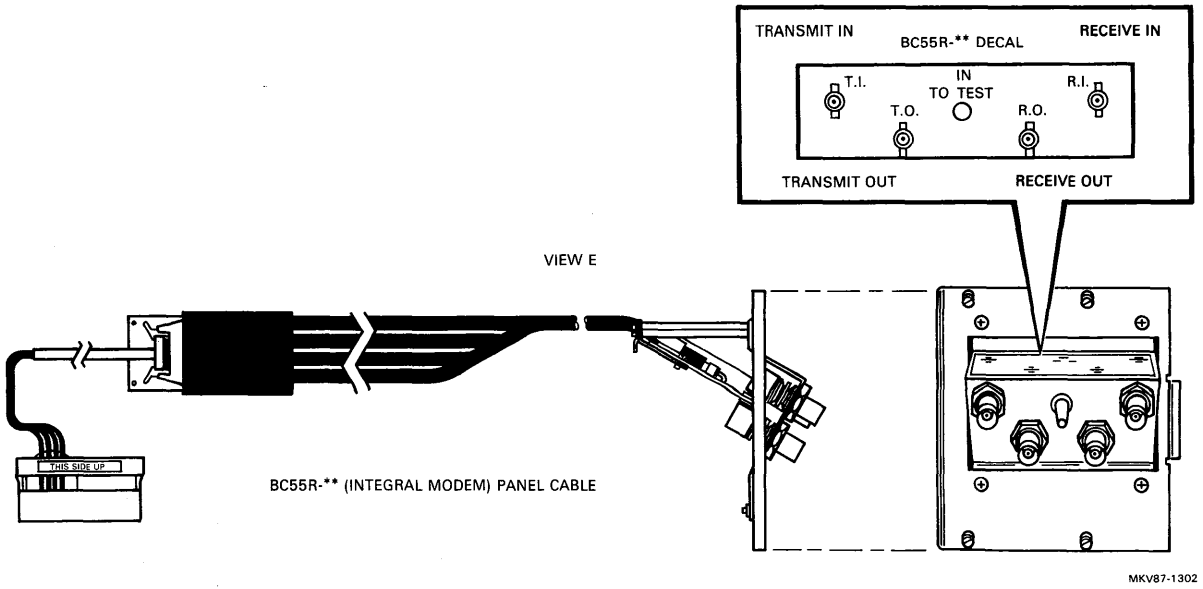
BC55N TWINAX CABLE

MK-3606

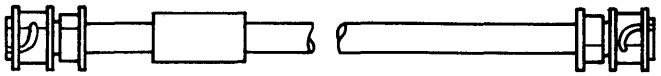
Recommended connector hardware for building BC55 type cables in excess of 30 m (98 feet):

Component	DIGITAL Part Number	AMP Part Number
Small cable clamp	12-11430-00	206062-1
Large cable clamp	12-11430-01	206358-1
Male housing	12-12527	206153-1
Male pin	12-12001	66589-2
Female housing	12-12526	206060-1
Female pin	12-12000	66590-2
14 gauge male pin	12-12001-1	66587-2

BC55R

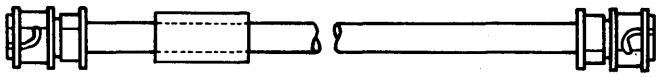

TRANSMIT IN
BC55R-** DECAL
RECEIVE IN
T.I.
IN
TO TEST
R.I.
T.O.
R.O.
TRANSMIT OUT
RECEIVE OUT
VIEW E
THIS SIDE UP
BC55R-** (INTEGRAL MODEM) PANEL CABLE
MKV87-1302

BC55S TRIAXIAL CABLE*



*FOR SPEEDS UP TO:
500K bits/s (FULL DUPLEX)
1M bits/s (HALF DUPLEX)

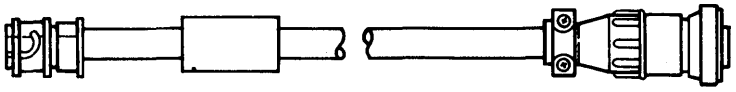
BC55T TWINAX CABLE*



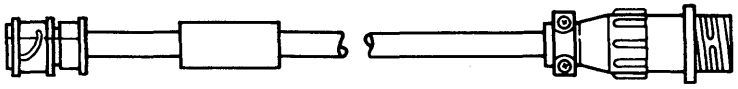
*FOR SPEEDS UP TO 56K bits/s

MKV84-0791

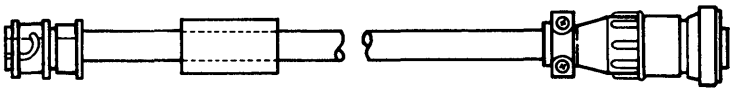
BC56A TRIAXIAL ADAPTOR CABLE*



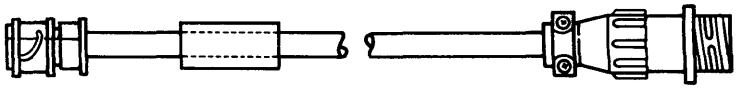
BC56B TRIAXIAL ADAPTOR CABLE*



BC56D TWINAX ADAPTOR CABLE*



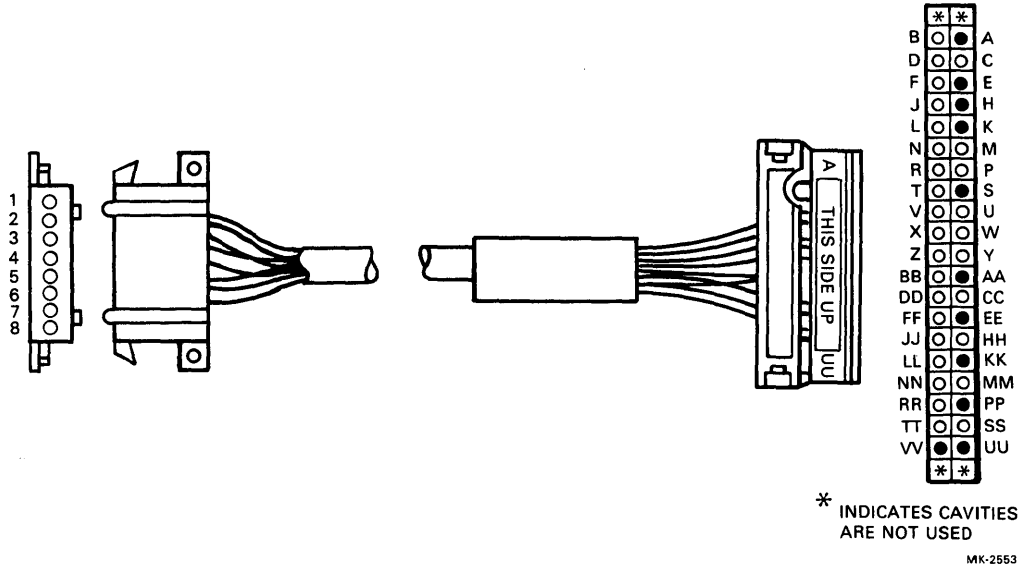
BC56E TWINAX ADAPTOR CABLE*



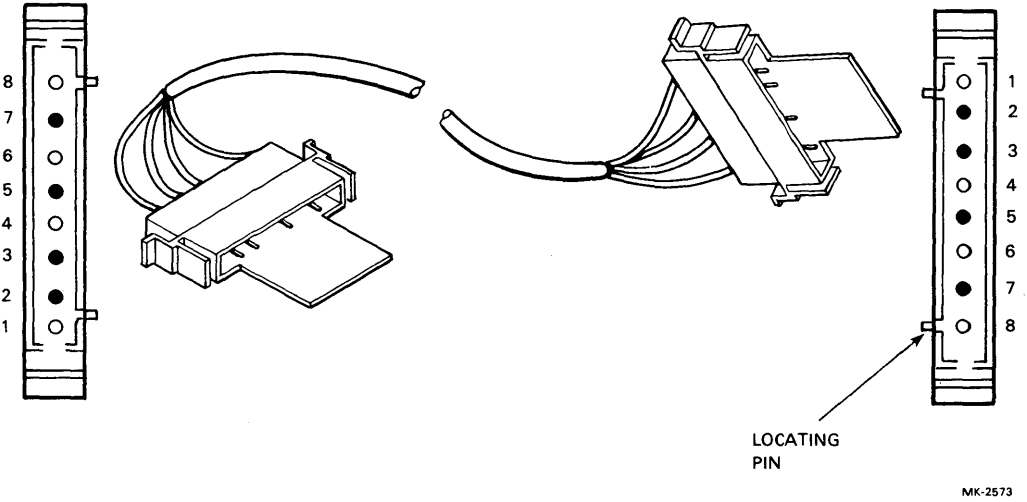
*USE ADAPTOR CABLES WHEN CONNECTING BC55R INTEGRAL MODEM PANEL/CABLE TO OLDER STYLE NETWORKS USING BC55A OR BC55J INTEGRAL MODEM PANEL/CABLES.

MKV84-0792

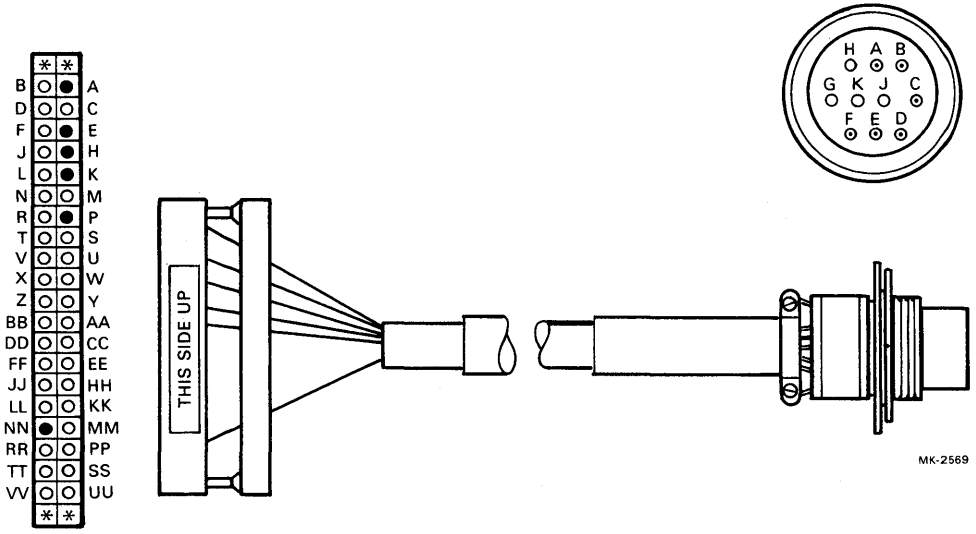
70-08360



70-08519

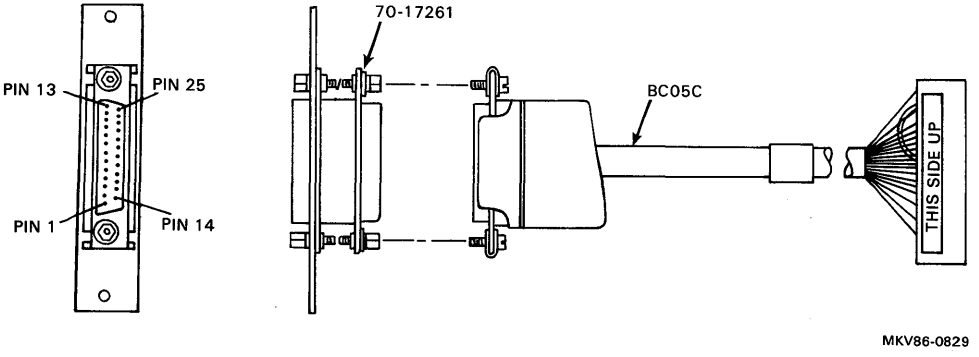


70-16428



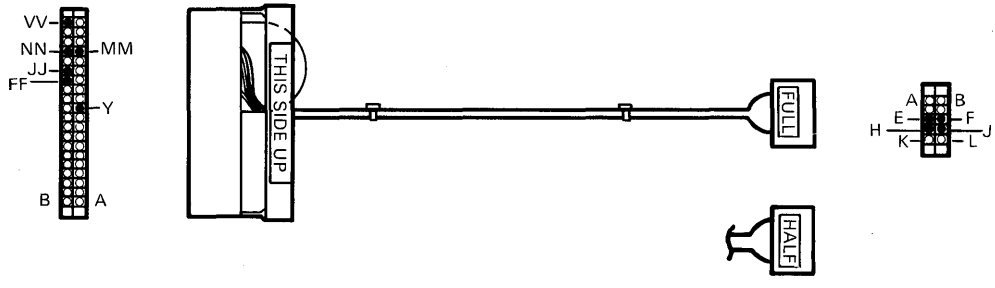
* INDICATES CAVITIES ARE USED TO MOUNT STRAIN RELIEF

70-18209 & 70-18194



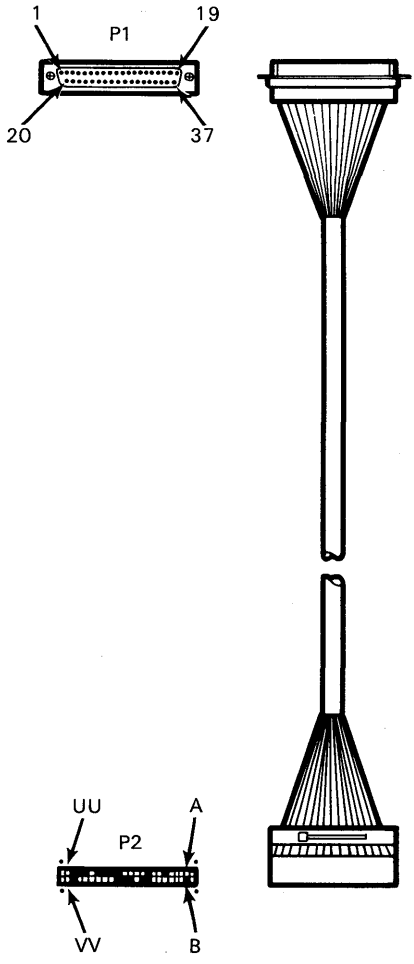
70-18250

FROM CONN	TO CONN
P1-JJ P1-FF	P2-J P2-H
P1-NN P1-MM	P2-F F2-E
P1-Y	P1-VV



MKV86-0834

FROM CONN	TO CONN
P1-4	P2-KK
P1-22	P2-AA
P1-6	P2-K
P1-24	P2-S
P1-5	P2-CC
P1-23	P2-TT
P1-8	P2-HH
P1-26	P2-SS
P1-17	P2-PP
P1-35	P2-EE
P1-7	P2-V
P1-19	P2-B
P1-11	P2-Z
P1-19	P2-B
P1-13	P2-BB
P1-12	P2-DD
P1-9	P2-T
P1-19	P2-B
P1-1	——



MKV86-0835

CHAPTER 4
TEST CONNECTORS AND TERMINATORS

4.1 TEST CONNECTORS AND TERMINATORS

This chapter contains a line drawing of each of the test connectors and terminators needed to test any of the device options described in Volumes 1 and 2 of this manual.

Table 4-1 can be used to quickly identify which test connectors and terminators are used with each communication device.

Test connector drawings are placed in alphanumeric order for speedy reference.

Terminator drawings follow test connector drawings.

Most test connectors and terminators are used with more than one device option.

Table 4-1 Test Connectors and Terminators for Communication Options

CONNECTORS / OPTIONS		DH11	DHU11	DHV11	DL11/E/W	DLV11	DMC11	DMF32	DMP11	DMR11	DMV11	DHQ11	DMB32	DSV11		
H315		X			X	X										
H325			X	X			X		X	X	X					
H861C		X														
H3101				X								X				
H3103				X								X				
H3248								X					X	X		
H3249								X								
H3250							X		X	X	X		X	X		
H3251									X	X	X			X		
H3254									X	X	X					
H3255									X	X	X					
H3276										X						
H3277				X								X				
H8568										X						
H8611		X														
H3195													X			
H3196													X			
H3197												X	X			
H3198													X			
H3199														X		
M974		X														
12-12528							X									
TERMINATORS																
H3257									X	X	X					
H3258									X	X	X					
H857O									X	X	X					

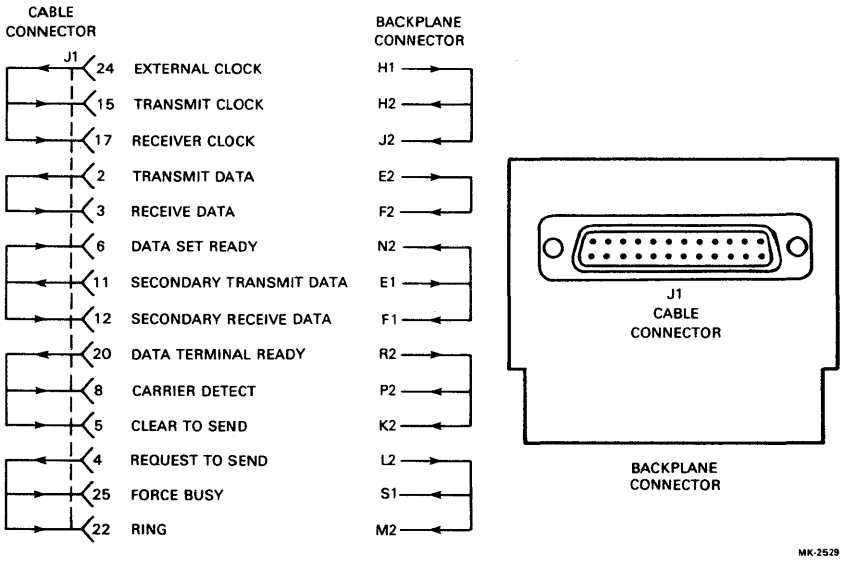
MKV87-1294

Table 4-1 Test Connectors and Terminators for Communication Options (Cont)

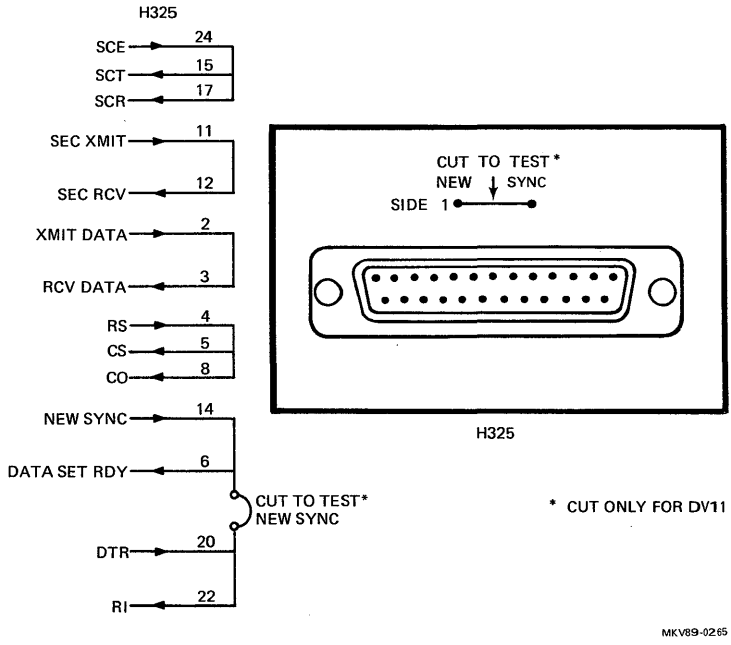
CONNECTORS / OPTIONS	DMZ32	DPV11	DQ11	DU11	DUP11	DUV11	DV11	DZ11	DZ11-X	DZ32	DZV11	DZQ11			
H315			X	X		X									
H325					X		X	X			X	X			
H327								X							
H329											X	X			
H861							X								
H3027	X														
H3028	X														
H3190								X							
H3248	X														
H3259		X								X					
H3260		X													
H3271								X	X						
H3272										X					
H3273									X						
H3274									X						
H8612								X							
29-24929-00	X														
TERMINATORS															

MKV86-0837

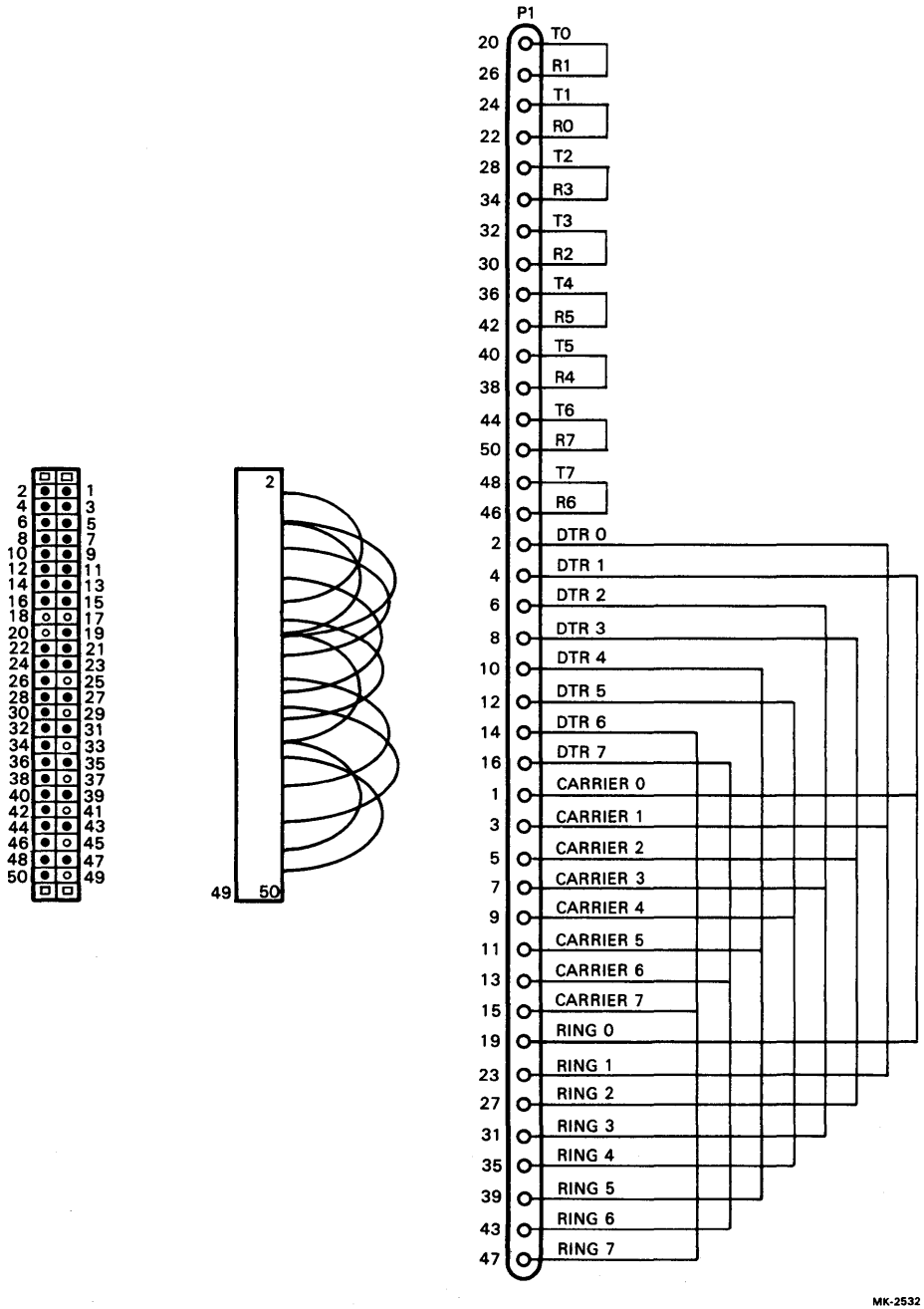
H315


CABLE CONNECTOR
J1
BACKPLANE CONNECTOR
24 EXTERNAL CLOCK
H1
15 TRANSMIT CLOCK
H2
17 RECEIVER CLOCK
J2
2 TRANSMIT DATA
E2
3 RECEIVE DATA
F2
6 DATA SET READY
N2
11 SECONDARY TRANSMIT DATA
E1
12 SECONDARY RECEIVE DATA
F1
20 DATA TERMINAL READY
R2
8 CARRIER DETECT
P2
5 CLEAR TO SEND
K2
4 REQUEST TO SEND
L2
25 FORCE BUSY
S1
22 RING
M2
J1
CABLE
CONNECTOR
BACKPLANE
CONNECTOR
MK-2529

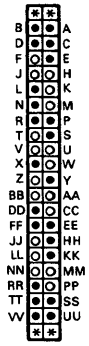
H325

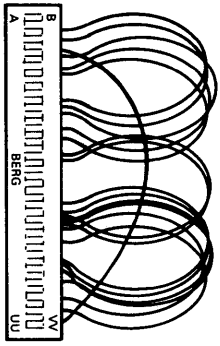

H325
SCE
24
SCT
15
SCR
17
SEC XMIT
11
SEC RCV
12
XMIT DATA
2
RCV DATA
3
RS
4
CS
5
CO
8
NEW SYNC
14
DATA SET RDY
6
CUT TO TEST*
NEW SYNC
DTR
20
RI
22
CUT TO TEST*
NEW SYNC
SIDE 1
H325
* CUT ONLY FOR DV11
MKV89-0265

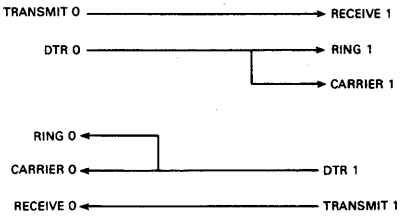
H327


P1
20 T0
26 R1
24 T1
22 R0
28 T2
34 R3
32 T3
30 R2
36 T4
42 R5
40 T5
38 R4
44 T6
50 R7
48 T7
46 R6
2 DTR 0
4 DTR 1
6 DTR 2
8 DTR 3
10 DTR 4
12 DTR 5
14 DTR 6
16 DTR 7
1 CARRIER 0
3 CARRIER 1
5 CARRIER 2
7 CARRIER 3
9 CARRIER 4
11 CARRIER 5
13 CARRIER 6
15 CARRIER 7
19 RING 0
23 RING 1
27 RING 2
31 RING 3
35 RING 4
39 RING 5
43 RING 6
47 RING 7
2 1
4 3
6 5
8 7
10 9
12 11
14 13
16 15
18 17
20 19
22 21
24 23
26 25
28 27
30 29
32 31
34 33
36 35
38 37
40 39
42 41
44 43
46 45
48 47
50 49
2
49 50
MK-2532

H329





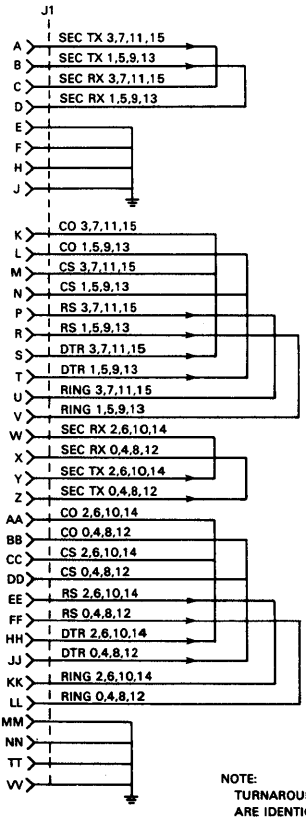


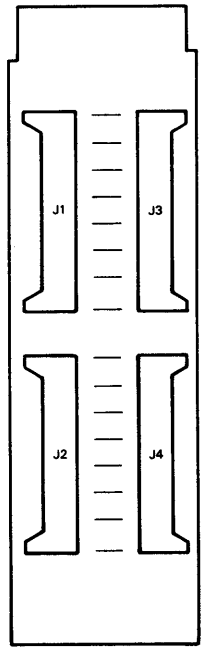
NOTE:
LINES 2 & 3 ARE STAGGERED
IN THE SAME WAY.

MK-2546

* INDICATES CAVITIES ARE NOT USED

H861



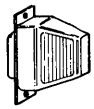


NOTE:
TURNAROUND SIGNAL FLOW AND PINNING
ARE IDENTICAL FOR ALL 4 CONNECTORS (J1-J4)

MK-2530

H3027

PIN NUMBER	SIGNAL NAME (REFERENCED TO H3027)
1	DATA OUT A (+
2	CHASSIS GROUND
3	DATA IN A (+)
4	CHASSIS GROUND
5	UNUSED
6	UNUSED
7	UNUSED
8	UNUSED
9	DATA OUT B (–)
10	UNUSED
11	DATA IN B (–)
12	UNUSED
13	SIGNAL GROUND
14	UNUSED
15	UNUSED



MKV84-0777

H3028

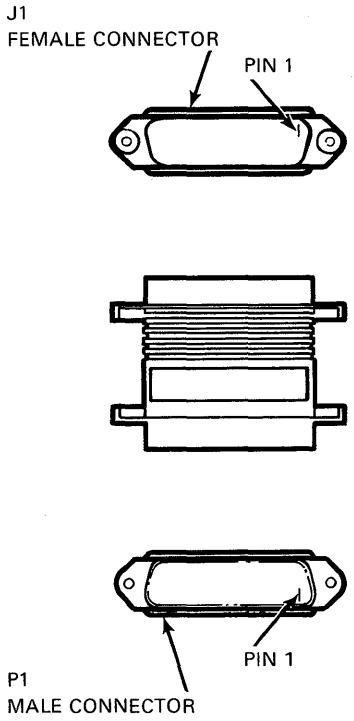
J1 PIN NUMBER	SIGNAL NAME
1	DATA IN A (+)
2	DATA IN B (–)
3	SIGNAL GROUND
4	UNUSED
5	UNUSED
6	UNUSED
7	UNUSED
8	UNUSED
9	DATA OUT A (+)
10	DATA OUT B (–)

MKV84-0778

H3101

FROM CONN	TO CONN
J1-1	J1-2
J1-3	J1-4
J1-5	J1-6
J1-7	J1-8
J1-9	J1-10
J1-11	J1-12
J1-13	J1-14
J1-15	J1-16
J1-17	NO CONN
J1-18	NO CONN
J1-19	J1-20
J1-21	J1-22
J1-23	J1-24
J1-25	J1-26
J1-27	J1-28
J1-29	J1-30
J1-31	J1-32
J1-33	J1-34
J1-35	NO CONN
J1-36	NO CONN

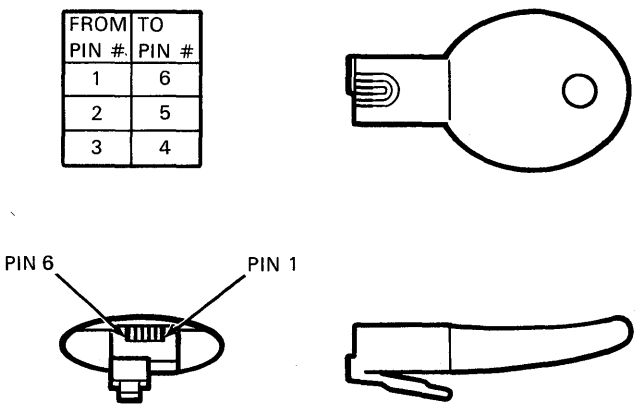
FROM CONN	TO CONN
P1-1	P1-2
P1-3	P1-4
P1-5	P1-6
P1-7	P1-8
P1-9	P1-10
P1-11	P1-12
P1-13	P1-14
P1-15	P1-16
P1-17	NO CONN
P1-18	NO CONN
P1-19	P1-20
P1-21	P1-22
P1-23	P1-24
P1-25	P1-26
P1-27	P1-28
P1-29	P1-30
P1-31	P1-32
P1-33	P1-34
P1-35	NO CONN
P1-36	NO CONN



MKV86-0839

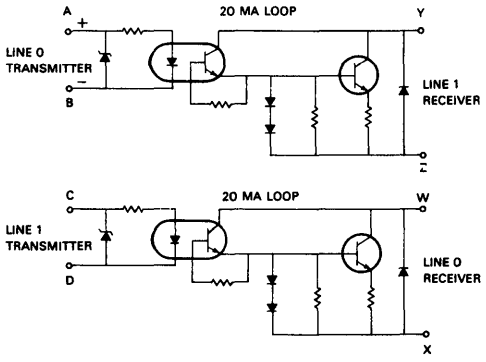
H3103

FROM PIN #	TO PIN #
1	6
2	5
3	4

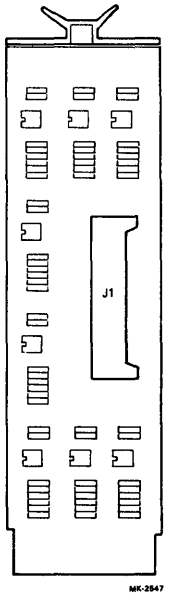


MKV86-0840

H3190



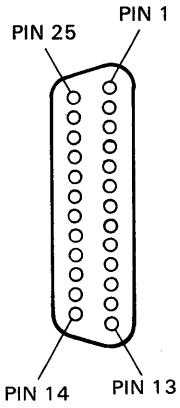
LINES 2&3, 4&5 AND 6&7 ARE STAGGERED THE SAME WAY



H3195 & H3196

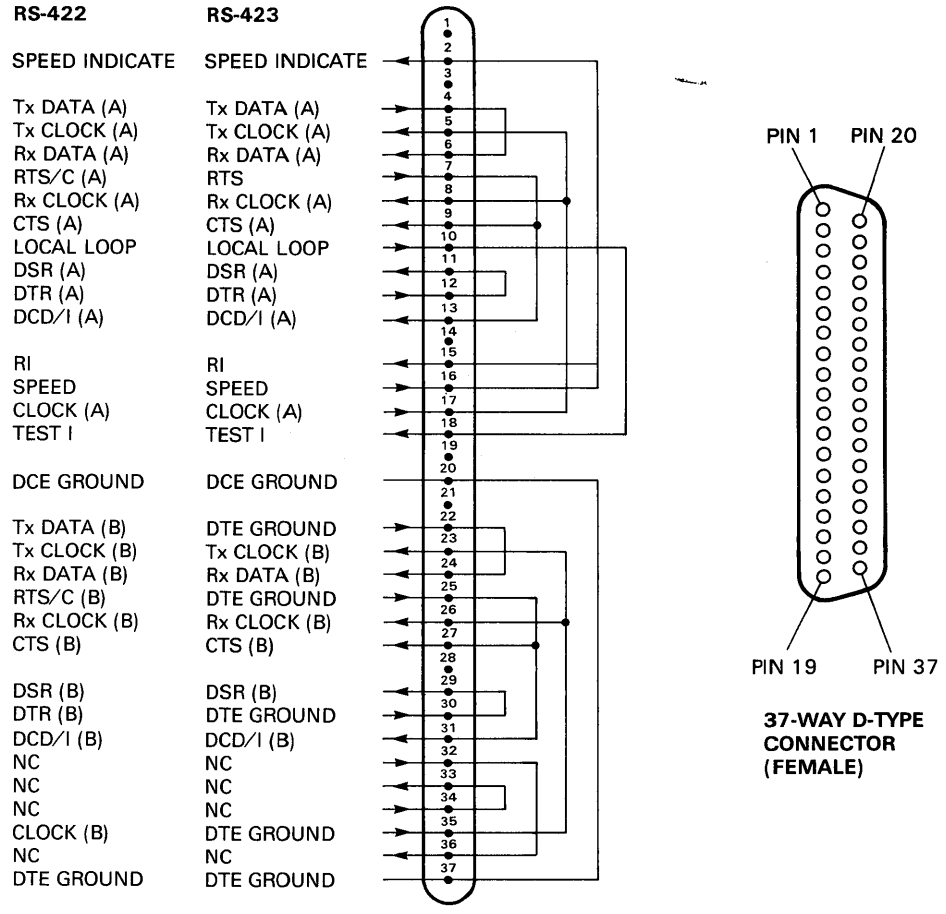
Pin Number	Signal
1, 3, 4, 5	Connector Identity Code
35, 41, 44	Ground and Receiver Inputs
6, 11	Data A
7, 12	Data B
9, 37	RTS/C A, DCD/I A
10, 38	RTS/C B, DCD/I B
13, 15	Local Loop, Test Indicator
50, 17, 14	Speed, Ring Indicator, and Speed Indicator
16, 34	Remote Loop, DSR A
47, 18, 20	Clock A
48, 19, 21	Clock B
45, 39	DTR A, CTS A
46, 40	DTR B, CTS B
29, 27	V.35 Data A
30, 28	V.35 Data B
25, 23, 31	V.35 Clock A
26, 24, 32	V.35 Clock B

CCITT No.	NAME	PIN
	NOT USED	19
	NOT USED	17
	NOT USED	12
	NOT USED	15
103	TXD	2
104	RXD	3
105	RTS	4
106	CTS	5
109	DCD	8
107	DSR	6
108.2	DTR	20
125	RI	22



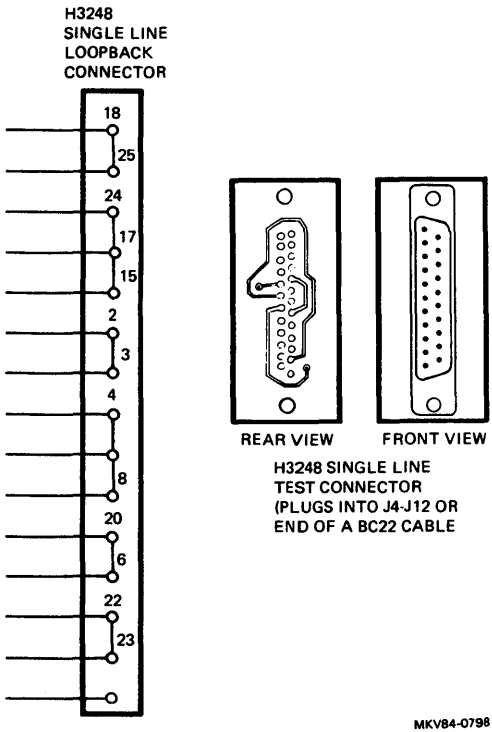
25-WAY D-TYPE CONNECTOR (MALE)

RE152


RS-422
RS-423
SPEED INDICATE
SPEED INDICATE
Tx DATA (A)
Tx CLOCK (A)
Rx DATA (A)
RTS/C (A)
Rx CLOCK (A)
CTS (A)
LOCAL LOOP
DSR (A)
DTR (A)
DCD/I (A)
RI
SPEED
CLOCK (A)
TEST I
DCE GROUND
Tx DATA (B)
Tx CLOCK (B)
Rx DATA (B)
RTS/C (B)
Rx CLOCK (B)
CTS (B)
DSR (B)
DTR (B)
DCD/I (B)
NC
NC
NC
CLOCK (B)
NC
DTE GROUND
Tx DATA (A)
Tx CLOCK (A)
Rx DATA (A)
RTS
Rx CLOCK (A)
CTS (A)
LOCAL LOOP
DSR (A)
DTR (A)
DCD/I (A)
RI
SPEED
CLOCK (A)
TEST I
DCE GROUND
DTE GROUND
Tx CLOCK (B)
Rx DATA (B)
DTE GROUND
Rx CLOCK (B)
CTS (B)
DSR (B)
DTE GROUND
DCD/I (B)
NC
NC
NC
DTE GROUND
NC
DTE GROUND
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37
PIN 1
PIN 20
PIN 19
PIN 37
37-WAY D-TYPE CONNECTOR (FEMALE)
RE153

Pin Number	Signal
1, 2, 3, 4, 5	Cable Code – All Grounded
35, 41, 44	Grounds and Receiver Inputs
6, 11	Data – Channel A
7, 12	Data – Channel B
9, 37	RTS/C, DCD/I – Channel A
10, 38	RTS/C, DCD/I – Channel B
13, 15	Local Loop, Test Indicator
16, 34	Remote Loop, DSR – Channel A
17, 50	Speed Select, Ring Indicate
47, 18, 20	Clock, RX Clock, TX Clock – Channel A
48, 19, 21	Clock, RX Clock, TX Clock – Channel B
45, 39	DTR, CTS – Channel A
46, 40	DTR, CTS – Channel B
33, 14	DTR, Test 4
8, 42	Data, Test 1
36, 43	RTS, Test 2
29, 27	V.35 Data – Channel A
30, 28	V.35 Data – Channel B
25, 23, 31	V.35 Clock – Channel A
26, 24, 32	V.35 Clock – Channel B
22, 49	Clock, Test 3

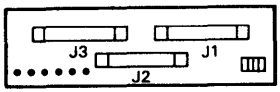
H3248



H3248 SINGLE LINE
TEST CONNECTOR
(PLUGS INTO J4-J12 OR
END OF A BC22 CABLE

MKV84-0798

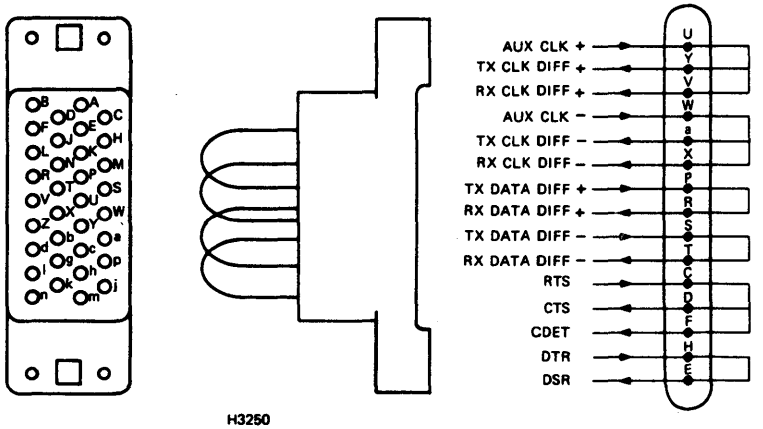
H3249



H3249 STAGGERED
TEST CONNECTOR
(USED IN PLACE
OF DISTRIBUTION
PANEL)

MKV84-1655

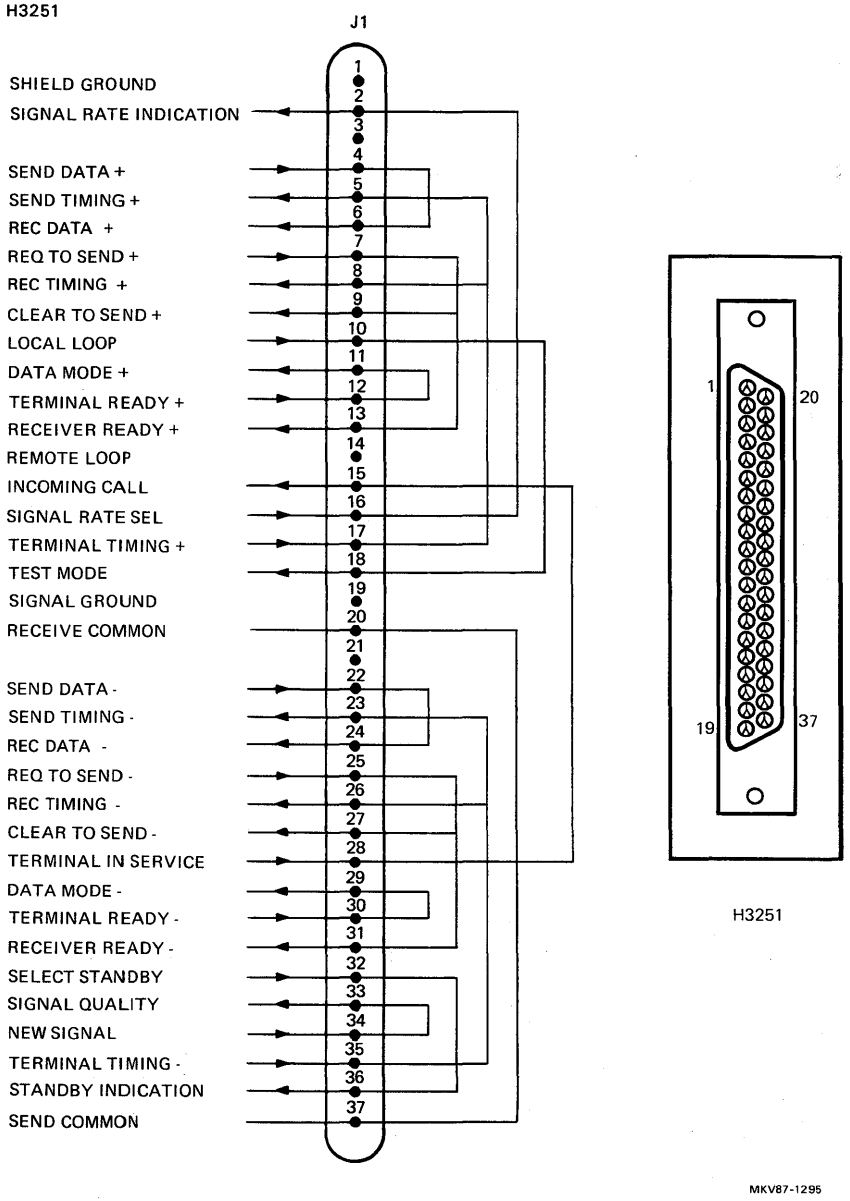
H3250

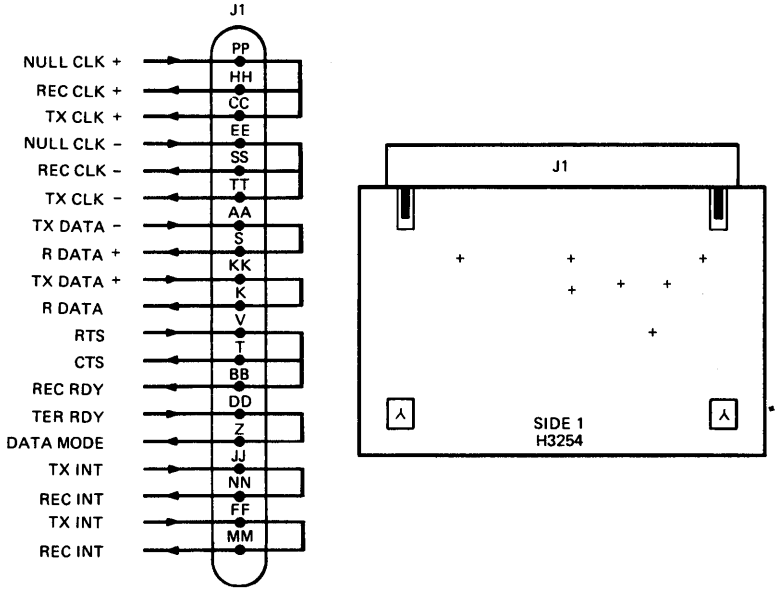


H3250

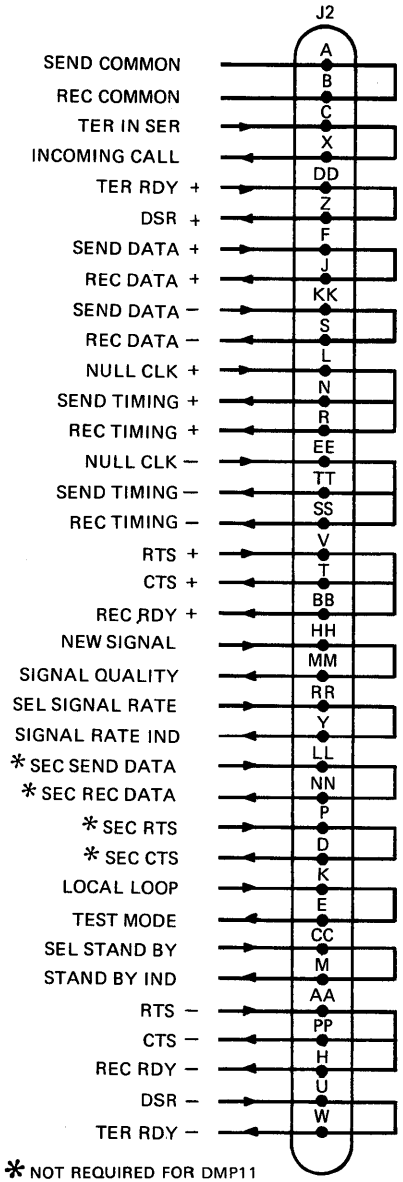
MKV84-0799

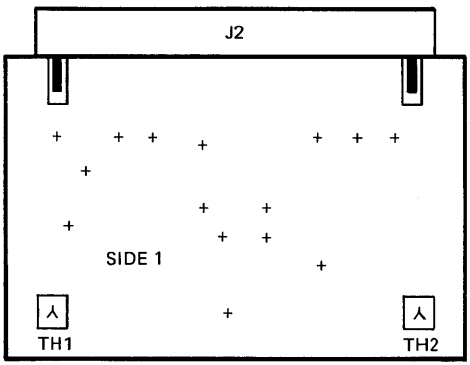
H3251


H3251
J1
SHIELD GROUND
SIGNAL RATE INDICATION
SEND DATA +
SEND TIMING +
REC DATA +
REQ TO SEND +
REC TIMING +
CLEAR TO SEND +
LOCAL LOOP
DATA MODE +
TERMINAL READY +
RECEIVER READY +
REMOTE LOOP
INCOMING CALL
SIGNAL RATE SEL
TERMINAL TIMING +
TEST MODE
SIGNAL GROUND
RECEIVE COMMON
SEND DATA -
SEND TIMING -
REC DATA -
REQ TO SEND -
REC TIMING -
CLEAR TO SEND -
TERMINAL IN SERVICE
DATA MODE -
TERMINAL READY -
RECEIVER READY -
SELECT STANDBY
SIGNAL QUALITY
NEW SIGNAL
TERMINAL TIMING -
STANDBY INDICATION
SEND COMMON
1
20
19
37
H3251
MKV87-1295


J1
NULL CLK +
REC CLK +
TX CLK +
NULL CLK –
REC CLK –
TX CLK –
TX DATA –
R DATA +
TX DATA +
R DATA
RTS
CTS
REC RDY
TER RDY
DATA MODE
TX INT
REC INT
TX INT
REC INT
PP
HH
CC
EE
SS
TT
AA
S
KK
K
V
T
BB
DD
Z
JJ
NN
FF
MM
J1
SIDE 1
H3254
MKV84-0800

H3255

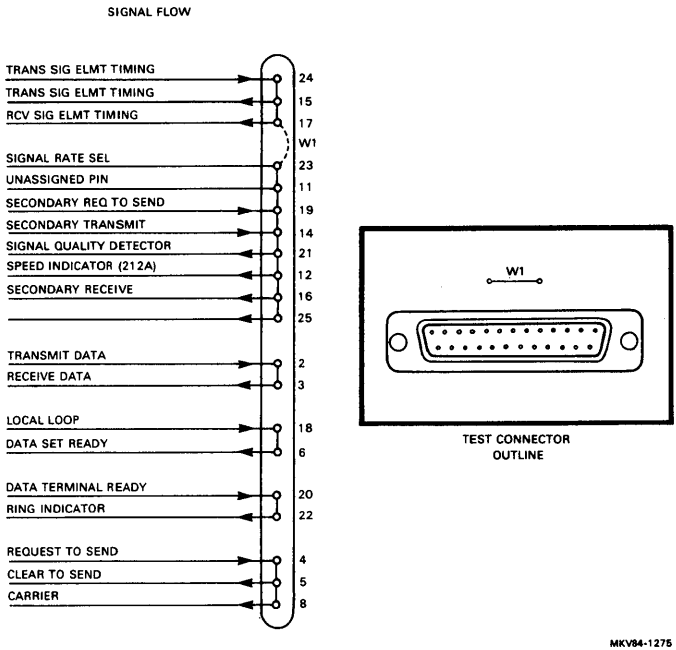




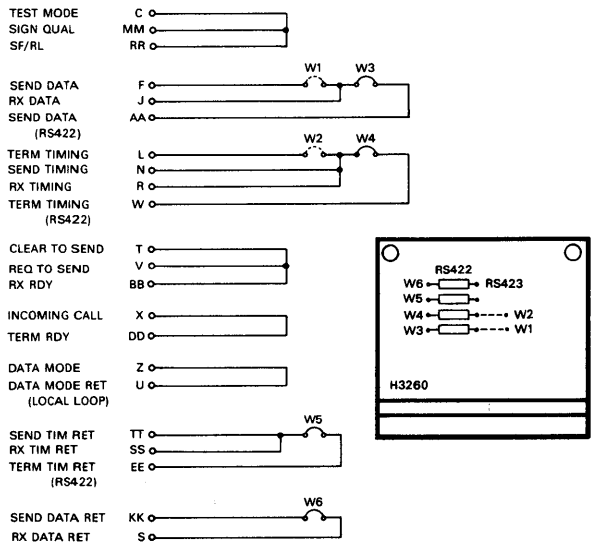
H3255

MKV86-0838

H3259



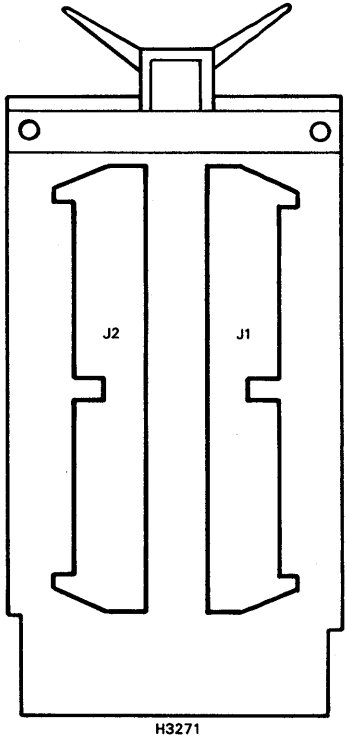
H3260



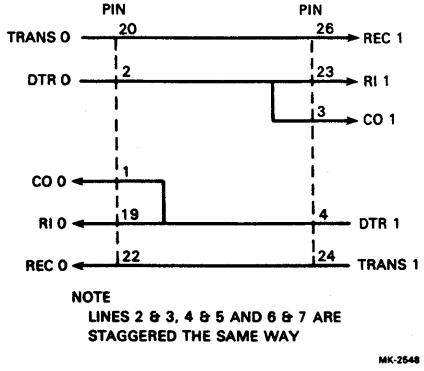
NOTE: 1. W1 & W2 IN, W3–W6 OUT } RS-423-A TESTING

2. W1 & W2 OUT, W3–W6 IN } RS-422-A TESTING

MKV84-1276

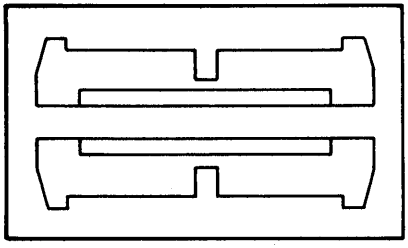


H3271

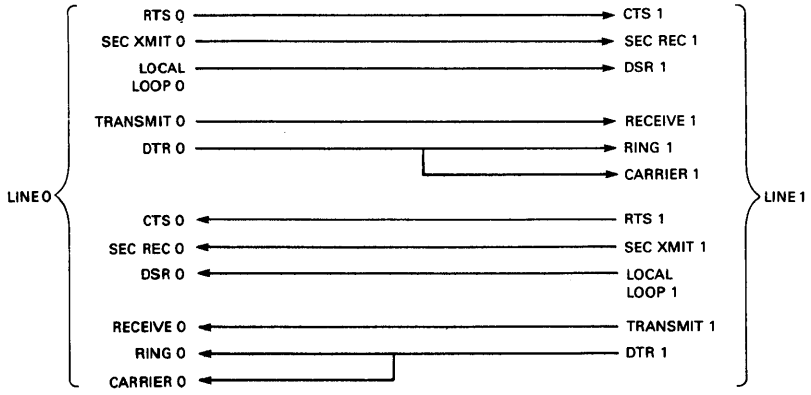


NOTE
LINES 2 & 3, 4 & 5 AND 6 & 7 ARE STAGGERED THE SAME WAY

MK-2548



H3272
TEST CONNECTOR
OUTLINE

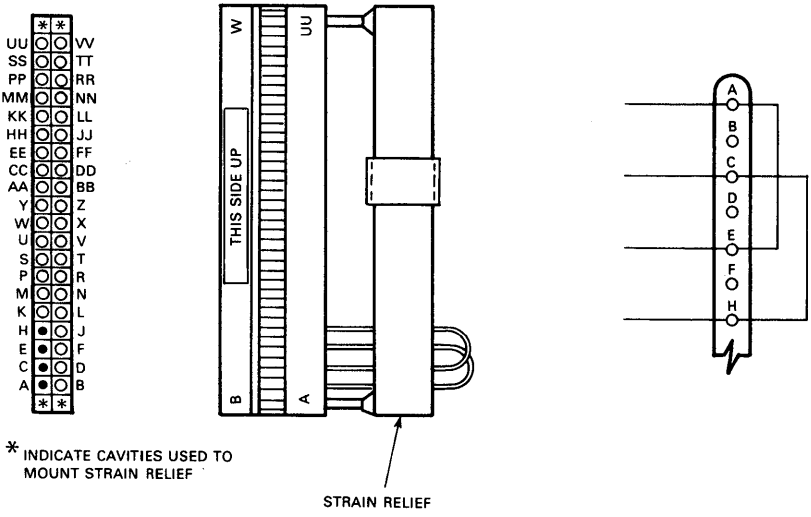


NOTE: LINES 2 & 3, 4 & 5, 6 & 7 ARE STAGGERED IN THE SAME WAY.

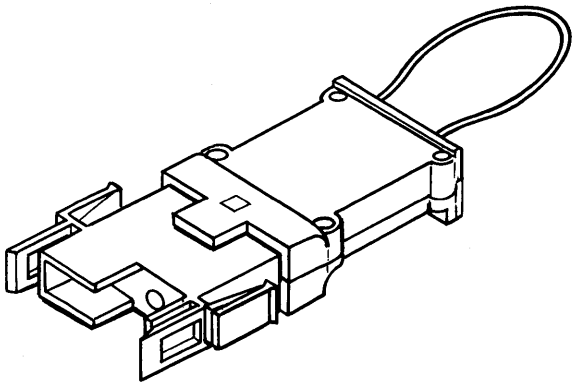
SIGNAL FLOW

MK-1824

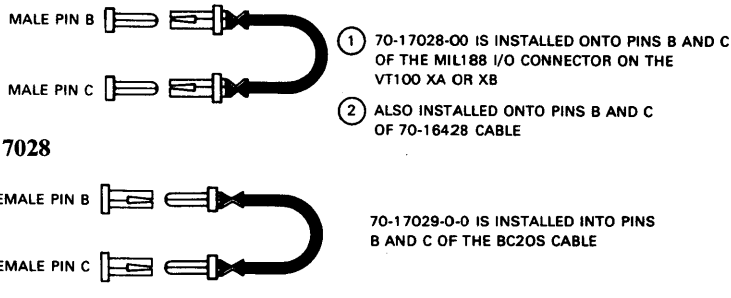
H3273



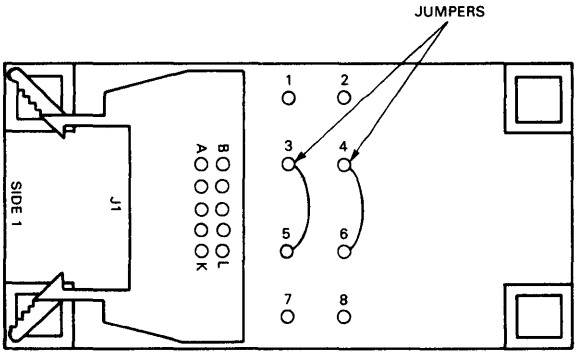
H3274



70-17029

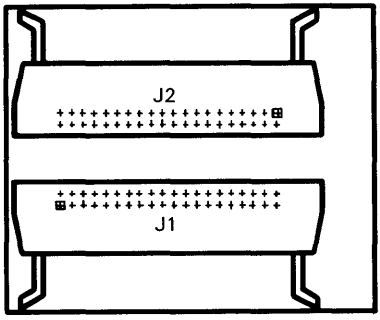


H3276



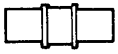
MKV84-0780

H3277



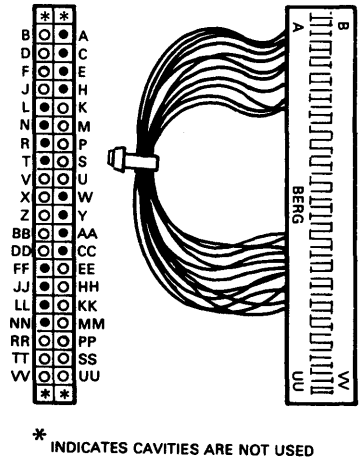
MKV86-0841

H8568

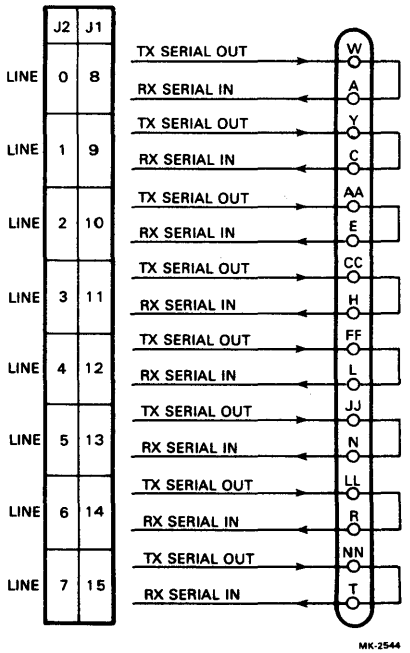


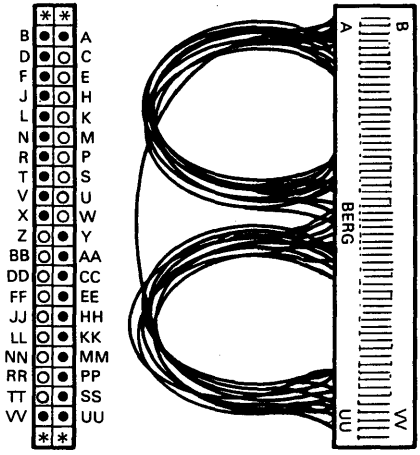
MKV84-0783

H8611

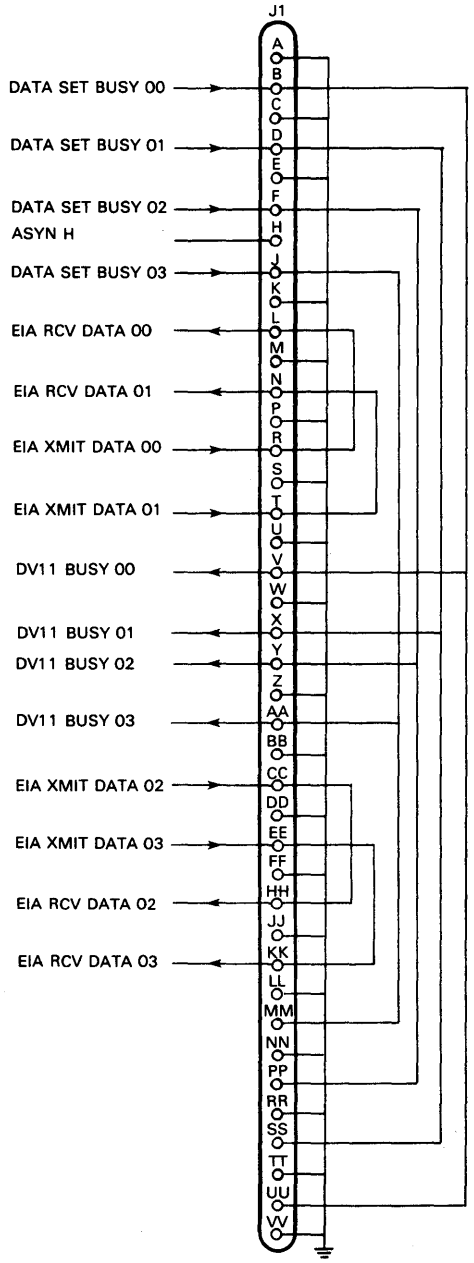


* INDICATES CAVITIES ARE NOT USED



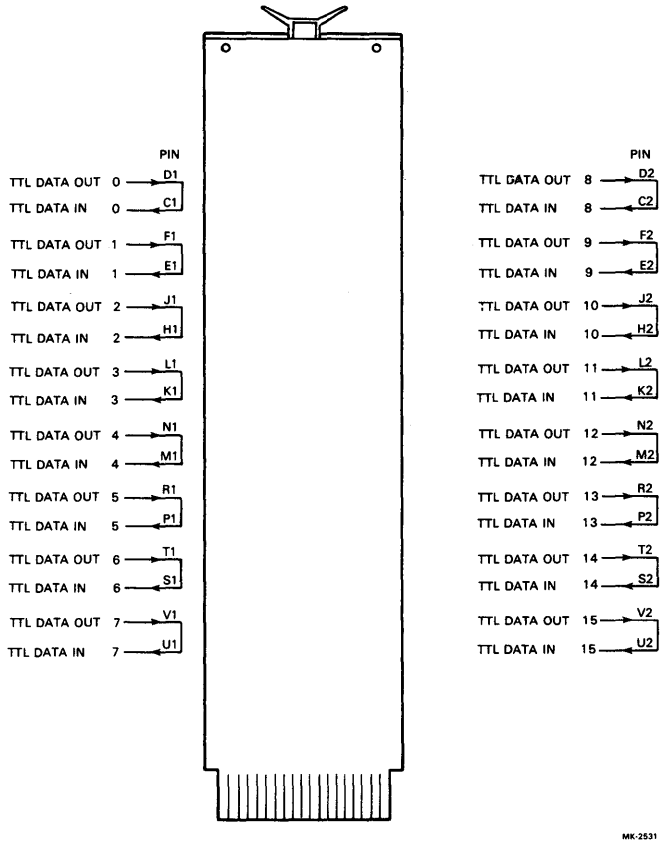


* INDICATES CAVITIES ARE NOT USED

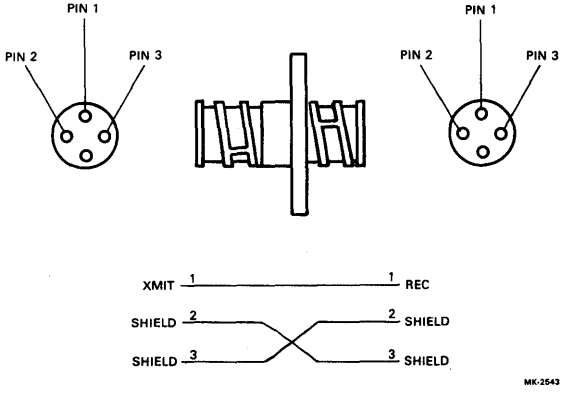


MK-2545

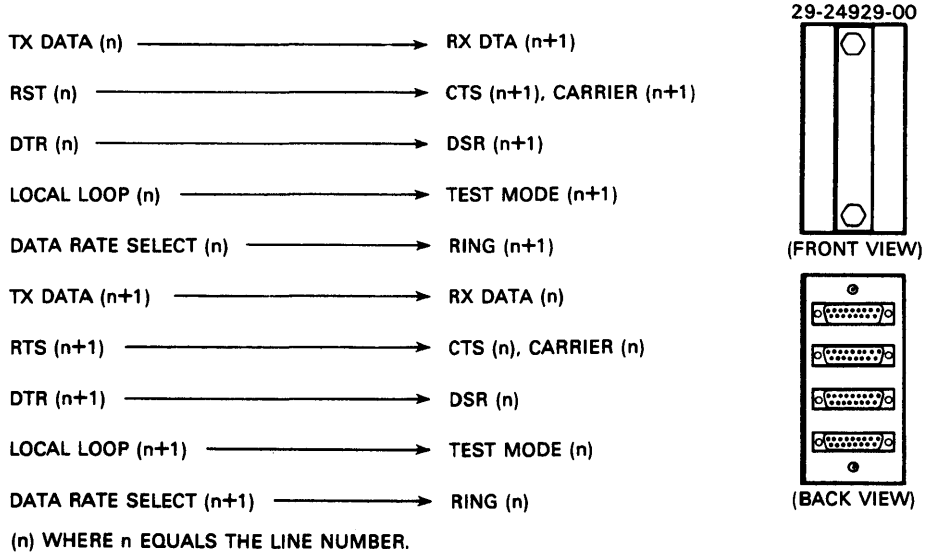
M974



12-12528



29-24929-00



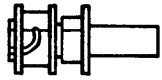
MKV84-0781

H3257/H3258

H3258
TERMINATOR
(FEMALE)

H3257
TERMINATOR
(MALE)

MK-2244



H8570
TERMINATOR (M)

MKV84-1277

CHAPTER 7
EIA/CCITT DATA

7.1 INTRODUCTION

This chapter provides a summary listing of the signal functions associated with each of the EIA and/or CCITT standards that are supported by the communications devices contained in this manual. The connector pin assignments (at the modem) for each signal are also included. Table 7-5 provides a cross-reference showing the relationship between each of the supported standards.

Table 7-1 RS-232-C Interface Pin/Signal Designations

Pin	Circuit	Direction	Function	CCITT Circuit Equivalent
1	AA		Protective Ground	101
2	BA	To Modem	Transmitted Data	103
3	BB	From Modem	Received Data	104
4	CA	To Modem	Request To Send	105
5	CB	From Modem	Clear To Send	106
6	CC	From Modem	Data Set Ready	107
7	AB		Signal Ground	102
8	CF	From Modem	Data Carrier Detector	109
9		(From Modem)	(Positive DC Test Voltage)	
10		(From Modem)	(Negative DC Test Voltage)	
11			Unassigned	
12	SCF	From Modem	Secondary Carrier Detector	122
13	SCB	From Modem	Secondary Clear To Send	121
14	SBA	To Modem	Secondary Transmitted Data	118
15	DB	From Modem	Transmitter Clock (Internal)114	
16	SBB	From Modem	Secondary Received Data	119
17	DD	From Modem	Receiver Clock	115
18		To Modem	Receiver Dibit Clock	
19	SCA	To Modem	Secondary Request To Send	120
20	CD	To Modem	Data Terminal Ready	108.2
21	CG	From Modem	Signal Quality Detector	110
22	CE	From Modem	Ring Indicator	125
23	CH/CI	To Modem	Data Rate Selector	111/112
24	DA	To Modem	External Transmitter Clock	113
25	CN	To Modem	Force Busy	

RS-232-C Voltage Standards

Measured at the Receiver Circuit:

Data

−25 V<LOGICAL / 1<−3 V(MARK)
+25 V>LOGICAL / 0>+3 V(SPACE)

Control

−25 V<LOGICAL / 0<−3 V(NEGATION)
+25 V>LOGICAL / 1>+3 V(ASSERTION)

Table 7-2 RS-449 (Physical Standard) Interface Pin/Signal Designations

				Circuit Equivalents	
Pin	**Circuit**	**Direction**	**Function**	**RS-232-C**	**CCITT**
1	SHIELD		Protective Ground		
2	SI	From Modem	Signal Rate Indicator	CI	112
3	SPARE				
4	SD	To Modem	Send Data (+)	BA	103
5	ST	From Modem	Send Timing (+)	DB	114
6	RD	From Modem	Receive Date (+)	BB	104
7	RS	To Modem	Request To Send (+)	CA	105
8	RT	From Modem	Receive Timing (+)	DD	115
9	CS	From Modem	Clear To Send (+)	CB	106
10	LL	To Modem	Local Loop		141
11	DM	From Modem	Data Mode (+)	CC	107
12	TR	To Modem	Terminal Ready (+)	CD	108.2
13	RR	From Modem	Receiver Ready (+)	CF	109
14	RL	To Modem	Remote Loop		140
15	IC	From Modem	Incoming Call	CE	125
16	SF/SR	To Modem	Select Frequency		126
			Signal Rate Select	CH	111
17	TT	To Modem	Terminal Timing (+)	DA	113
18	TM	From Modem	Test Mode		142
19	SG	To Modem	Signal Ground	AB	102
20	RC	From Modem	Receive Common		102b
21	SPARE				
22	SD	To Modem	Send Data (–)		
23	ST	From Modem	Send Timing (–)		
24	RD	From Modem	Receive Data (–)		
25	RS	To Modem	Request To Send (–)		
26	RT	From Modem	Receive Timing (–)		
27	CS	From Modem	Clear To Send (–)		
28	IS	To Modem	Terminal in Service		
29	DM	From Modem	Data Mode (–)		
30	TR	To Modem	Terminal Ready (–)		
31	RR	From Modem	Receiver Ready (–)		
32	SS	To Modem	Select Standby		116
33	SQ	From Modem	Signal Quality	CG	110
34	NS	To Modem	New Signal		
35	TT	To Modem	Terminal Timing (–)		
36	SB	From Modem	Standby Indication		117
37	SC	To Modem	Send Common		102a

Table 7-3 CCITT/V.35 Interface Pin/Signal Designations

				Circuit Equivalents	
Pin	**Circuit**	**Direction**	**Function**	**CCITT RS-232**	**RS-449**
A	101		Protective Ground		
B	102		Signal Ground	AB	SG
C	105	To Modem	Request To Send	CA	RS
D	106	From Modem	Ready for Sending	CB	CS
E	107	From Modem	Data Set Ready	CC	DM
F	109	From Modem	RCV Line Signal Det	CF	RR
H	108/1	To Modem	Connect Data Set		
	108/2	To Modem	Data Terminal Ready	CD	TR
J	125	From Modem	Calling Indicator	CE	IC
R	104	From Modem	Received Data A	BB	RD
T	104	From Modem	Received Data B		RD
V	115	From Modem	Receive Timing A	DD	RT
X	115	From Modem	Receive Timing B		RT
Y	114	From Modem	Transmit Timing A	DB	ST
AA	114	From Modem	Transmit Timing B		ST
P	103	To Modem	Transmit Data A	BA	SD
S	103	To Modem	Transmit Data B		SD
U	113	To Modem	Terminal Timing A	DA	TT
W	113	To Modem	Terminal Timing B		

Table 7-4 RS-366 ACU Interface Pin/Signal Designations

Pin	Direction	ACU Designation	Function
1		FGD	Frame Ground
2	To ACU	DPR	Digit Present
3	From ACU	ACR	Abandon Call, Retry
4	To ACU	CRQ	Call Request
5	From ACU	PND	Present Next Digit
6	From ACU	PWI	Power Indicator
7		SGD	Signal Ground
8			Not Used
9	From ACU		+ DC Test Voltage
10	From ACU		− DC Test Voltage
11			Not Used
12			Not Used
13	From ACU	DSS	Data Set Status
14	To ACU	NB1	Number Bit Weight 1
15	To ACU	NB2	Number Bit Weight 2
16	To ACU	NB4	Number Bit Weight 4
17	To ACU	NB8	Number Bit Weight 8
18			Not Used
19			Not Used
20			Not Used
21			Not Used
22	From ACU	DLO	Data Line Occupied
23			Not Used
24			Not Used
25			Not Used

Table 7-5 EIA/CCITT Standards Equivalency

EIA Electrical Characteristic Standard	EIA Interchange Circuit Definition Standard (DCE to DTE) with Connector	CCITT Electrical Characteristic Standard	CCITT Interchange Circuit Definition Standard (DCE to DTE) Without Connector	Recommended CCITT Interchange Connector
RS-232-C	RS-232-C	CCITT V.28	CCITT V.24	ISO 2110
RS-423-A	RS-449	CCITT V.10/X.26	CCITT V.24	ISO 4902
RS-422-A	RS-449	CCITT V.11/X.27	CCITT V.24	ISO 4902
N/A	N/A	CCITT V.35	CCITT V.24	ISO 2593

CHAPTER 8
VENDOR MODEM PRODUCTS

8.1 INTRODUCTION

This chapter contains a summary of the operational characteristics of some of the more commonly used modems and the option variations available with each of them.

Also included is the DIGITAL recommendation for configuring each of the options for optimum performance.

Table 8-1 Characteristic Summary for Selected Modems

Device Type	Speed	Auto Answer	Auto Dial	Remote Testing	Line	Operation
103J	0-300 bits/s (Async)	Yes	With 801 ACU	Yes	Switched	Half-Duplex or Full-Duplex (2 Wire)
108	0-300 bits/s (Async)	No	No	No	Series 2000 or 3002	Full-Duplex (2 Wire)
113	0-300 bits/s (Async)	Yes	No	Yes	Switched	Half-Duplex or Full-Duplex (2 Wire)
113A	0-300 bits/s (Async)	No	No	Yes	Switched	Manual Originate Full-Duplex (2 Wire)
201C	2400 bits/s (Sync)	Yes	With 801 ACU	Yes	Switched or 3002 Private Channel	Half-Duplex (2 Wire) Full-Duplex (4 Wire)
202S	1200 bits/s No conditioning 1800 bits/SC2 conditioning (Async)	Yes	With 801 ACU	Yes	Switched Series 2000 or Private Line Series 3000	Half-Duplex (2 Wire)

Table 8-1 Characteristic Summary for Selected Modems (Cont)

Device Type	Speed	Auto Answer	Auto Dial	Remote Testing	Line	Operation
202T	Same as 202S	No	No	Yes	2 or 4 Wire Series 3000 Private Line	Half-Duplex (2 Wire) Full-Duplex (4 Wire)
208A	4800 bits/s (Sync)	No	No	Yes	4 Wire 3002 Private Line	Full-Duplex (4 Wire)
208B	4800 bits/s (Sync)	Yes	With 801 ACU	Yes	Switched	Half-Duplex (2 Wire)
209A	1-9600 bits/s Channel, or 1-7200 bits/s and 1-2400 bits/s Channels or 2-4800 bits/s Channels or 4-2400 bits/s Channels (Sync)	No	No	Yes	3002 with D1 Conditioning	Full-Duplex (4 Wire)
212A	0-300 bits/s Async, or 1200 bits/s Char Async, or 1200 bits/s Sync	Yes	With 801 ACU	Yes		Full-Duplex (2 Wire)
402C	0-600 bits/s	Yes	With 801 ACU	Yes	Switched 2000 or 3002 Private Line	Half-Duplex (2 Wire) or Full-Duplex (4 Wire)
500A DSU	2.4K, 4.8K 9.6K, 56K Sync	No	No	Yes	4 Wire DDS	Full-Duplex Half-Duplex
501A DSU	9.6K, 56K Sync	Yes	Yes	Yes	4 Wire DDS	Full-Duplex Half-Duplex
510A DSU	2.4K, 4.8K	No	No	Yes	4 Wire DDS Multiport	Full-Duplex Half-Duplex

Table 8-1 Characteristic Summary for Selected Modems (Cont)

Device Type	Speed	Auto Answer	Auto Dial	Remote Testing	Line	Operation
550A CSU	56K Sync	No	No	N/A	4 Wire DDS	Analog
551A CSU	56K Sync	No	No	N/A	4 Wire DDS	Analog

Table 8-2 Modem Options

Modem	Option	Designation	DIGITAL Recommendation
103J	Receive Space Disconnect	V	Yes
	Send Space Disconnect	T	Yes
	Loss of Carrier Disconnect	R	No
	CC Indication	ZD	Early
	CB and CF Indications	B	Separate
	CC Indication for Analog Loop	ZF	On
	Auto Answer	ZH	Yes
	Failsafe State of CN Circuit	J	Off
	Tip/Ring Make Busy	E	No
	Ground	Q	Common
108	To Be Supplied		
113B	Common Ground	V	In
	CB/CF Indication	W	Out
	CN Control	X	In
	Tip/Ring Force Busy	Y	Out
	Data Terminal Control of Disconnect	Z	In

Table 8-2 Modem Options (Cont)

Modem	Option	Designation	DIGITAL Recommendation
201C	Ground	YK	Common
	Transmitter Timing	YC	Internal
	Auto Calling	By ACU	As required
	Auto Answer	YF	Under DTR control
	Ring Indication	YG	EIA RS-232 on pin 22
	Line Interface	XA	4 wire private (Full-duplex)
	Carrier Control	XA	Switched, 7 ms delay
	New Sync	YA	Not used
	Carrier Detector Sensitivity	ZU ZV	−24 dBm private wire −44 dBm switched net
202S	Receive Data Squelch	R	156 ms
	Soft Carrier Turnoff	R	24 ms
	Clear To Send Delay	G	180 ms
	Fast Carrier Detection	N	Out (23 ms)
	Received Data Clamp	F	In (Required)
	Local Copy Primary Channel	ZB	Out
	Reverse Channel	ZC ZD	As required (In or out)
	Local Copy Reverse Channel	ZF	Out
	Auto Answer	B	In
	Transmit Only	YH	Out
	CC Indicator In Analog Loopback	YJ	Off
	Ground	ZG	Common
	801 ACU	–	As required

Table 8-2 Modem Options (Cont)

Modem	Option	Designation	DIGITAL Recommendation
202T	4 Wire Full-Duplex	ZK	Full-Duplex
	2 Wire Half-Duplex	See Reverse Channel Below	Half-duplex only recommended for controllers with full modem control and 2780 software package
	Receive Data Squelch	R	156 ms
	Soft Carrier Turnoff	R	24 ms
	Clear To Send Delay	G	180 ms
	Fast Carrier Detection	N	Out (23 ms)
	Received Data Clamp	F	In (Required)
	Local Copy Primary Channel	ZB	Out
	Reverse Channel	ZC ZD ZK	In (As required) Out 4 wire operation
	Local Copy Reverse Channel	ZF	Out
	Carrier Detector Reset	ZM	Out
	Continuous Carrier	ZO	Out
	Compromise Equalization	ZU ZV	Maximum (determined by installer) Minimum (to match channel characteristics)
	Ground	ZG	Common
	Alternate Voice	A B	Out (as required) In

Table 8-2 Modem Options (Cont)

Modem	Option	Designation	DIGITAL Recommendation
208A	Transmitter Timing	YC	Modem provides transmitter clock
	Carrier Control	XB	Continuous carrier (as required)
		XA	Switched carrier
	Request To Send	YS	Continuous RTS (as required)
		YT	Switched RTS
	One Second Holdover	YX	Enabled (recommended for use with continuous carrier, selected above)
		YW	Disabled (recommended for use with multipoint master station)
	New Sync	YA	Not used
	CC Condition in Analog Loopback	YM	DSR asserted in analog loopback
	Alternate Voice	YI	Data auxiliary set installed
		YJ	No data auxiliary set
	Automatic Retrain	YU	Must be installed
	Compromise Equalizer	YQ	Must be disabled
208B	Transmitter Timing		Internal
	Auto Call		As required
	CC Condition in Analog Loopback		CC on when analog loopback button is pressed
	Auto Answer		Yes
209A	Transmitter Timing Provided		Internal
	Carrier Control		Switched

Table 8-2 Modem Options (Cont)

Modem	Option	Designation	DIGITAL Recommendation
	Request To Send Control		Switched
	Elastic Store		Out
	Slaved Transmitter Timing		Out
	Data Set Ready (CC) Condition in AL Mode (Form Used in Test 4)		CC on
	Grounding		AA not connected to AB
212	Tip/Ring Make Busy	E	Out
	CC Indication Analog Loop	ZF	On
	CN Circuit	YF	Out
	Transmitter Timing	YC	Internal
	1200 Baud Operation	YG	Async/Start-Stop
	Character Length	YJ	10 Bit
	Receiver Respond Digital Loop	YK	In
	Loss of Carrier Disconnect	S	Out
	Receive Space Disconnect	V	In
	CB and CF Indications	B	Separate
	Send Space Disconnect	T	In
	Auto Answer	ZH	In

Table 8-2 Modem Options (Cont)

Modem	Option	Designation	DIGITAL Recommendation
	Answer Mode Indication	W	Off
	Speed Mode	YP	Dual
	Interface Speed Indication	YQ	In
	Signal Ground to Frame Connect	Q	In

Table 8-3 801-C ACU Options

Option	Designation	DIGITAL Recommendation
Call Termination	Z or A G or ZD	After DSS via CRQ or After DSS via data set
ACR Timer	R	Stop timer when DSS sets
DSS Transfer	B	Answer tone detection or at 'EON' code
Answer Detection	W X S T	Detect end of answer tone Detect beginning of answer tone Detect 2025 tone Detect 2225 tone
Ground Start	V Y	In Out
Data Set Answer Detection	E	Without 'EON'
Circuit	ZH ZJ ZK	2 wire 4 wire loop start 4 wire ground start
DLO Lead	ZM ZL	801 only control 801 and dataset control

DF127 MODEM

DF127 General Description

The DF127 modem provides both half- and full-duplex, synchronous, binary serial data communications over 2- or 4-wire private/leased telephone network facilities. At high speed (4800 bits/s), the DF127 modem uses 8-phase differential phase shift keying (DPSK). At low speed (2400 bits/s), the DF127 modem uses quaternary differential phase shift keying (QDPSK).

The DF127-AA modem consists of:

- DF127-AM modem module
- DF100-DT desktop enclosure

The DF127-BB modem consists of the DF127-BM modem module.

Multiple modem enclosure available is the DF100-RM.

The DF127-AM and DF127-BM modem modules can also be installed into the DFM statistical multiplexer.

DF127 registration numbers:

- FCC: Not Required
- DOC: 192 1040B

DF127-AM and DF127-BM Specifications

Data Rate	
Low Speed	2400 bits/s
High Speed	4800 bits/s
Modulation	
Low Speed	Quaternary differential phase shift keying (QDPSK)
High Speed	Eight-phase differential phase shift keying (DPSK)
Format	Synchronous binary stream data
Telephone Connectors	2- or 4-wire private/leased telephone network (P/LTN)
Compatibility	CCITT V.27 bis
Interface Compatibility	EIA RS-232-C/CCITT V.24, V.28 compatible voltages

Communication Mode	Full-duplex over 4-wire and half-duplex over 2-wire
Interface Cables	BC22F or BCC04 (or equivalent) for synchronous operation
Signal Detect	
Turn ON	−26 dBm
Turn OFF	−31 dBm
Operating Temperature	10°C to 40°C (50°F to 104°F)
Storage Temperature	−40°C to +66°C (−40°F to +150°F)
Relative Humidity	10% to 90% noncondensing
Module Weight	0.635 kg (1.44 lb)
DC Power Requirements	+5 Vdc @ 0.900 A maximum +12 Vdc @ 0.070 A maximum −12 Vdc @ 0.250 A maximum

DF127 Reference Documentation
Refer to the following documents if the level of content in this section is insufficient:

- *DF127 Modem Family User Guide* EK-DF127-UG
- *DF127-B Series Modem Family Installation Guide* EK-UK127-IG

DF127-AM and DF127-BM Modem Options

The DF127 modem modules contain four jumpers and three switchpacks (S1 through S3) to select a variety of options. Tables DF127-1 through DF127-10 list each of the jumpers and switches and the option that is selected. Each module is shipped from the factory with preset options. In the tables, factory settings are printed in blue. Refer to Chapter 8 for descriptions of the modem options.

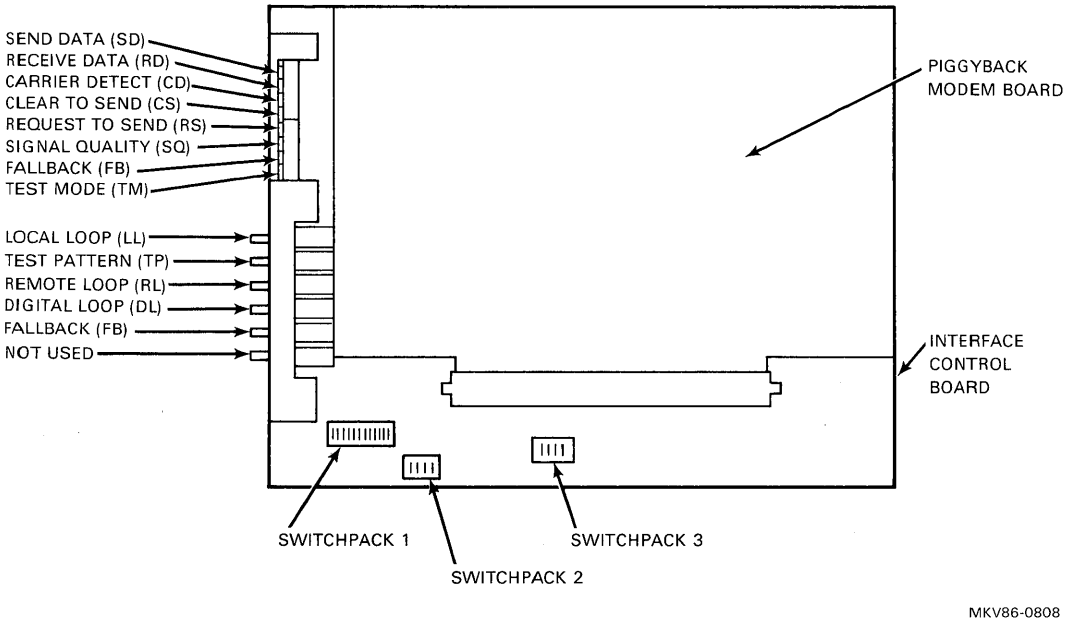


Figure DF127-1 DF127-AM and DF127-BM (Version 2) Module Layout

Table DF127-1 DF127-AM and DF127-BM (Version 2) Jumper Descriptions

Jumper Group	Pad	Description
J3	1,2,3,4, & 6	Selects EIA pin 23 as speed indicate signal or speed select signal depending on jumper configuration.
	7,8,9, & 10	Allows the DTE to initiate local analog loopback (instead of the front panel LL switch) by placing a positive signal on EIA pin 18.
	11,12,13, & 14	Allows the DTE to initiate remote digital loopback (instead of the front panel RL switch) by placing a positive signal on EIA pin 21.
J5	1 & 2	Always installed for DF127 modem.
J6	1 & 2	Connects EIA pin 1 (protective ground) to modem ground. Normally this jumper is left open.
J7	1,2, & 3	Selects 2-wire or 4-wire mode.

Table DF127-2 DF127-AM and DF127-BM (Version 2) Jumper Selections

Jumper	In	Out	Function
J3	1 - 2 4 - 6	3 - 4	DTE selects modem speed by controlling EIA pin 23.
	3 - 4	1 - 2 4 - 6	Allows the modem to indicate speed by placing a signal on EIA pin 23.
	7 - 8	9 - 10	Enables DTE to initiate LL.
	9 - 10	7 - 8	Disables DTE LL control.
	11 - 12	13 - 14	Enables DTE to initiate RL
	13 - 14	11 - 12	Disables DTE RL control.
J5	1 - 2		Selects V.27 mode. Always installed on DF127-AM modem module.
J6	1 - 2		Connects EIA pin 1 (protective ground) to modem ground.
		1 - 2	Disconnects EIA pin 1 (protective ground) from modem ground.
J7	1 - 2	2 - 3	Selects 2-wire configuration.
	2 - 3	1 - 2	Selects 4-wire configuration.

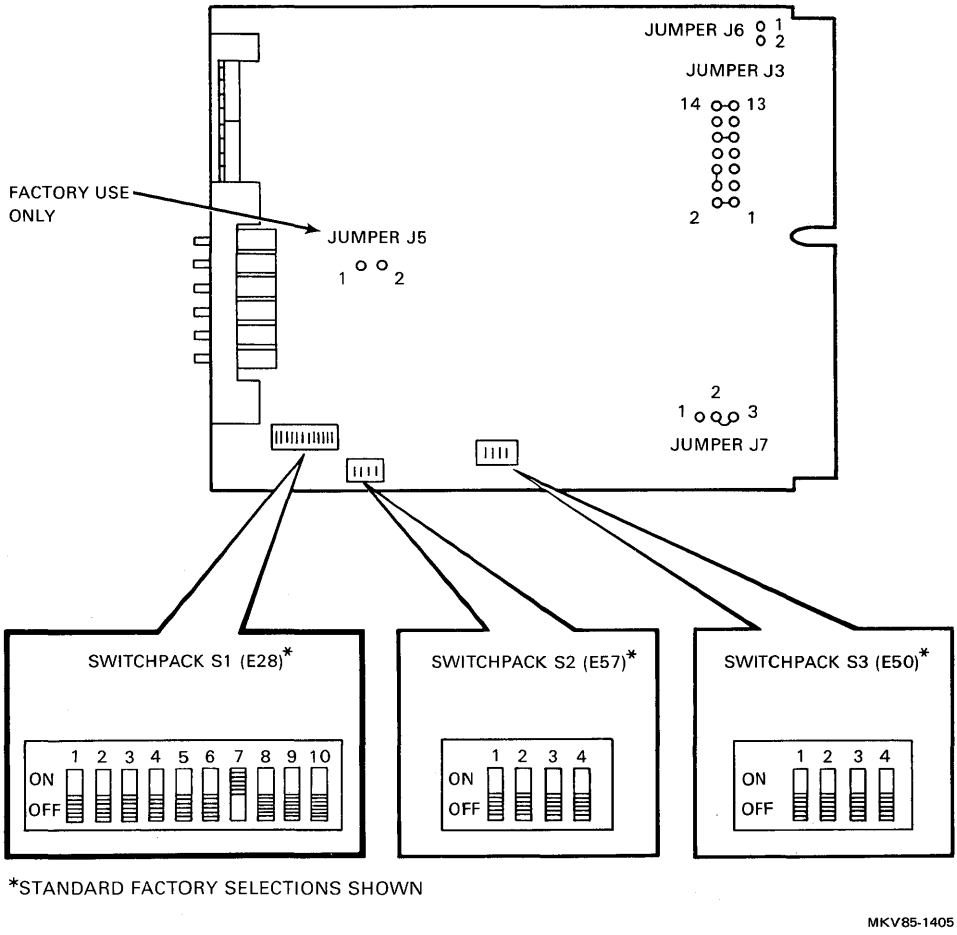


Figure DF127-2 DF127-AM and DF127-BM (Version 2) Switchpack Locations

Table DF127-3 DF127-AM and DF127-BM (Version 2) Switchpack 1 Selections

Option	Selection	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Transmit Clock 1	External	ON									
	Internal	OFF									
Equalizer Sampling	T		ON								
	T/2		OFF (Note 4)								
Carrier Control	RTS			ON							
	Continuous			OFF (Note 4)							
Loopback Control	Bi-Direction				ON						
	Uni-Direction				OFF						
Squelch	Enabled					ON					
	Disabled					OFF (Note 4)					
Transmit Clock 2	Slave						ON				
	Independent						OFF (Note 1)				
Carrier Threshold	−26 dBm							ON			
	−43 dBm							OFF			
Data Quality Threshold	10^{-4}								ON		
	10^{-3}								OFF (Note 2)		
RTS to CTS & CD (Notes 3 & 4)	<15 ms									ON	
	Training									OFF	
Remote Loopback	Disabled										ON
	Enabled										OFF

NOTES:

1. This option only applies when the Transmit Clock 1 option is set to Internal (switchpack 1, switch 1 OFF).

2. This option is enabled or disabled by switchpack 2, switch 1. When enabled, retraining occurs when the error rate reaches the data quality threshold selected by switchpack 1, switch 8.

3. The training period varies with modem speed and the selection of switchpack 2, switch 3 (see below).

Speed	Long Interval (Switch 3 OFF)	Short Interval (Switch 3 ON)
Low	708 ms	50 ms
High	943 ms	66 ms

4. These options must be set to OFF when the DF127 modem is used in the DFM statistical multiplexer as an integral modem.

Table DF127-4 DF127-AM and DF127-BM (Version 2) Switchpack 2 Selections

Option	Selection	S1	S2	S3	S4
Data Quality Retrain (Notes 1 & 2)	Disabled	ON			
	Enabled	OFF			
Round-Robin Retrain (Note 3)	Disabled		ON		
	Enabled		OFF		
Training Interval (Notes 2 & 4)	Short			ON	
	Long			OFF	
Reserved					NOT USED

NOTES:

1. This switch works together with switchpack 1, switch 8.

2. This option must be set to OFF when the DF127 modem module is used in the DFM statistical multiplexer as an integral modem.

3. This switch is valid only in RTS controlled carrier mode (switchpack 1, switch 3 ON). In continuous carrier mode, the round-robin feature is always enabled, regardless of the position of this switch.

4. This switch selects the timing interval when switchpack 1, switch 9 is set to OFF. See below:

Speed	Long Interval (Switch 3 OFF)	Short Interval (Switch 3 ON)
High	708 ms	50 ms
Low	943 ms	66 ms

Table DF127-5 DF127-AM and DF127-BM (Version 2) Switchpack 3 Selections

Option	Selection	S1	S2	S3	S4
Private Line XMIT Level	0 dBm	OFF	OFF	OFF	OFF
	− 1 dBm	ON	OFF	OFF	OFF
	− 2 dBm	OFF	ON	OFF	OFF
	− 3 dBm	ON	ON	OFF	OFF
	− 4 dBm	OFF	OFF	ON	OFF
	− 5 dBm	ON	OFF	ON	OFF
	− 6 dBm	OFF	ON	ON	OFF
	− 7 dBm	ON	ON	ON	OFF
	− 8 dBm	OFF	OFF	OFF	ON
	− 9 dBm	ON	OFF	OFF	ON
	−10 dBm	OFF	ON	OFF	ON
	−11 dBm	ON	ON	OFF	ON
	−12 dBm	OFF	OFF	ON	ON
	−13 dBm	ON	OFF	ON	ON
	−14 dBm	OFF	ON	ON	ON
	−15 dBm	ON	ON	ON	ON

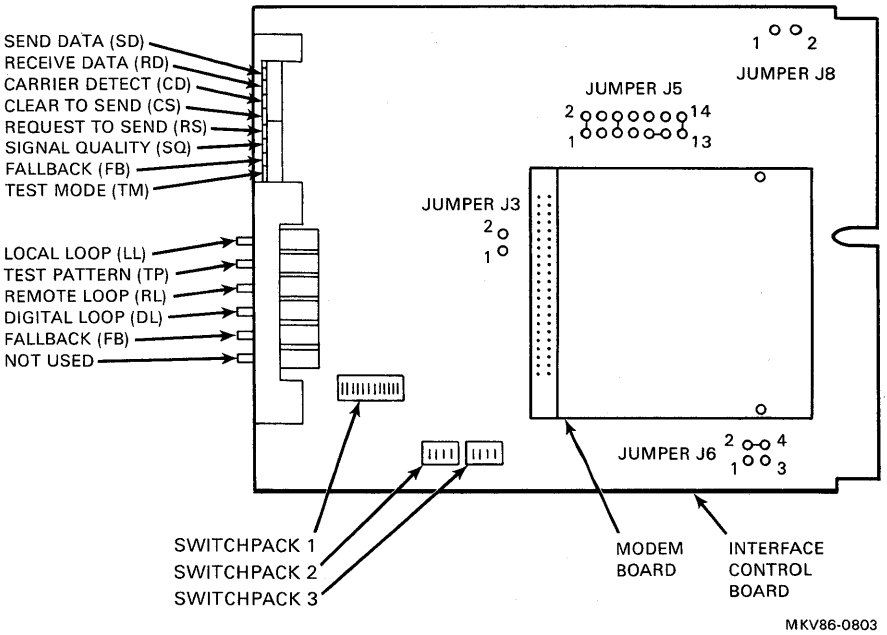


Figure DF127-3 DF127-AM and DF127-BM (Version 3) Module Layout

Table DF127-6 DF127-AM and DF127-BM (Version 3) Jumper Descriptions

Jumper Group	Pad	Description
J5	9,11,12,13, & 14	Selects EIA pin 23 as speed indicate signal or speed select signal depending on jumper configuration.
	5,6,7, & 8	Allows the DTE to initiate local analog loopback (instead of the front panel LL switch) by placing a positive signal on EIA pin 18.
	1,2,3, & 4	Allows the DTE to initiate remote digital loopback (instead of the front panel RL switch) by placing a positive signal on EIA pin 21.
J3	1 & 2	Always installed for DF127 modem.
J8	1 & 2	Connects EIA pin 1 (protective ground) to modem ground. Normally this jumper is left open.
J6	1,2,3, & 4	Selects 2-wire or 4-wire mode.

Table DF127-7 DF127-AM and DF127-BM (Version 3) Jumper Selections

Jumper	In	Out	Function
J5	11 - 12	9 - 11	DTE selects modem speed by controlling EIA pin 23.
	9 - 11 13 - 14	11 - 12	Allows the modem to indicate speed by placing a signal on EIA pin 23.
	7 - 8	5 - 6	Enables DTE to initiate LL.
	5 - 6	7 - 8	Disables DTE LL control.
	3 - 4	1 - 2	Enables DTE to initiate RL
	1 - 2	3 - 4	Disables DTE RL control.
J3	1 - 2		Selects V.27 mode. Always installed on DF127-AM modem module.
J8	1 - 2		Connects EIA pin 1 (protective ground) to modem ground.
		1 - 2	Disconnects EIA pin 1 (protective ground) from modem ground.
J6	1 - 3	2 - 4	Selects 2-wire configuration.
	2 - 4	1 - 3	Selects 4-wire configuration.

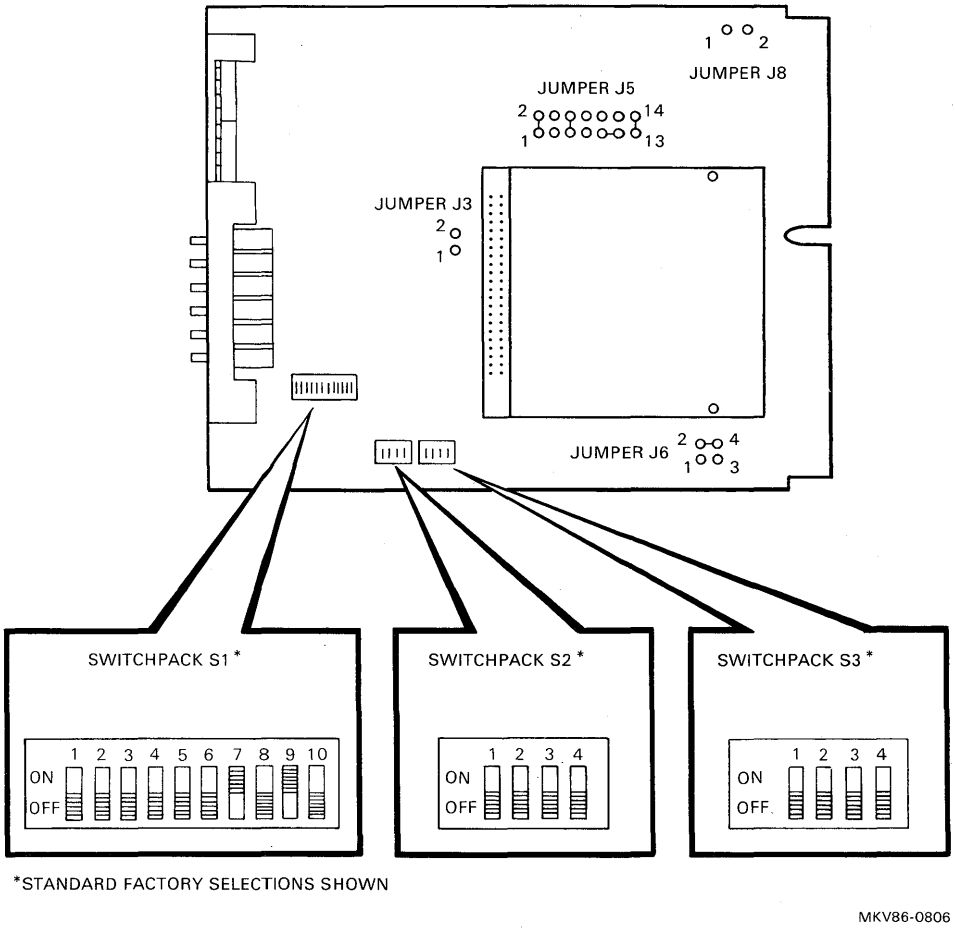


Figure DF127-4 DF127-AM and DF127-BM (Version 3) Switchpack Locations

Table DF127-8 DF127-AM and DF127-BM (Version 3) Switchpack 1 Selections

Option	Selection	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Transmit Clock 1	External	ON									
	Internal	OFF									
Equalizer Sampling	T		ON								
	T/2		OFF								
Carrier Control	RS			ON							
	Continuous			OFF							
Loopback Control	Bi-Direction				ON						
	Uni-Direction				OFF						
Squelch	Enabled					ON					
	Disabled					OFF					
Transmit Clock 2	Slave						ON				
	Independent						OFF (Note 1)				
Carrier Threshold	−26 dBm							ON			
	−43 dBm							OFF			
Data Quality Threshold	10^{-4}								ON		
	10^{-3}								OFF (Note 2)		
RS to CS	<3 ms									ON	
	50 ms									OFF (Note 3)	
Remote Loopback	Disabled										ON
	Enabled										OFF

NOTES:

1. This option only applies when the Transmit Clock 1 option is set to Internal.

2. This option is enabled or disabled by switchpack 2, switch 1. When enabled, retraining occurs when the error rate reaches the data quality threshold selected by switchpack 1, switch 8.

3. This selection is valid only in continuous carrier mode (switchpack 1, switch 3=OFF) when the modems are already trained. In RS controlled carrier mode, the RS to CS delay is dependent on modem speed and the training interval selection of switchpack 2, switch 3.

Table DF127-9 DF127-AM and DF127-BM (Version 3) Switchpack 2 Selections

Option	Selection	S1	S2	S3	S4
Data Quality Retrain (Notes 1 & 2)	Disabled	ON			
	Enabled	OFF			
Round-Robin Retrain (Note 3)	Disabled		ON		
	Enabled		OFF		
Training Interval (Notes 2 & 4)	Short			ON	
	Long			OFF	
Reserved					NOT USED

NOTES:

1. This switch works together with switchpack 1, switch 8.
2. These options must be set to OFF when the DF127 modem module is used in the DFM statistical multiplexer as an integral modem.
3. This switch is valid only in RS controlled carrier mode. In continuous carrier mode, the round-robin feature is always enabled, regardless of the position of this switch.
4. This switch selects the timing interval (see chart below) when the RS controlled carrier option is selected (switchpack 1, switch 3=ON).

Speed	Long Interval (Switch 3 OFF)	Short Interval (Switch 3 ON)
Normal (4800 b/s)	708 ms	50 ms
Fallback (2400 b/s)	943 ms	66 ms

Table DF127-10 DF127-AM and DF127-BM (Version 3) Switchpack 3 Selections

Option	Selection	S1	S2	S3	S4
Private Line XMIT Level	0 dBm	OFF	OFF	OFF	OFF
	− 1 dBm	ON	OFF	OFF	OFF
	− 2 dBm	OFF	ON	OFF	OFF
	− 3 dBm	ON	ON	OFF	OFF
	− 4 dBm	OFF	OFF	ON	OFF
	− 5 dBm	ON	OFF	ON	OFF
	− 6 dBm	OFF	ON	ON	OFF
	− 7 dBm	ON	ON	ON	OFF
	− 8 dBm	OFF	OFF	OFF	ON
	− 9 dBm	ON	OFF	OFF	ON
	−10 dBm	OFF	ON	OFF	ON
	−11 dBm	ON	ON	OFF	ON
	−12 dBm	OFF	OFF	ON	ON
	−13 dBm	ON	OFF	ON	ON
	−14 dBm	OFF	ON	ON	ON
	−15 dBm	ON	ON	ON	ON

Installing the Modem Module
Since the DF127-AM and DF127-BM modem modules are packaged individually, the modem module must be installed into the standalone or multiple modem enclosure before connecting to the network. Refer to the Desktop Enclosure section in Chapter 5 for installation of the DF127-AM and DF127-BM modem modules into the DF100-DT desktop enclosure. Refer to the Rack Mount Enclosure section in Chapter 5 for installation into the DF100-RM multiple modem enclosure.

Refer to Chapter 6 for installation of the DF127-AM and DF127-BM modem modules into the DFM statistical multiplexer.

Installing the Modem
The DF127 modem can be installed to a private/leased line. Refer to Chapter 5 for installation of the modem to private line telephone services.

NOTE

DF127-AM modem modules up to serial number NQ01800 are designed for use with the DFM statistical multiplexer only, and should not be used in any other enclosure. Modules above serial number NQ01800 can be used in any of the available enclosures.

DF127 TESTING

General
Diagnostic testing of the DF127-AM, -BM modem module exists for the following types of tests:

- **Power-Up Self-Test**
- **Local DTE Test**
- **Local Analog Loopback Test**
  Set LL switch on local modem
- **Local Analog Loopback Self-Test**
  Set LL and TP switches and verify TM indicator
- **Digital Loopback Self-Test**
  Set DL switch on local modem, TP switch on remote modem, and verify TM indicator on remote modem
- **Remote Digital Loopback Test**
  Set RL switch on local modem
- **Remote Digital Loopback Self-Test**
  Set TP and RL switches on local modem and verify TM indicator on local modem
- **End-To-End Self-Test**
  Set TP switch on both modems and verify TM indicator on both modems

Refer to Chapter 7 for the test procedures for the DF127-AM and DF127-BM modem modules.

NOTES

NOTES

DF129 MODEM

DF129 General Description

The DF129 modem provides full-duplex, synchronous, binary serial data communications over 4-wire private/leased telephone network facilities. At high speed (9600 bits/s), the DF129 modem uses 16-point quadrature amplitude modulation (QAM). At the low speed of either 7200 bits/s or 4800 bits/s, the DF129 modem uses either 8-point quadrature amplitude modulation (QAM), or quaternary differential phase shift keying (QDSPK).

The DF129-AA modem consists of:

- DF129-AM modem module
- DF100-DT desktop enclosure

The DF129-BB modem consists of the DF129-BM modem module.

The multiple modem enclosure available is the DF100-RM.

The DF129-AM and DF129-BM modem modules can also be installed into the DFM statistical multiplexer.

DF129 registration numbers:

- FCC: Not Required
- DOC: 192 1040B

DF129-AM and DF129-BM Specifications

Data Rate	
Low Speed	4800 bits/s or 7200 bits/s
High Speed	9600 bits/s
Modulation	
Low Speed	4800 bits/s quaternary differential phase shift keying (QDPSK)
	7200 bits/s 8-point quadrature amplitude modulation (QAM)
High Speed	9600 bits/s 16-point quadrature amplitude modulation (QAM)
Format	Synchronous binary stream data
Telephone Connections	4-wire private/leased telephone network (PLTN) capable of supporting 9600 bits/s communications

Compatibility	CCITT V.29
Communications Mode	Full-duplex at all data rates
Interface Compatibility	EIA RS-232-C/CCITT V.24 compatible voltages
Interface Cables	BC22F or BCC04 (or equivalent) for synchronous operation
Signal Detect	
Turn ON	−26 dBm
Turn OFF	−31 dBm
Operating Temperature	10°C to 40°C (50°F to 104°F)
Storage Temperature	−40°C to +66°C (−40°F to +150°F)
Relative Humidity	10% to 90% noncondensing
Module Weight	0.635 kg (1.44 lb)
DC Power Requirements	+5 Vdc @ 0.900 A maximum +12 Vdc @ 0.070 A maximum −12 Vdc @ 0.250 A maximum

DF129 Reference Documentation
Refer to the following documents if the level of content in this section is insufficient:

- *DF129 Modem Family User Guide* EK-DF129-UG
- *DF129-B Series Modem Family Installation Guide* EK-UK129-IG

DF129-AM and DF129-BM Modem Options

The DF129 modem modules contain four jumpers and three switchpacks (S1 through S3) to select a variety of options. Tables DF129-1 through DF129-10 list each of the jumpers and switches and the option that is selected. Each module is shipped from the factory with preset options. In the tables, factory settings are printed in blue. Refer to Chapter 8 for descriptions of the modem options.

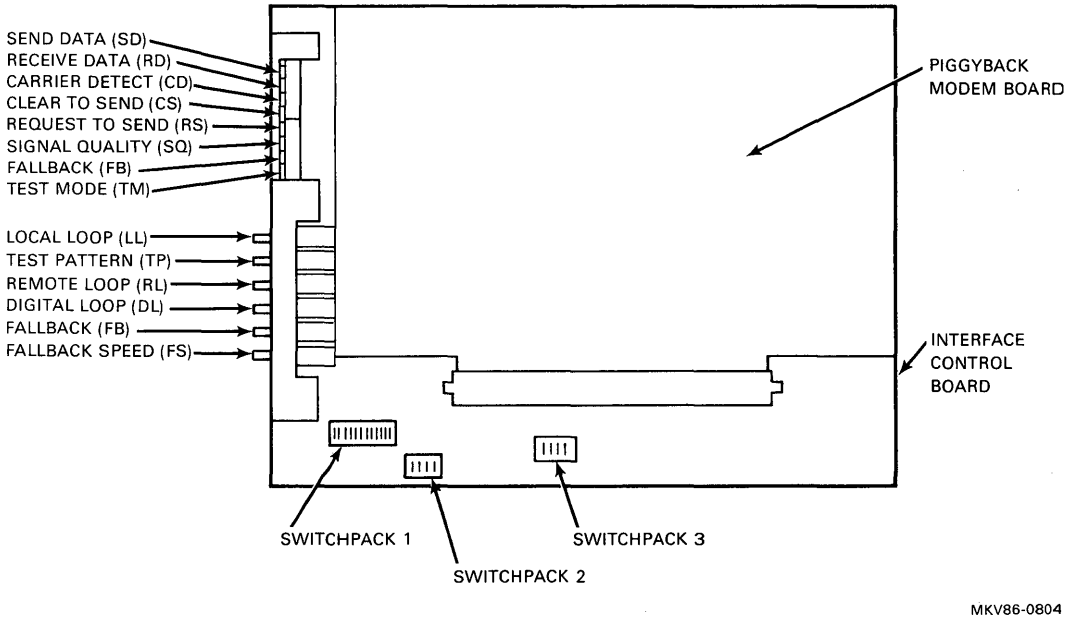


Figure DF129-1 DF129-AM and DF129-BM (Version 2) Module Layout

Table DF129-1 DF129-AM and DF129-BM (Version 2) Jumper Descriptions

Jumper Group	Pad	Description
J3	1,2,3,4, & 6	Selects EIA pin 23 as speed indicate signal or speed select signal depending on jumper configuration.
	7,8,9, & 10	Allows the DTE to initiate local analog loopback (instead of the front panel LL switch) by placing a positive signal on EIA pin 18.
	11,12,13, & 14	Allows the DTE to initiate remote digital loopback (instead of the front panel RL switch) by placing a positive signal on EIA pin 21.
J5	1 & 2	For factory use only.
J6	1 & 2	Connects EIA pin 1 (protective ground) to modem ground. Normally this jumper is left open.
J7	1,2, & 3	Not used

Table DF129-2 DF129-AM and DF129-BM (Version 2) Jumper Selections

Jumper	In	Out	Function
J3	1 – 2 4 – 6	3 – 4	DTE selects modem speed by controlling EIA pin 23.
	3 – 4	1 – 2 4 – 6	Allows the modem to indicate speed by placing a signal on EIA pin 23.
	7 – 8	9 – 10	Enables DTE to initiate LL.
	9 – 10	7 – 8	Disables DTE LL control.
	11 – 12	13 – 14	Enables DTE to initiate RL.
	13 – 14	11 – 12	Disables DTE RL control.
J6	1 – 2		Connects EIA pin 1 (protective ground) to modem ground.
		1 – 2	Disconnects EIA pin 1 (protective ground) from modem ground.

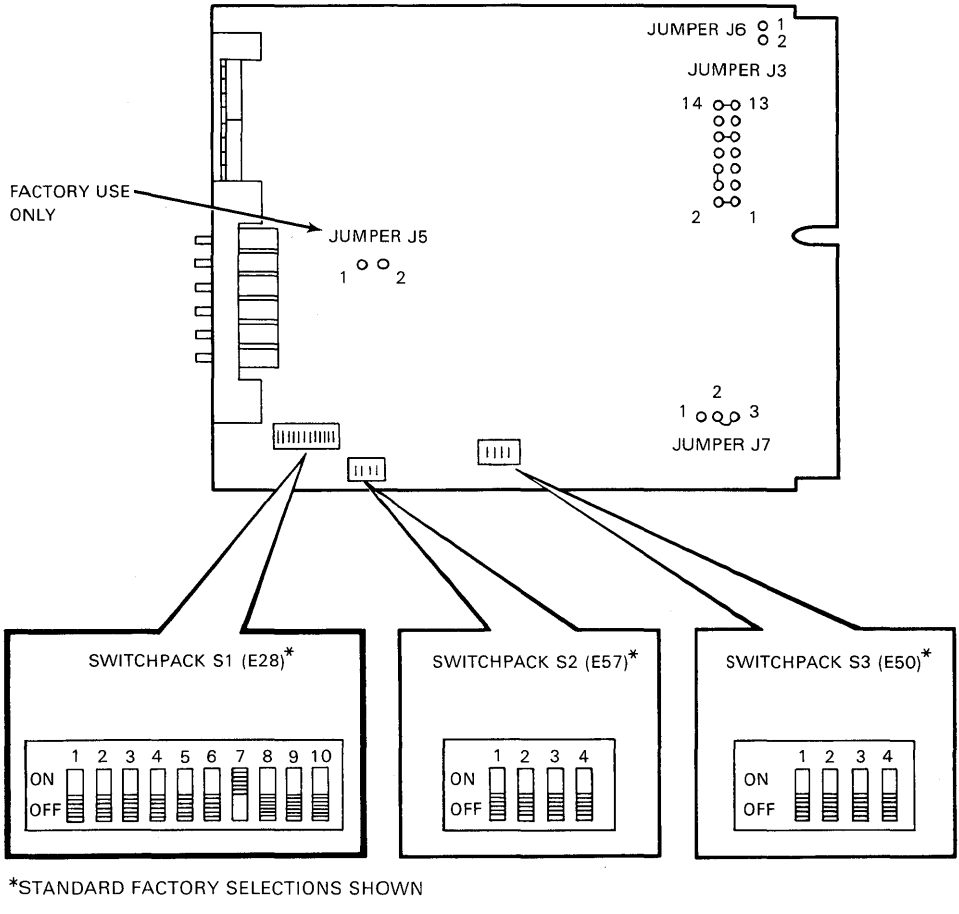


Figure DF129-2 DF129-AM and DF129-BM (Version 2) Switchpack Locations

Table DF129-3 DF129-AM and DF129-BM (Version 2) Switchpack 1 Selections

Option	Selection	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Transmit Clock 1	External	ON									
	Internal	OFF									
Equalizer Sampling	T		ON								
	T/2		OFF (Note 1)								
Carrier Control	RTS			ON							
	Continuous			OFF (Note 1)							
Loopback Control	Bi-Direction				ON						
	Uni-Direction				OFF						
Squelch	Enabled					ON					
	Disabled					OFF (Note 1)					
Transmit Clock 2	Slave						ON				
	Independent						OFF (Note 2)				
Carrier Threshold	–26 dBm							ON			
	–43 dBm							OFF			
Data Quality Threshold	10^{-4}								ON		
	10^{-3}								OFF (Note 3)		
RTS to CTS & CD (Notes 1 & 4)	<15 ms									ON	
	253 ms									OFF	
Remote Loopback	Disabled										ON
	Enabled										OFF

NOTES:

1. These options must be set to OFF when the DF129 modem is used in the DFM statistical multiplexer as an integral modem.
2. This option only applies when the Transmit Clock 1 option is set to Internal (switchpack 1, switch 1 OFF).
3. This option is enabled or disabled by switchpack 2, switch 1. When enabled, retraining occurs when the error rate reaches the data quality threshold selected by switchpack 1, switch 8.
4. This option is valid only in continuous carrier mode (switchpack 1, switch 3 OFF).

Table DF129-4 DF129-AM and DF129-BM (Version 2) Switchpack 2 Selections

Option	Selection	S1	S2	S3	S4
Data Quality Retrain	Disabled	ON			
	Enabled	OFF (Notes 1 & 2)			
Round Robin Retrain	Disabled		ON		
	Enabled		OFF (Note 3)		
Training Interval	Long			NOT USED	
	Short				
Reserved					NOT USED

NOTES:

1. This switch works together with switchpack 1, switch 8.
2. This option must be set to OFF when the DF129 modem module is used in the DFM statistical multiplexer as an integral modem.
3. This switch is valid only in RTS controlled carrier mode (switchpack 1, switch 3 ON). In continuous carrier mode, the round-robin feature is always enabled, regardless of the position of this switch.

Table DF129-5 DF129-AM and DF129-BM (Version 2) Switchpack 3 Selections

Option	Selection	S1	S2	S3	S4
Private Line XMIT Level	0 dBm	OFF	OFF	OFF	OFF
	− 1 dBm	ON	OFF	OFF	OFF
	− 2 dBm	OFF	ON	OFF	OFF
	− 3 dBm	ON	ON	OFF	OFF
	− 4 dBm	OFF	OFF	ON	OFF
	− 5 dBm	ON	OFF	ON	OFF
	− 6 dBm	OFF	ON	ON	OFF
	− 7 dBm	ON	ON	ON	OFF
	− 8 dBm	OFF	OFF	OFF	ON
	− 9 dBm	ON	OFF	OFF	ON
	−10 dBm	OFF	ON	OFF	ON
	−11 dBm	ON	ON	OFF	ON
	−12 dBm	OFF	OFF	ON	ON
	−13 dBm	ON	OFF	ON	ON
	−14 dBm	OFF	ON	ON	ON
	−15 dBm	ON	ON	ON	ON

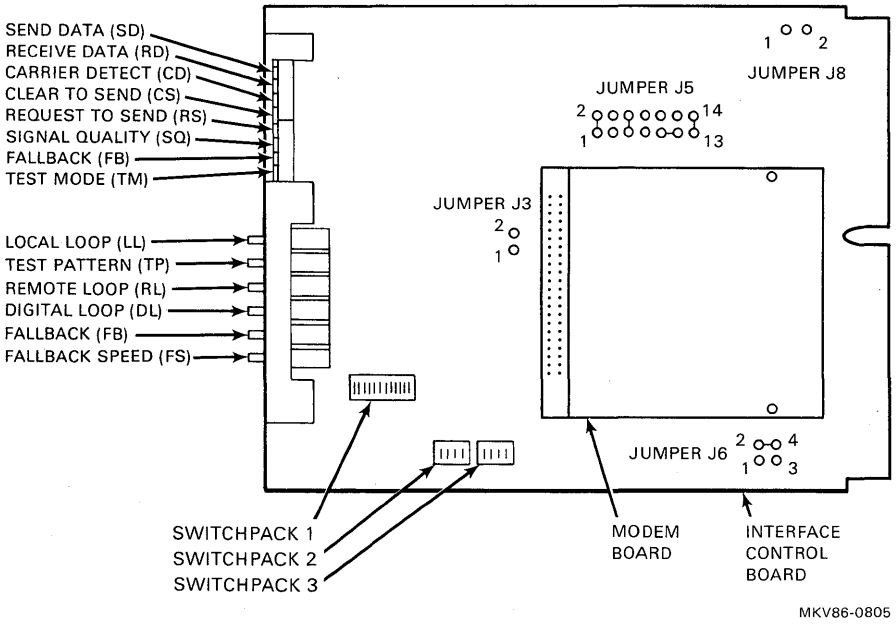


Figure DF129-3 DF129-AM and DF129-BM (Version 3) Module Layout

Table DF129-6 DF129-AM and DF129-BM (Version 3) Jumper Descriptions

Jumper Group	Pad	Description
J5	9,11,12,13 & 14	Selects EIA pin 23 as speed indicate signal or speed select signal depending on jumper configuration.
	5,6,7, & 8	Allows the DTE to initiate local analog loopback (instead of the front panel LL switch) by placing a positive signal on EIA pin 18.
	1,2,3, & 4	Allows the DTE to initiate remote digital loopback (instead of the front panel RL switch) by placing a positive signal on EIA pin 21.
J3	1 & 2	For factory use only.
J8	1 & 2	Connects EIA pin 1 (protective ground) to modem ground. Normally this jumper is left open.
J6	1,2,3, & 4	Not used

Table DF129-7 DF129-AM and DF129-BM (Version 3) Jumper Selections

Jumper	In	Out	Function
J5	11 - 12	9 - 11	DTE selects modem speed by controlling EIA pin 23.
	9 - 11 13 - 14	11 - 12	Allows the modem to indicate speed by placing a signal on EIA pin 23.
	7 - 8	5 - 6	Enables DTE to initiate LL.
	5 - 6	7 - 8	Disables DTE LL control.
	3 - 4	1 - 2	Enables DTE to initiate RL.
	1 - 2	3 - 4	Disables DTE RL control.
J8	1 - 2		Connects EIA pin 1 (protective ground) to modem ground.
		1 - 2	Disconnects EIA pin 1 (protective ground) from modem ground.

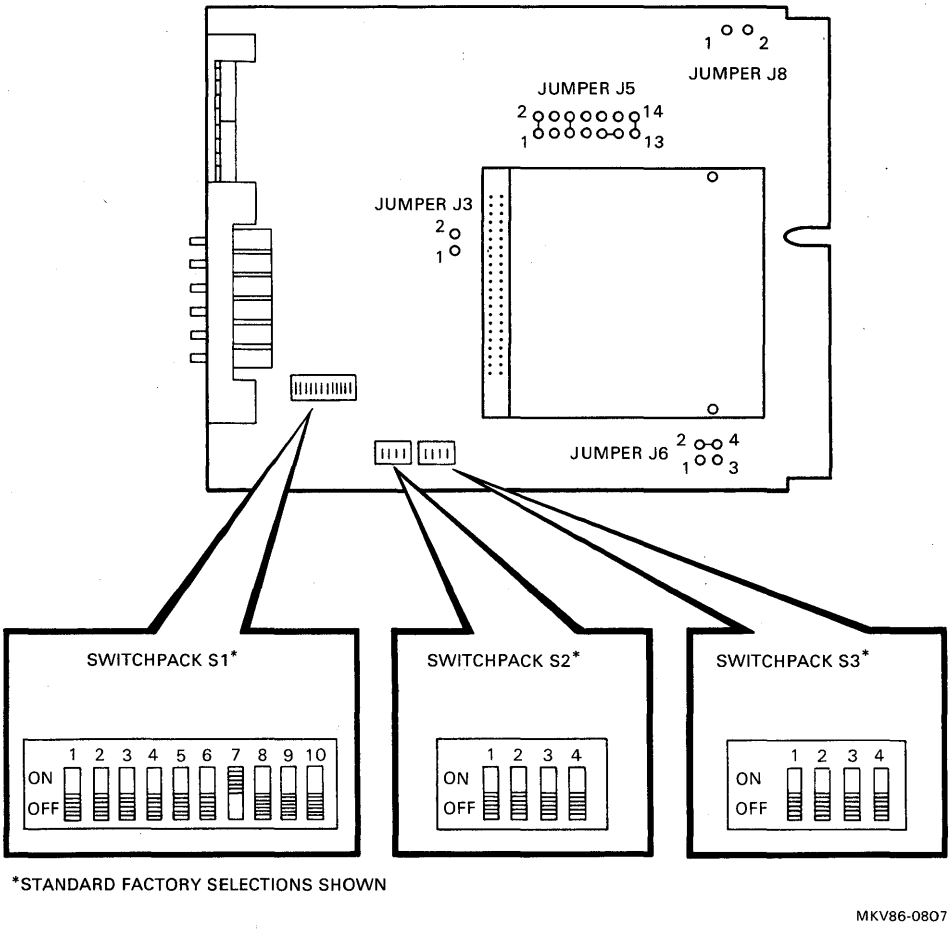


Figure DF129-4 DF129-AM and DF129-BM (Version 3) Switchpack Locations

Table DF129-8 DF129-AM and DF129-BM (Version 3) Switchpack 1 Selections

Option	Selection	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
Transmit Clock 1	External	ON									
	Internal	OFF									
Equalizer Sampling	T		ON								
	T/2		OFF								
Carrier Control	RS			ON							
	Continuous			OFF							
Loopback Control	Bi-Direction				ON						
	Uni-Direction				OFF						
Squelch	Enabled					ON					
	Disabled					OFF					
Transmit Clock 2	Slave						ON				
	Independent						OFF (Note 1)				
Carrier Threshold	−26 dBm							ON			
	−43 dBm							OFF			
Data Quality Threshold	10^{-4}								ON		
	10^{-3}								OFF (Note 2)		
RS to CS	<15 ms									ON	
	253 ms									OFF (Note 3)	
Remote Loopback	Disabled										ON
	Enabled										OFF

NOTES:

1. This option only applies when the Transmit Clock 1 option is set to Internal.

2. This option is enabled or disabled by switchpack 2, switch 1. When enabled, retraining occurs when the error rate reaches the data quality threshold selected by switchpack 1, switch 8.

3. This selection is valid only in continuous carrier mode (switchpack 1, switch 3=OFF) when the modems are already trained.

Table DF129-9 DF129-AM and DF129-BM (Version 3) Switchpack 2 Selections

Option	Selection	S1	S2	S3	S4
Data Quality Retrain (Notes 1 & 2)	Disabled	ON			
	Enabled	OFF			
Round-Robin Retrain (Note 3)	Disabled		ON		
	Enabled		OFF		
Training Interval	Long			NOT USED	
	Short				
Reserved					NOT USED

NOTES:

1. This switch works together with switchpack 1, switch 8.
2. This option must be set to OFF when the DF129 modem module is used in the DFM statistical multiplexer as an integral modem.
3. This switch is valid only in RS controlled carrier mode. In continuous carrier mode, the round-robin feature is always enabled, regardless of the position of this switch.

Table DF129-10 DF129-AM and DF129-BM (Version 3) Switchpack 3 Selections

Option	Selection	S1	S2	S3	S4
Private Line XMIT Level	0 dBm	OFF	OFF	OFF	OFF
	− 1 dBm	ON	OFF	OFF	OFF
	− 2 dBm	OFF	ON	OFF	OFF
	− 3 dBm	ON	ON	OFF	OFF
	− 4 dBm	OFF	OFF	ON	OFF
	− 5 dBm	ON	OFF	ON	OFF
	− 6 dBm	OFF	ON	ON	OFF
	− 7 dBm	ON	ON	ON	OFF
	− 8 dBm	OFF	OFF	OFF	ON
	− 9 dBm	ON	OFF	OFF	ON
	−10 dBm	OFF	ON	OFF	ON
	−11 dBm	ON	ON	OFF	ON
	−12 dBm	OFF	OFF	ON	ON
	−13 dBm	ON	OFF	ON	ON
	−14 dBm	OFF	ON	ON	ON
	−15 dBm	ON	ON	ON	ON

Installing the Modem Module
Since the DF129-AM and DF129-BM modem modules are packaged individually, the modem module must be installed into the standalone or multiple modem enclosure before connecting to the network. Refer to the Desktop Enclosure section in Chapter 5 for installation of the DF129-AM and DF129-BM modem modules into the DF100-DT desktop enclosure. Refer to the Rack Mount Enclosure section in Chapter 5 for installation into the DF100-RM multiple modem enclosure.

Refer to Chapter 6 for installation of the DF129-AM and DF129-BM modem modules into the DFM statistical multiplexer.

Installing the Modem
The DF129 modem can be installed to a 4-wire private/leased line. Refer to Chapter 5 for installation of the modem to private line telephone services.

NOTE

DF129-AM modem modules up to serial number NQ01700 are designed for use with the DFM statistical multiplexer only, and should not be used in any other enclosure. Modules above serial number NQ01700 can be used in any of the available enclosures.

DF129 TESTING

General
Diagnostic testing of the DF129-AM, -BM modem module exists for the following types of tests:

- **Power-Up Self-Test**
- **Local DTE Test**
- **Local Analog Loopback Test**
  Set LL switch on local modem
- **Local Analog Loopback Self-Test**
  Set LL and TP switches and verify TM indicator
- **Digital Loopback Self-Test**
  Set DL switch on local modem, TP switch on remote modem, and verify TM indicator on remote modem
- **Remote Digital Loopback Test**
  Set RL switch on local modem
- **Remote Digital Loopback Self-Test**
  Set TP and RL switches on local modem and verify TM indicator on local modem
- **End-To-End Self-Test**
  Set TP switch on both modems and verify TM indicator on both modems

Refer to Chapter 7 for the test procedures for the DF129-AM and DF129-BM modem modules.

DF129 Tech Tips/FCO Index

The table below lists Tech Tips and FCOs for the DF129 modem.

Table DF129-11 DF129 Tech Tip/FCO Index

Tech Tip/ FCO No.	Title	Speed Bulletin No.
DF129-TT-01	DF129 Modems at Wrong Speed	558

NOTES

NOTES

DF212 MODEM

DF212 General Description

The DF212 (1200) modem is a powerful, high-performance, high-speed and versatile modem that uses standard dial-up telephone service to communicate serial binary data from one place to another.

DF212 Features

- Supports two command languages: DIGITAL modem command languge (DMCL) and Hayes™ Smart Modem compatible AT command language™.
- Performs asynchronous speed buffering up to 9600 b/s from 1200 b/s only.
- Error correction is supported for on-line error detection and retransmission using either MICROCOM™ networking protocol (MNP) or X.PC (TYMNET™ implementation) protocols at 1200 b/s.
- Access/callback security provides two forms of password security:
  - Restricts access in changing stored phone numbers and other parameters
  - Controls the callback feature.
- Speed changes automatically to match the speed of the other modem (except in 600 b/s).
- DF212 modem is compatible with the following standard protocols:
  - Bell 212™ @ 1200 b/s
  - Bell 103™ @ 300 b/s
  - V.22 @ 1200 b/s
  - V.22 @ 600 b/s.
- All option parameters can be changed from a terminal keyboard or computer.
- Advance autodialer
  - Provides compatibility with tone and pulse dialing techniques
  - Provides numerous commands to control a variety of functions
  - Dials telephone numbers in interactive terminal mode or CPU mode
  - Stores up to 30 telephone numbers (a maximum of 36 characters each)
  - Provides nonvolatile memory so that telephone numbers are saved when the unit is turned off
  - Allows stored telephone numbers to be identified by Mn memory designations (M1-M30) or optional 6-character names
  - Links a group of stored telephone numbers in sequence so that the next number is dialed if the current telephone number is busy or if there is no answer.

DF212 INTRODUCTION

The DF212 modem consists of:

- Unit (PN 29-26379-00)
- Wall-mounted power supply (PN 29-26240)
- Telephone extension cord (RJ11C)
- *DF212 1200 Modem User's Guide* (EK-DF212-UG)
- *SCHOLAR Plus Reference Card* (EK-DF242-RC).

DF212 Specifications

Specifications for the DF212 modem are shown in Table DF212-1.

Table DF212-1 Specifications

Item	Specification
Data Rate	300 b/s asynchronous format 1200/600 b/s asynchronous/synchronous formats
Modulation	Frequency shift keying (FSK) at 300 b/s
	Differential phase shift keying (DPSK) at 1200/600 b/s
Format	Asynchronous 5, 6, 7, or 8 data bits for 300, 600, or 1200 b/s
	Bit synchronous for 1200/600 b/s
Mode	Public switched telephone network (PSTN) only
Interface	EIA RS-232-D, RS-422, and RS-423 compatible voltages
Interface Cables	BC22E, BC22F, or equivalent for asynchronous operation
	BC22F or equivalent for synchronous operation
Operating Temperature	10°C to 40°C (50°F to 104°F) free air (normal convection)
Storage Temperature	−40°C to 66°C (−40°F to 150°F)
Relative Humidity	10% to 90% noncondensing and noncaustic
Diagnostics	Power-up self-test Local analog loopback test Remote digital loopback test
Dimensions	Height: 30.3 mm (1.19 inch) Width: 152.4 mm (6.00 inch) Length: 219.0 mm (8.62 inch)
Weight	0.9 kg (2 lb) including power supply

Table DF212-1 Specifications (Cont)

Item	Specification
Power Supply	AC input: 120 Vac @ 60 Hz (normal) Power: Operates between 104 and 128 Vrms at 57 to 63 Hz with a maximum input current of 120 mA at 128 Vac. The input power is 19.2 VA
DC Output	+5 Vdc @ 0.8 A maximum +12 Vdc @ 0.1 A maximum −12 Vdc @ 0.1 A maximum
Dial Memory Capacity	Up to 30 telephone numbers, each consisting of a maximum of 36 characters
Callback Memory Capacity	Up to 30 telephone numbers can be logged into callback memory and authorizing callback
Error Correction	MICROCOM™ networking protocol (MNP) or TYMNET™ (X.PC)
Speed Buffering	Asynchronous speed buffering up to 9600 b/s with optional XON/OFF or RTS/CTS flow control

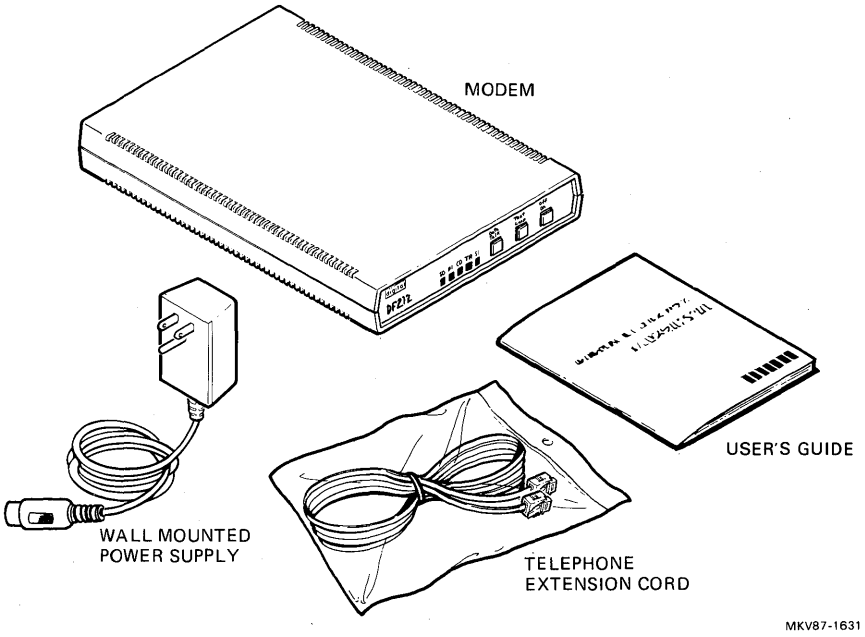
DF212 Reference Documentation
Refer to the following documents for more information:

- *DF212 1200 Modem User's Guide* EK-DF212-UG
- *SCHOLAR Plus Reference Card* EK-DF242-RC

Unpacking and Inspecting the DF212 Modem
The DF212 modem (PN 29-26379-00) is packaged in a cardboard container with the following items:

- Wall-mounted power supply (PN 29-26240)
- Telephone extension cord (RJ11C)
- *DF212 1200 Modem User's Guide* (EK-DF212-UG)
- *SCHOLAR Plus Reference Card* (EK-DF242-RC).

Verify the contents with Figure DF212-1 and check each piece for damage.



DF212-1 Package Contents

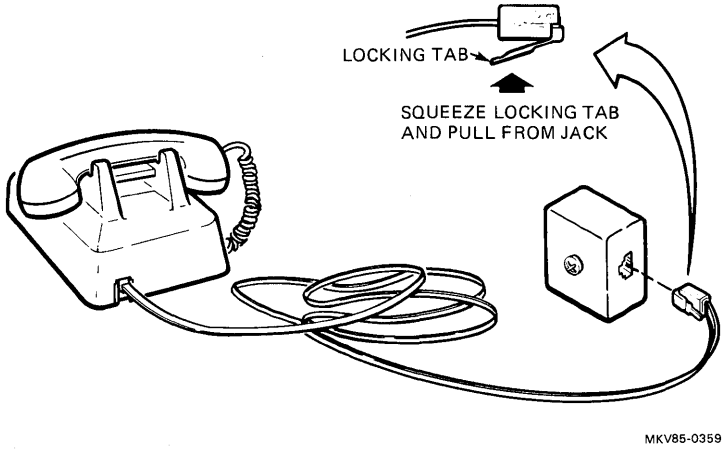
Installing the DF212 Modem
Procedures for installing the modem to the public switched telephone network vary, depending on the type of service that is requested and installed by the telephone company. The two types of service are:

- Connecting to telephone service
- Connecting to exclusion key/programmed service.

Connecting to Telephone Service
The RJ11C (U.S.) or CA11A (Canada) are the most common types of service. The installation procedures are:

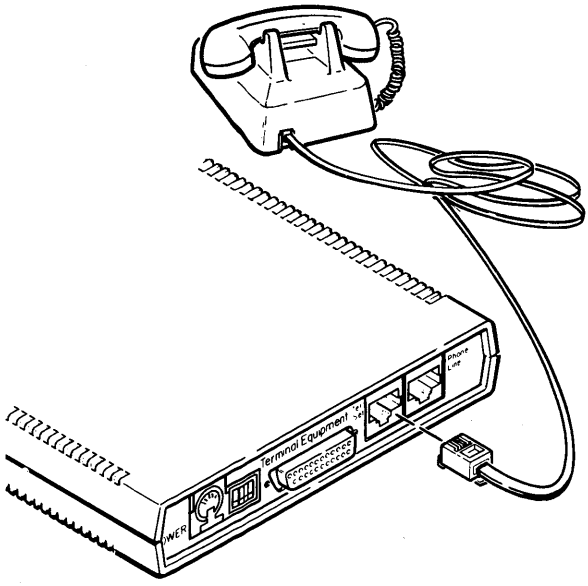
1. Unplug the telephone from the wall-mounted modular telephone jack. See Figure DF212-2.

WARNING
Hazardous voltages may be present on telephone lines.
DO NOT leave any telephone cords disconnected, and
DO NOT TOUCH any bare telephone connection.



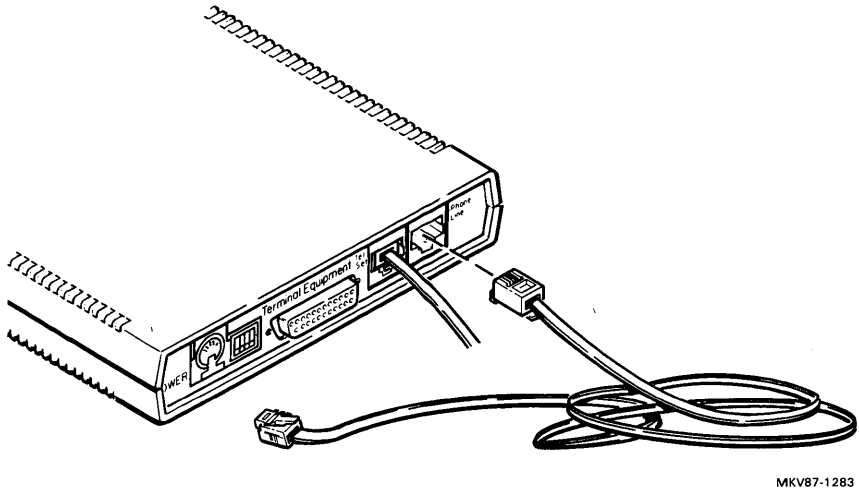
DF212-2 Installing Telephone Service (Sheet 1 of 7)

2. Plug the telephone into the modular telephone jack marked TEL SET. Push in until the tab snaps into the jack.



DF212-2 Installing Telephone Service (Sheet 2 of 7)

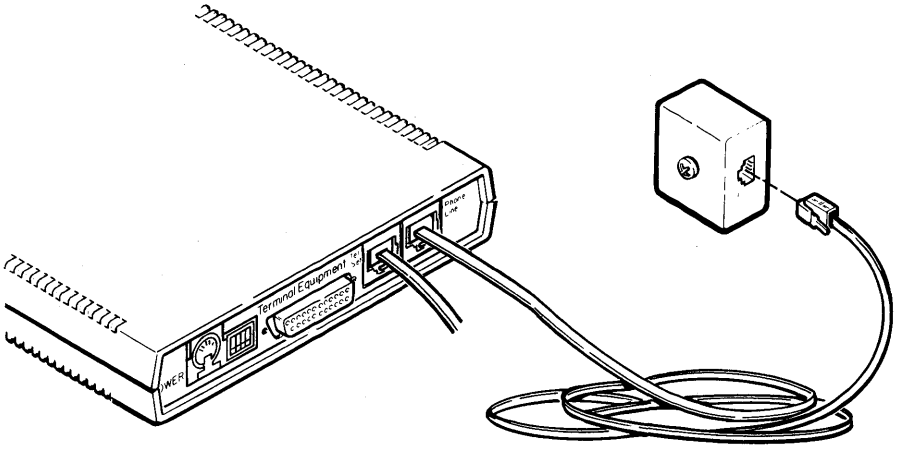
3. Plug the telephone extension cord (supplied with the modem) into the other modular telephone jack marked PHONE LINE. Push in until the tab snaps into the jack.



DF212-2 Installing Telephone Service (Sheet 3 of 7)

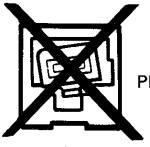
4. Plug the other end of the telephone extension cord into the wall-mounted modular telephone jack (RJ11C/CA11A).

WARNING
Hazardous voltages are present on telephone lines. Do not leave any telephone cords disconnected. Above all, DO NOT TOUCH any bare telephone connections.



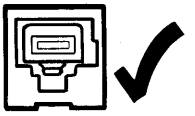
WHEN INSTALLING MODEM, ALWAYS MAKE THIS CONNECTION LAST. WHEN REMOVING MODEM, ALWAYS REMOVE THIS CONNECTION FIRST.

BE SURE THAT TELEPHONE CONNECTIONS ARE NOT FORCED IN THE WRONG WAY.



WRONG WAY

PLUG THEM STRAIGHT IN.

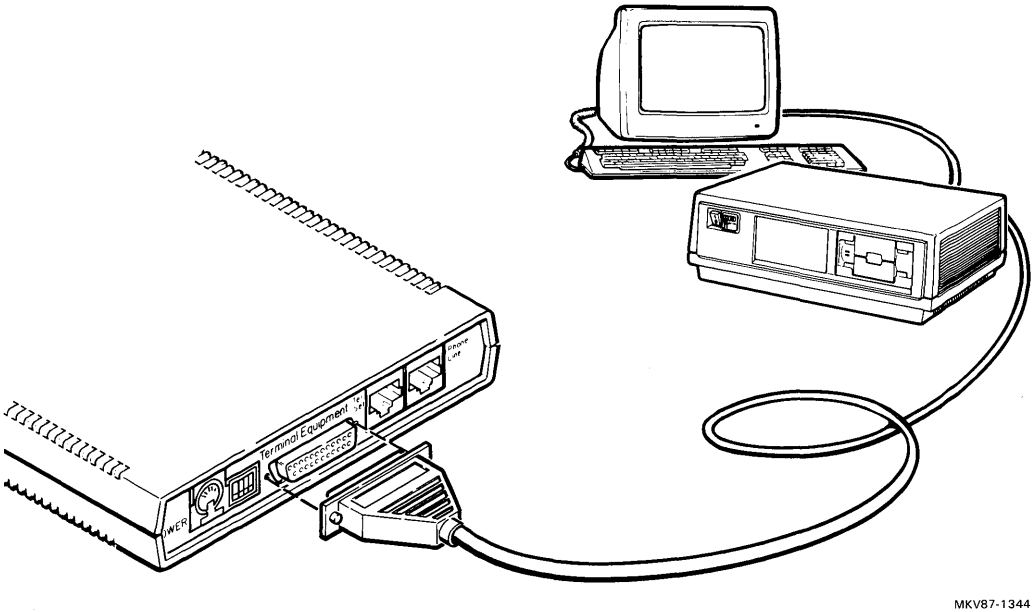


RIGHT WAY

MKV87-1622

DF212-2 Installing Telephone Service (Sheet 4 of 7)

5. Plug the data cable from your terminal equipment into the RS-232 connector marked TERMINAL EQUIPMENT. Make sure that the data cable is also connected to your terminal equipment.



DF212-2 Installing Telephone Service (Sheet 5 of 7)

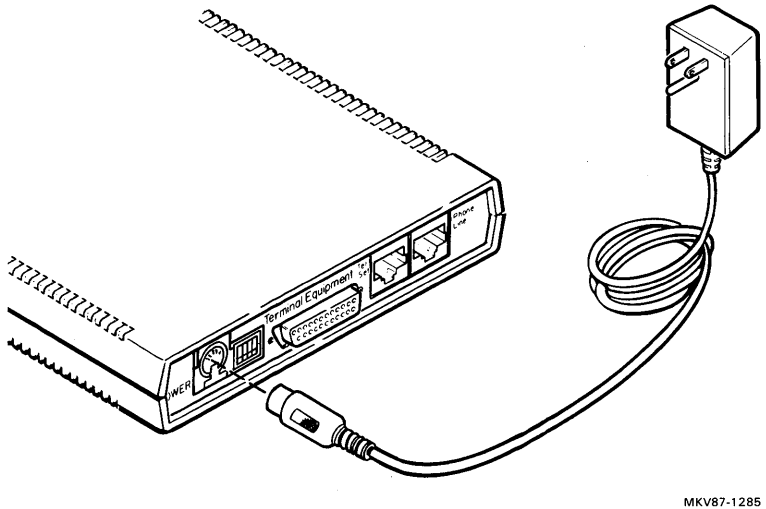
6. Set the data terminal characteristics at:

– Operating mode	Asynchronous
– Speed	1200 b/s
– Data bits/character	8 bits
– Stop bits	1 stop bit
– Parity	None

NOTE

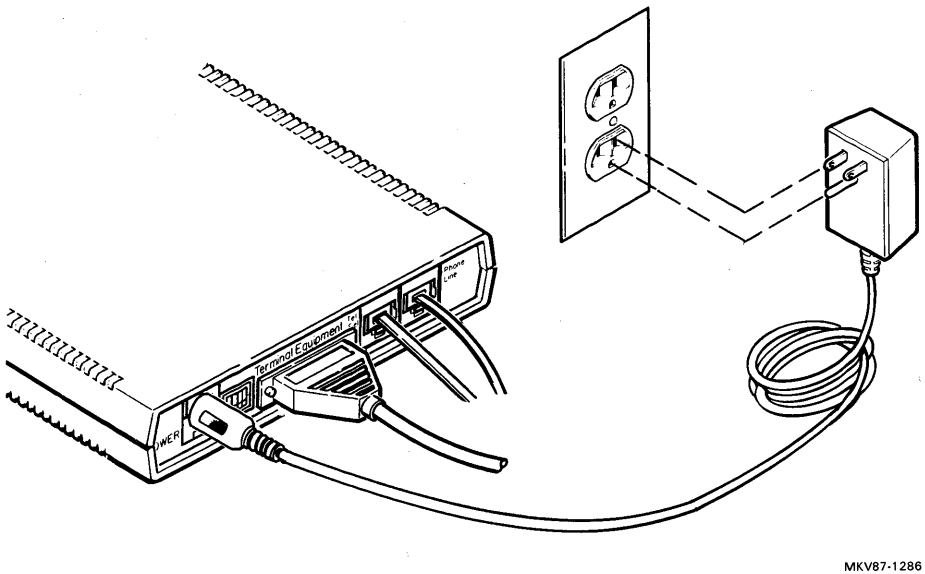
The data cable is not supplied with the modem. It is usually provided by the terminal manufacturer. If you need to purchase a cable, DIGITAL cable (PN BC22E) is recommended for asynchronous operations.

7. Plug the power supply cord into the connector marked POWER.



DF212-2 Installing Telephone Service (Sheet 6 of 7)

8. Plug the power supply into a 3-prong, grounded, ac wall outlet.



DF212-2 Installing Telephone Service (Sheet 7 of 7)

Checking for Ready
This test shows that the terminal communicates with the modem by displaying the Ready prompt. See Table DF212-2.

Table DF212-2 Checking for Ready

Steps	Indications	Remedies
Press CTRL/B on the terminal	The Ready prompt displays on terminal	Go to next step
	No display of Ready on terminal	1. Press CTRL/B again 2. Recheck terminal characteristics 3. Type AT. If OK displays, the modem is in AT mode 4. Call Atlanta Hotline: 1-800-241-2546 or DTN 435-4654
Enter command string: LIST P	Terminal displays modem parameters and concludes with a Ready prompt	Test completed
	Terminal displays no parameters	1. Input command string again 2. Call Atlanta Hotline: 1-800-241-2546 or DTN 435-4654

Connecting to Exclusion Key/Programmed Telephone Service

When you install the DF212 to exclusion key/programmed telephone service, no connection is required to the modular telephone jack (marked TEL SET). Open the modem enclosure and change two of the modem's options (PR/PC and MI/MIC), then use an 8-wire telephone extension cord (not supplied). Follow the procedure below:

1. Open the DF212 modem enclosure to enable options.

   a. PR/PC must be set to select programmed. Removed the jumper from E1 to E2 and connect it between E2 and E3.

   b. MI is enabled by removing the jumper from E6 to E5 and connecting it between E4 and E5.

   c. MIC is enabled by removing the jumper from E8 to E9 and connecting it between E7 and E8.

2. Close the modem box.

3. Connect one end of the telephone extension cord (8-wire) to the wall-mounted, modular telephone jack.

4. Connect the other end of the extension cord to the modular telephone jack marked PHONE LINE on the back of the modem. Be sure to push the modular connector in until the tab snaps into the jack.

   NOTE

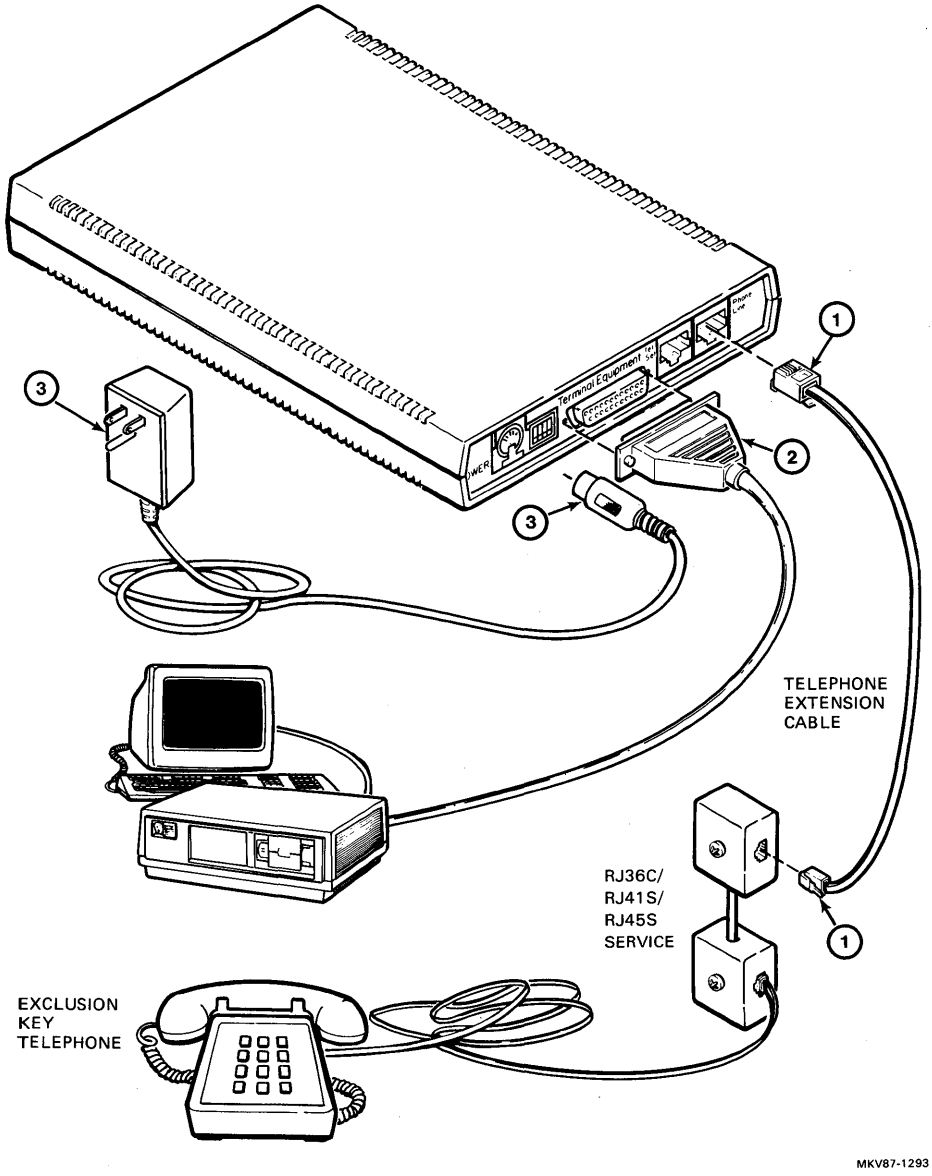
   No connection to the modular telephone jack (marked TEL SET on the modem) is required.

5. Connect the data cable from your terminal equipment into the RS-232 interface connector marked TERMINAL EQUIPMENT on the back of the modem.

   NOTE

   The data cable is not supplied with the modem. It is usually provided by the terminal manufacturer. If you need to purchase a cable, DIGITAL cable (PN BC22E) is recommended for asynchronous operations.

6. Connect the power supply cord into the connector marked POWER. Plug the power supply into a 110 to 120 V grounded, ac wall outlet. See Figure DF212-3.

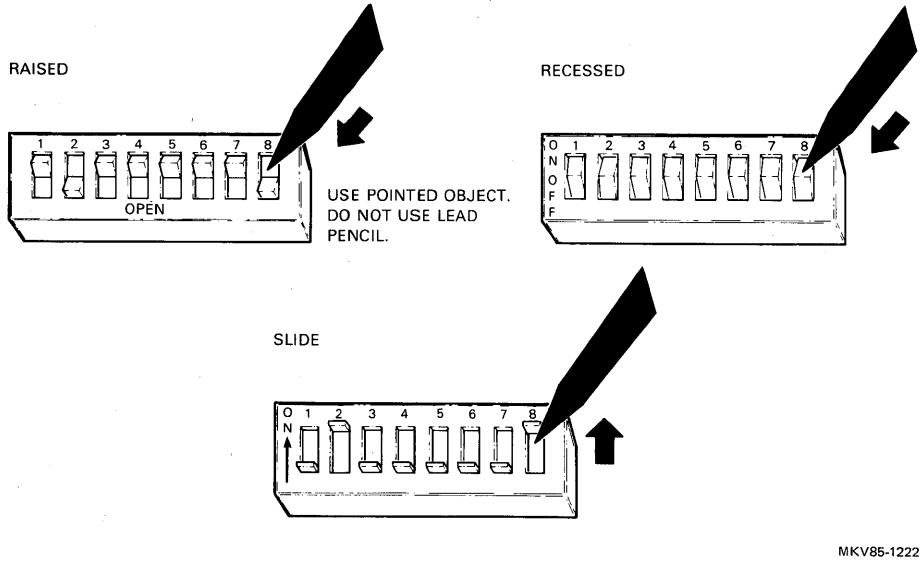


DF212-3 Installing Exclusion Key/Programmed Service

Option Settings
All configuration parameters are software-selected. Some parameters may be overridden by using switchpacks and jumpers.

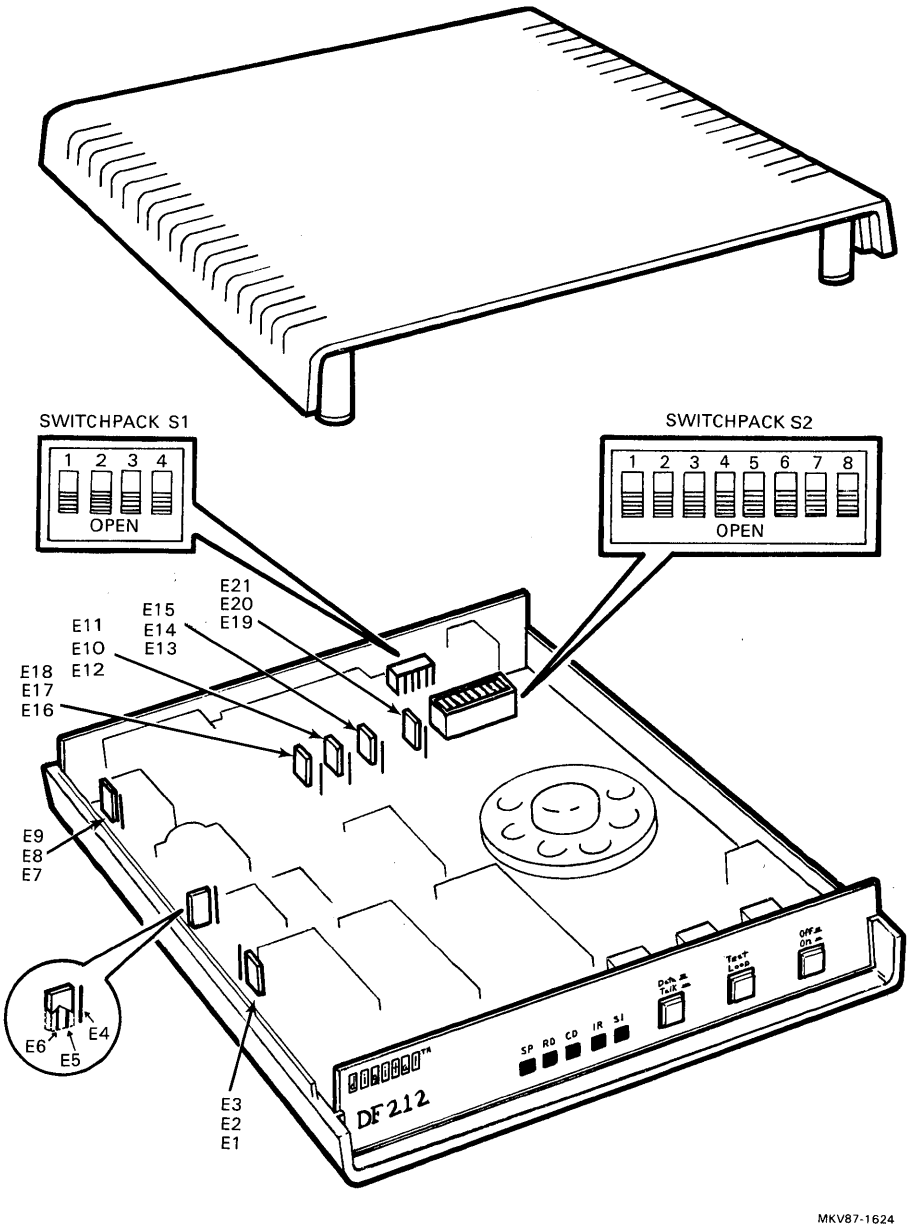
Hardware-Select Options
The DF212 modem has one external switchpack (SWPK1), one internal switchpack (SWPK2), and several internal jumpers that can be used to select a variety of modem options. These options are referred to as hardware-select.

The modem module can contain any one of three types of switchpacks (see Figure DF212-4). Some switches are marked ON and OFF, some are marked OPEN and CLOSED, and others are just marked OPEN. Tables DF212-3, DF212-4, and DF212-5 use ON/OFF terminology. For switches that are marked OPEN/CLOSED, OPEN equals ON and CLOSED equals OFF.



DF212-4 Types of Switches

Hardware-select options on SWPK2 are used only when the user selects the default option on SWPK1 (switch 2 must be on). Otherwise, the hardware-select options are ignored. See Figure DF212-5 for the switch and jumper locations. Tables DF212-3, DF212-4, and DF212-5 list the factory default settings of the switches.



DF212-5 Switch and Jumper Location

Table DF212-3 Switchpack 1 (SWPK1)

Option	Selection	SW1	SW2	SW3	SW4
Factory Defaults	**Disabled**	**OFF**			
	Enabled	ON			
User Defaults	**Disabled**		**OFF**		
	Enabled		ON		
Remote Diagnostics	**Disabled**			**OFF**	
	Enabled			ON	
Callback Security	**Disabled**				**OFF**
	Enabled				ON

NOTE:
Standard factory configurations are printed in blue.

Table DF212-4 Switchpack 2 for Asynchronous Operation

Option	Selection	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Autodial Protocol	**DMCL Mode**	**OFF**							
	AT Mode	ON							
Communication Protocol	**Asynchronous**		**OFF**						
Parity Type	**Odd**			**OFF**					
	Even			ON					
Parity Select	**Disable**				**OFF**				
	Enable				ON				
Number of Data Bits	5 Bits					ON	ON		
	6 Bits					ON	OFF		
	7 Bits					OFF	ON		
	8 Bits					**OFF**	**OFF**		
Modem Protocol	Bell 103™							ON	ON
	Bell 212™							ON	OFF
	V.22 600							OFF	ON
	V.22 1200							**OFF**	**OFF**

NOTES:
Switches 3 through 8 have different functions, depending on the setting of switch 2 in Table DF212-5.

Standard factory configurations are printed in blue.

Table DF212-5 Switchpack 2 for Synchronous Operation

Option	Selection	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Autodial Protocol	**DMCL Mode**	**OFF**							
	AT Mode	ON							
Communication Protocol	**Synchronous**		**ON**						
Reserved				NOT USED					
Reserved					NOT USED				
Terminal Timing	Not Used					ON	ON		
	Slave					ON	OFF		
	External					OFF	ON		
	Internal					**OFF**	**OFF**		
Modem Protocol	Not Used							ON	ON
	Bell 212™							ON	OFF
	V.22 600							OFF	ON
	V.22 1200							**OFF**	**OFF**

NOTES:
Switches 3 through 8 have different functions, depending on the setting of switch 2 in Table DF212-4.

Standard factory configurations are printed in blue.

Internal Jumpers
The jumpers are stake pins with push-on shorting plugs. The shorting plugs can connect to a 3-stake pin configuration. See Figure DF212-5 for the location of the jumpers. Jumper selection is provided in Table DF212-6.

Table DF212-6 Jumper Selection

Option	Selection	E1-E2	E2-E3	E4-5	E5-E6	E7-E8	E8-E9	E10-E11	E11-E12
PR/PC	Permissive	IN	OUT						
	Programmed	OUT	IN						
MI	Enabled			IN	OUT				
	Disabled			OUT	IN				
MIC	Enabled					IN	OUT		
	Disabled					OUT	IN		
DTR	**Normal**							IN	OUT
	Forced							OUT	IN

Option	Selection	E13-E14	E14-15	E16-E17	E17-E18	E19-E20	E20-E21
EIA-RDL (RL)	Enabled	IN	OUT				
	Disabled	OUT	IN				
EIA-ANL (LL)	Enabled			IN	OUT		
	Disabled			OUT	IN		
EIA-TM (TM)	Enabled					IN	OUT
	Disabled					OUT	IN

NOTE:
Standard factory configurations are printed in blue.

Software-Select Options
The DMCL command set allows the terminal or computer to select and change parameters. Tables DF212-7 through DF212-12 list parameters (P) according to classes.

Table DF212-7 Operational Class (/OPE) Parameters

Parameter No.	Description	Selection	Factory Default
P1	Modem protocol	1200 Bell 212™ = 0 300 Bell 103™ = 1 1200 V.22 = 2 600 V.22 = 3	V.22 (2400)
P2	Character echo	Off = 0 On = 1	On
P3	Answer mode	Automatic = 0 Manual = 1	Auto
P4	Attached message on incoming call	Off = 0 On = 1	Off
P5	Delete key effect	Hard copy = 0 CRT = 1	CRT
P6	Enabled remote digital loopback	Off = 0 On = 1	On
P7	Blind dialing	Off = 0 On = 1	Off
P12	Speaker enable	Off = 0 On = 1	On if no CD
P13	Speaker volume	Low = 1 Medium = 2 High = 3	Medium
P14	Ring to answer on	1 to 10 rings	2 rings
P15	Callback timer	10 s = 1 20 s = 2 30 s = 3 40 s = 4 50 s = 5 60 s = 6	10 seconds

Table DF212-8 Communication Class (/COM) Parameters

Parameter No.	Description	Selection		Factory Default
P1	Data bits	7 bits	= 3	
		8 bits	= 4	8 bits
P2	Parity	None	= 1	None
		Even	= 2	
		Odd	= 3	
P3	Stop bits	One	= 1	One
		Two	= 2	
P4	Off-line XON/XOFF recognition	Off	= 0	On
		On	= 1	
P5	Communication protocol	Asynchronous	= 0	Asynchronous
		Synchronous	= 1	
P6	Synchronous mode timing	Internal	= 0	Internal
		External	= 1	
		Slave	= 2	
P7	DSR forced	On	= 0	
		Normal	= 1	Normal
P8	CD/CTS signals	Separate	= 0	Separate
		Common	= 1	

Table DF212-9 Disconnect Class (/DIS) Parameters

Parameter No.	Description	Selection		Factory Default
P1	Send space disconnect	Off	= 0	
		On	= 1	On
P2	Receive space disconnect	Off	= 0	
		On	= 1	On
P3	Carrier loss disconnect	Off	= 0	
		On	= 1	On
P4	Current loss disconnect	Off	= 0	
		On	= 1	On

Table DF212-10 Error Class (/ERR) Parameters

Parameter No.	Description	Selection		Factory Default
P1	Error corrections	Off	= 0	Off
		MNP on	= 1	
		X.PC on	= 2	
P2	Error correction auto-fallback	Off	= 0	Off
		On	= 1	
P3	MNP reaction to BREAK from DTE			Disregard
		Disregard	= 0	
		Destructive	= 1	
		Nondestructive immediate	= 2	
		Nondestructive sequenced	= 3	
P4	MNP reaction to BREAK from remote			Disregard
		Disregard	= 0	
		Destructive	= 1	
		Nondestructive immediate	= 2	
		Nondestructive sequenced	= 3	
P6	MNP disconnect type			Nondisruptive
		Nondisruptive	= 0	
		Disruptive	= 1	

Table DF212-11 Speed Buffering Class (/SBU) Parameters

Parameter No.	Description	Selection		Factory Default
P1	Speed buffering state	Off On	= 0 = 1	Off
P2	DTE flow control	None XON/XOFF RTS/CTS Both	= 0 = 1 = 2 = 3	XON/XOFF
P3	Autobaud state	Off On	= 0 = 1	On
P4	Line speed with DTE	1200 b/s 2400 b/s 4800 b/s 9600 b/s	= 0 = 1 = 2 = 3	1200 b/s

Table DF212-12 Access Security Class (/PRO) Parameters

Parameter No.	Description	Selection		Factory Default
P1	"C" callback memory access	Off On	= 0 = 1	Off
P2	"M" dial memory access	Off On	= 0 = 1	Off
P3	"P" parameter access	Off On	= 0 = 1	Off

Software-Select SET Command
Software-select parameters are set by using the SET P (set parameter) command followed by a qualifier. The qualifiers for the different classes are as follows.

- Operational – /OPE (default)
- Communication – /COM
- Disconnect – /DIS
- Error correction – /ERR
- Speed buffering – /SBU
- Access security – /PRO
- Set all classes – /ALL

The parameters can be set by using one of two formats: dialog or expert. The dialog format prompts the user for input information, and the expert format relies on the user to input information directly.

CTRL/B	Activate DMCL mode
Ready	DMCL ready
SET P2/DIS	Parameter 2 in the Disconnect class is selected
2 RECEIVE SPACE DISCONNECT: OFF=0, ON=1 <0>: < >	The selected parameter menu line appears, showing the current value
1 <RETURN>	DMCL changes the current value from a zero to a one. To use the current value without changing the value, press RETURN

Example DF212-1 Setting a Parameter

CTRL/B	Activate DMCL
Ready	DMCL ready
SET P/COM	All parameters in the Communication class are selected
1 DATA BITS: 7 BITS=3 8 BITS=4	
[4]:	The first parameter is displayed, showing the current value (8 bits)
<RETURN>	To accept the current value (4), press RETURN
3 **<RETURN>**	To change the value from 8 bits (4) to 7 bits, enter new value 3 and press RETURN
2 PARITY: NONE=1, EVEN=2, ODD=3 [1]:	The next parameter line is displayed
<RETURN>	To accept the current value (1), press RETURN or enter a new value and press RETURN
	Continue in this manner for the remaining parameters
CTRL/U	To cancel a value that has been entered before pressing RETURN, CTRL/U will prompt the value again
CTRL/Z	To accept all remaining values in the class, press CTRL/Z
Ready	Ready prompt is displayed after CTRL/Z is pressed

Example DF212-2 Setting All Parameters in One Class

CTRL/B	DMCL activated
READY	DMCL ready
SET P/ALL	All classes will be displayed one by one, starting with Operational

NOTE:
After making changes to any of the following parameters, change the corresponding characteristics of the serial line connected to the modem.

Example DF212-3 Setting Parameters in All Classes

CTRL/B	DMCL activated
READY	DMCL ready
SET P2:1/DIS	Parameter 2 in the Disconnect class is set to 1 (receive space disconnect)
READY	The parameter changes and the Ready prompt displays

Example DF212-4 Setting Parameters Without Dialog

DF212 TESTING

General

Diagnostic testing of the DF212 modem consists of the following tests:

- Self-test
- Local loopback
- Remote digital loopback.

Self-Test

When power is applied to the modem, the diagnostic power-up self-test routine is automatically executed. This test (which takes about five seconds) checks approximately 90% of the modem's electronic circuits. The test loop (TL) switch has a built-in light emitting diode (LED) to indicate the status of the self-test. The two conditions for the TL LED are:

- Remains on for five seconds while executing self-test
- Blinks if an error has been detected.

To run self-test from DMCL, follow the procedure below:

1. Press CTRL/B to activate the DMCL
2. Type ENA TEST at the Ready prompt and RETURN.

If an error has been detected, error code "-1" displays on the terminal.

Local Loopback Test (DMCL Mode)

This test verifies that the DF212 modem can transmit and receive data. See Figure DF212-6.

CAUTION
Make sure that the modem speed is set for 600 or 1200 b/s.

Procedure:

1. Verify that the terminal ready (TR) LED is on. The speed indicator (SI) is either green or red, depending on the speed selected.

2. Press the test loop (TL) switch to the IN position. The data/talk switch can be in either position.

3. Verify that the TL LED (inside the test loop switch) comes on.

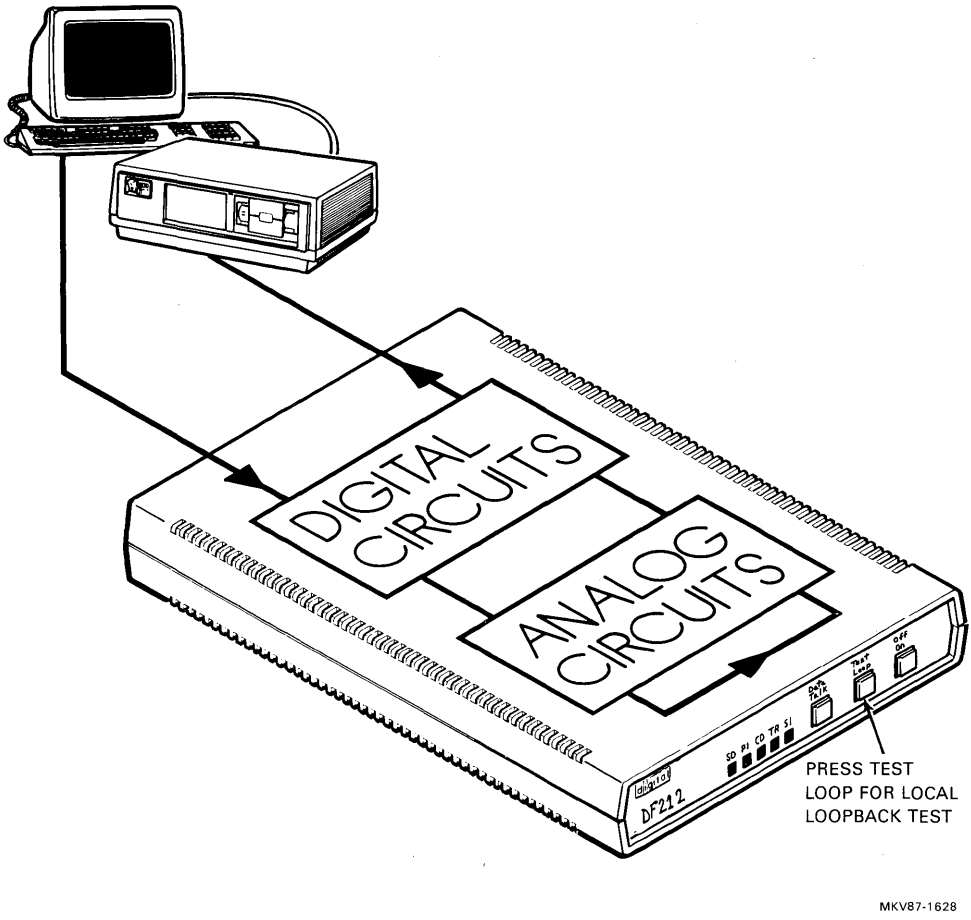
4. Type a test message on the terminal and verify that the same data is displayed at the terminal. Incorrect data indicates that:

   a. Some modem options such as data bits, parity, or stop bit selections are set incorrectly

   b. The terminal is set to the wrong speed

   c. The modem is defective.

5. Set the test loop switch to the OUT position to terminate the test. The LED will go off.



DF212-6 Local Analog Loopback Test

Remote Digital Loopback Test

This test verifies that the DF212 modem can transmit or receive data over the telephone line, through the remote modem, and back over the telephone line. See Figure DF212-7.

CAUTION

Make sure that the modem speed is set for 600 or 1200 b/s.

Procedure:

1. Verify that the TR LED is on. The SI indicator is either green or red, depending on the speed selected.

2. Establish a connection by dialing the remote end. Upon receiving the message ATTACHED, the modem is connected and on-line.

3. Press the test loop switch to the IN position.

4. The LED inside the test loop switch blinks while the modems are attempting to establish remote digital loopback (RDL). If RDL is established, the TL LED remains on. If RDL does not come on, have the remote operator verify that parameter P6 of the operational class parameter group is set on the remote modem.

5. Type a test message on the terminal and verify that the same data is displayed at your terminal. Incorrect data indicates that:

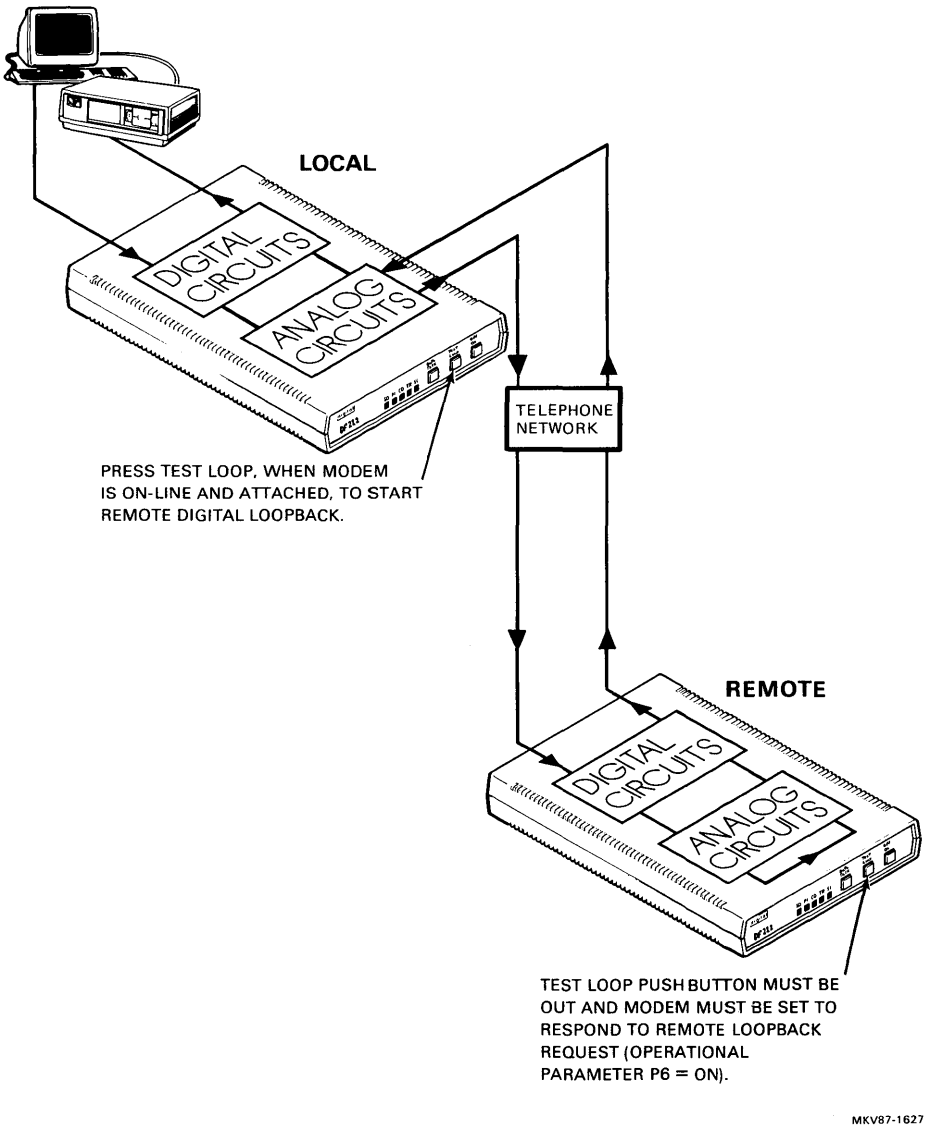
   a. Modem options (data bits, parity, or stop bit) are set incorrectly

   b. Terminal set to wrong speed

   c. Telephone lines may be noisy or faulty

   d. Remote modem may be defective.

6. Set the test loop switch to the OUT position to terminate the test.



DF212-7 Remote Digital Loopback Test

DF212 Tech Tips/FCO Index

The table below lists Tech Tips and FCOs for the DF212 modem.

Table DF212-13 DF212 Tech Tip/FCO Index

Tech Tip/ FCO No.	Title	Speed Bulletin No.
DF212-CA-TT-01	DF212-CA Async DECnet (Hangs)	558

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DF224 MODEM

DF224 General Description

The DF224 (Scholar) modem provides full-duplex, asynchronous or synchronous, binary serial data communications over 2-wire, switched telephone network facilities. Low speed operation (300, 600, or 1200 bits/s) is asynchronous or synchronous; 300/600 bits/s is frequency shift keying (FSK) and 1200 bits/s is differential phase shift keying (DPSK). High speed operation (2400 bits/s) can be either character asynchronous or bit synchronous, 16-point quadrature amplitude modulation (QAM).

NOTE

Digital will no longer support the synchronous command interface for control of the DF224-AA modem. The modem may still be used for synchronous data transmission but only in the Manual/Autoanswer and Manual Originate modes. (See Tech Tip DF224-AA-TT-02.)

The DF224 (SCHOLAR) modem consists of:

- DF224 — Modem module and enclosure (PN 29-25042)
- Power Supply — Wall-mounted power supply (PN 29-25043)

DF224 registration numbers:

- FCC: AMQ9SQ-14859-DM-E
- Ringer Eq.: 0.9B
- DOC: 192 104 2A
- LNRS: 26B

DF224 Specifications

Data Rate	
Low Speed	300 bits/s asynchronous format or 600/1200 bits/s asynchronous/synchronous format
High Speed	2400 bits/s asynchronous/synchronous format
Modulation	
Low Speed	300/600 bits/s frequency shift keying (FSK)
	1200 bits/s differential phase shift keying (DPSK)
High Speed	2400 bits/s 16-point quadrature amplitude modulation (QAM)
Format	
Low Speed	Asynchronous 8, 9, 10, or 11 bit ASCII characters
High Speed	Character asynchronous or bit synchronous binary stream data

Telephone Connections	2-wire public switched telephone network (PSTN) RJ11C (CA11A) or RJ41S/RJ45S (CA41A/CA45A)
Compatibility	Bell 103J @ 300 bits/s, Bell 212A @ 1200 bits/s, V.22 @ 1200 bits/s and V.22 bis @ 2400 bits/s with fallback to 1200 bits/s
Interface Compatibility	EIA RS-232-C/RS-423-A compatible voltages. Distances up to 15.24 m (50 ft)
Interface Cables	BC22E, BC22F, (or equivalent) for asynchronous operation
	BC22F (or equivalent) for synchronous operation
Operating Temperature	10°C to 40°C (50°F to 104°F)
Storage Temperature	−40°C to +66°C (−40°F to +150°F)
Relative Humidity	10% to 90% noncondensing
Dimensions	
Height	30.3 mm (1.19 in)
Width	152.4 mm (6.00 in)
Length	219.0 mm (8.62 in)
Weight	0.680 kg (1.5 lb)
Power Supply	
AC Input	120 Vac, 60 Hz (104 to 128 VRMS at 57 to 63 Hz) with maximum input current of 150 mA at 128 Vac. Protected by an externally accessible 0.5 A fuse
DC Output	+5 Vdc @ 0.800 A maximum +12 Vdc @ 0.100 A maximum −12 Vdc @ 0.100 A maximum

DF224 Reference Documentation
Refer to the following documents if the level of content in this section is insufficient.

- *SCHOLAR Installation Guide* EK-DF224-IN
- *SCHOLAR Owner's Manual* EK-DF224-OM

DF224 Modem Options

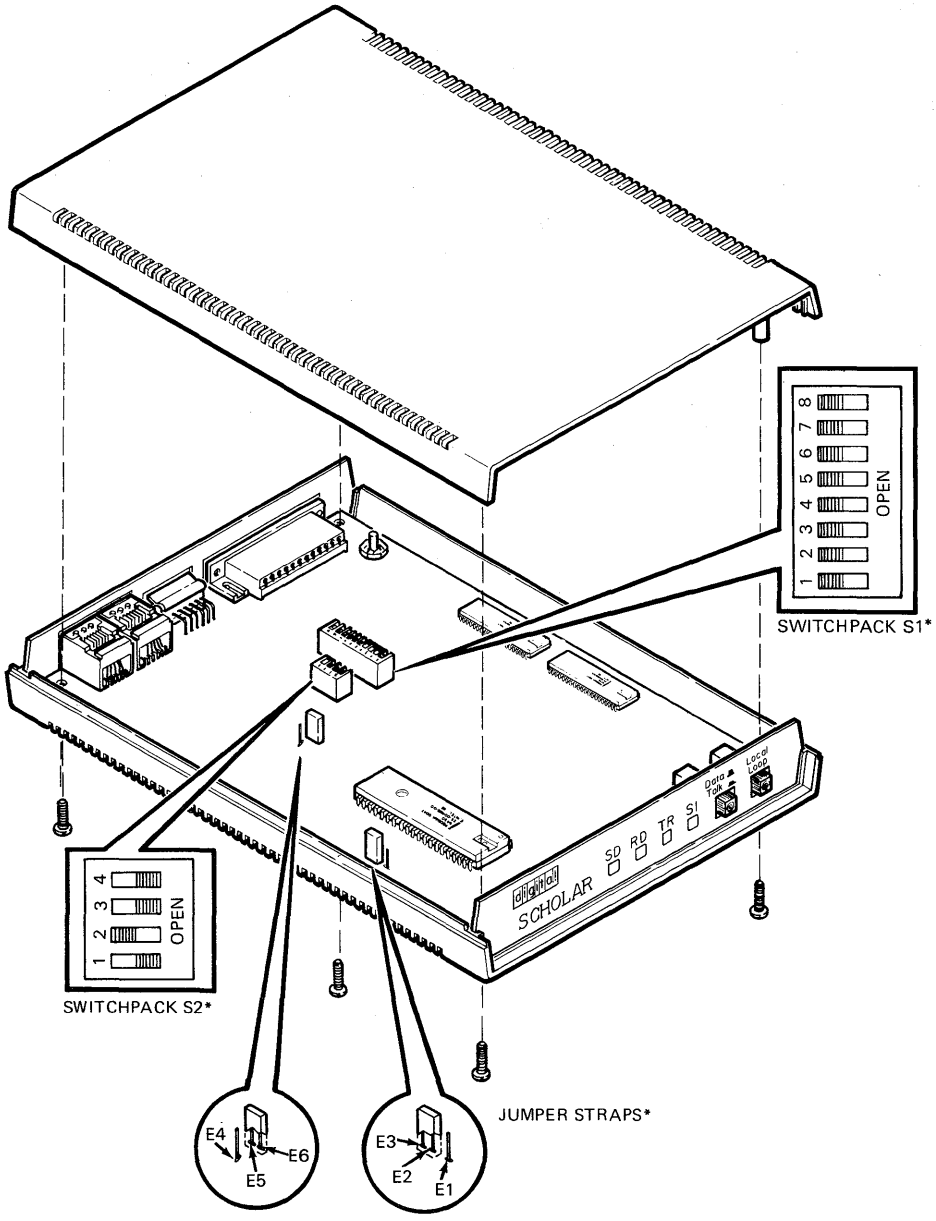
Options for the DF224 modem are selected by the hardware and software. The DF224 modem module hardware options are either selected by switchpacks or jumper straps. Two switchpacks and four jumpers are available for option selection.

Tables DF224-1 through DF224-3 list the jumpers and switchpacks for option selection. Each module is shipped from the factory with preset options. In the tables, factory settings are printed in blue. Refer to Chapter 8 for descriptions of the modem options.

Before hardware selected options can be verified or changed, the enclosure must be opened. To open the enclosure, remove the four screws on the bottom and separate the two halves of the enclosure.

NOTE

There are changes in the way the DF224-AA modem (Revisions C1 - D1) stores set-up parameters. See Tech Tip DF224-AA-TT-02.



*FACTORY SELECTIONS ARE SHOWN

MKV86-0802

Figure DF224-1 DF224 (SCHOLAR) Modem Top Cover Removal and Module Layout

Table DF224-1 DF224 Switchpack 1 Selections

Option	Selection	S1	S2	S3	S4	S5	S6	S7	S8
Local Character Echo	Enabled	ON							
	Disabled	OFF							
Answer Mode	Auto		ON						
	Manual		OFF						
Modem Response	Full			ON					
	Abbreviated			OFF					
Terminal Timing	Internal				ON	ON			
	External				OFF	ON			
	Slave				OFF	OFF			
	Not Used				ON	OFF			
Transmission Mode Select	Async						ON		
	Sync						OFF		
Configuration Mode Select	V.22 bis							ON	ON
	Bell 212A							OFF	ON
	Bell 103J							ON	OFF
	V.22							OFF	OFF

Table DF224-2 DF224 Switchpack 2 Selections

Option	Selection	S1	S2	S3	S4
Force DTR ON	Enabled	ON	OFF		
	Disabled	OFF	ON		
MI/MIC Ground	Enabled			ON	
	Disabled			OFF	
Interface Speed Select	Enabled				ON
	Disabled				OFF

Table DF224-3 DF224 Jumper Selections

Option	Selection	E1 to E2	E2 to E3	E4 to E5	E5 to E6
PR/PC	Permissive	OUT	IN		
	Programmed	IN	OUT		
MI	Disabled			OUT	IN
	Enabled			IN	OUT

Selecting DF224 Modem Options by Using the Software
Software option selection is achieved from the DF224 modem's set-up feature of the autodialer.

To set options with the DF224 software, evoke the autodialer with CTRL B. At the READY prompt type % and a <RETURN> and then enter selections as they appear on the option menu.

CTRL B	Enter Control B. This activates the autodialer.
READY	Indicates that the autodialer is ready.
% <RET>	Enter the percent sign (%) followed by a carriage return <RET> to activate the menu selection process. The number in the bracket is the default selection. The menu appears as follows:

```
AUTO CALL DF03=0 DF224=1 [1]
CHAR ECHO OFF=0 ON=1 [1]
ANSWER AUTO=0 MAN=1 [0]

MODE BELL 212=0 BELL103=1
          V22 BIS=2 V22A=3    [2]

MODE ASYNC=0 SYNC=1 [0]

TIMING INT=0 EXT=1 SLAVE=2 [0]

CHAR LENGTH 8BITS=1  9BITS=2
            10BITS=3 11BITS=4    [3]

PARITY NONE=1 EVEN=2 ODD=3 [1]

STOP BITS ONE=1 TWO=2 [1]

ENAB REM DIG LOOPBACK OFF=0 ON=1 [1]

SEND SPACE DISCONNECT OFF=0 ON=1 [0]

REC SPACE DISCONNECT OFF=0 ON=1 [0]

CARRIER LOSS DISCONNECT OFF=0 ON=1 [1]

CURRENT LOSS DISCONNECT OFF=0 ON=1 [1]

MODEM RESPONSE ABBREVIATED=0 FULL=1 [1]

DSR FORCED=0 NORMAL=1 [1]
```

Enter your selection followed by a <RET>. If the current selection is satisfactory, just enter <RET>. After the selection is made the cursor advances to the next line.

Figure DF224-2 DF224 Software Option Selection

Installing the Modem

The DF224 (SCHOLAR) modem can be installed to either RJ11C (CA11A) service or RJ41S/RJ45S (CA41A/CA45A) exclusion key service.

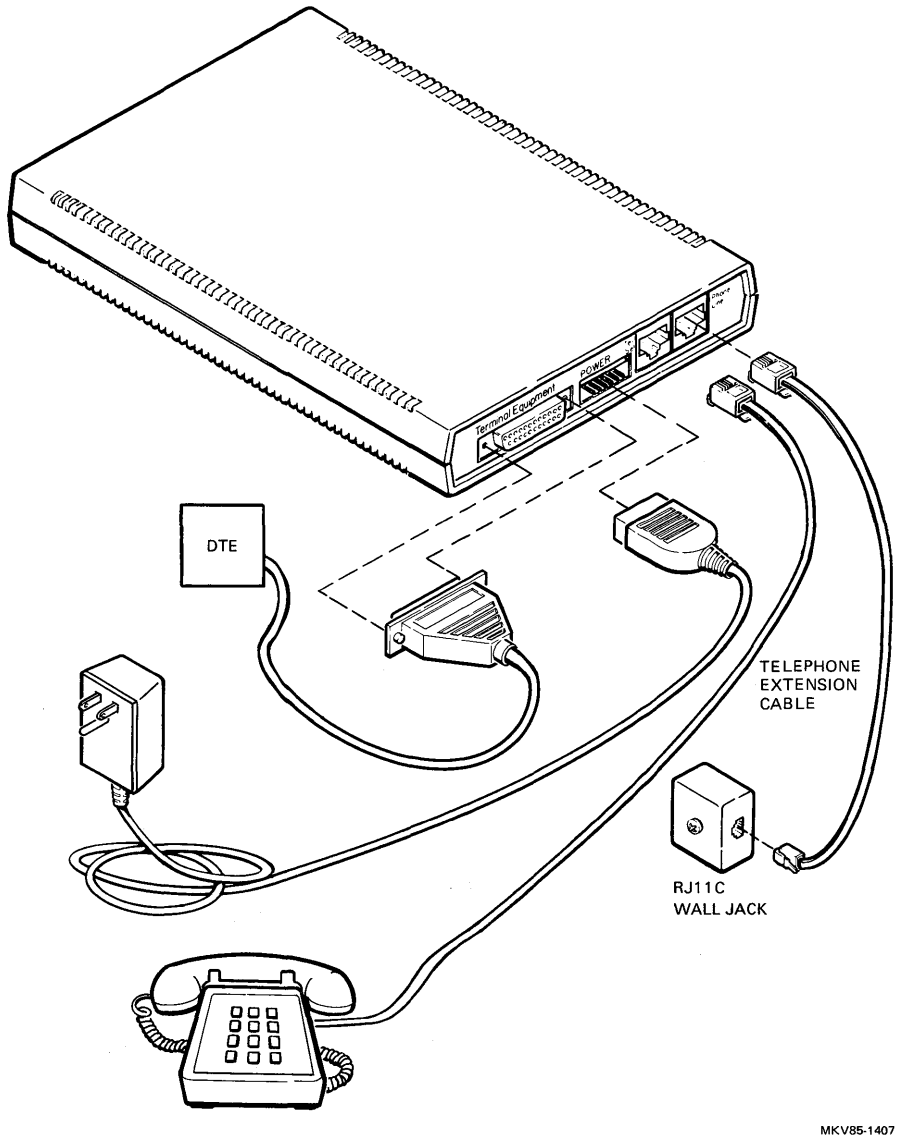


Figure DF224-3 Installing the DF224 (SCHOLAR) Modem on RJ11C (CA11A) Service

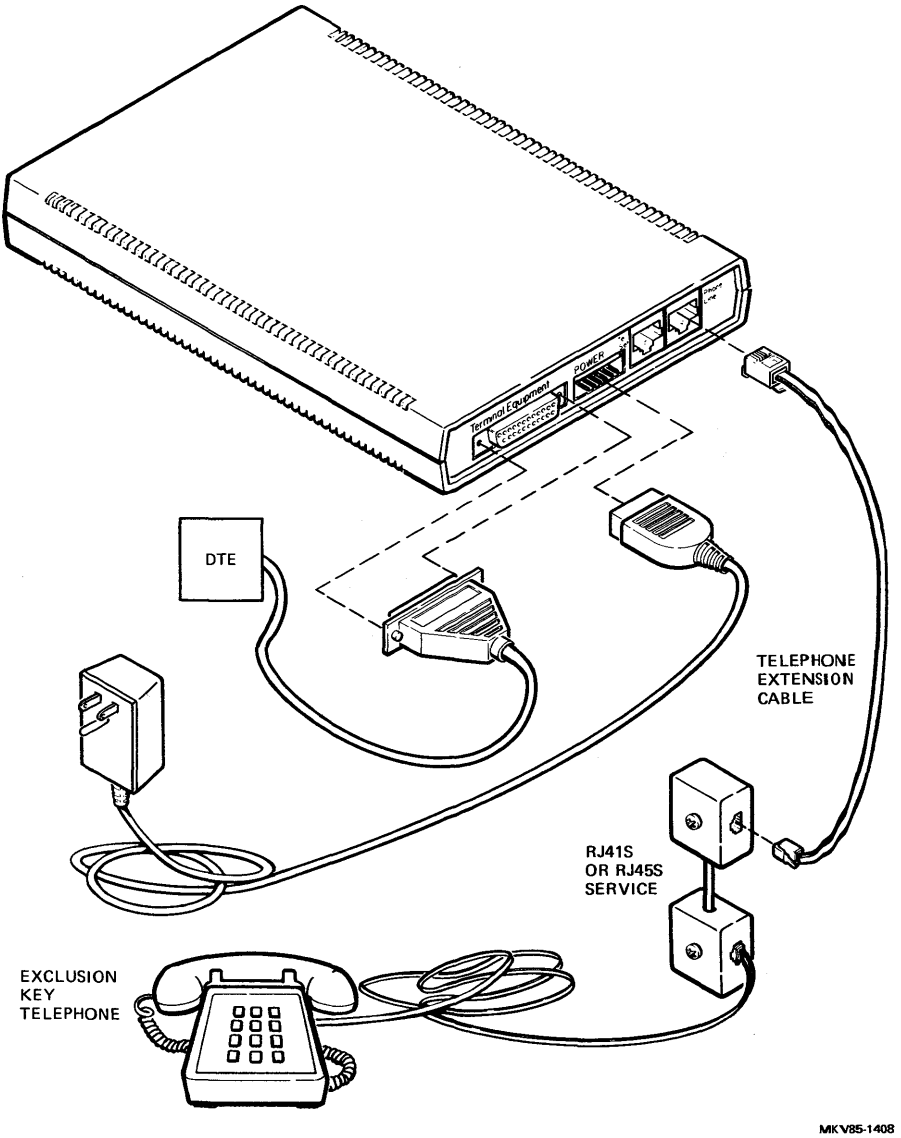


Figure DF224-4 Installing the DF224 (SCHOLAR) Modem on RJ41S/RJ45S (CA41A/CA45A) Service

General
Diagnostic testing of the DF224 modem exists for the following types of tests:

- **Power-Up Self-Test**
- **Local Analog Loopback Test**
  Set the LOCAL LOOP switch
- **Remote Digital Loopback Test**
  Set the LOCAL LOOP switch

Refer to Chapter 7 for the test procedures for the DF224 modem.

DF224 Tech Tips/FCO Index

The following table lists Tech Tips and FCOs for the DF224 modem.

Table DF224-4 DF224 Tech Tip/FCO Index

Tech Tip/ FCO No.	Title	Speed Bulletin No.
DF224-R-B1-001	Garbage Data, Blind Dialing, and 300 μs Ring Fixes	403
DF224-AA-TT-01	DF224 Does Not Recognize Special Rings	452/449
DF224-TT-01	DF224 Connection to System	427
DF224-TT-02	DF224 Autodialing	429
DF224-AA-TT-02	DF224 Synchronous Mode	560

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DF242 MODEM

DF242-CA General Description

The DF242-CA (Scholar Plus) modem is a powerful, high-performance, high-speed and versatile modem that uses standard dial-up telephone service to communicate serial binary data from one place to another.

DF242 Features

- Supports two command languages: Digital modem command languge (DMCL) and an expanded version of the Hayes Smartmodem™ 2400 AT command language.
- Performs asynchronous speed buffering up to 9600 bits/s from 1200/2400 bits/s only.
- Error correction is supported for on-line error detection and retransmission using either MICROCOM™ networking protocol (MNP) or X.PC (TYMNET™ implementation) protocols at 1200/2400 bits/s.
- Access/callback security provides two forms of password security (DMCL only):
  - Restricts access in changing stored phone numbers and other parameters
  - Controls the callback feature.
- Speed changes automatically to match the speed of the other modem.
- DF242 modem is compatible with the following standard protocols:
  - Bell 212™ @ 1200 bits/s
  - Bell 103™ @ 300 bits/s
  - V.22 bis @ 2400 bits/s
  - V.22 @ 1200 bits/s
- All option parameters can be changed from a terminal keyboard or computer.
- Advance autodialer
  - Provides compatibility with tone and pulse dialing techniques
  - Provides numerous commands to control a variety of functions
  - Dials telephone numbers in interactive terminal mode or CPU mode
  - Stores up to 30 telephone numbers (a maximum of 36 characters each)
  - Provides nonvolatile memory so that telephone numbers are saved when the unit is turned off
  - Allows stored telephone numbers to be identified by Mn memory designations (M1-M30) or optional 6-character names
  - Links a group of stored telephone numbers in sequence so that the next number is dialed if the current telephone number is busy or if there is no answer.

NOTE
Modems with serial numbers RN9200 or greater contain Revision 1.5 firmware.

DF242 INTRODUCTION

The DF242-CA modem consists of:

- Scholar Plus modem (PN 29-26380-00)
- External power supply (PN 29-26240)
- Telephone extension cord (RJ11C or CA11A)
- Documentation

DF242 Specifications

Specifications for the DF242-CA modem are shown in Table DF242-1.

Table DF242-1 Specifications

Item	Specification
Data Rate	300 bits/s asynchronous format 1200 bits/s asynchronous/synchronous formats 2400 bits/s asynchronous/synchronous formats
Modulation	Frequency shift keying (FSK) at 300 bits/s
	Differential phase shift keying (DPSK) at 1200 bits/s
	Quadrature amplitude modulation (QAM) at 2400 bits/s
Format	Asynchronous 5, 6, 7, or 8 data bits at 300/1200/2400 bits/s
	Character asynchronous or bit synchronous at 1200/2400 bits/s
Telephone Service	Public switched telephone network (PSTN) only
Interface	EIA RS-232-D, RS-422, and RS-423 compatible voltages
Interface Cables	BC22E, BC22F, or equivalent for asynchronous operation
	BC22F or equivalent for synchronous operation
Operating Temperature	10° to 40°C (50° to 104°F) Free air (normal convection)
Storage Temperature	–40° to 66°C (–40° to 150°F)
Relative Humidity	10% to 90% noncondensing and noncaustic
Diagnostics	Power-up self-test Local analog loopback test Remote digital loopback test
Dimensions	Height: 30.3 mm (1.19 inch) Width: 152.4 mm (6.00 inch) Length: 219.0 mm (8.62 inch)

Table DF242-1 Specifications (Cont)

Item	Specification
Weight	0.9 kg (2 lb) including power supply
Power Supply	AC input: 120 Vac @ 60 Hz (normal)
	Power: Operates between 104 and 128 Vrms at 57 to 63 Hz with a maximum input current of 120 mA at 128 Vac. The input power is 19.2 VA
DC Output	+5 Vdc @ 0.8 A maximum +12 Vdc @ 0.1 A maximum −12 Vdc @ 0.1 A maximum
Dial Memory Capacity	Up to 30 telephone numbers, each consisting of a maximum of 36 characters
Callback Memory Capacity	Up to 30 telephone numbers can be logged into callback memory and authorizing callback
Error Correction	MICROCOM™ networking protocol (MNP) or TYMNET™ (X.PC)
Speed Buffering	Asynchronous speed buffering at 1200/2400/4800 or 9600 bits/s with optional XON/OFF or RTS/CTS flow control

DF242 Reference Documentaion
Refer to the following documents for more information:

Before firmware Revision 1.5:

- *DF242 SCHOLAR Plus 2400 Modem User's Guide* EK-DF242-UG
- *SCHOLAR Plus Reference Card* EK-DF242-RC
- *DF212 and DF242: Getting Started* EK-DF242-GS

For firmware Revision 1.5:

- *DF212/DF242 Modem (DMCL) User's Guide* EK-DF2XD-UG
- *DF212/DF242 Modem (AT) User's Guide* EK-DF2XA-UG
- *DF212/DF242 Modem Reference Manual* EK-DF2XX-RM

Unpacking and Inspecting the DF242-CA Modem
The DF242-CA modem is packaged in a cardboard container with the following items:

- Power supply
- Telephone cord
- Accessories
- Documentation

Verify the contents with Figure DF242-1 (before firmware Revision 1.5) or Figure DF242-2, and check each piece for damage.

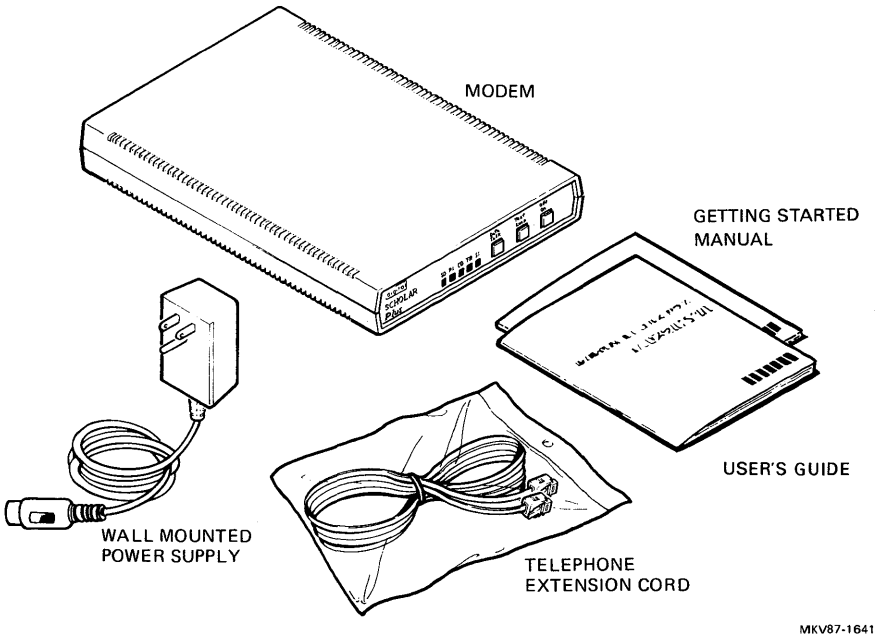


Figure DF242-1 Package Contents (Before Revision 1.5)

Installing the DF242 Modem
Procedures for installing the modem to the public switched telephone network vary, depending on the type of service that is requested and installed by the telephone company. The two types of service are:

- Connection to RJ11C (U.S.) or CA11A (Canada)
- Connection to RJ36X/RJ41S/RJ45S (U.S.) or CA36A/CA41A/CA45A (Canada) exclusion key/programmed

After the modem is connected to the telephone service, terminal baud rate must be set to match the modem (for modems with firmware before Revision 1.5, the default is 2400 bits/s). For Revision 1.5 firmware, the default is speed buffering at 9600 bits/s enabled.

Unpacking and Inspection
The modem is packaged in a single cardboard container along with the power supply, telephone cord, and accessories. Check the contents with Figure DF242-2. Also, check each piece for damage.

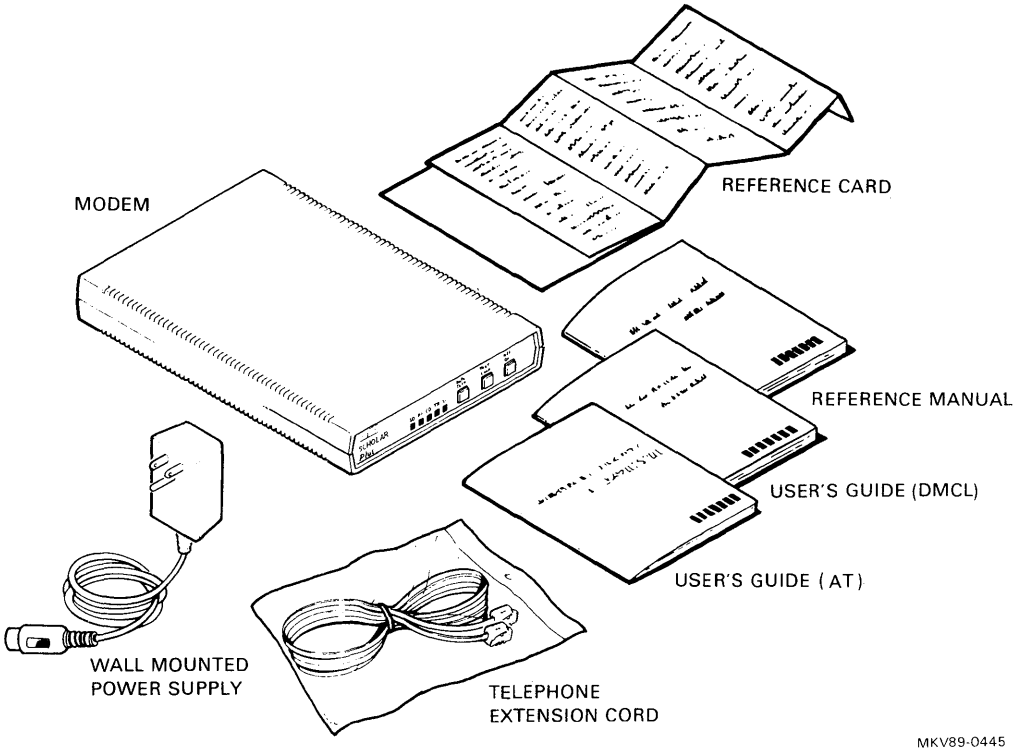


Figure DF242-2 Contents of Shipping Container

Connecting to Telephone Service

Use the following procedure to connect the modem to RJ11C (U.S.) or CA11A (Canada) telephone service.

1. Unplug the telephone from the wall-mounted modular telephone jack. See Figure DF242-3.

WARNING

Hazardous voltages may be present on telephone lines.
DO NOT leave any telephone cords disconnected, and
DO NOT TOUCH any bare telephone connection.

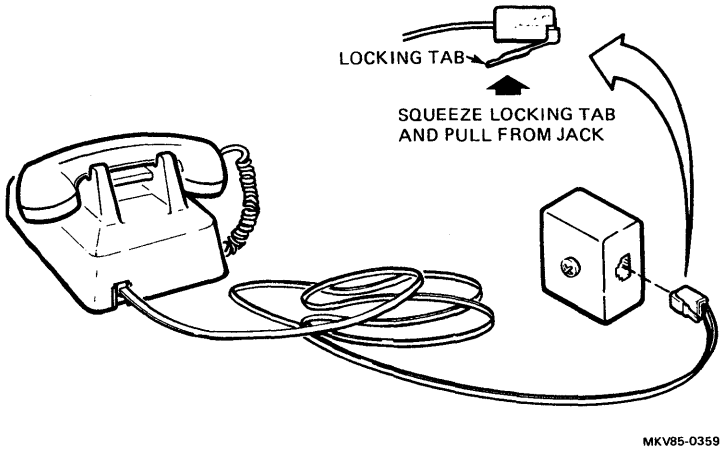


Figure DF242-3 Installing Standalone Modem (Sheet 1 of 4)

2. Plug the telephone into the modular telephone jack marked TEL SET. Push in until the tab snaps into the jack.

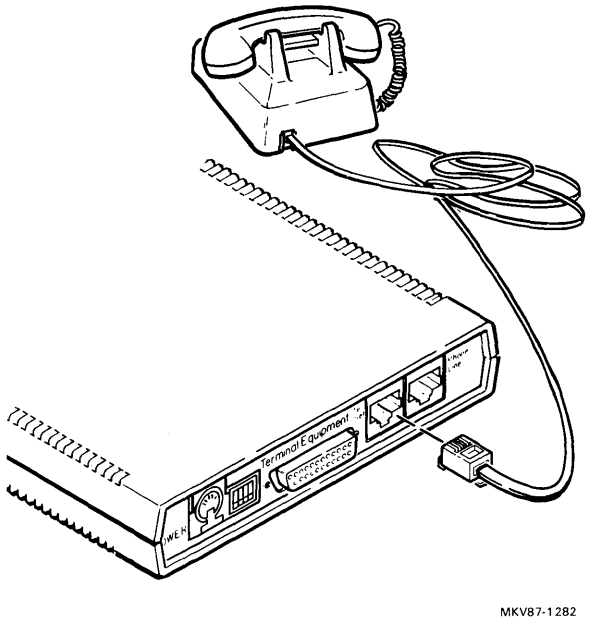


Figure DF242-3 Installing Standalone Modem (Sheet 2 of 4)

3. Plug the telephone extension cord (supplied with modem) into the other modular telephone jack marked PHONE LINE. Push in until the tab snaps into the jack.

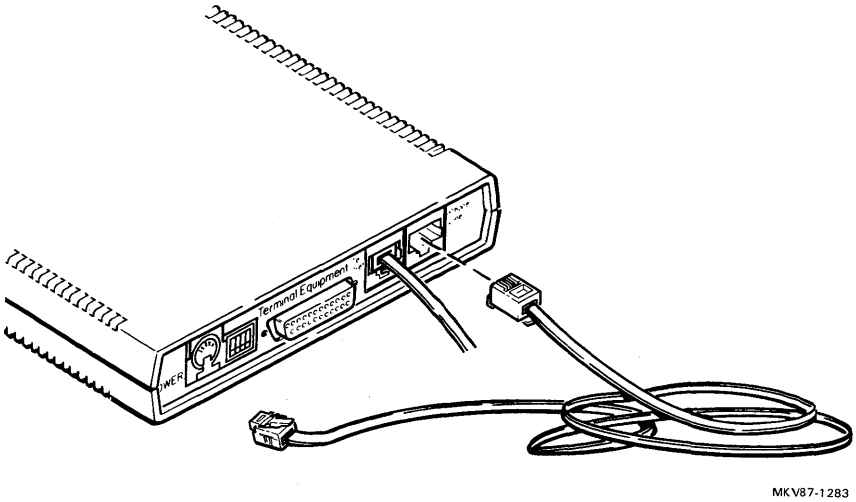
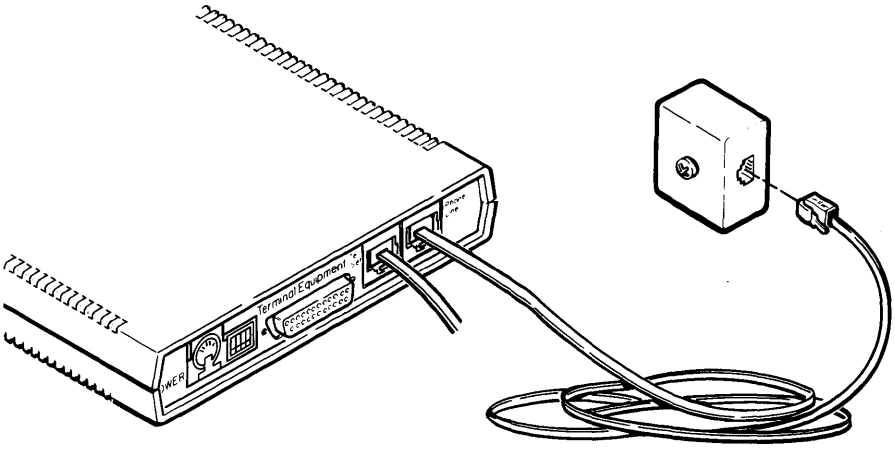


Figure DF242-3 Installing Standalone Modem (Sheet 3 of 4)

4. Plug the other end of the telephone extension cord into the wall-mounted modular telephone jack (RJ11C/CA11A).

WARNING

Hazardous voltages can be present on telephone lines. Do not leave any telephone cords disconnected. Above all, DO NOT TOUCH any bare telephone connections.



WHEN INSTALLING MODEM, ALWAYS MAKE THIS CONNECTION LAST. WHEN REMOVING MODEM, ALWAYS DISCONNECT THIS CONNECTION FIRST.

BE SURE THAT TELEPHONE CONNECTIONS ARE NOT FORCED IN THE WRONG WAY.

WRONG WAY

PLUG THEM STRAIGHT IN.

RIGHT WAY

MKV87-1284

Figure DF242-3 Installing Standalone Modem (Sheet 4 of 4)

5. Plug the data cable from your terminal equipment into the RS-232 connector marked TERMINAL EQUIPMENT. Make sure that the data cable is also connected to your terminal equipment. See Figure DF242-4.

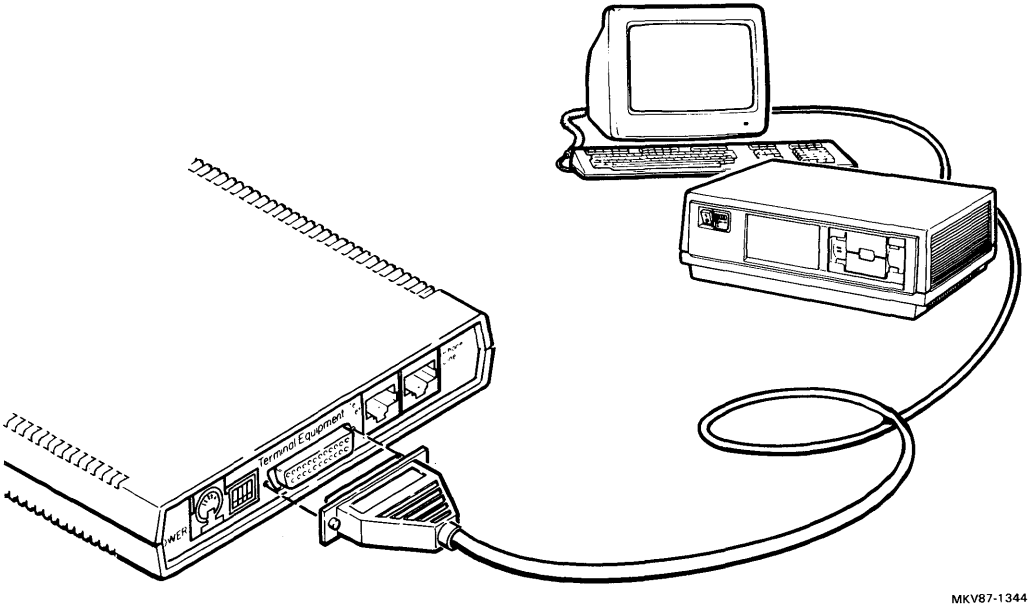


Figure DF242-4 Terminal Equipment

NOTE

The data cable is not supplied with the modem; it is usually provided by the terminal manufacturer. If you need to purchase a cable, Digital cable (PN BC22E) is recommended for asynchronous operations.

6. Set the data terminal characteristics at:

Operating mode	Asynchronous
Speed	2400 bits/s
Data bits/character	8 bits
Stop bits	1 stop bit
Parity	None

WARNING
Use only indoors. Do not use the power supply with an extension cord.

CAUTION
Use only the power supply provided.

7. Plug the power supply cord into the connector marked POWER. See Figure DF242-5.

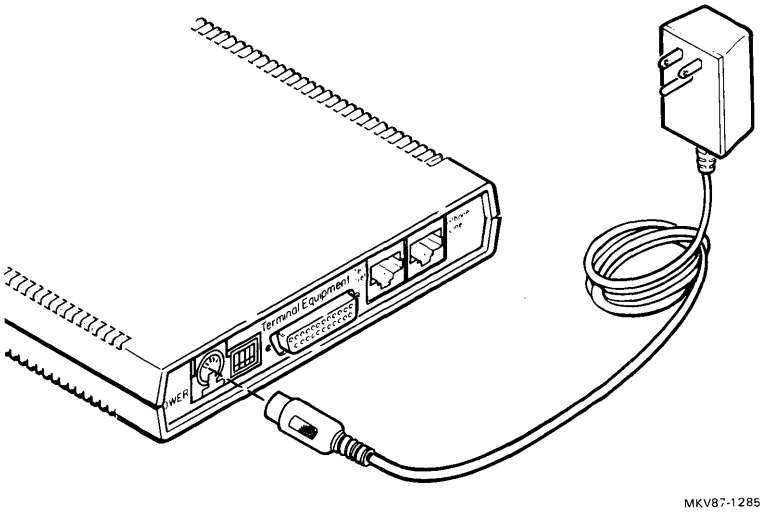


Figure DF242-5 Power Cable

8. Plug the power supply into a 3-prong, grounded, 110 Vac to 120 Vac wall outlet. See Figure DF242-6.

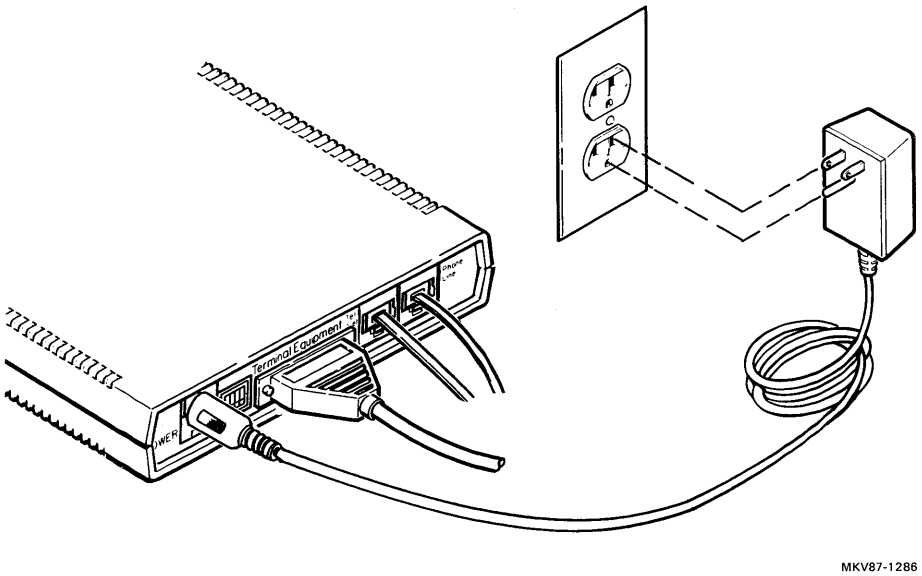


Figure DF242-6 Power Outlet

Checking for Ready
This test shows that the terminal communicates with the modem by displaying the Ready prompt. See Table DF242-2.

Table DF242-2 Checking for Ready

Steps	Indications	Remedies
Press CTRL/B on the terminal	The Ready prompt displays on terminal	Go to next step
	No display of Ready on terminal	1. Press CTRL/B again 2. Recheck terminal characteristics 3. Type AT. If OK displays, the modem is in AT mode 4. Call Atlanta Hotline: 1-800-241-2546 or DTN 435-4654
Enter command string: LIST P	Terminal displays modem parameters and concludes with a Ready prompt	Test completed
	Terminal displays no parameters	1. Input command string again 2. If terminal displays error, return to step 1 3. Call Atlanta Hotline: 1-800-241-2546 or DTN 435-4654

Connecting to Exclusion Key/Programmed Telephone Service (RJ41/CA41A or RJ45S/CA45A)
When you install the DF242-CA to exclusion key/programmed telephone service, no connection is required to the modular telephone jack (marked TEL SET). Open the modem enclosure and change two of the modem's options (PR/PC and MI/MIC), then use an 8-wire telephone extension cord (not supplied). Follow the procedure below:

1. Open the DF242 (Scholar Plus) modem enclosure to enable options.

   a. PR/PC (RJ45S or CA45A only) must be set to select programmed. Remove the jumper from E2 and E3, and connect it between E3 and E1.

   b. MI is enabled by removing the jumper from E6 to E5, and connecting it between E4 and E5.

   c. MIC is enabled by removing the jumper from E8 to E9, and connecting it between E7 and E8.

   d. Close the modem box.

2. Connect one end of the telephone extension cord (8-wire) to the wall-mounted, modular telephone jack.

3. Connect the other end of the extension cord to the modular telephone jack marked PHONE LINE on the back of the modem. Be sure to push the modular connector in until the tab snaps into the jack.

NOTE
No connection to the modular telephone jack (marked TEL SET on the modem) is required.

4. Connect the data cable from your terminal equipment into the RS-232 interface connector marked TERMINAL EQUIPMENT on the back of the modem.

NOTE
The Data cable is not supplied with the modem. It is usually provided by the terminal manufacturer. If you need to purchase a cable, Digital cable (PN BC22E) is recommended for asynchronous operations.

5. Connect the power supply cord into the connector marked POWER. Plug the power supply into a 110 to 120 V grounded, ac wall outlet. See Figure DF242-7.

WARNING
Use only indoors. Do not use an extension cord with the power supply.

CAUTION
Use only the power supply provided.

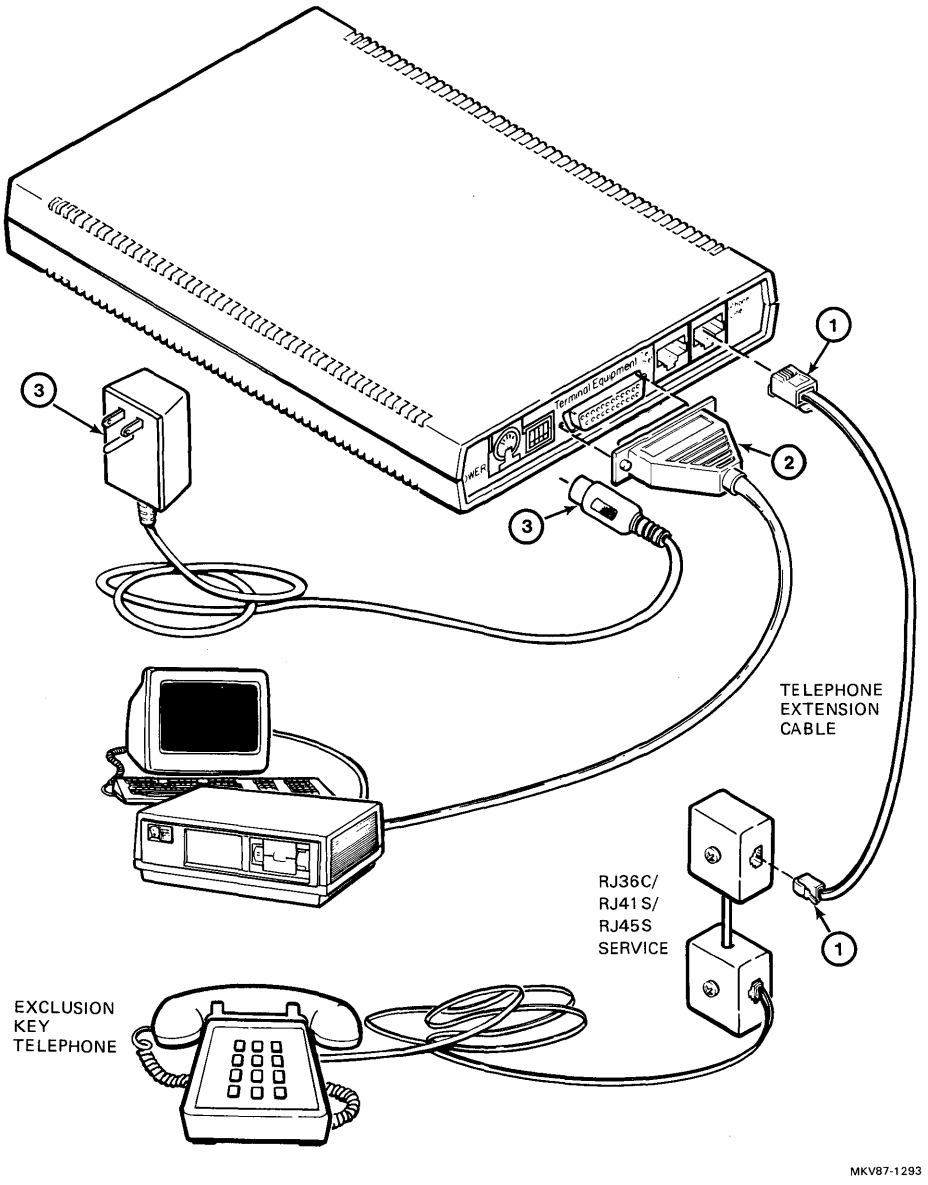


Figure DF242-7 Exclusion Key/Programmed Service

Options Settings
All configuration parameters are software-selected. Some parameters may be overridden by using switchpacks and jumpers.

Hardware-Select Options
The Scholar Plus modem has one external switchpack (SWPK1), one internal switchpack (SWPK5), and several internal jumpers that can be used to select a variety of modem options. These options are referred to as hardware-select.

The modem module can contain any one of three types of switchpacks (Figure DF242-8). Some switches are marked ON and OFF, some are marked OPEN and CLOSED, and others are just marked OPEN. Tables DF242-3, DF242-4, and DF242-5 use ON/OFF terminology. For switches that are marked OPEN/CLOSED, OPEN equals ON and CLOSED equals OFF.

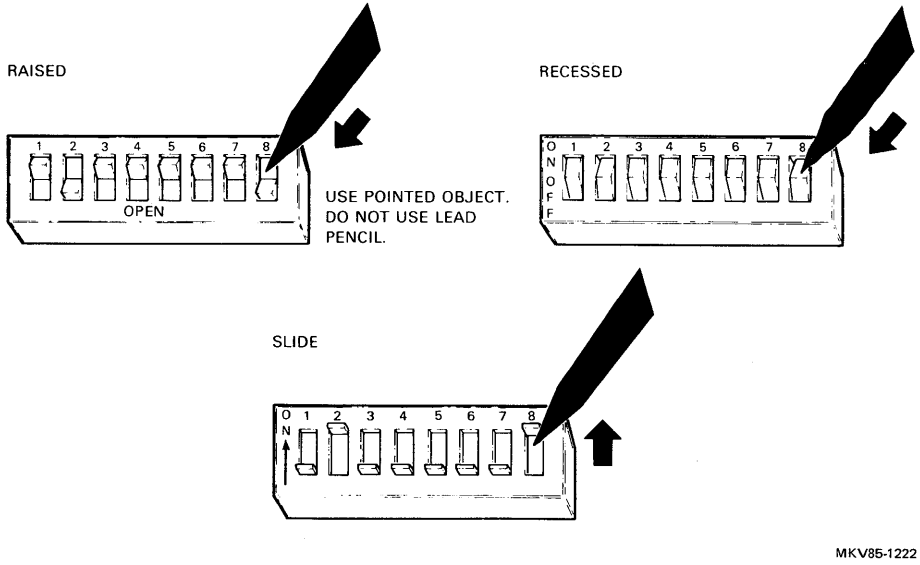


Figure DF242-8 Types of Switches

Hardware-select options on SWPK5 are used only when the user selects the default option on SWPK1 (switch 2 must be on). Otherwise, the hardware-select options are ignored. See Figure DF242-9 for the switch and jumper locations. Tables DF242-3, DF242-4, and DF242-5 list the factory default settings of the switches.

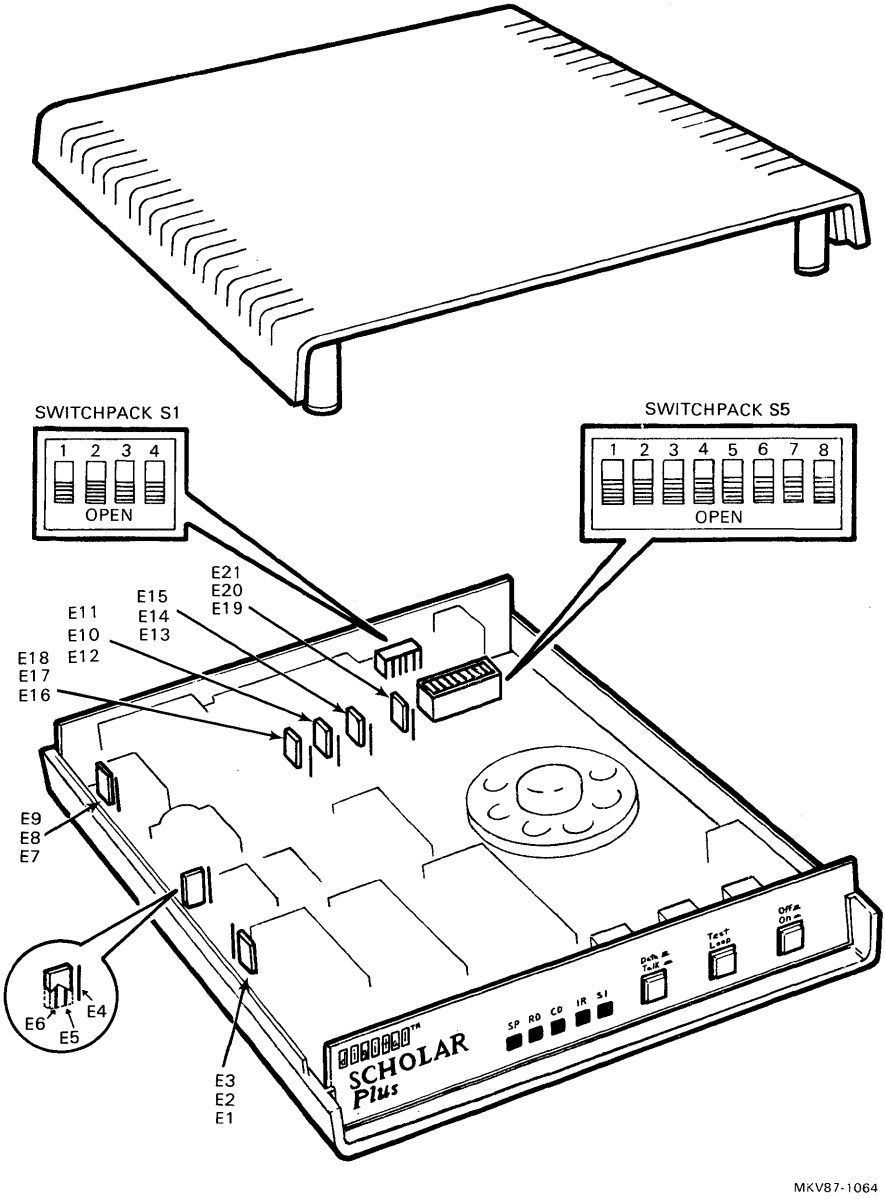


Figure DF242-9 Switch and Jumper Location

Table DF242-3 Switchpack 1 (SWPK1)

Option	Selection	SW1	SW2	SW3	SW4
Factory Defaults	**Disabled**	OFF			
	Enabled	ON			
User Defaults	**Disabled**		OFF		
	Enabled		ON		
Remote Diagnostics	**Disabled**			OFF	
	Enabled			ON	
Callback Security	**Disabled**				OFF
	Enabled				ON

NOTE:
Standard factory configurations are printed in blue.

Table DF242-4 Switchpack 5 for Asynchronous Operation

Option	Selection	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Autodial Protocol	DMCL Mode	OFF							
	AT Mode	ON							
Communication Protocol	Asynchronous		OFF						
Parity Type	Odd			OFF					
	Even			ON					
Parity Select	Disable				OFF				
	Enable				ON				
Number of Data Bits	5 Bits					ON	ON		
	6 Bits					ON	OFF		
	7 Bits					OFF	ON		
	8 Bits					OFF	OFF		
Modem Protocol	Bell 103™							ON	ON
	Bell 212™							ON	OFF
	V.22							OFF	ON
	V.22 bis							OFF	OFF

NOTES: Switches 3 through 8 have different functions, depending on the setting of switch 5 in Table DF242-5.

Standard factory configurations are printed in blue.

Table DF242-5 Switchpack 5 for Synchronous Operation

Option	Selection	SW1	SW2	SW3	SW4	SW5	SW6	SW7	SW8
Autodial Protocol	DMCL Mode	OFF							
	AT Mode	ON							
Communication Protocol	Synchronous		ON						
Reserved				NOT USED					
Reserved					NOT USED				
Terminal Timing	Not Used					ON	ON		
	Slave					ON	OFF		
	External					OFF	ON		
	Internal					OFF	OFF		
Modem Protocol	Not Used							ON	ON
	Bell 212™							ON	OFF
	V.22							OFF	ON
	V.22 bis							OFF	OFF

NOTES: Switches 3 through 8 have different functions, depending on the setting of switch 2 in Table DF242-4.

Standard factory configurations are printed in blue.

Internal Jumpers

The jumpers are stake pins with push-on shorting plugs. The shorting plugs can connect to a 3-stake pin configuration. See Figure DF242-9 for the location of the jumpers. Jumper selection is provided in Table DF242-6.

Table DF242-6 Jumper Selection

Option	Selection	E3-E2	E1-E3	E4-5	E5-E6	E7-E8	E8-E9	E10-E11	E10-E12
PR/PC	Permissive	IN	OUT						
	Programmed	OUT	IN						
MI	Enabled			IN	OUT				
	Disabled			OUT	IN				
MIC	Enabled					IN	OUT		
	Disabled					OUT	IN		
DTR	Normal							IN	OUT
	Forced							OUT	IN

Option	Selection	E13-E14	E14-15	E16-E17	E17-E18	E19-E20	E20-E21
EIA-RDL (RL)	Enabled	IN	OUT				
	Disabled	OUT	IN				
EIA-ANL (LL)	Enabled			IN	OUT		
	Disabled			OUT	IN		
EIA-TM (TM)	Enabled					IN	OUT
	Disabled					OUT	IN

NOTE:
Standard factory configurations are printed in blue.

Software-Select Options

The DMCL command set allows the terminal or computer to select and change parameters. Tables DF242-7 through DF242-12 list parameters (P) according to classes.

Table DF242-7 Operational Class (/OPE) Parameters

Parameter No.	Description	Selection		Factory Default (Before Rev 1.5)	Factory Default (Rev 1.5)
P1	Modem protocol	1200 Bell 212™ 300 Bell 103™ 2400 V.22 bis 1200 V.22	= 0 = 1 = 2 = 3	2	2
P2	Character echo	Off On	= 0 = 1	1	1
P3	Answer mode	Auto Man	= 0 = 1	0	0
P4	Attached msg on incoming call	Off On	= 0 = 1	0	0
P5	Delete key effect	CRT Hardcopy	= 0 = 1	0	0
P6	Enabled rem Digital Loopback	Off On	= 0 = 1	1	0
P7	Blind Dialing	Off On	= 0 = 1	0	0
P11	Automatic Retrain	Off On	= 0 = 1	0	0
P12	Speaker enable	Off On On (if no CD)	= 0 = 1	2	2
P13	Speaker volume	Low Medium High	= 1 = 2 = 3	2	1
P14	Ring to answer on	Ring	= 1 to 10	2	2
P15	Callback timer*	Time	= 1–6	1	1

* 1 = 10 seconds, 2 = 20 seconds, 3 = 30 seconds, and so forth.

Table DF242-8 Communication Class (/COM) Parameters

Parameter No.	Description	Selection		Factory Default (Before Rev 1.5)	Factory Default (Rev 1.5)
P1	Data bits	7 bits	= 3		
		8 bits	= 4	4	4
P2	Parity	None	= 1	1	1
		Even	= 2		
		Odd	= 3		
P3	Stop bits	One	= 1	1	1
		Two	= 2		
P4	Off-line XON/XOFF recognition	Off	= 0	1	1
		On	= 1		
P5	Communication protocol	Asyn	= 0	0	0
		Sync	= 1		
P6	Sync mode timing	Int	= 0	0	0
		Ext	= 1		
		Slave	= 2		
P7	DSR forced	On	= 1		
		Normal	= 2	2	2
P8	EIA CD/CTS signals	Separate	= 0	0	0
		Common	= 1		

DF242-9 Disconnect Class (/DIS) Parameters

Parameter No.	Description	Selection		Factory Default (Before Rev 1.5)	Factory Default (Rev 1.5)
P1	Send Space Disconnect	Off On	= 0 = 1	1	0
P2	Receive Space Disconnect	Off On	= 0 = 1	1	0
P3	Carrier Loss Disconnect	Off On	= 0 = 1	1	1
P4	Current Loss Disconnect	Off On	= 0 = 1	1	1

Table DF242-10 Speed Buffering Class (/SBU) Parameters

Parameter No.	Description	Selection		Factory Default (Before Rev 1.5)	Factory Default (Rev 1.5)
P1	Speed Buffering State	Off On	= 0 = 1	0	1
P2	DTE Flow Control	None XON/XOFF RTS/CTS Both	= 0 = 1 = 2 = 3	1	1
P3	Autobaud State	Off On	= 0 = 1	1	1
P4	Local Baud Rate	1200 bits/s 2400 bits/s 4800 bits/s 9600 bits/s	= 0 = 1 = 2 = 3	1	3

Table DF242-11 Error Class (/ERR) Parameters

Parameter No.	Description	Selection		Factory Default (Before Rev 1.5)	Factory Default (Rev 1.5)
P1	Error Correction	Off	= 0	0	0
		MNP on	= 1		
		X.PC on	= 2		
P2	Error Correction Auto-Fallback	Off	= 0	0	0
		On	= 1		
P3	Transmit Break Reaction			0	3
		Disregard	= 0		
		Destructive Non-destructive	= 1		
		Immediate Non-destructive	= 2		
		Sequenced	= 3		
P4	Receive Break Reaction			0	3
		Disregard	= 0		
		Destructive Non-destructive	= 1		
		Immediate Non-destructive	= 2		
		Sequenced	= 3		
P6	MNP Disconnect Type			0	0
		Non-disruptive	= 0		
		Disruptive	= 1		

Table DF242-12 Access Security Class (/PRO) Parameters

Parameter No.	Description	Selection		Factory Default (Before Rev 1.5)	Factory Default (Rev 1.5)
P1	Callback Memory Access	Off	= 0	0	0
		On	= 1		
P2	Dial Memory Access	Off	= 0	0	0
		On	= 1		
P3	Parameter Access	Off	= 0	0	0
		On	= 1		

Software-Select Procedures

Software-select parameters are set by using the SET P (set parameter) command followed by a qualifier. The qualifiers for the different classes are as follows.

- Operational - /OPE (default)
- Communication - /COM
- Disconnect - /DIS
- Error correction - /ERR
- Speed buffering - /SBU
- Access security - /PRO
- Set all classes - /ALL

The parameters can be set by using one of two formats: dialog or expert. The dialog format prompts the user for input information, and the expert format relies on the user to input information directly.

NOTE

After the parameters have been changed, the WRITE command should be used to store the changed parameters. When the DF242 is powered up, it will use the stored parameters as default settings.

CTRL/B	Activate DMCL mode
Ready	DMCL ready
SET P2/DIS	Parameter 2 in the Disconnect class is selected
2 Receive Space Disconnect: OFF=0, ON=1 [0]:	The selected parameter menu line appears, showing the current value
1 <RETURN>	DMCL changes the current value from a zero to a one. To use the current value without changing the value, press RETURN

Example DF242-1 Setting a Parameter

CTRL/B	Activate DMCL
Ready	DMCL ready
SET P/COM	All parameters in the Communication class are selected
1 Data Bits: 7 Bits=3 8 Bits=4 [4]:	The first parameter displays, showing the current value (8 bits)
<RETURN>	To accept the current value (4), press RETURN
3 <RETURN>	To change the value from 8 bits (4) to 7 bits, enter new value 3 and press RETURN
2 Parity: None=1, Even=2, Odd=3 [1]:	The next parameter line is displayed
<RETURN>	To accept the current value (1), press RETURN or enter a new value and press RETURN
	Continue in this manner for the remaining parameters
CTRL/U	To cancel a value that has been entered before pressing RETURN, CTRL/U will prompt the value again
CTRL/Z	To accept all remaining values in the class, press CTRL/Z
Ready	Ready prompt displays after CTRL/Z is pressed

Example DF242-2 Setting All Parameters in One Class

CTRL/B	DMCL activated
Ready	DMCL ready
SET P/ALL	All classes display one by one, starting with Operational

Example DF242-3 Setting Parameters in All Classes

NOTE
After making changes to any of the following parameters, change the corresponding characteristics of the serial line connected to the modem.

CTRL/B	DMCL activated
Ready	DMCL ready
SET P2:1/DIS	Parameter 2 in the Disconnect class is set to 1 (receive space disconnect)
Ready	The parameter changes and the Ready prompt displays

Example DF242-4 Setting Parameters Without Dialog

DF242 TESTING

General

Diagnostic testing of the DF242 modem consists of the following tests in DMCL mode. For AT mode, see the "Command Summary" section.

- Self-test
- Local analog loopback test
- Remote digital loopback test
- Remote diagnostics test

Self-Test

When power is applied to the modem, the built-in diagnostic self-test routine automatically executes. This test (which takes about five seconds) checks approximately 90% of the modem's electronic circuits. This test can also be executed by the enable test commands at the Ready prompt (DMCL mode). The test loop (TL) switch has a built-in light emitting diode (LED) to indicate the status of the self-test. The two conditions for the TL LED are:

- Remains on for five seconds while executing self-test
- Blinks if an error has been detected.

To run self-test from DMCL, follow the procedure below:

1. Press CTRL/B to activate the DMCL.
2. Type ENA TEST at the Ready prompt and RETURN.

If an error has been detected, error code "-1" displays on the terminal.

Local Analog Loopback Test (DMCL Mode)

This test verifies that the DF242 modem can transmit and receive data. See Figure DF242-10.

CAUTION

The local loopback test operates at 1200 or 2400 bits/s only. The terminal speed setting must be set to match the modem speed because speed buffering is not functional when loopback is activated.

NOTE

The Test Loop switch on the front panel has no effect while the modem is in AT mode.

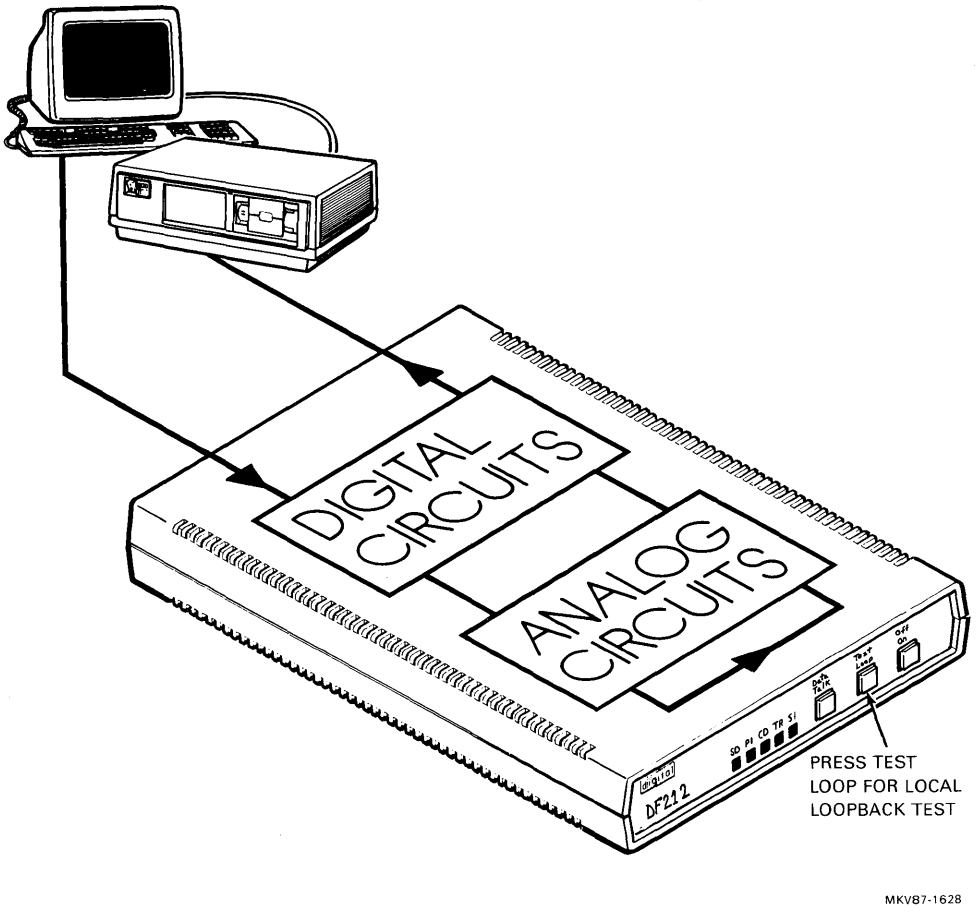


Figure DF242-10 Local Analog Loopback Test

Procedure:

1. Verify that the terminal ready (TR) LED is on. The speed indicator (SI) is either green or red, depending on the speed selected.

2. Make sure that the terminal or interface is set to 2400 bits/s or 1200 bits/s. Speed buffering is not functional in test mode.

   a. For DMCL mode, press the test loop switch to the IN position. Verify that the TL LED (inside the test loop switch) goes on, and then the carrier detect (CD) LED goes on.

   b. For AT mode, type AT&T1 followed by RETURN. Verify that the CD and TM LEDs come on.

3. Type a test message on the terminal and verify that the same data is displayed at the terminal. Incorrect data indicates that:

   a. Some modem options such as data, parity, or stop bit selections are set incorrectly.

   b. The terminal is set to the wrong speed.

   c. The modem is defective.

4. In DMCL mode, set the test loop switch to the OUT position to terminate the test. The LED will go out. In AT mode, enter +++ (the escape code). After the OK message, type AT&T0. The LED will go out.

Remote Digital Loopback Test (DMCL Mode Only)
This test verifies that the DF242 modem can transmit or receive data over the telephone line, through a remote modem, and back over the telephone line. See Figure DF242-11.

CAUTION
The remote digital loopback test operates at 1200 or 2400 bits/s only. The terminal speed setting must be set to match the modem speed because speed buffering is not functional when loopback is activated.

Procedure (DMCL Mode):

1. Verify that the TR LED is on. The SI indicator is either green or red, depending on the speed selected.

2. Establish a connection by dialing the remote end. When you receive the message ATTACHED, the modem is connected to the line. Wait for the CD LED to come on.

3. Press the test loop (TL) switch to the IN position.

4. The LED inside the test loop switch blinks while the modems are attempting to establish remote digital loopback (RDL). When RDL is established, the TL LED remains on. If RDL does not come on, have the remote operator verify that parameter P6 (enable remote/digital loopback) of the Operational class parameter group is set on (digital loopback). If the remote modem is not a DF242, set the remote modem to RDL.

5. Type a test message on the terminal and verify that the same data is displayed at your terminal. Incorrect data indicates that:

   a. Modem options (data bits, parity, or stop bit) are set incorrectly.

   b. Terminal is set to wrong speed.

   c. Telephone lines may be noisy or faulty.

   d. Remote modem may be defective.

6. Set the test loop switch to the OUT position to terminate the tests.

Procedure (AT Mode):

1. Verify that the TR LED is on. The SI indicator is either green or red, depending on the speed selected.

2. Establish a connection by dialing the remote end. When you receive the message ATTACHED, the modem is connected to the line. Wait for the CD LED to come on.

3. Type +++ (the escape code). After the OK message, type AT&T6 followed by RETURN.

4. Observe that the TL LED is on.

NOTE

In AT mode, the command AT&T6 forces RDL. The remote modem must be enabled to respond to the remote loop (AT&T4).

5. Type a test message on the terminal and verify that the same data is displayed at your terminal. Incorrect data indicates that:

   a. Modem options (data bits, parity, or stop bit) are set incorrectly.

   b. Terminal is set to wrong speed.

   c. Telephone lines may be noisy or faulty.

   d. Remote modem may be defective.

6. To terminate the test, type +++ (escape code). After OK message, type AT&T0 followed by RETURN.

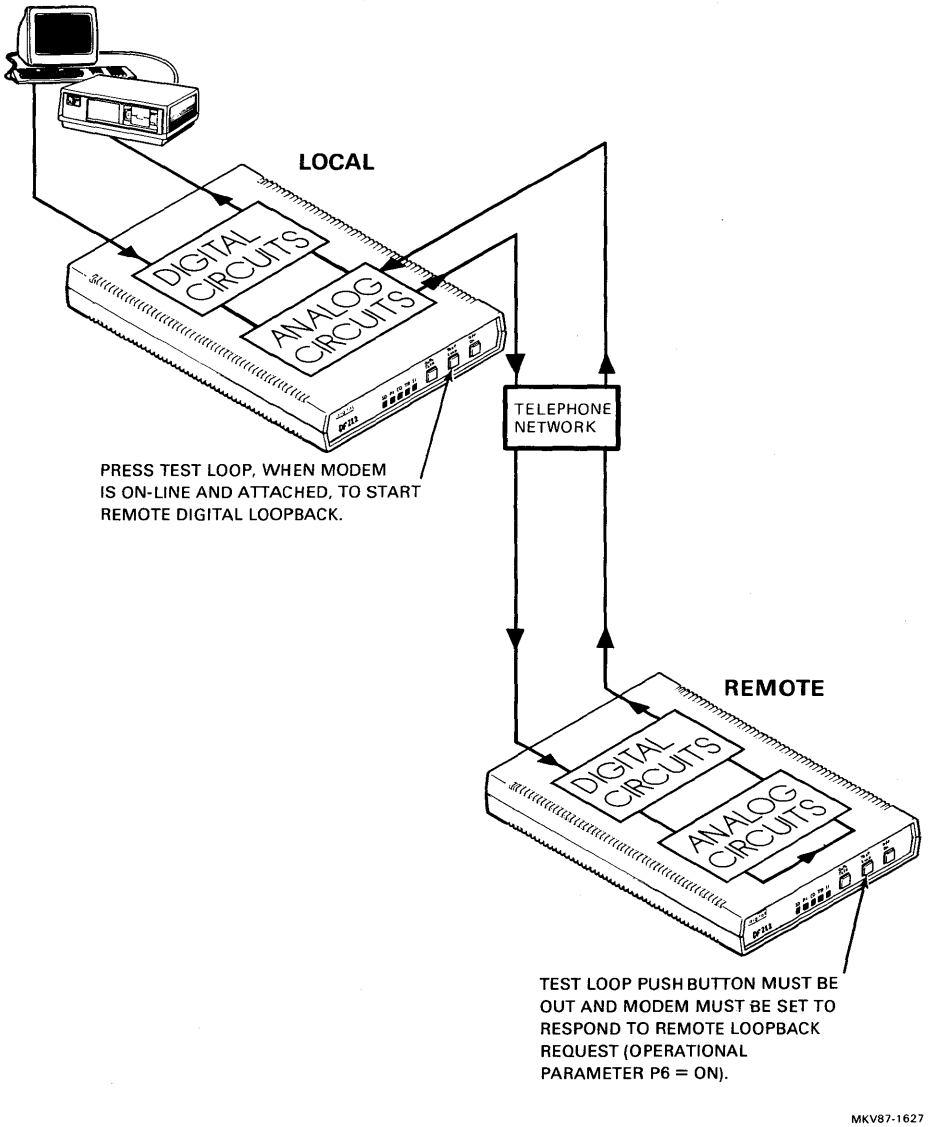


Figure DF242-11 Remote Digital Loopback Test

Remote Diagnostic Test
This test allows Field Service personnel to dial from a local modem and to examine the operational parameters of a remote modem.

1. On the remote modem, set switchpack 1 (SWPK1) SW3 to the ON position (enable remote diagnostics).

2. From the local modem, dial the number of the remote modem.

3. When a connection has been established between the local and remote modems, type the password from the local modem's data terminal equipment (DTE).

4. From the local modem's DTE, use the DMCL command LIST to display parameters.

5. By viewing the parameters, the user can tell if the remote modem parameters are set up correctly.

6. To terminate the test, the local modem must be disconnected and the remote modem's SWPK1 SW3 must be set to the OFF position (disable remote diagnostic).

DF242 Tech Tips/FCO Index

Table DF242-13 lists Tech Tips for the DF242 modem.

Table DF242-13 DF242 Tech Tip/FCO Index

Tech Tip/ FCO No.	Title	Speed Bulletin No.
DF242-CA-TT-01	DF242-CA Async DECnet (Hangs)	558

NOTES

NOTES

CHAPTER 9
MODEM THEORY

9.1 INTRODUCTION

This chapter provides refresher information on some important aspects of modem communications.

9.2 U.S. MODEM TYPES AND STANDARDS

Typical Bell modem types are listed below.

Bell 103J

Data Rate:	0 – 300 b/s
Modulation:	Frequency Shift Keying (FSK)
Data Format:	Asynchronous, Binary, Serial
Operation Mode:	Full-Duplex
Line Connection:	PSTN
Interface:	EIA RS-232-C

Bell 201C

Data Rate:	2400 b/s
Modulation:	Differential Phase Shift Keying (DPSK)
Data Format:	Synchronous, Binary, Serial
Operation Mode:	Half- or Full-Duplex
Line Connection:	
Half-Duplex:	PSTN or Two-Wire P/LTN
Full-Duplex:	PSTN or Four-Wire P/LTN
Interface:	EIA RS-232-C

Bell 212A

Data Rate:	
Low Speed:	0 – 300 b/s
High Speed:	1200 b/s
Modulation:	
Low Speed:	Frequency Shift Keying (FSK)
High Speed:	Differential Phase Shift Keying (DPSK)
Data Format:	
Low Speed:	Asynchronous, Binary, Serial
High Speed:	Synchronous, Binary, Serial or Character Asynchronous, Binary, Serial
Operation Mode:	Full-Duplex
Line Connection:	PSTN or Two-Wire P/LTN
Interface:	EIA RS-232-C

9.3 CCITT MODEM TYPES AND STANDARDS

Typical CCITT compatibility standards are listed below.

CCITT V.22

Data Rate:	1200 b/s
Modulation:	Differential Phase Shift Keying (DPSK)
Data Format:	Synchronous, Binary, Serial
Operation Mode:	Full-Duplex
Line Connection:	PSTN or Two-Wire P/LTN

CCITT V.22 bis

Data Rate:	
Low Speed:	1200 b/s
High Speed:	2400 b/s
Modulation:	
Low Speed:	Differential Phase Shift Keying (DPSK)
High Speed:	Quadrature amplitude modulation (QAM)
Data Format:	Synchronous, Binary, Serial
Operation Mode:	Full-Duplex
Line Connection:	PSTN and Two-Wire P/LTN

CCITT V.27

Data Rate:	4800 b/s
Modulation:	Differential Phase Shift Keying (DPSK)
Data Format:	Synchronous, Binary, Serial
Operation Mode:	Half- or Full-Duplex
Line Connection:	
Half-Duplex:	PSTN or Two-Wire P/LTN
Full-Duplex:	PSTN or Four-Wire P/LTN

CCITT V.29

Data Rate:	
Low Speed:	4800 b/s or 7200 b/s
High Speed:	9600 b/s
Modulation:	
Low Speed:	4800 b/s Quadrature amplitude modulation (QAM) 7200 b/s 8-point Quadrature amplitude modulation (QAM)
High Speed:	9600 b/s 16-point Quadrature amplitude modulation (QAM)
Data Format:	Synchronous binary stream data
Operation Mode:	Full-duplex
Line Connection:	Four-wire P/LTN

9.4 MODEM COMMUNICATIONS CIRCUITS

The two types of modem communications circuits used are:

Public Switched Telephone Network (PSTN) – Used for low-volume data communications at data rates up to 2400 b/s in full-duplex operation.

The four basic connections are:

- RJ11C (Figure 9-1) – A miniature six-position jack for single-line nonkey telephones that provides a bridged connection to the tip and ring conductors of the telephone line. Typically associated with residential telephones. The output level is fixed at a maximum of −9 dBm.

- RJ12C (Figure 9-1) – A miniature six-position jack for single-line key telephones that provides a bridged connection to the tip and ring conductors of the telephone line and, to the mode indicate and mode control conductors of the key system. Typically associated with commercial telephones. The output level is fixed at a maximum of −9 dBm.

- RJ41S (Figure 9-1) – A miniature eight-position jack for exclusion key telephones that provides series connections to the tip and ring conductors of the telephone line. Has user switch to select either fixed loss loop or programmed loss loop. When the switch is set for fixed loss loop, the modem output level is fixed at −4 dBm. When it is set for programmed loss loop, the output level is set from 0 to −12 dBm as determined by a telephone company installed resistor.

- RJ45S (Figure 9-1) – Same as RJ41S except user switch is omitted and the output level is set from 0 to −12 dBm by a telephone company installed resistor.

Private/Leased Line Telephone Network (P/LTN) – Used for high-volume data communications at data rates up to 9600 b/s in full-duplex operation.

The two basic connections are:

- 2-wire (Figure 9-2) – Usually used in local telephone loops between the telephone and the local exchange office. One wire is used for transmission of data in both directions while the other wire serves as a common ground.

- 4-wire (Figure 9-2) – Usually used between central offices for long distance calls, with one pair being used for each direction of transmission.

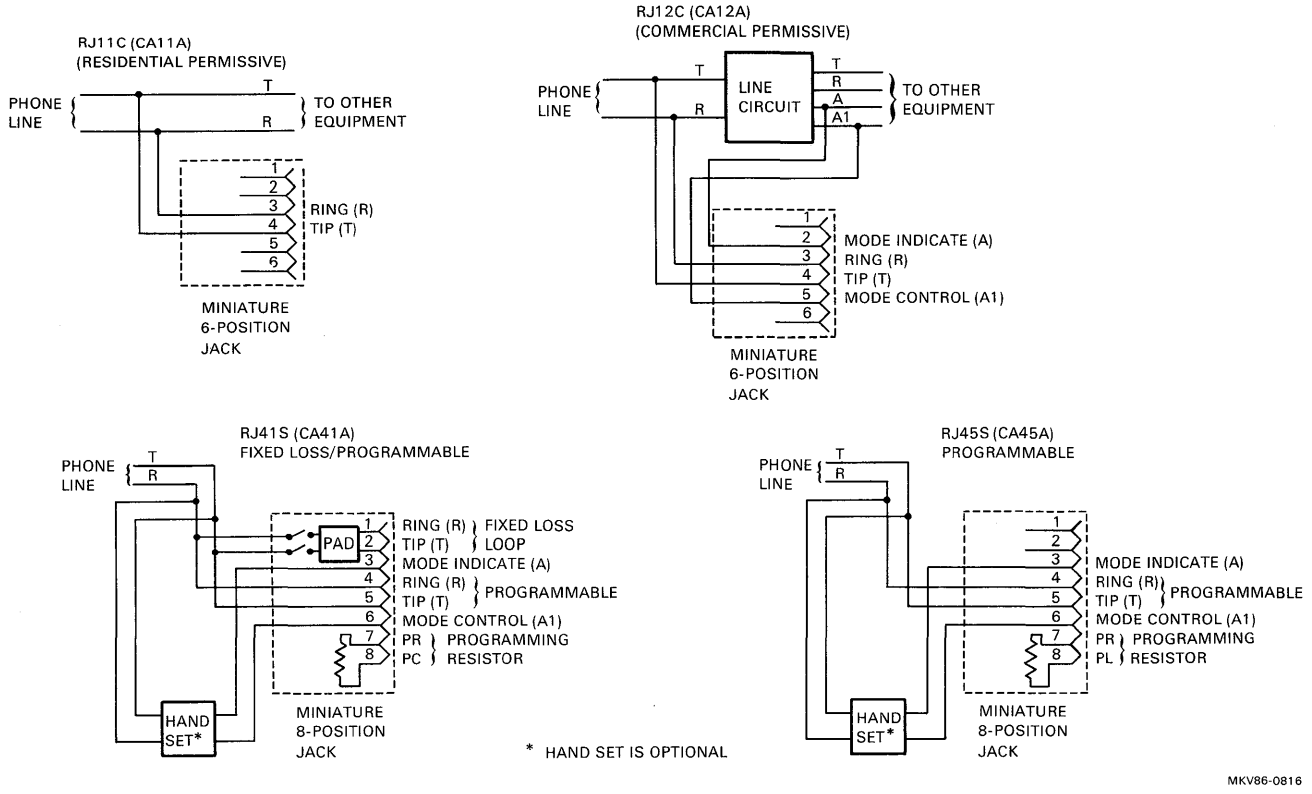


Figure 9-1 Public Switched Telephone Network (PSTN) Connections

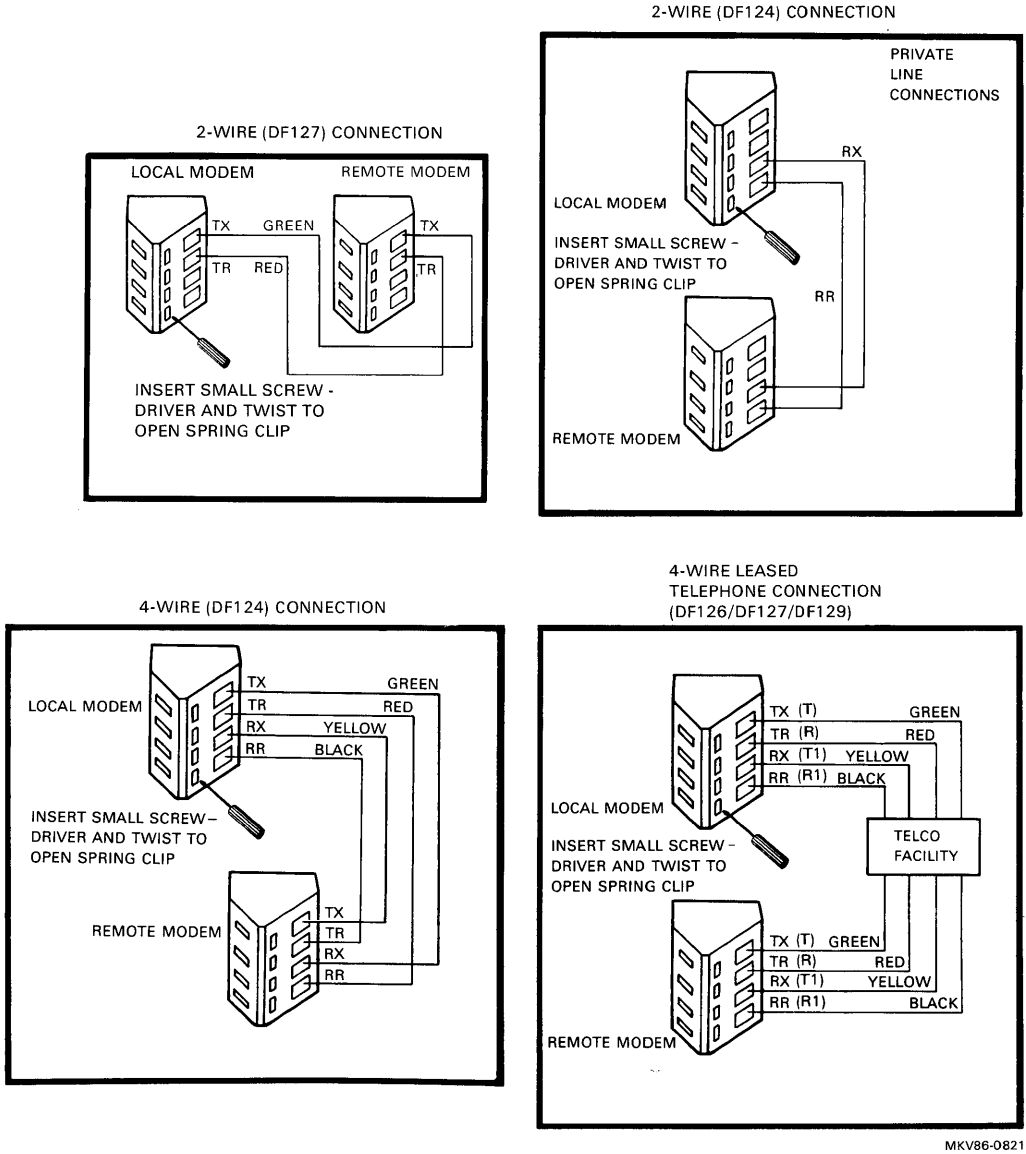


Figure 9-2 Private/Leased Line Network (P/LTN) Connections

9.5 HANDSHAKING SEQUENCES

Before data is transmitted between local and remote modems, the two modems must be in the data mode and the communications channel must be established (connect). Figures 9-3 through 9-6 show the channel connect sequences for Bell 103J and 212A type, and V.22 and V.22 bis compatible modems.

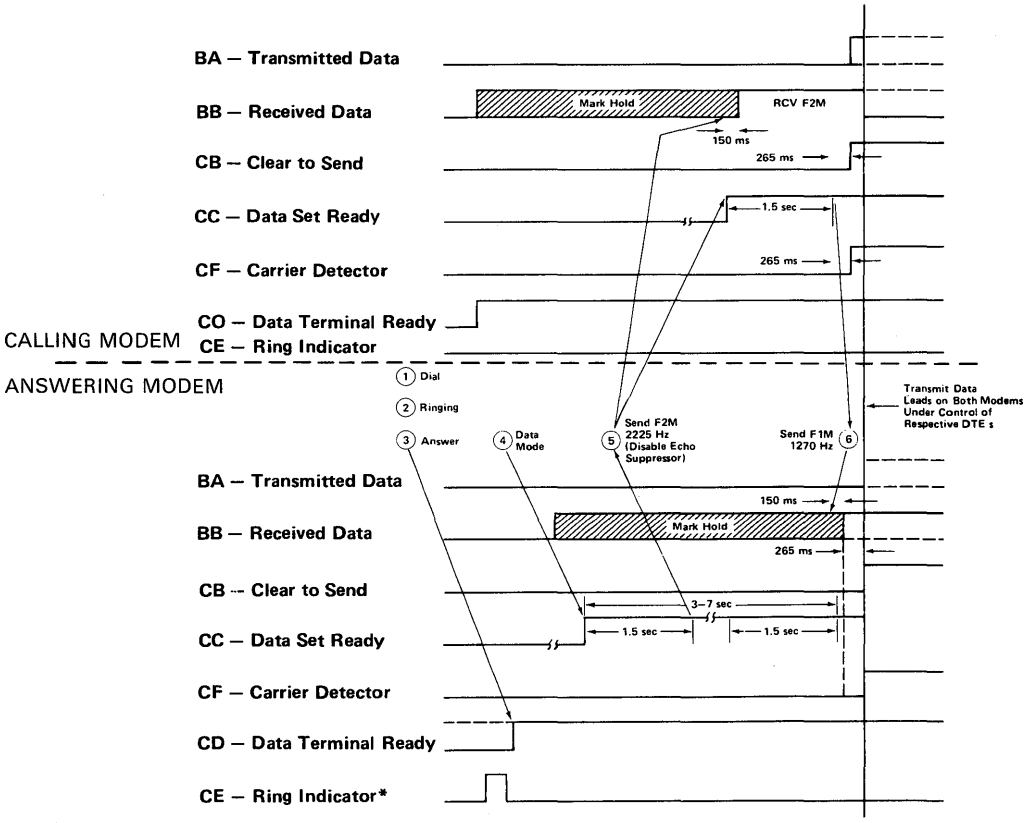


Figure 9-3 Bell 103J and 212A (300 b/s) Type Modem Connect Sequences

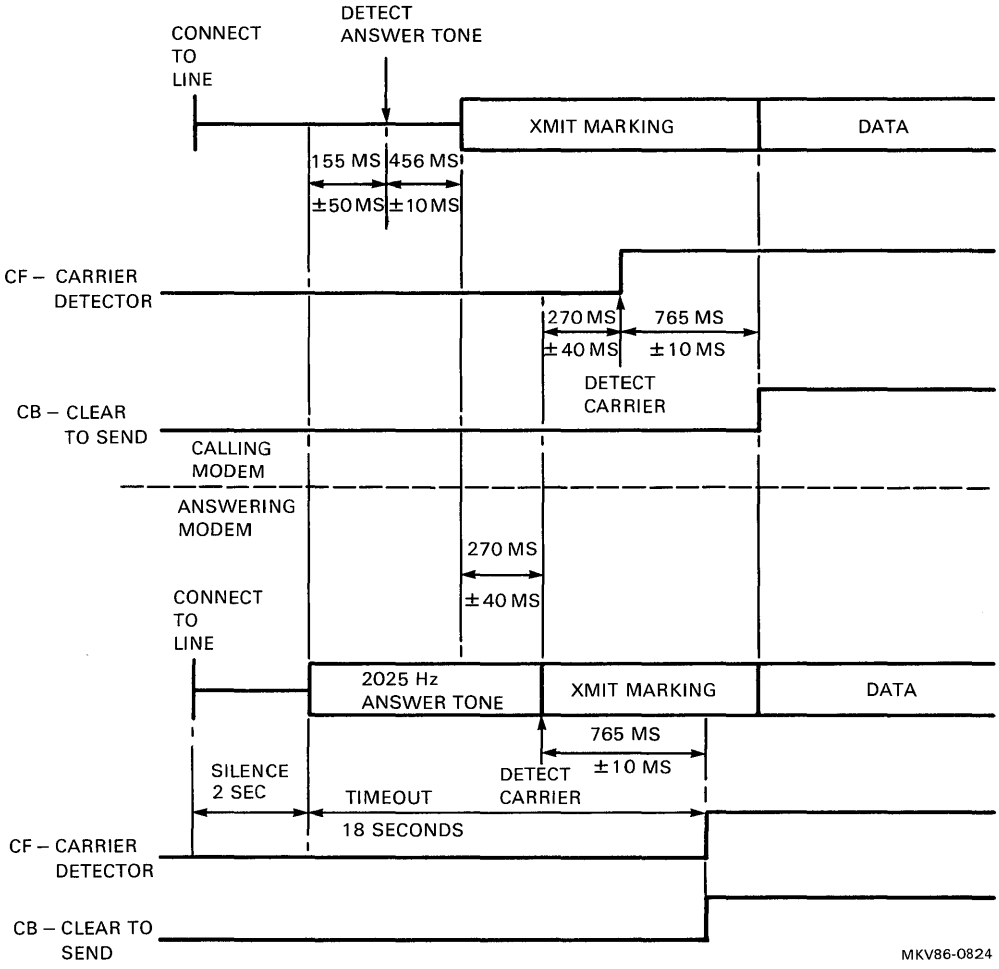


Figure 9-4 Bell 212A (1200 b/s) Type Modem Connect Sequence

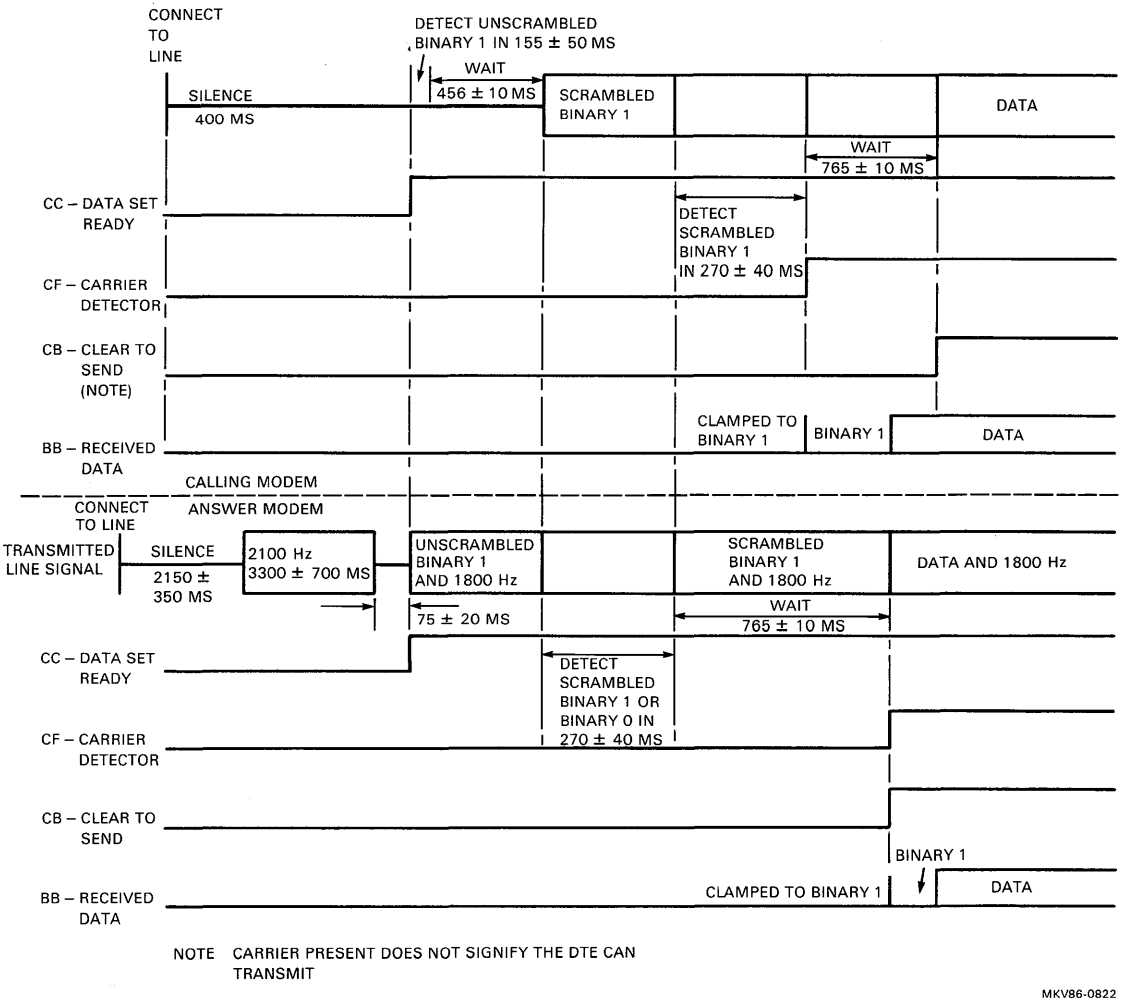


Figure 9-5 CCITT V.22 and V.22 bis (1200 b/s) Compatible Modem Connect Sequences

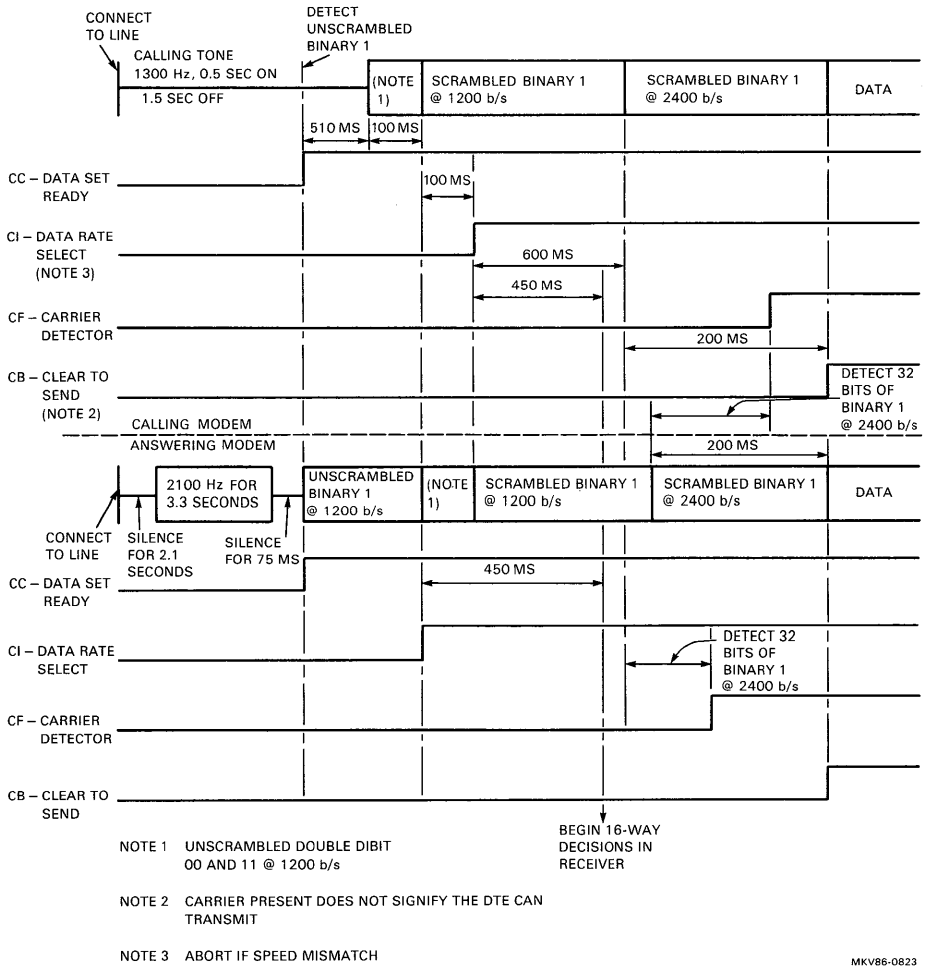


Figure 9-6 CCITT V.22 bis (2400 b/s) Compatible Modem Connect Sequence

9.6 CONSTELLATION DISPLAYS

A method of presenting the different signal formats for quadrature amplitude modulation (QAM) or differential phase shift keying (DPSK) at data rates of 1200 b/s and higher is the signal constellation display. This is the display of demodulated signal amplitude and phase. In this constellation display:

- Each point shown represents a signal element comprising the bits in the element as determined by its location in the signal space. Figures 9-7, 9-8, and 9-9 show the constellation displays for 2, 3, and 4 bits in an element.
- A good quality communications line is better represented with the modem in remote loopback mode.
- Good demodulated signal quality is represented with less displacement in the dot position. Figure 9-10 shows a constellation display with dot patterns representing *good* quality.
- Poor demodulated signal quality is represented by a great amount of displacement in the dot position. Figure 9-10 shows a constellation display with dot patterns representing *poor* quality.
- A 2-dot pattern is shown once the data exchange between two modems begins. When the amplitude or phase modulated signal is exchanged, either a 4-, 8-, or 16-dot pattern is displayed.

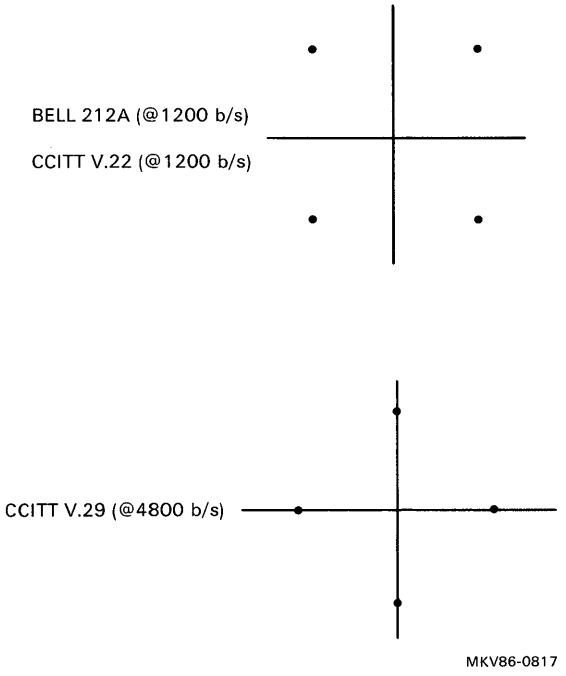


Figure 9-7 Constellation Displays for 2-Bit Elements

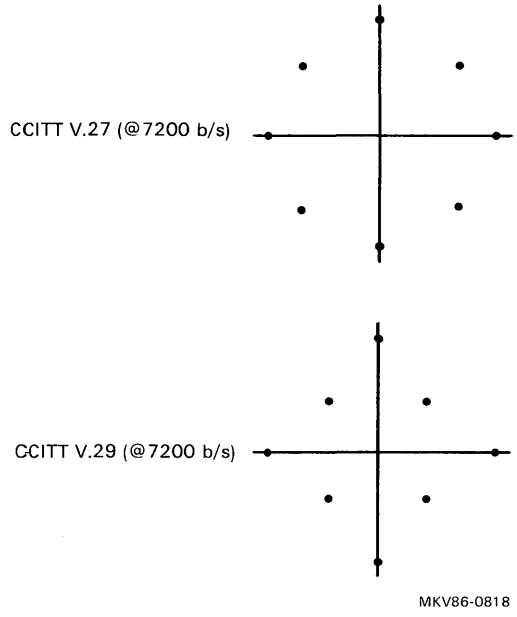


Figure 9-8 Constellation Displays for 3-Bit Elements

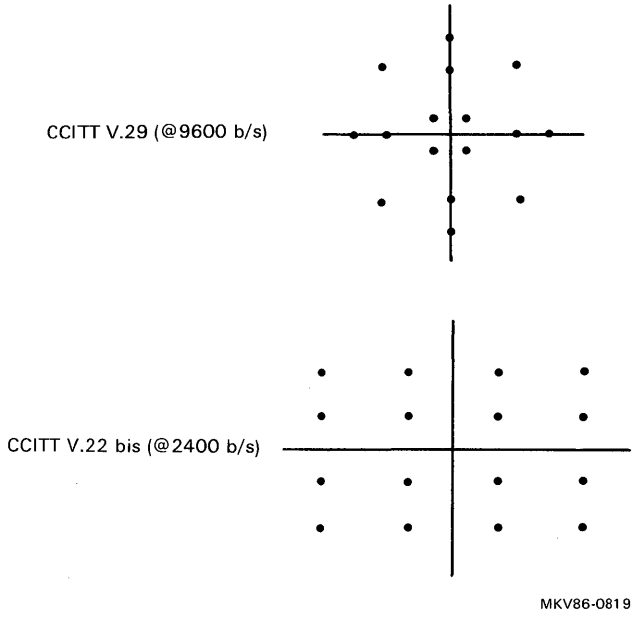


Figure 9-9 Constellation Displays for 4-Bit Elements

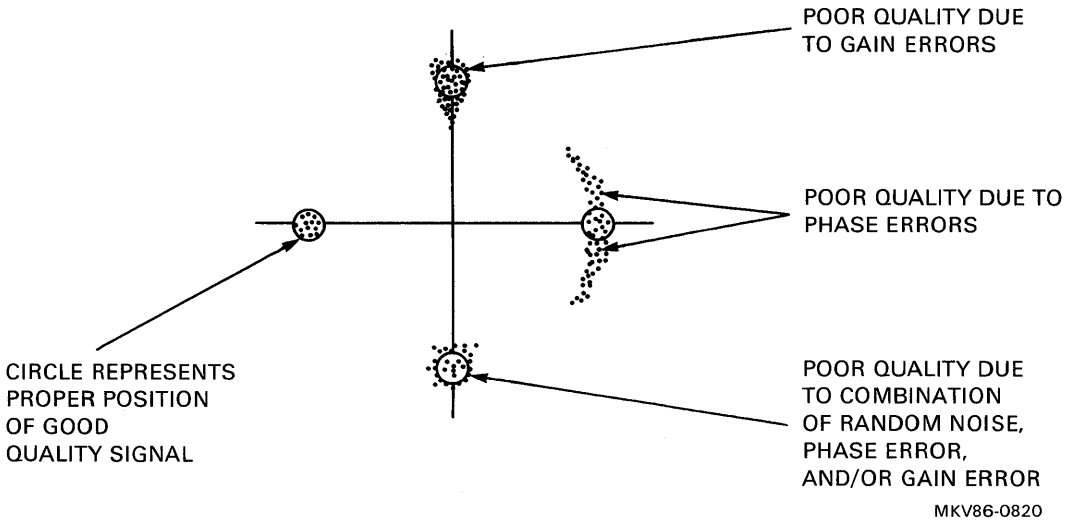


Figure 9-10 2-Bit Element Constellation Display with Good and Poor Quality Represented

9.7 P/LTN LINE CONDITIONING

Line conditioning is the process of controlling the electrical properties of the private/leased line for a result in higher transmission rates (above 2400 b/s) and/or a reduction in data errors. Tables 9-1 and 9-2 list the the types of conditioning levels for various transmission line impairments.

For more information on line conditioning, refer to the Bell System Technical Reference PUB 41004, *Data Communication Using Voiceband Private Line Channels.*

Table 9-1 Line Conditioning Specifications for Transmission Line Impairments

IMPAIRMENT	BASIC CHANNEL	LINE CONDITIONING C-1	C-2	C-3	C-4	C-5	D-1	D-2
Intermodulation Distortion	Second Order 27 dB Third Order 32 dB	*	*	*	*	*	Second Order 28 dB Third Order 40 dB	Second Order 28 dB Third Order 40 dB
C Notched Noise	At least 24 dB below received 1004 Hz test tone	*	*	*	*	*	At least 28 dB below received 1004 Hz test tone	At least 28 dB below received 1004 Hz test tone
Impulse Noise	Threshold with Repeat to Receiver 1004 Hz Test Tone / Max. Counts Allowed in 15 Minutes -2 dB: 5 2 dB: 9 6 dB: 15	*	*	*	*	*	*	*
C Message Noise	Facility Miles / Max. Noise 8001 - 16000: 50 dBm 4001 - 8000: 47 2501 - 4000: 44 1501 - 2500: 42 1001 - 1500: 40 401 - 1000: 38 101 - 400: 34 51 - 100: 31 0 - 50: 28	*	*	*	*	*	*	*
Phase Jitter	Conductor Length (Miles) / Max. Degree Peak-to-Peak 2001 - 4000: 4-20 Hz 5, 4-300 Hz 15, 20-300 Hz 10 1001 - 2000: 5, 13, 8 501 - 1000: 5, 11, 5 251 - 500: 5, 9, 4 0 - 250: 5, 7, 3	*	*	*	*	*	*	*
1004 Hz Loss	No more than +/- 4 dB long term and +/- 3 dB short term	*	*	*	*	*	*	*
Phase Hits	</- 8 in 15 min. >/- 20 dB	*	*	*	*	*	*	*
Gain Hits	</- 8 in 15 min. >/- 3 dB	*	*	*	*	*	*	*
Dropouts	</- 2 in 15 min. >/- 12 dB	*	*	*	*	*	*	*
Envelope Delay	Refer to Table 9-2	*	*	*	*	*	*	*
Attenuation Distortion	Refer to Table 9-2	*	*	*	*	*	*	*

Peak-to-Average Ratios (P/AR) are not set. It Is recommended that after line acceptance by an envelope delay and attenuation distortion measurement, that a P/AR measurement be taken and the results recorded as a benchmark. A future reading of +/- 4 P/AR units indicates trouble in envelope delay, return loss, or attenuation distortion.

* Same as the Basic Channel column.

Table 9-2 Bandwidth Parameter Limits for Certain Line Conditioning Techniques (See Notes 1 and 2)

	Attenuation Distortion (Frequency Response) Relative to 1004 Hz		Envelope Delay Distortion	
Channel Conditioning	**Frequency Range (Hz)**	**Variation (dB)†**	**Frequency Range (Hz)**	**Variation (μs)**
Basic	500 – 2500 300 – 3000	−2 to +8 −3 to +12	800 – 2600	1750
C1	*1000 – 2400 *300 – 2700 300 – 3000	−1 to +3 −2 to +6 −3 to +12	*1000 – 2400 800 – 2600	1000 1750
C2	*500 – 2800 *300 – 3000	−1 to +3 −2 to +6	*1000 – 2600 *600 – 2600 *500 – 2800	500 1500 3000
C3 (access line)	*500 – 2800 *300 – 3000	−0.5 to +1.5 −0.8 to +3	*1000 – 2600 *600 – 2600 *500 – 2800	110 300 650
C3 (trunk)	*500 – 2800 *300 – 3000	−0.5 to +1.5 −0.8 to +2	*1000 – 2600 *600 – 2600 *500 – 2800	80 260 500
C4	*500 – 2800 *300 – 3200	−2 to +3 −2 to +6	*1000 – 2600 *800 – 2800 *600 – 3000 *500 – 3000	300 500 1500 3000
C5	*500 – 2800 *300 – 3000	−0.5 to +1.5 −1 to +3	*1000 – 2600 *600 – 2600 *500 – 2800	100 300 600

NOTES:

1. C conditioning applies only to the attenuation and envelope delay characteristics.

2. Measurement frequencies will be 4 Hz above those shown. For example, the basic channel will have −2 to +8 dB loss, with respect to the 1004 Hz loss, between 504 and 2504 Hz.

* These specifications are tariffed items.

† (+) means loss with respect to 1004 Hz.
(−) means gain with respect to 1004 Hz.

9.8 THE TIMS AND TESTING THE TELEPHONE LINE

The Hewlett Packard 4945A transmission impairment measuring set (TIMS) is used to measure the quality of the telephone line. Measurements performed by the TIMS include:

- Level and Frequency – To determine amplitude and frequency response of a voice channel.
- Gain Slope – To determine usable bandwidth of a voice channel.
- Signal-to-Noise – To determine the interference effects of background noise and tones.
- Noise-to-Ground – To determine the longitudinal noise presence on a voice channel with respect to ground.
- Transients – To determine simultaneous impulse noise, phase hits, gain hits, and dropout counts.
- Jitter – To determine if unwanted phase or frequency modulation, and incidental amplitude modulation caused by interference and noise are present.
- Envelope Delay – To determine the phase linearity or nonlinearity.
- Intermodulation Distortion – To determine if new signal components are present in the original transmitted signal.
- Return Loss – To determine how well the input and output impedances are matched throughout a circuit.
- Peak-to-Average Ratio – To determine the fidelity of a channel as a benchmark for future reference. Then, if trouble is suspected, the measurement is taken again for an indication of either envelope delay, attenuation distortion, or return loss.

For more information on the HP 4945A TIMS, refer to the Hewlett Packard *4954A Transmission Impairment Measuring Set Operating Manual* (Manual Part Number 04945-90023).

9.9 IMPORTANT TELEPHONE LINE MEASUREMENTS

The telephone line measurements that are most important to Digital Equipment Corporation field service personnel are:

- Signal-to-Noise – 3 kHz weighted.
- Level-and-Frequency – .6 to 3 kHz insteps of 100 Hz.
- Envelope Delay – .6 to 3 kHz insteps of 100 Hz.

NOTES

NOTES

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