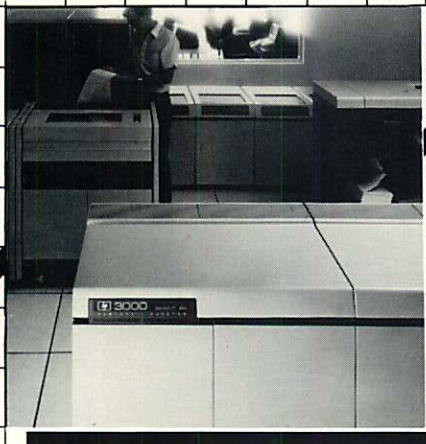
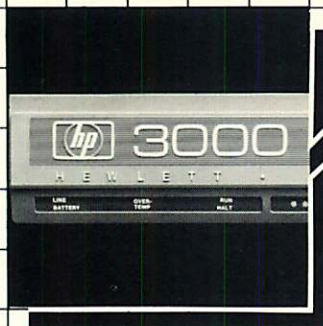


HP 3000 Computer Systems



Communications Handbook



FUNDAMENTAL

Data Communications Handbook

Sections 1-5

The *Communications Handbook* (obsolete part number 30000-90105) has been restructured to make it more widely available and more readily updated. The complete handbook, the *Data Communications Handbook*, is now available from Computer Supplies Operation (CSO) as new part number 5957-4633. In addition, the various sections of the handbook have been made available in two ways:

1. Those sections pertinent to all datacomm products, including controller, modem, CS Trace and troubleshooting guides, are now combined and expanded into a separate handbook, the *Fundamental Data Communications Handbook* (5957-4634). This handbook is included with each new HP 3000 and as such is updated under operating system and software contracts. It can be separately ordered from CSO.
2. The product specific sections are now provided with each product for use as quick references and as such are updated under operating system, software and manual contracts for the products. These sections can also be separately ordered from CSO, as can additional binders (P/N 9282-0683).

The FUNDAMENTAL section of the *Data Communications Handbook* is intended for use as a quick reference. It is not a set of product specifications. Refer to the appropriate reference manual for complete product, system, and component specifications.



Information Networks Division

Part No. 5957-4634
E0684

Printed in U.S.A. June 1984

Copyright © 1984 HEWLETT PACKARD

NOTICE

The information contained in this document is subject to change without notice.

HEWLETT-PACKARD MAKES NO WARRANTY OF ANY KIND WITH REGARD TO THIS MATERIAL, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Hewlett-Packard shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance or use of this material.

Hewlett-Packard assumes no responsibility for the use or reliability of its software on equipment that is not furnished by Hewlett-Packard.

This document contains proprietary information which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced or translated to another language without the prior written consent of Hewlett-Packard Company.

PRINTING HISTORY

New editions are complete revisions of the manual. Update packages, which are issued between editions, contain additional and replacement pages to be merged into the manual by the customer. The dates on the title page change only when a new edition or a new update is published. No information is incorporated into a reprinting unless it appears as a prior update; the edition does not change when an update is incorporated.

Many product updates and fixes do not require manual changes and, conversely, manual corrections may be done without accompanying product changes. Therefore, do not expect a one to one correspondence between product updates and manual updates.

First Edition..... Jun 1984

CONTENT

SUBJECT	SECTION
GENERAL INFORMATION	1
ASYNCHRONOUS CONTROLLERS AND MODEMS	2
SYNCHRONOUS CONTROLLERS AND MODEMS	3
CS TRACE FACILITY AND ERROR MESSAGES	4
DATA COMMUNICATIONS TROUBLESHOOTING GUIDE	5

GENERAL INFORMATION

SECTION

1

CONTENT	PAGE
ASCII/EBCDIC/Hollerith.....	1-2
ASCII/BYTES.....	1-10
Octal/Decimal Conversion.....	1-11
Binary.....	1-16
Decimal to Octal to Hexadecimal.....	1-18
EIA Modem/Terminal Interface.....	1-22

General Information

ASCII/EBCDIC/Hollerith

CHAR CODE			ASCII			EBCDIC		
Dec	Oct	Hex	Cntl/ Gph	to EBCDIC (Oct)	Hollerith	Cntl/ Gph	to ASCII (Oct)	to ASCII (Hex)
0	000	00	NUL	000	12-0-1-8-9	NUL	000	00
1	001	01	SOH	001	12-1-9	SOH	001	01
2	002	02	STX	002	12-2-9	STX	002	02
3	003	03	ETX	003	12-3-9	ETX	003	03
4	004	04	EOT	067	7-9	PF	234	9C
5	005	05	ENQ	055	0-5-8-9	HT	011	09
6	006	06	ACK	056	0-6-8-9	LC	206	86
7	007	07	BEL	057	0-7-8-9	DEL	177	7F
8	010	08	BS	026	11-6-9		227	97
9	011	09	HT	005	12-5-9		215	8D
10	012	0A	LF	045	0-5-9	SMM	216	8E
11	013	0B	VT	013	12-3-8-9	VT	013	0B
12	014	0C	FF	014	12-4-8-9	FF	014	0C
13	015	0D	CR	015	12-5-8-9	CR	015	0D
14	016	0E	SO	016	12-6-8-9	SO	016	0E
15	017	0F	SI	017	12-7-8-9	SI	017	0F
16	020	10	DLE	020	12-11-1-8-9	DLE	020	10
17	021	11	DC1	021	11-1-9	DC1	021	11
18	022	12	DC2	022	11-2-9	DC2	022	12
19	023	13	DC3	023	11-3-9	TM	023	13
20	024	14	DC4	074	4-8-9	RES	235	9D
21	025	15	NAK	075	5-8-9	NL	205	85
22	026	16	SYN	062	2-9	BS	010	08
23	027	17	ETB	046	0-6-9	IL	207	87
24	030	18	CAN	030	11-8-9	CAN	030	18
25	031	19	EM	031	11-1-8-9	EM	031	19
26	032	1A	SUB	077	7-8-9	CC	222	92
27	033	1B	ESC	047	0-7-9	CU1	217	8F
28	034	1C	FS	034	11-4-8-9	IFS	034	1C
29	035	1D	GS	035	11-5-8-9	IGS	035	1D
30	036	1E	RS	036	11-6-8-9	IRS	036	1E
31	037	1F	US	037	11-7-8-9	IUS	037	1F

NOTE: ASCII is a seven bit code, EBCDIC is an eight bit code.

ASCII/EBCDIC/Hollerith (cont'd)

CHAR CODE			ASCII			EBCDIC		
Dec	Oct	Hex	Cntl/ Gph	to EBCDIC (Oct)	Hollerith	Cntl/ Gph	to ASCII (Oct)	to ASCII (Hex)
32	040	20	SP	100	Blank	DS	200	80
33	041	21	!	117	12-7-8	SOS	201	81
34	042	22	"	177	7-8	FS	202	82
35	043	23	#	173	3-8		203	83
36	044	24	\$	133	11-3-8	BYP	204	84
37	045	25	%	154	0-4-8	LF	012	0A
38	046	26	&	120	12	ETB	027	17
39	047	27	'	175	5-8	ESC	033	1B
40	050	28	(	115	12-5-8		210	88
41	051	29	)	135	11-5-8		211	89
42	052	2A	*	134	11-4-8	SM	212	8A
43	053	2B	+	116	12-6-8	CU2	213	8B
44	054	2C	,	153	0-3-8		214	8C
45	055	2D	-	140	11	ENQ	005	05
46	056	2E	.	113	12-3-8	ACK	006	06
47	057	2F	/	141	0-1	BEL	007	07
48	060	30	0	360	0		220	90
49	061	31	1	361	1		221	91
50	062	32	2	362	2	SYN	026	16
51	063	33	3	363	3		223	93
52	064	34	4	364	4	PN	224	94
53	065	35	5	365	5	RS	225	95
54	066	36	6	366	6	UC	226	96
55	067	37	7	367	7	EOT	004	04
56	070	38	8	370	8		230	98
57	071	39	9	371	9		231	99
58	072	3A	:	172	2-8		232	9A
59	073	3B	;	136	11-6-8	CU3	233	9B
60	074	3C	<	114	12-4-8	DC4	024	14
61	075	3D	=	176	6-8	NAK	025	15
62	076	3E	>	156	0-6-8		236	9E
63	077	3F	?	157	0-7-8	SUB	032	1A

General Information

ASCII/EBCDIC/Hollerith (cont'd)

CHAR CODE			ASCII			EBCDIC		
Dec	Oct	Hex	Cnt/ Gph	to EBCDIC (Oct)	Hollerith	Cnt/ Gph	to ASCII (Oct)	to ASCII (Hex)
64	100	40	@	174	4-8	SP	040	20
65	101	41	A	301	12-1		240	A0
66	102	42	B	302	12-2		241	A1
67	103	43	C	303	12-3		242	A2
68	104	44	D	304	12-4		243	A3
69	105	45	E	305	12-5		244	A4
70	106	46	F	306	12-6		245	A5
71	107	47	G	307	12-7		246	A6
72	110	48	H	310	12-8		247	A7
73	111	49	I	311	12-9		250	A8
74	112	4A	J	321	11-1	¢	133	5B
75	113	4B	K	322	11-2	.	056	2E
76	114	4C	L	323	11-3	<	074	3C
77	115	4D	M	324	11-4	(	050	28
78	116	4E	N	325	11-5	+	053	2B
79	117	4F	O	326	11-6	|	041	21
80	120	50	P	327	11-7	&	046	26
81	121	51	Q	330	11-8		251	A9
82	122	52	R	331	11-9		252	AA
83	123	53	S	342	0-2		253	AB
84	124	54	T	343	0-3		254	AC
85	125	55	U	344	0-4		255	AD
86	126	56	V	345	0-5		256	AE
87	127	57	W	346	0-6		257	AF
88	130	58	X	347	0-7		260	B0
89	131	59	Y	350	0-8		261	B1
90	132	5A	Z	351	0-9	!	135	5D
91	133	5B	[	112	12-2-8	\$	044	24
92	134	5C	\	340	0-2-8	*	052	2A
93	135	5D	]	132	11-2-8	)	051	29
94	136	5E	^	137	11-7-8	;	073	3B
95	137	5F	_	155	0-5-8	┘	136	5E

NOTE: ASCII is a seven bit code, EBCDIC is an eight bit code.

ASCII/EBCDIC/Hollerith (cont'd)

CHAR CODE			ASCII			EBCDIC		
Dec	Oct	Hex	Cntl/ Gph	to EBCDIC (Oct)	Hollerith	Cntl/ Gph	to ASCII (Oct)	to ASCII (Hex)
96	140	60		171	1-8	-	055	2D
97	141	61	a	201	12-0-1	/	057	2F
98	142	62	b	202	12-0-2		262	B2
99	143	63	c	203	12-0-3		263	B3
100	144	64	d	204	12-0-4		264	B4
101	145	65	e	205	12-0-5		265	B5
102	146	66	f	206	12-0-6		266	B6
103	147	67	g	207	12-0-7		267	B7
104	150	68	h	210	12-0-8		270	B8
105	151	69	i	211	12-0-9		271	B9
106	152	6A	j	221	12-11-1	|	174	7C
107	153	6B	k	222	12-11-2	,	054	2C
108	154	6C	l	223	12-11-3	%	045	25
109	155	6D	m	224	12-11-4	—	137	5F
110	156	6E	n	225	12-11-5	>	076	3E
111	157	6F	o	226	12-11-6	?	077	3F
112	160	70	p	227	12-11-7		272	BA
113	161	71	q	230	12-11-8		273	BB
114	162	72	r	231	12-11-9		274	BC
115	163	73	s	242	11-0-2		275	BD
116	164	74	t	243	11-0-3		276	BE
117	165	75	u	244	11-0-4		277	BF
118	166	76	v	245	11-0-5		300	C0
119	167	77	w	246	11-0-6		301	C1
120	170	78	x	247	11-0-7		302	C2
121	171	79	y	250	11-0-8	,	140	69
122	172	7A	z	251	11-0-9	:	072	3A
123	173	7B	{	300	12-0	#	043	23
124	174	7C	|	152	12-11	@	100	40
125	175	7D	}	320	11-0	,	047	27
126	176	7E	~	241	11-0-1	=	075	3D
127	177	7F	DEL	007	12-7-9	"	042	22

ASCII/EBCDIC/Hollerith (cont'd)

CHAR CODE			ASCII			EBCDIC		
Dec	Oct	Hex	Cntl/ Gph	to EBCDIC (Oct)	Hollerith	Cntl/ Gph	to ASCII (Oct)	to ASCII (Hex)
128	200	80		040	11-0-1-8-9		303	C3
129	201	81		041	0-1-9	a	141	61
130	202	82		042	0-2-9	b	142	62
131	203	83		043	0-3-9	c	143	63
132	204	84		044	0-4-9	d	144	64
133	205	85		025	11-5-9	e	145	65
134	206	86		006	12-6-9	f	146	66
135	207	87		027	11-7-9	g	147	67
136	210	88		050	0-8-9	h	150	68
137	211	89		051	0-1-8-9	i	151	68
138	212	8A		052	0-2-8-9		304	C4
139	213	8B		053	0-3-8-9		305	C5
140	214	8C		054	0-4-8-9		306	C6
141	215	8D		011	12-1-8-9		307	C7
142	216	8E		012	12-2-8-9		310	C8
143	217	8F		033	11-3-8-9		311	C9
144	220	90		060	12-11-0-1-8-9		312	CA
145	221	91		061	1-9	j	152	6A
146	222	92		032	11-2-8-9	k	153	6B
147	223	93		063	3-9	l	154	6C
148	224	94		064	4-9	m	155	6D
149	225	95		065	5-9	n	156	6E
150	226	96		066	6-9	o	157	6F
151	227	97		010	12-8-9	p	160	70
152	230	98		070	8-9	q	161	71
153	231	99		071	1-8-9	r	162	72
154	232	9A		072	2-8-9		313	CB
155	233	9B		073	3-8-9		314	CC
156	234	9C		004	12-4-9		315	CD
157	235	9D		024	11-4-9		316	CE
158	236	9E		076	6-8-9		317	CF
159	237	9F		341	11-0-1-9		320	D0

NOTE: ASCII is a seven bit code, EBCDIC is an eight bit code.

ASCII/EBCDIC/Hollerith (cont'd)

CHAR CODE			ASCII			EE		
Dec	Oct	Hex	Cntl/ Gph	to EBCDIC (Oct)	Hollerith	Cntl/ Gph	to ASCII (Oct)	to ASCII (Hex)
160	240	A0		101	12-0-1-9		321	D1
161	241	A1		102	12-0-2-9	~	176	7E
162	242	A2		103	12-0-3-9	s	163	73
163	243	A3		104	12-0-4-9	t	164	74
164	244	A4		105	12-0-5-9	u	165	75
165	245	A5		106	12-0-6-9	v	166	76
166	246	A6		107	12-0-7-9	w	167	77
167	247	A7		110	12-0-8-9	x	170	78
168	250	A8		111	12-1-8	y	171	79
169	251	A9		121	12-11-1-9	z	172	7A
170	252	AA		122	12-11-2-9		322	D2
171	253	AB		123	12-11-3-9		323	D3
172	254	AC		124	12-11-4-9		324	D4
173	255	AD		125	12-11-5-9		325	D5
174	256	AE		126	12-11-6-9		326	D6
175	257	AF		127	12-11-7-9		327	D7
176	260	B0		130	12-11-8-9		330	D8
177	261	B1		131	11-1-8		331	D9
178	262	B2		142	11-0-2-9		332	DA
179	263	B3		143	11-0-3-9		333	DB
180	264	B4		144	11-0-4-9		334	DC
181	265	B5		145	11-0-5-9		335	DD
182	266	B6		146	11-0-6-9		336	DE
183	267	B7		147	11-0-7-9		337	DF
184	270	B8		150	11-0-8-9		340	E0
185	271	B9		151	0-1-8		341	E1
186	272	BA		160	12-11-0		342	E2
187	273	BB		161	12-11-0-1-9		343	E3
188	274	BC		162	12-11-0-2-9		344	E4
189	275	BD		163	12-11-0-3-9		345	E5
190	276	BE		164	12-11-0-4-9		346	E6
*191	277	BF		165	12-11-0-5-9		347	E7

ASCII/EBCDIC/Hollerith (cont'd)

CHAR CODE			ASCII			EBCDIC		
Dec	Oct	Hex	Cntl/ Gph	to EBCDIC (Oct)	Hollerith	Cntl/ Gph	to ASCII (Oct)	to ASCII (Hex)
192	300	C0		166	12-11-0-6-9	{	173	7B
193	301	C1		167	12-11-0-7-9	A	101	41
194	302	C2		170	12-11-0-8-9	B	102	42
195	303	C3		200	12-0-1-8	C	103	43
196	304	C4		212	12-0-2-8	D	104	44
197	305	C5		213	12-0-3-8	E	105	45
198	306	C6		214	12-0-4-8	F	106	46
199	307	C7		215	12-0-5-8	G	107	47
200	310	C8		216	12-0-6-8	H	110	48
201	311	C9		217	12-0-7-8	I	111	49
202	312	CA		220	12-11-1-8		350	E8
203	313	CB		232	12-11-2-8		351	E9
204	314	CC		233	12-11-3-8	J	352	EA
205	315	CD		234	12-11-4-8		353	EB
206	316	CE		235	12-11-5-8	K	354	EC
207	317	CF		236	12-11-6-8		355	ED
208	320	D0		237	12-11-7-8	}	175	7D
209	321	D1		240	11-0-1-8	J	112	4A
210	322	D2		252	11-0-2-8	K	113	4B
211	323	D3		253	11-0-3-8	L	114	4C
212	324	D4		254	11-0-4-8	M	115	4D
213	325	D5		255	11-0-5-8	N	116	4E
214	326	D6		256	11-0-6-8	O	117	4F
215	327	D7		257	11-0-7-8	P	120	50
216	330	D8		260	12-11-0-1-8	Q	121	51
217	331	D9		261	12-11-0-1	R	122	52
218	332	DA		262	12-11-0-2		356	EE
219	333	DB		263	12-11-0-3		357	EF
220	334	DC		264	12-11-0-4		360	F0
221	335	DD		265	12-11-0-5		361	F1
222	336	DE		266	12-11-0-6		362	F2
223	337	DF		267	12-11-0-7		363	F3

NOTE: ASCII is a seven bit code, EBCDIC is an eight bit code.

ASCII/EBCDIC/Hollerith (cont'd)

CHAR CODE			ASCII			EBCDIC		
Dec	Oct	Hex	Cntl/ Gph	to EBCDIC (Oct)	Hollerith	Cntl/ Gph	to ASCII (Oct)	to ASCII (Hex)
224	340	E0		270	12-11-0-8	\	134	5C
225	341	E1		271	12-11-0-9		237	9F
226	342	E2		272	12-11-0-2-8	S	123	53
227	343	E3		273	12-11-0-3-8	T	124	54
228	344	E4		274	12-11-0-4-8	U	125	55
229	345	E5		275	12-11-0-5-8	V	126	56
230	346	E6		276	12-11-0-6-8	W	127	57
231	347	E7		277	12-11-0-7-8	X	130	58
232	350	E8		312	12-0-2-8-9	Y	131	59
233	351	E9		313	12-0-3-8-9	Z	132	5A
234	352	EA		314	12-0-4-8-9		364	F4
235	353	EB		315	12-0-5-8-9		365	F5
236	354	EC		316	12-0-6-8-9	H	366	F6
237	355	ED		317	12-0-7-8-9		367	F7
238	356	EE		332	12-11-2-8-9		370	F8
239	357	EF		333	12-11-3-8-9		371	F9
240	360	F0		334	12-11-4-8-9	0	060	30
241	361	F1		335	12-11-5-8-9	1	061	31
242	362	F2		336	12-11-6-8-9	2	062	32
243	363	F3		337	12-11-7-8-9	3	063	33
244	364	F4		352	11-0-2-8-9	4	064	34
245	365	F5		353	11-0-3-8-9	5	065	35
246	366	F6		354	11-0-4-8-9	6	066	36
247	367	F7		355	11-0-5-8-9	7	067	37
248	370	F8		356	11-0-6-8-9	8	070	38
249	371	F9		357	11-0-7-8-9	9	071	39
250	372	FA		372	12-11-0-2-8-9	|	372	FA
251	373	FB		373	12-11-0-3-8-9		373	FB
252	374	FC		374	12-11-0-4-8-9		374	FC
253	375	FD		375	12-11-0-5-8-9		375	FD
254	376	FE		376	12-11-0-6-8-9		376	FE
255	377	FF		377	12-11-0-7-8-9	EO	377	FF

General Information

ASCII/BYTES

BYTE POSITION				BYTE POSITION				
CHAR	Left	Right	Dec.	CHAR	Left	Right	Dec.	Control Char
A	040400	000101	65	NUL	000000	000000	0	@
B	041000	000102	66	SOH	000000	000001	1	A
C	041400	000103	67	STX	001000	000002	2	B
D	042000	000104	68	ETX	001400	000003	3	C
E	042400	000105	69	EOT	002000	000004	4	D
F	043000	000106	70	ENO	002400	000005	5	E
G	043400	000107	71	ACK	003000	000006	6	F
H	044000	000110	72	BEL	003400	000007	7	G
I	044400	000111	73	BS	004000	000010	8	H
J	045000	000112	74	HT	004400	000011	9	I
K	045400	000113	75	LF	005000	000012	10	J
L	046000	000114	76	VT	005400	000013	11	K
M	046400	000115	77	FF	006000	000014	12	L
N	047000	000116	78	CR	006400	000015	13	M
O	047400	000117	79	SO	007000	000016	14	N
P	050000	000120	80	SI	007400	000017	15	O
Q	050400	000121	81	DLE	010000	000020	16	P
R	051000	000122	82	DC1	010400	000021	17	Q
S	051400	000123	83	DC2	011000	000022	18	R
T	052000	000124	84	DC3	011400	000023	19	S
U	052400	000125	85	DC4	012000	000024	20	T
V	053000	000126	86	NAK	012400	000025	21	U
W	053400	000127	87	SYN	013000	000026	22	V
X	054000	000130	88	ETB	013400	000027	23	W
Y	054400	000131	89	CAN	014000	000030	24	X
Z	055000	000132	90	EM	014400	000031	25	Y
				SUB	015000	000032	26	Z
				ESC	015400	000033	27	[
a	060400	000141	97	FS	016000	000034	28	\
b	061000	000142	98	GS	016400	000035	29]
c	061400	000143	99	RS	017000	000036	30	^
d	062000	000144	100	US	017400	000037	31	_
e	062400	000145	101	SPACE	020000	000040	32	
f	063000	000146	102	!	020400	000041	33	
g	063400	000147	103	"	021000	000042	34	
h	064000	000150	104	#	021400	000043	35	
i	064400	000151	105	\$	022000	000044	36	
j	065000	000152	106	%	022400	000045	37	
k	065400	000153	107	&	023000	000046	38	
l	066000	000154	108	'	023400	000047	39	
m	066400	000155	109	(	024000	000050	40	
n	067000	000156	110	)	024400	000051	41	
o	067400	000157	111	*	025000	000052	42	
p	070000	000160	112	+	025400	000053	43	
q	070400	000161	113	,	026000	000054	44	
r	071000	000162	114	-	026400	000055	45	
s	071400	000163	115	.	027000	000056	46	
t	072000	000164	116	/	027400	000057	47	
u	072400	000165	117	:	035000	000072	58	
v	073000	000166	118	;	035400	000073	59	
w	073400	000167	119	<	036000	000074	60	
x	074000	000170	120	=	036400	000075	61	
y	074400	000171	121	>	037000	000076	62	
z	075000	000172	122	?	037400	000077	63	
				@	040000	000100	64	
0	030000	000060	48	[	055400	000133	91	
1	030400	000061	49	]	056000	000134	92	
2	031000	000062	50	^	056400	000135	93	
3	031400	000063	51	_	057000	000136	94	
4	032000	000064	52	~	057400	000137	95	
5	032400	000065	53	!	060000	000140	96	
6	033000	000066	54	"	075400	000173	123	
7	033400	000067	55	#	076000	000174	124	
8	034000	000070	56	\$	076400	000175	125	
9	034400	000071	57	%	077000	000176	126	
				~	077400	000177	127	
				DEL				?

Bit: 0 1 2 3 4 5 6 7

- ① An alphabetic character upshift turns bit two on.
- ② A control character turns bit one off; however, terminal software may prevent you from using a specific control character.

NOTE: ASCII is a seven bit code

Octal/Decimal Conversion

2'S COMP		0	1	2	3	4	5	6	7
0	0	0	1	2	3	4	5	6	7
177770	10	8	9	10	11	12	13	14	15
177760	20	16	17	18	19	20	21	22	23
177750	30	24	25	26	27	28	29	30	31
177740	40	32	33	34	35	36	37	38	39
177730	50	40	41	42	43	44	45	46	47
177720	60	48	49	50	51	52	53	54	55
177710	70	56	57	58	59	60	61	62	63
177700	100	64	65	66	67	68	69	70	71
177670	110	72	73	74	75	76	77	78	79
177660	120	80	81	82	83	84	85	86	87
177650	130	88	89	90	91	92	93	94	95
177640	140	96	97	98	99	100	101	102	103
177630	150	104	105	106	107	108	109	110	111
177620	160	112	113	114	115	116	117	118	119
177610	170	120	121	122	123	124	125	126	127
177600	200	128	129	130	131	132	133	134	135
177570	210	136	137	138	139	140	141	142	143
177560	220	144	145	146	147	148	149	150	151
177550	230	152	153	154	155	156	157	158	159
177540	240	160	161	162	163	164	165	166	167
177530	250	168	169	170	171	172	173	174	175
177520	260	176	177	178	179	180	181	182	183
177510	270	184	185	186	187	188	189	190	191
177500	300	192	193	194	195	196	197	198	199
177470	310	200	201	202	203	204	205	206	207
177460	320	208	209	210	211	212	213	214	215
177450	330	216	217	218	219	220	221	222	223
177440	340	224	225	226	227	228	229	230	231
177430	350	232	233	234	235	236	237	238	239
177420	360	240	241	242	243	244	245	246	247
177410	370	248	249	250	251	252	253	254	255

General Information

Octal/Decimal Conversion (cont'd)

2'S COMP		0	1	2	3	4	5	6	7
177400	400	256	257	258	259	260	261	262	263
177370	410	264	265	266	267	268	269	270	271
177360	420	272	273	274	275	276	277	278	279
177350	430	280	281	282	283	284	285	286	287
177340	440	288	289	290	291	292	293	294	295
177330	450	296	297	298	299	300	301	302	303
177320	460	304	305	306	307	308	309	310	311
177310	470	312	313	314	315	316	317	318	319
177300	500	320	321	322	323	324	325	326	327
177270	510	328	329	330	331	332	333	334	335
177260	520	336	337	338	339	340	341	342	343
177250	530	344	345	346	347	348	349	350	351
177240	540	352	353	354	355	356	357	358	359
177230	550	360	361	362	363	364	365	366	367
177220	560	368	369	370	371	372	373	374	375
177210	570	376	377	378	379	380	381	382	383
177200	600	384	385	386	387	388	389	390	391
177170	610	392	393	394	395	396	397	398	399
177160	620	400	401	402	403	404	405	406	407
177150	630	408	409	410	411	412	413	414	415
177140	640	416	417	418	419	420	421	422	423
177130	650	424	425	426	427	428	429	430	431
177120	660	432	433	434	435	436	437	438	439
177110	670	440	441	442	443	444	445	446	447
177100	700	448	449	450	451	452	453	454	455
177070	710	456	457	458	459	460	461	462	463
177060	720	464	465	466	467	468	469	470	471
177050	730	472	473	474	475	476	477	478	479
177040	740	480	481	482	483	484	485	486	487
177030	750	488	489	490	491	492	493	494	495
177020	760	496	497	498	499	500	501	502	503
177010	770	504	505	506	507	508	509	510	511

Octal/Decimal Conversion (cont'd)

2'S COMP		0	1	2	3	4	5	6	7
177000	1000	512	513	514	515	516	517	518	519
176770	1010	520	521	522	523	524	525	526	527
176760	1020	528	529	530	531	532	533	534	535
176750	1030	536	537	538	539	540	541	542	543
176740	1040	544	545	546	547	548	549	550	551
176730	1050	552	553	554	555	556	557	558	559
176720	1060	560	561	562	563	564	565	566	567
176710	1070	568	569	570	571	572	573	574	575
176700	1100	576	577	578	579	580	581	582	583
176670	1110	584	585	586	587	588	589	590	591
176660	1120	592	593	594	595	596	597	598	599
176650	1130	600	601	602	603	604	605	606	607
176640	1140	608	609	610	611	612	613	614	615
176630	1150	616	617	618	619	620	621	622	623
176620	1160	624	625	626	627	628	629	630	631
176610	1170	632	633	634	635	636	637	638	639
176600	1200	640	641	642	643	644	645	646	647
176570	1210	648	649	650	651	652	653	654	655
176560	1220	656	657	658	659	660	661	662	663
176550	1230	664	665	666	667	668	669	670	671
176540	1240	672	673	674	675	676	677	678	679
176530	1250	680	681	682	683	684	685	686	687
176520	1260	688	689	690	691	692	693	694	695
176510	1270	696	697	698	699	700	701	702	703
176500	1300	704	705	706	707	708	709	710	711
176470	1310	712	713	714	715	716	717	718	719
176460	1320	720	721	722	723	724	725	726	727
176450	1330	728	729	730	731	732	733	734	735
176440	1340	736	737	738	739	740	741	742	743
176430	1350	744	745	746	747	748	749	750	751
176420	1360	752	753	754	755	756	757	758	759
176410	1370	760	761	762	763	764	765	766	767

General Information

Octal/Decimal Conversion (cont'd)

2'S COMP		0	1	2	3	4	5	6	7
176400	1400	768	769	770	771	772	773	774	775
176370	1410	776	777	778	779	780	781	782	783
176360	1420	784	785	786	787	788	789	790	791
176350	1430	792	793	794	795	796	797	798	799
176340	1440	800	801	802	803	804	805	806	807
176330	1450	808	809	810	811	812	813	814	815
176320	1460	816	817	818	819	820	821	822	823
176310	1470	824	825	826	827	828	829	830	831
176300	1500	832	833	834	835	836	837	838	839
176270	1510	840	841	842	843	844	845	846	847
176260	1520	848	849	850	851	852	853	854	855
176250	1530	856	857	858	859	860	861	862	863
176240	1540	864	865	866	867	868	869	870	871
176230	1550	872	873	874	875	876	877	878	879
176220	1560	880	881	882	883	884	885	886	887
176210	1570	888	889	890	891	892	893	894	895
176200	1600	896	897	898	899	900	901	902	903
176170	1610	904	905	906	907	908	909	910	911
176160	1620	912	913	914	915	916	917	918	919
176150	1630	920	921	922	923	924	925	926	927
176140	1640	928	929	930	931	932	933	934	935
176130	1650	936	937	938	939	940	941	942	943
176120	1660	944	945	946	947	948	949	950	951
176110	1670	952	953	954	955	956	957	958	959
176100	1700	960	961	962	963	964	965	966	967
176070	1710	968	969	970	971	972	973	974	975
176060	1720	976	977	978	979	980	981	982	983
176050	1730	984	985	986	987	988	989	990	991
176040	1740	992	993	994	995	996	997	998	999
176030	1750	1000	1001	1002	1003	1004	1005	1006	1007
176020	1760	1008	1009	1010	1011	1012	1013	1014	1015
176010	1770	1016	1017	1018	1019	1020	1021	1022	1023

General Information

Binary

2^n	n	2^{-n}			
1	0	1.0			
2	1	0.5			
4	2	0.25			
8	3	0.125			
16	4	0.0625			
32	5	0.03125			
64	6	0.01562	5		
128	7	0.00781	25		
256	8	0.00390	625		
512	9	0.00195	3125		
1 024	10	0.00097	65625		
2 048	11	0.00048	82812	5	
4 096	12	0.00024	41406	25	
8 192	13	0.00012	20703	125	
16 384	14	0.00006	10351	5625	
32 768	15	0.00003	05175	78125	
65 536	16	0.00001	52587	89062	5
131 072	17	0.00000	76293	94531	25
262 144	18	0.00000	38146	97265	625
524 288	19	0.00000	19073	48632	8125
1 048 576	20	0.00000	09536	74316	40625

Binary (cont'd)

2 ⁿ			n	2 ⁻ⁿ								
2	097	152	21	0.00000	04768	37158	20312	5				
4	194	304	22	0.00000	02384	18579	10156	25				
8	388	608	23	0.00000	01192	09289	55078	125				
16	777	216	24	0.00000	00596	04644	77539	0625				
33	554	432	25	0.00000	00298	02322	38769	53125				
67	108	864	26	0.00000	00149	01161	19384	76562	5			
134	217	728	27	0.00000	00074	50580	59692	38281	25			
268	435	456	28	0.00000	00037	25290	29846	19140	625			
536	870	912	29	0.00000	00018	62645	14923	09570	3125			
1	073	741	824	30	0.00000	00009	31322	57461	54785	15625		
2	147	483	648	31	0.00000	00004	65661	28730	77392	57812	5	
4	294	967	296	32	0.00000	00002	32830	64365	38696	28906	25	
8	589	934	592	33	0.00000	00001	16415	32182	69348	14453	125	
17	179	869	184	34	0.00000	00000	58207	66091	34674	07226	5625	
34	359	738	368	35	0.00000	00000	29103	83045	67337	03613	28125	
68	719	476	736	36	0.00000	00000	14551	91522	83668	51806	64062	5
137	438	953	472	37	0.00000	00000	07275	95761	41834	25903	32031	25
274	877	906	944	38	0.00000	00000	03637	97880	70917	12951	66015	625
549	755	813	888	39	0.00000	00000	01818	98940	35458	56475	83007	8125

General Information

Decimal to Octal to Hexadecimal

Decimal	Octal	Hex	Decimal	Octal	Hex
0	000000	0000	64	000100	0040
1	000001	0001	65	000101	0041
2	000002	0002	66	000102	0042
3	000003	0003	67	000103	0043
4	000004	0004	68	000104	0044
5	000005	0005	69	000105	0045
6	000006	0006	70	000106	0046
7	000007	0007	71	000107	0047
8	000010	0008	72	000110	0048
9	000011	0009	73	000111	0049
10	000012	000A	74	000112	004A
11	000013	000B	75	000113	004B
12	000014	000C	76	000114	004C
13	000015	000D	77	000115	004D
14	000016	000E	78	000116	004E
15	000017	000F	79	000117	004F
16	000020	0010	80	000120	0050
17	000021	0011	81	000121	0051
18	000022	0012	82	000122	0052
19	000023	0013	83	000123	0053
20	000024	0014	84	000124	0054
21	000025	0015	85	000125	0055
22	000026	0016	86	000126	0056
23	000027	0017	87	000127	0057
24	000030	0018	88	000130	0058
25	000031	0019	89	000131	0059
26	000032	001A	90	000132	005A
27	000033	001B	91	000133	005B
28	000034	001C	92	000134	005C
29	000035	001D	93	000135	005D
30	000036	001E	94	000136	005E
31	000037	001F	95	000137	005F
32	000040	0020	96	000140	0060
33	000041	0021	97	000141	0061
34	000042	0022	98	000142	0062
35	000043	0023	99	000143	0063
36	000044	0024	100	000144	0064
37	000045	0025	101	000145	0065
38	000046	0026	102	000146	0066
39	000047	0027	103	000147	0067
40	000050	0028	104	000150	0068
41	000051	0029	105	000151	0069
42	000052	002A	106	000152	006A
43	000053	002B	107	000153	006B
44	000054	002C	108	000154	006C
45	000055	002D	109	000155	006D
46	000056	002E	110	000156	006E
47	000057	002F	111	000157	006F
48	000060	0030	112	000160	0070
49	000061	0031	113	000161	0071
50	000062	0032	114	000162	0072
51	000063	0033	115	000163	0073
52	000064	0034	116	000164	0074
53	000065	0035	117	000165	0075
54	000066	0036	118	000166	0076
55	000067	0037	119	000167	0077
56	000070	0038	120	000170	0078
57	000071	0039	121	000171	0079
58	000072	003A	122	000172	007A
59	000073	003B	123	000173	007B
60	000074	003C	124	000174	007C
61	000075	003D	125	000175	007D
62	000076	003E	126	000176	007E
63	000077	003F	127	000177	007F

Decimal to Octal to Hexadecimal (cont'd)

Decimal	Octal	Hex	Decimal	Octal	Hex
128	000200	0080	192	000300	00C0
129	000201	0081	193	000301	00C1
130	000202	0082	194	000302	00C2
131	000203	0083	195	000303	00C3
132	000204	0084	196	000304	00C4
133	000205	0085	197	000305	00C5
134	000206	0086	198	000306	00C6
135	000207	0087	199	000307	00C7
136	000210	0088	200	000310	00C8
137	000211	0089	201	000311	00C9
138	000212	008A	202	000312	00CA
139	000213	008B	203	000313	00CB
140	000214	008C	204	000314	00CC
141	000215	008D	205	000315	00CD
142	000216	008E	206	000316	00CE
143	000217	008F	207	000317	00CF
144	000220	0090	208	000320	00D0
145	000221	0091	209	000321	00D1
146	000222	0092	210	000322	00D2
147	000223	0093	211	000323	00D3
148	000224	0094	212	000324	00D4
149	000225	0095	213	000325	00D5
150	000226	0096	214	000326	00D6
151	000227	0097	215	000327	00D7
152	000230	0098	216	000330	00D8
153	000231	0099	217	000331	00D9
154	000232	009A	218	000332	00DA
155	000233	009B	219	000333	00DB
156	000234	009C	220	000334	00DC
157	000235	009D	221	000335	00DD
158	000236	009E	222	000336	00DE
159	000237	009F	223	000337	00DF
160	000240	00A0	224	000340	00E0
161	000241	00A1	225	000341	00E1
162	000242	00A2	226	000342	00E2
163	000243	00A3	227	000343	00E3
164	000244	00A4	228	000344	00E4
165	000245	00A5	229	000345	00E5
166	000246	00A6	230	000346	00E6
167	000247	00A7	231	000347	00E7
168	000250	00A8	232	000350	00E8
169	000251	00A9	233	000351	00E9
170	000252	00AA	234	000352	00EA
171	000253	00AB	235	000353	00EB
172	000254	00AC	236	000354	00EC
173	000255	00AD	237	000355	00ED
174	000256	00AE	238	000356	00EE
175	000257	00AF	239	000357	00EF
176	000260	00B0	240	000360	00F0
177	000261	00B1	241	000361	00F1
178	000262	00B2	242	000362	00F2
179	000263	00B3	243	000363	00F3
180	000264	00B4	244	000364	00F4
181	000265	00B5	245	000365	00F5
182	000266	00B6	246	000366	00F6
183	000267	00B7	247	000367	00F7
184	000270	00B8	248	000370	00F8
185	000271	00B9	249	000371	00F9
186	000272	00BA	250	000372	00FA
187	000273	00BB	251	000373	00FB
188	000274	00BC	252	000374	00FC
189	000275	00BD	253	000375	00FD
190	000276	00BE	254	000376	00FE
191	000277	00BF	255	000377	00FF

General Information

Decimal to Octal to Hexadecimal (cont'd)

Decimal	Octal	Hex	Decimal	Octal	Hex
0	000000	0000	16384	040000	4000
256	000400	0100	16640	040400	4100
512	001000	0200	16896	041000	4200
768	001400	0300	17152	041400	4300
1024	002000	0400	17408	042000	4400
1280	002400	0500	17664	042400	4500
1536	003000	0600	17920	043000	4600
1792	003400	0700	18176	043400	4700
2048	004000	0800	18432	044000	4800
2304	004400	0900	18688	044400	4900
2560	005000	0A00	18944	045000	4A00
2816	005400	0B00	19200	045400	4B00
3072	006000	0C00	19456	046000	4C00
3328	006400	0D00	19712	046400	4D00
3584	007000	0E00	19968	047000	4E00
3840	007400	0F00	20224	047400	4F00
4096	010000	1000	20480	050000	5000
4352	010400	1100	20736	050400	5100
4608	011000	1200	20992	051000	5200
4864	011400	1300	21248	051400	5300
5120	012000	1400	21504	052000	5400
5376	012400	1500	21760	052400	5500
5632	013000	1600	22016	053000	5600
5888	013400	1700	22272	053400	5700
6144	014000	1800	22528	054000	5800
6400	014400	1900	22784	054400	5900
6656	015000	1A00	23040	055000	5A00
6912	015400	1B00	23296	055400	5B00
7168	016000	1C00	23552	056000	5C00
7424	016400	1D00	23808	056400	5D00
7680	017000	1E00	24064	057000	5E00
7936	017400	1F00	24320	057400	5F00
8192	020000	2000	24576	060000	6000
8448	020400	2100	24832	060400	6100
8704	021000	2200	25088	061000	6200
8960	021400	2300	25344	061400	6300
9216	022000	2400	25600	062000	6400
9472	022400	2500	25856	062400	6500
9728	023000	2600	26112	063000	6600
9984	023400	2700	26368	063400	6700
10240	024000	2800	26624	064000	6800
10496	024400	2900	26880	064400	6900
10752	025000	2A00	27136	065000	6A00
11008	025400	2B00	27392	065400	6B00
11264	026000	2C00	27648	066000	6C00
11520	026400	2D00	27904	066400	6D00
11776	027000	2E00	28160	067000	6E00
12032	027400	2F00	28416	067400	6F00
12288	030000	3000	28672	070000	7000
12544	030400	3100	28928	070400	7100
12800	031000	3200	29184	071000	7200
13056	031400	3300	29440	071400	7300
13312	032000	3400	29696	072000	7400
13568	032400	3500	29952	072400	7500
13824	033000	3600	30208	073000	7600
14080	033400	3700	30464	073400	7700
14336	034000	3800	30720	074000	7800
14592	034400	3900	30976	074400	7900
14848	035000	3A00	31232	075000	7A00
15104	035400	3B00	31488	075400	7B00
15360	036000	3C00	31744	076000	7C00
15616	036400	3D00	32000	076400	7D00
15872	037000	3E00	32256	077000	7E00
16128	037400	3F00	32512	077400	7F00

Decimal to Octal to Hexadecimal (cont'd)

Decimal	Octal	Hex	Decimal	Octal	Hex
32768	100000	8000	49152	140000	C000
33024	100400	8100	49408	140400	C100
33280	101000	8200	49664	141000	C200
33536	101400	8300	49920	141400	C300
33792	102000	8400	50176	142000	C400
34048	102400	8500	50432	142400	C500
34304	103000	8600	50688	143000	C600
34560	103400	8700	50944	143400	C700
34816	104000	8800	51200	144000	C800
35072	104400	8900	51456	144400	C900
35328	105000	8A00	51712	145000	CA00
35584	105400	8B00	51968	145400	CB00
35840	106000	8C00	52224	146000	CC00
36096	106400	8D00	52480	146400	CD00
36352	107000	8E00	52736	147000	CE00
36608	107400	8F00	52992	147400	CF00
36864	110000	9000	53248	150000	D000
37120	110400	9100	53504	150400	D100
37376	111000	9200	53760	151000	D200
37632	111400	9300	54016	151400	D300
37888	112000	9400	54272	152000	D400
38144	112400	9500	54528	152400	D500
38400	113000	9600	54784	153000	D600
38656	113400	9700	55040	153400	D700
38912	114000	9800	55296	154000	D800
39168	114400	9900	55552	154400	D900
39424	115000	9A00	55808	155000	DA00
39680	115400	9B00	56064	155400	DB00
39936	116000	9C00	56320	156000	DC00
40192	116400	9D00	56576	156400	DD00
40448	117000	9E00	56832	157000	DE00
40704	117400	9F00	57088	157400	DF00
40960	120000	A000	57344	160000	E000
41216	120400	A100	57600	160400	E100
41472	121000	A200	57856	161000	E200
41728	121400	A300	58112	161400	E300
41984	122000	A400	58368	162000	E400
42240	122400	A500	58624	162400	E500
42496	123000	A600	58880	163000	E600
42752	123400	A700	59136	163400	E700
43008	124000	A800	59392	164000	E800
43264	124400	A900	59648	164400	E900
43520	125000	AA00	59904	165000	EA00
43776	125400	AB00	60160	165400	EB00
44032	126000	AC00	60416	166000	EC00
44288	126400	AD00	60672	166400	ED00
44544	127000	AE00	60928	167000	EE00
44800	127400	AF00	61184	167400	EF00
45056	130000	B000	61440	170000	F000
45312	130400	B100	61696	170400	F100
45568	131000	B200	61952	171000	F200
45824	131400	B300	62208	171400	F300
46080	132000	B400	62464	172000	F400
46336	132400	B500	62720	172400	F500
46592	133000	B600	62976	173000	F600
46848	133400	B700	63232	173400	F700
47104	134000	B800	63488	174000	F800
47360	134400	B900	63744	174400	F900
47616	135000	BA00	64000	175000	FA00
47872	135400	BB00	64256	175400	FB00
48128	136000	BC00	64512	176000	FC00
48384	136400	BD00	64768	176400	FD00
48640	137000	BE00	65024	177000	FE00
48896	137400	BF00	65280	177400	FF00

EIA Modem/Terminal Interface

**EIA RS-232-C AND CCITT V24
PLUG/PIN DESIGNATIONS**

PIN	NAME	TO DTE TO DCE		FUNCTION	CIRCUIT	
		↑	↓		(CCITT)	(EIA)
1	FG			FRAME GROUND	101	(AA)
2	TD		→	TRANSMITTED DATA . . .	103	(BA)
3	RD	←		RECEIVED DATA	104	(BB)
4	RTS		→	REQUEST TO SEND	105	(CA)
5	CTS	←		CLEAR TO SEND	106	(CB)
6	DSR	←		DATA SET READY	107	(CC)
7	SG			SIGNAL GROUND	102	(AB)
8	DCD	←		DATA CARRIER DETECT	109	(CF)
9		←		POSITIVE DC TEST VOLTAGE		
10		←		NEGATIVE DC TEST VOLTAGE		
11				UNASSIGNED		
12	(S)DCD	←		SECONDARY DATA CARRIER DETECT	122	(SCF)
13	(S)CTS	←		SECONDARY CLEAR TO SEND	121	(SCB)
14	(S)TD		→	SECONDARY TRANSMITTED DATA	118	(SBA)
15	TC	←		TRANSMITTER CLOCK . . .	114	(DB)
16	(S)RD	←		SECONDARY RECEIVED DATA	119	(SBB)
17	RC	←		RECEIVER CLOCK	115	(DD)
18			→	RECEIVER DIBIT CLOCK		
19	(S)RTS		→	SECONDARY REQUEST TO SEND	120	(SCA)
20	DTR		→	DATA TERMINAL READY	108.2	(CD)
21	SQ	←		SIGNAL QUALITY DETECT	110	(CG)
22	RI	←		RING INDICATOR	125	(CE)
23			→	DATA RATE SELECT	111/112	(CH/CI)
24	(TC)		→	EXTERNAL TRANSMITTER CLOCK	113	(DA)
25			→	BUSY		

NOTE: DCE – DATA COMMUNICATIONS EQUIPMENT

DTE – DATA TERMINAL EQUIPMENT

*SCA is on Pin 11 for 202C's.

EIA-Modem Interface

INTERFACE VOLTAGE

NOTATION	NEGATIVE	POSITIVE
Binary State	1	0
Signal Condition	Marking	Spacing
Function	OFF	ON

EIA Modem Interface (cont'd)

INTERCHANGE CIRCUITS BY CATEGORY

CIRCUIT Type	Circuit	PIN	RS-232C	Circuit	RS-449
COMMON	AB	7	SIGNAL GROUND	SG SC RC	SIGNAL GROUND SEND COMMON RECEIVE COMMON
	CE CD CC	22 20 6	RING INDICATOR DATA TERMINAL READY DATA SET READY	IS IC TR DM	TERMINAL IN SERVICE INCOMING CALL TERMINAL READY DATA MODE
CONTROL	BA BB	2 3	TRANSMITTED DATA RECEIVED DATA	SD RD	SEND DATA RECEIVE DATA
	DA DB DD	24 15 17	TRANSMITTER SIGNAL ELEMENT TIMING (DTE SOURCE) TRANSMITTER SIGNAL ELEMENT TIMING (DCE SOURCE) RECEIVER SIGNAL ELEMENT TIMING	TT ST RT	TERMINAL TIMING SEND TIMING RECEIVE TIMING
TIMING	CA CB CF	4 5 8	REQUEST TO SEND CLEAR TO SEND RECEIVED LINE SIGNAL DETECTOR	RS CS RR	REQUEST TO SEND CLEAR TO SEND RECEIVER READY
CONTROL	CG	21	SIGNAL QUALITY DETECTOR	SQ NS SF SR	SIGNAL QUALITY NEW SIGNAL SELECT FREQUENCY SIGNALLING RATE SELECTOR
	CH CI	23 23	DATA SIGNAL RATE SELECTOR (DTE SOURCE) DATA SIGNAL RATE (DCE SOURCE)	SI	SIGNALLING RATE INDICATOR
DATA	SBA SBB	14 16	SECONDARY TRANSMITTED DATA SECONDARY RECEIVED DATA	SSD SRD	SECONDARY SEND DATA SECONDARY RECEIVE DATA
	SCA SCB SCF	19 13 12	SECONDARY REQUEST TO SEND SECONDARY CLEAR TO SEND SECONDARY RECEIVED LINE SIGNAL DETECTOR	SRS SCS SRR	SECONDARY REQUEST TO SEND SECONDARY CLEAR TO SEND SECONDARY RECEIVER READY
OTHER				LL RL TM	LOCAL LOOPBACK REMOTE LOOPBACK TEST MODE
				SS SB	SELECT STANDBY STANDBY INDICATOR
	1 9,10 11,18		PROTECTIVE GROUND RESERVED FOR DATA SET TESTING UNASSIGNED		SHIELD SPARE

EIA Modem Interface (cont'd)

INTERCHANGE CIRCUITS BY CATEGORY

CONTACT NUMBERS		Circuit	C.C.I.T.T. RECOMMENDATION V.24	CIRCUIT DIRECTION
37 PIN	9 PIN			
19 37 20	5 9 6	102 102a 102b	SIGNAL GROUND DTE COMMON DCE COMMON	
28 15 12,30a 11,29a		125 108/2 107	CALLING INDICATOR DATA TERMINAL READY DATA SET READY	- TO DCE FROM DCE
4,22a 6,24a		103 104	TRANSMITTED DATA RECEIVED DATA	TO DCE FROM DCE TO DCE FROM DCE
17,35a 5,23a 8,26		113 114 115	TRANSMITTER SIGNAL ELEMENT TIMING (DTE SOURCE) TRANSMITTER SIGNAL ELEMENT TIMING (DCE SOURCE) RECEIVER SIGNAL ELEMENT TIMING (DCE SOURCE)	TO DCE FROM DCE TO DCE FROM DCE FROM DCE
7,25a 9,27a 13,31a 33 34 16b 16b 2		105 108 109 110 126 111 112	REQUEST TO SEND READY FOR SENDING DATA CHANNEL RECEIVED LINE SIGNAL DETECTOR DATA SIGNAL QUALITY DETECTOR SELECT TRANSMIT FREQUENCY DATA SIGNALING RATE SELECTOR (DTE SOURCE) DATA SIGNALING RATE (DCE SOURCE)	TO DCE FROM DCE FROM DCE FROM DCE TO DCE TO DCE TO DCE FROM DCE TO DCE FROM DCE
	3 4	118 119	TRANSMITTED BACKWARD CHANNEL DATA RECEIVED BACKWARD CHANNEL DATA	TO DCE FROM DCE FROM DCE
	7 8 2	120 121 122	TRANSMIT BACKWARD CHANNEL LINE SIGNAL BACKWARD CHANNEL READY BACKWARD CHANNEL RECEIVED LINE SIGNAL DETECTOR	TO DCE TO DCE FROM DCE TO DCE FROM DCE
	10 14 18	141 140 142	LOCAL LOOPBACK REMOTE LOOPBACK TEST INDICATOR	
32 36		116 117	SELECT STANDBY STANDBY INDICATOR	
1 3,21a	1			

a = First segment, second segment
b = Joint assignment

ASYNCHRONOUS CONTROLLERS AND MODEMS

SECTION

2

CONTENT	PAGE
References.....	2-2
ATC/ADCC/ATP Descriptions.....	2-3
Configuration Dialogue.....	2-4
Configuring a Terminal Port.....	2-4
Terminal Buffers.....	2-6
Configuring a Printer Port.....	2-9
ATP, ADCC, and ATC Comparison.....	2-12
Terminal Type Characteristics.....	2-16
Input Modes and Terminal Editing.....	2-27
Recommended Modems.....	2-31
Modem Options.....	2-33
HP Modems.....	2-33
Bell Modems.....	2-36
ATP/ADCC/ATC Cabling.....	2-40
Selected MPE Intrinsic.....	2-51
FCONTROL Control Codes.....	2-51
FCHECK Status and Error Codes.....	2-55
Functions of FDEVICECONTROL.....	2-56
Actions on FCLOSE.....	2-57
ATP Error Messages.....	2-58
ADCC (MPE V/E) Error Messages.....	2-63
Terminal System Failures.....	2-66
Supported Terminals and Printers.....	2-69

Asynchronous Controllers and Modems

REFERENCES

Point-to-Point Workstation I/O Reference Manual (30000-90250)

Workstation Configurator Reference Manual (30239-90001)

Terminal (TERMDSM) On-Line Diagnostic/Support Monitor Reference Manual (30144-90013)

Computer Users Catalog (5953-2450D)

Guide to a Successful Installation (HP 3000 Computer Systems) (30000-90135)

HP 3000 Computer Systems Site Preparation Set (30000-60029)

Data Communications Guide Book (5955-1715)

Advanced Terminal Processor (ATP) Manuals

DSN/ATP Installation Manual (30144-90002)

DSN/ATP On-Line Diagnostic Manual (30144-90004)

DSN/ATP Off-Line Diagnostic Manual (30144-90003)

Asynchronous Data Communications Controller (ADCC) Manuals

HP 30018A/30019A Add-on ADCC Installation Manual (30070-90023)

HP 3000 Series 33 and HP 3000 Series 30 Computer Systems Reference/Training Manual (30070-90003)

Asynchronous Terminal Controller Manuals

HP 3000 Series III Computer Systems Reference/Training Manual (Section 7-6) (30000-90143)

HP 320032B ATC Installation and Service Manual (30032-90004)

HP 30032B Terminal Data Interface Stand-Alone Diagnostic Manual (D427A) (30032-90001)

ATP/ADCC/ATC DESCRIPTIONS

Asynchronous Terminal Controller (ATC)

The HP 30032B Asynchronous Terminal Controller (ATC) is an interface for bit-serial asynchronous devices (e.g., terminals, bit serial line printers, etc.). The controller can multiplex data transmission for up to 16 ports, which may be hardwired or modem connected, or any mix thereof. Supported speeds range from 110 to 2400 bps. IOTERM0 interfaces the ATC hardware to the MPE operating system.

ATC Hardware Components

- HP 30032B Provides transmit and receive signals for support of data transfers for up to 16 hardwired ports.
- HP 30032B-001 Adds four signals per port for support of full duplex modem control signals for these same 16 ports.
- HP 30032B-002 Adds four additional signals for support of half duplex control signals for the same 16 ports.

With the HP 30032B, options 001 and 002, any of these 16 ports can support either direct connected devices or full or half duplex modems in any combination.

Asynchronous Data Communications Controller (ADCC)

The HP 30018 and HP 30019A Asynchronous Data Communications Controller (ADCC) is an interface for bit-serial asynchronous devices. The interface consists of an ADCC main and extend PCA which multiplexes data transmission for 8 ports which may be hardwired or modem connected or any mix thereof. Supported speeds range from 110 to 9600 bps. For MPE IV or MPE V/P, HIOTERM0 interfaces the ADCC hardware to the MPE operating system. For MPE V/E, (version 6.00.00 or later), HIOTERM2 (for terminals) and HIOASLP2 (for printers) interfaces the ADCC hardware to the MPE operating system.

Advanced Terminal Processor (ATP)

The HP 30144A, HP 30145A, and HP 30155A Advanced Terminal Processor (ATP) is an interface for bit-serial asynchronous devices. The interface consists of a System Interface Board (SIB) (30144A) and up to 8 Asynchronous Interface Boards (AIB) (30145A or 30155A). It can multiplex data for up to 96 ports which may be hardwired, modem connected, or a mix thereof. Supported speeds range from 110 to 19.2K bps. HIOTERM1 (for terminals) and HIOASLP0 (for printers) interfaces the ATP hardware to the MPE operating system.

TABLE 2-1. HARDWARE COMPONENTS AND DRIVERS

Controller	Product Number	Driver
ATC	HP 30032B	IOTERM0
ADCC	HP 30018A or HP 30019A	HIOTERM0 (MPE IV or V/P) HIOTERM2 (Terminal Support-MPE V/E) HIOASLP2 (Printer Support-MPE V/E)
ATP	HP 30144A SIB HP 30145A Direct Connect AIB HP 30155A Modem AIB	HIOTERM1 (Terminal Support) HIOASLP0 (Printer Support)

CONFIGURATION DIALOGUE

For further information on System Initialization and SYSDDUMP, refer to the *System Operation and Resource Management Reference Manual* (32033-90005) for MPE V, or the *System Manager/System Supervisor Reference Manual* (30000-90014) and the *Console Operator's Guide* (30000-90013) for MPE IV and earlier, as well as the *Point-to-Point Workstation I/O Reference Manual* (30000-90250)

Configuring a Terminal Port

LOGICAL DEVICE #? User choice -- any unique number.

DRT #? ATP (Series 4X/6X) -- calculate using this formula:
 (*imb#* * 128) + (*channel#* * 8)

 ADCC (Series 3X and 4X) -- calculate using this formula:
 ((*channel#* * 8) + *device#*)

 ATC Determined by switches or jumpers on the TERM DATA INTFL
 (TDI) (30032-60001). On Series II/III, the minimum DRT number is 4.

 7 (for first subsystem)
 8, 9 (reserved for modem support)
 10 (for subsecond system)
 13 (for third subsystem)
 16 (for fourth subsystem)

UNIT #? ATP 0-95 for each subsystem.
 (Unit numbers 0-11 for the ATP correspond to ports 0-11 on AIB0, unit
 numbers 12-23 correspond to ports 0-11 on AIB1, and so on.)

 ADCC 0 for all ports on each system

 ATC 0-15 for each system

SOFTWARE CHANNEL #? 0

TYPE? 16

SUBTYPE? ATP 0,1,9
 For MPE V/E, any invalid subtypes entered map to subtype 0.

 ADCC 0,1,2,3,4,5
 For MPE V/E, subtype 4 maps to 0, and subtype 5 maps to 1.

 ATC 0,1,2,3,4,5,6,7

Refer to Tables 2-3 and 2-4 for subtype definitions. For subtypes 4, 5, 6, and 7, you must also configure a port line speed (refer to Table 2-2).

TERM TYPE?

MPE IV or MPE V/P TERM TYPE?

for MPE V/E ENTER [TERM TYPE#], [DESCRIPTOR FILENAME]?

ATP 6,9,10,12,13,15,16,18,31

ADCC 4,6,9,10,12,13,15,16,18,31

ATC 0,1,2,3,4,5,6,9,10,12,13,15,16,18,31

See also Tables 2-8 through 13 for Terminal Type Characteristics. ATP and ADCC (HIOTERM2) allow you to specify a user-created terminal type by entering the fully qualified filename in addition to or instead of the terminal type number. Refer to the *Workstation Configurator Reference Manual* (30239-90001) for more information.

SPEED IN CPS?

The following speeds are supported by controllers:

TABLE 2-2. LINE SPEEDS SUPPORTED FOR ATP, ADCC, and ATC

Line Speed	Chars/Sec	ATP sensed	ADCC HIOTERM2 sensed/specified	ADCC HIOTERM0 sensed/specified	ATC sensed/specified
110	10	Y	N / N	N / N	Y / Y
150	15	N	N / Y	Y / Y	Y / Y
300	30	Y	Y / Y	Y / Y	Y / Y
600	60	Y	Y / Y	N / Y	Y / Y
1200	120	Y	Y / Y	Y / Y	Y / Y
2400	240	Y	Y / Y	Y / Y	Y / Y
4800	480	Y	Y / Y	N / Y	N / N
9600	960	Y	Y / Y	N / Y	N / N
19200	1920	Y	N / N	N / N	N / N

RECORD WIDTH?

User choice. Usually 40 words (or 80 bytes), the screen width of most terminals.

OUTPUT DEVICE?

ldev#

ACCEPT JOBS/SESSIONS?

YES (logon terminals) NO (still allows programmatic opening of the terminal)

ACCEPT DATA?

YES (if you wish to use the :DATA command) or NO

INTERACTIVE?

YES (allows :HELLO, :(command), or :JOB commands) or NO

DUPLICATIVE?

YES (output is echoed character-by-character, rather than line-by-line).

INITIALLY SPOOLED?

NO

DRIVER NAME?

ATP HIOTERM1

ADCC HIOTERM0 (MPE IV or V/P) / HIOTERM2 (MPE V/E)

ATC IOTERM0

Asynchronous Controllers and Modems

DEVICE CLASSES? User choice. The console must be unique and *must* be device class CONSOLE.

NOTE : The following prompt appears only in the SYSDDUMP dialog, and only if you respond YES to the SYSTEM TABLE CHANGES? prompt.

TERMINAL BUFFERS PER PORT? 1 - 12

Recommended:

ATP and ADCC (HIOTERM2) 3 per port.
Software guarantees that a minimum number of buffers are configured.

ADCC (HIOTERM0) 5 per port, minimum of 30 buffers

ATC 8 per port, minimum of 40 buffers

If heavy use is made of block mode I/O, or many printers are operated concurrently, or large reads (>1000 characters) are common, then 12 buffers per port should be configured on all systems.

Terminal Buffers

ATP (HIOTERM1 or HIOASLP0). The TBUFs are in an extra data segment called the Terminal Data Segment. There is one data segment built for units 0-47, and another for units 48-95. The maximum number of TBUFs is determined by the configured "Maximum Extra Data Segment Size" and the number of data segments used. The following formula finds the maximum number of TBUFs per data segment of a given size:

$$\left(maseg - \left(2023 + (\# \text{ of ports} * 184) \right) \right) / 69$$

where:

maseg = Maximum Extra Data Segment Size

2023 = Fixed ATP overhead

184 = Size of an ATP Device Information Table (DIT) contained in the XDS

69 = The number of words in an ATP TBUF

ADCC (HIOTERM2 or HIOASLP2). The TBUFs are contained in an extra data segment. Only one extra data segment is constructed, however. The formula for calculating the maximum number of TBUFs is:

$$\left(\text{maxseg} - \left(1775 + (\# \text{ of ports} * 210) \right) \right) / 69$$

where:

- maxseg* = Maximum Extra Data Segment Size
- 1775 = Fixed ADCC (HIOTERM2) overhead
- 210 = Size of an ADCC DIT contained in the XDS
- 69 = The number of words in an ADCC (HIOTERM2) TBUF

If more TBUFs are configured than can fit in an extra data segment, the system builds as many as possible and prints a warning message each time the system is warmstarted or coolstarted. If more TBUFs are needed, the configured "Maximum Extra Data Segment" size may be increased.

ADCC (HIOTERM0) and ATC. The maximum number of TBUFs that can be configured is 255. They are located in Bank 0.

Asynchronous Controllers and Modems

TABLE 2-3. SPEED SENSING TERMINAL SUBTYPES

Subtype	Description
0	Directly connected terminals requiring speed sensing. Not recommended for use with modems.
1	Asynchronous full duplex modems. Compatible with Bell 103, 202T, 212A, and CCITT V. 21 modems requiring speed sensing. ATP and ADCC (HIOTERM2) require Data Set Ready (RS-232-C "CC", CCITT 107) and Data Carrier Detect (RS-232-C "CF", CCITT 109) to be ON.
2	Asynchronous half duplex modems with reverse channels (such as Bell 202S and CCITT V. 23 modems). Speed sensing is performed and "Data Rate Select" (RS232C "CH"-CCITT 111) is set ON. Not available on HP 4X/6X. "Data Set Ready" and "Data Carrier Detect" on the ADCC must be set ON.
3	Identical to subtype 2 except that "Data Rate Select" is set OFF. Not available on HP 4X/6X. "Data Set Ready" and "Data Carrier Detect" on the ADCC is set ON.
9	ATP only - Asynchronous CCITT modem that requires monitoring circuit 108; clear to send, otherwise identical to subtype 1.

TABLE 2-4. SPEED SPECIFIED TERMINAL SUBTYPES

Subtype	Description
4	Identical to subtype 0 except that automatic speed sensing is disabled. This subtype is intended for operation with leased-line full duplex modems which can be configured to operate without control signals (i.e., 202T). (Not supported for MPE V/E).
5	Identical to subtype 1 except that automatic speed sensing is disabled. (Not supported for MPE V/E).
6	Identical to subtype 2 except that automatic speed sensing is disabled. Series II/II only.
7	Identical to subtype 3 except that automatic speed sensing is disabled. Series II/III only.

Configuring a Printer Port

LOGICAL DEVICE# ? User choice

DRT# ? **ATP** (Series 6X) -- calculate using this formula:
 $(imb\# * 128) + (channel\# * 8) + device\#$

ATP (Series 4X) -- calculate using this formula:
 $(channel\# * 8)$

ADCC (Series 3X and 4X) -- calculate using this formula:
 $(channel\# * 8) + device\#$

ATC Refer to terminal configuration.

UNIT# ? **ATP** 0-95 for each subsystem.
 (Unit numbers 0-11 for the ATP correspond to ports 0-11 on AIB0, unit numbers 12-23 correspond to ports 0-11 on AIB1, and so on.)

ADCC 0 for all ports on each system

ATC 0-15 for each system

SOFTWARE CHANNEL# ? 0

TYPE? 32

SUBTYPE? 14 or 15

 14 = Speed-specified, direct connect. May be used with full duplex leased line modems not requiring any control signals, such as 202T.

 15 = Speed-specified, modem connect. Use with full duplex modems requiring the following control signals: CC, CF.

TERM TYPE? **MPE IV** or **V/P TERM TYPE?**
 for **MPE V/E ENTER [TERM TYPE #], [DESCRIPTOR FILENAME]?**

ATP and **ADCC (HIOASLP2)** 19, 20, 21, 22

 You can specify a user-created terminal type by entering the fully qualified filename in addition to or instead of the terminal type number. Refer to the *Workstation Configurator Reference Manual* (30239-90001) for more information.

ADCC (HIOTERM0) and **ATC** allows 19 only.

Status Request Protocol

For terminal types 19 (7-bit) and 20 (8-bit): The software driver asks for the status of the printer before printer initialization, at every FOPEN to the printer, at the end of every FWRITE record, and when the printer issues an XOFF(dc3). This is called a Status Request (esc?dc1). If the printer responds to this request by telling the computer that it is in trouble (paper jam, out of paper, etc.), a message is sent to the console telling the operator what is wrong with the printer. These terminal types are recommended for remote spooled printers as well as local spooled printers and non-spooled printers.

For terminal types 21 (7-bit) and 22(8-bit): A status request is sent to the printer before printer initialization, at every FOPEN to the printer, and after every carriage control (CR-LF or FF). Error messages are sent to the console if the printer is in trouble, but since status is checked less frequently than with termtypes 19 and 20, a problem may not be detected as quickly. These terminal types are recommended for local spooled printers and non-spooled printers. They can be used for remote spooled printers but are not recommended.

Some application printers (printers that are not compatible with 2631B) are configured using terminal type 18. Since Status Request Protocol is not used with this terminal type, the driver has no way of knowing when something has gone wrong with the printer. The application that controls the printer must read the printer's status or data may be lost. Consult the documentation of the application to see whether or not the application reads the printer's status.

SPEED IN CHARACTERS
PER SECOND?

Printer ports are not speed-sensed. The line speed must correspond to the printer's configured speed. The following speeds are supported by the controllers:

TABLE 2-5. SUPPORTED SPEEDS FOR PRINTER PORTS

Line Speed	Chars/Sec	ATP	ADCC	ATC
110	10	Y	N	Y
150	15	N	Y	Y
300	30	Y	Y	Y
600	60	Y	Y	Y
1200	120	Y	Y	Y
2400	240	Y	Y	Y
4800	480	Y	Y	N
9600	960	Y	Y	N
19200	1920	Y	N	N

RECORD WIDTH? User choice. Usually 66 words (132 bytes), the standard page width of most printers.

ACCEPT JOBS/SESSIONS NO

ACCEPT DATA? NO

INTERACTIVE? NO

DUPLICATIVE? NO

INITIALLY SPOOLED? YES or NO

Yes, if you want the system to automatically spool the device at system startup time.

No, if you want programmatic control, however, you will need to initially spool the device yourself with :STARTSPOOL.

DRIVER NAME? **ATP HIOASLP0**
ADCC HIOTERM0 (MPE IV or V/P) / HIOASLP2 (MPE V/E)
ATC IOTERM0

DEVICE CLASS? User choice.

NOTE : The following prompt appears only in the SYSDUMP dialog, and only if you respond YES to the SYSTEM TABLE CHANGES? prompt.

IO QUEUE=XXX? If you are planning to run multiple synchronous printers simultaneously, it is recommended the value be increased to the maximum, usually 255.

TERMINAL BUFFERS PER PORT? 1 - 12

Recommendations:

ATP and ADCC (HIOTERM2) 3 per port.
 Software guarantees that a minimum number of buffers are configured.

ADCC (HIOTERM0) 5 per port, minimum of 30 buffers.

ATC 8 per port, minimum of 40 buffers.

If heavy use is made of block mode I/O, or many printers are operated concurrently, or large reads (>1000 characters) are common, then 12 buffers per port should be configured on all systems. (Refer to "Terminal Buffers" earlier in this section.)

ATP, ADCC, and ATC COMPARISON

Each HP 3000 environment (whether it is hardware or software) has its restrictions and advantages that must be considered when you are going from one HP 3000 environment to another. A comparison of the differences between the three asynchronous interfaces available in the HP 3000 family of computers is listed below.

TABLE 2-6. COMPARISON OF ASYNCHRONOUS CONTROLLERS

	ATP ADCC (MPE V/E)	ADCC (MPE IV or MPE V/P)	ATC
Terminal Type	6, 9, 10, 12, 13, 15, 16, 18	4, 6, 9, 10, 12, 13, 15, 16, 18, 19, 31	0-6, 9, 10, 12, 13, 15, 16, 18, 19, 31
Printer Terminal Types	19, 21 (7-bit) and 20, 22 (8-bit)	19 (7-bit only)	19 (7-bit only)
Terminal Subtypes	0, 1, 9 (eliminates all speed-specified and half-duplex devices)	For Series 30/33 - 0-5 (eliminates all speed-specified and half-duplex devices). For Series 39/4X - 0, 1, 4, 5 (eliminates all half duplex devices).	0 - 7: speed-sensed and speed-specified devices supported for direct or modem connect and for both full and half duplex.
Printer Subtypes	14 (direct) and 15 (modem) for printers that support Status Request protocol.	14 (direct) and 15 (modem) for printers that support Status Request protocol.	14 (direct) and 15 (modem) for printers that support Status Request protocol.
Paper Tape Mode	Paper Tape Mode is not supported.	Paper Tape Mode is not supported.	It is supported under Terminal Type 6.
Delay Character Requirements	Terminal Types 5 and 6 provide a delay of 0.3 seconds after the CR, LF and/or FF. Terminal Type 9 provides a delay of 0.3 for LF and FF, none for CR. ADCC will use the NULL character for delays.	The NULL character is used for delays (that is, the start bit is followed by seven zeros and the appropriate parity bit). See Table 2-7A for the number of nulls sent per CR or LF, and TABLE 2-7C for the number of nulls sent per FF.	Delays are used after CR, LF, and/or FF with the datacomm line held in the mark condition. See Table 2-7B for the number of nulls sent per CR or LF, and TABLE 2-7C for the number of nulls sent per FF.

TABLE 2-6. COMPARISON OF ASYNCHRONOUS CONTROLLERS (cont'd)

	ATP ADCC (MPE V/E)	ADCC (MPE IV or MPE V/P)	ATC
Initial Speed and Parity Sensing	Performed by the hardware, up to 19200 bps (ATP) or 9600 bps (ADCC), resulting in a line speed and generation of even parity or the use of 8-bit pass-through (no parity checking).	Performed by software, up to 2400 bps, resulting in a line speed and generation of even parity or the use of 8-bit pass-through (no parity checking).	Performed by hardware, up to 2400 bps, resulting in a line speed and generation of either even or odd parity.
Parity Control	The 8th output bit can be set (via FCONTROL logic) to odd or even parity, or to 8-bit pass-through.	The 8th output bit can be set (via FCONTROL logic) to odd or even parity, or to 8-bit pass-through.	The 8th output bit can be set (via FCONTROL logic) to odd or even parity, to 8-bit pass-through, or forced to 1.
Input Character Handling (7-Bit)	The 8th input bit is passed through in standard and unedited modes with parity disabled. With parity enabled, it is both checked and generated.	The 8th input bit is passed through in standard and unedited modes with parity disabled. With parity enabled, it is both checked and generated.	The 8th input bit is forced to zero in standard and unedited modes with parity disabled. When parity is enabled, it can be set to either generate and check parity or generate but NOT check parity.
XON/XOFF Handshake	XON/XOFF characters are never ignored.	When a write is not posted to the driver, XON/XOFF characters are ignored.	XON/XOFF characters are never ignored.

Asynchronous Controllers and Modems

TABLE 2-7A. # TIME DELAY CHARACTERS BY SPEED(BPS) FOR ATC

TERM TYPE	2400 BPS	1200 BPS	600 BPS	300 BPS	150 BPS	110 BPS
0	0 LF	0 LF	0 LF	0 LF	0 LF	0 LF
	90 CR	30 CR	6 CR	3 CR	2 CR	1 CR
1	0 LF	0 LF	0 LF	0 LF	0 LF	0 LF
	90 CR	30 CR	6 CR	3 CR	2 CR	1 CR
2	0 LF	0 LF	0 LF	0 LF	0 LF	0 LF
	90 CR	30 CR	6 CR	3 CR	2 CR	1 CR
3	0 LF	0 LF	0 LF	0 LF	0 LF	0 LF
	25 CR	15 CR	7 CR	5 CR	3 CR	1 CR
4	4 LF	4 LF	4 LF	4 LF	4 LF	0 LF
	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR
5	45 LF	7 LF	3 LF	1 LF	1 LF	1 LF
	125 CR	75 CR	45 CR	25 CR	10 CR	10 CR
6	45 LF	35 LF	20 LF	10 LF	5 LF	3 LF
	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR
9	4 LF	4 LF	4 LF	4 LF	4 LF	0 LF
	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR

TABLE 2-7B. # TIME DELAY CHARACTERS BY SPEED(BPS) FOR ADCC (HIOTERM0)

TERM TYPE	9600 BPS	4800 BPS	2400 BPS	1200 BPS	600 BPS	300 BPS	150 BPS	110 BPS
4	4 LF	4 LF	4 LF	4 LF	4 LF	4 LF	4 LF	0 LF
	4 CR	4 CR	2 CR	0 CR	0 CR	0 CR	0 CR	0 CR
6	45 LF	45 LF	45 LF	35 LF	20 LF	10 LF	5 LF	3 LF
	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR
9	4 LF	4 LF	4 LF	4 LF	4 LF	4 LF	4 LF	0 LF
	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR	0 CR

TABLE 2-7C. # TIME DELAY CHARACTERS PER FF (ANY DELAY TERMINAL TYPE)

TERM TYPE	2400 BPS	1200 BPS	600 BPS	300 BPS	150 BPS	110 BPS
ATC	255	240	120	60	30	20
ADCC (HIOTERM0)	0	255	240	120	60	30

TERMINAL TYPE CHARACTERISTICS

The terminal type is a set of characteristics that define much of the relationship between your device and the controller. Each controller supports a subset of the terminal types available (refer to Table 2-8). Tables 2-9 through 11 show the terminal types and their characteristics for each asynchronous controller. All of the terminal types available and their associated characteristics are shown in Table 2-12.

The terminal types supported for each controller are:

TABLE 2-8. SUPPORTED TERMINAL TYPES

Controller	Device Type 16	Device Type 32
ATP and ADCC (MPE V/E)	6,9,10,12,13,15,16,18,31 or user-created	19,20,21,22 or user-created
ADCC (MPE IV or V/P)	4,6,9,10,12,13,15,16,18,31	19
ATC	0,1,2,3,4,5,6,9,10,12,13,15,16,18,31	19

TABLE 2-9. ATP AND ADCC (HIOTERM2) TERMINAL TYPES AND CHARACTERISTICS

Characteristics	Terminal Types
Page-block mode data transfers supported.	10 12 13
Formfeed characters changed to linefeed.	
ESCAPE : enables echo; ESCAPE : disables echo.	6 9 10 12 13 15 16 18
CONTROL T dumps the input buffer to the device.	
Data Flow Control Characteristics	Terminal Types
ENQ/ACK Protocol:	
ENQ and ACK used as the protocol characters.	10 12 15 16
Blocks of 80 characters between ENQ's	10 12 15 16
ENQ/ACK timeout is 10 seconds.	10 12 15 16
ENQ/ACK Timeout Actions:	
Send more data.	10 12
Send ENQ; restart timer.	15 16
Report timeout to console.	
Delay issued after each Carriage Return, Linefeed, or Formfeed.	6 9
XON/XOFF protocol enabled.	6 9 10 12 13 15 16 18 19 20 21 22
Action upon receipt of XOFF:	
Wait indefinitely.	6 9 10 12 13 15 16 18
Perform serial printer status request and act upon response.	19 20
Start XON/XOFF timer; notify console if it expires.	21 22
Before each write is completed, device status is requested to ensure that the data is received without error.	19

TABLE 2-9. ATP AND ADCC (HIOTERM2) TERMINAL TYPES AND CHARACTERISTICS (cont'd)

Character Width Characteristics	Terminal Types
7-bits only.	19 21
7 or 8 bits	6 9 10 13 16 18
8-bits only.	12 15 20 22
Read Processing Characteristics	Terminal Types
Read echo initially enabled.	6 9 10 12 15 16 18
Additional Backspace Response:	
None.	9 10 12 18
Write and delete character.	
Write Line Feed.	6 15 16
Write Space and Second Backspace.	
Write EM character	
Delete Line (<u>CONTROL</u> X) enabled.	6 9 10 12 13 15 16 18
DC1, DC3, and <u>CONTROL</u> Y removed from input data.	6 9 10 12 13 15 16 18
Linefeeds, Dels, and Nulls stripped from input data.	6 9 10 12 13 15 16 18
Reads are triggered by DC1.	6 9 10 12 13 15 16

TABLE 2-10. ADCC (HIOTERM0) CHARACTERISTICS BY TERMTYPES

Characteristics	Terminal Types
Page-block mode data transfers supported.	10 12 13
Formfeed characters changed to linefeed.	4
ESCAPE : enables echo; ESCAPE ; disables echo.	4 6 9 10 12 13 15 16 18
CONTROL T dumps the input buffer to the device.	
Data Flow Control Characteristics	Terminal Types
ENQ/ACK Protocol:	
ENQ and ACK used as the protocol characters.	10 12 15 16
Blocks of 80 characters between ENQ's	10 12 15 16
ENQ/ACK timeout is 10 seconds.	10 12 15 16
ENQ/ACK Timeout Actions:	
Send more data.	10 12
Send ENQ; restart timer.	15 16
Report timeout to console.	
Delay issued after each Carriage Return, Linefeed, or Formfeed.	4 6 9
XON/XOFF protocol enabled.	4 6 9 10 12 13 15 16 18 19 20 21 22
Action upon receipt of XOFF:	
Wait indefinitely.	4 6 9 10 12 13 15 16 18
Perform serial printer status request and act upon response.	19
Start XON/XOFF timer; notify console if it expires.	
Before each write is completed, device status is requested to ensure that the data is received without error.	19

TABLE 2-10. ADCC (HIOTERM0) TERMINAL TYPES AND CHARACTERISTICS (cont'd)

Character Width Characteristics	Terminal Types
7-bits only.	19
7 or 8 bits	4 6 9 10 13 16 18
8-bits only.	12 15
Read Processing Characteristics	Terminal Types
Read echo initially enabled.	4 6 9 10 12 15 16 18
Additional Backspace Response:	
None.	9 10 12 18
Write and delete character.	
Write Line Feed.	6 15 16
Write Space and Second Backspace.	
Write EM character	4
Delete Line ((CONTROL)X) enabled.	4 6 9 10 12 13 15 16 18
DC1, DC3, and (CONTROL)Y removed from input data.	4 6 9 10 12 13 15 16 18
Linefeeds, Dels, and Nulls stripped from input data.	4 6 9 10 12 13 15 16 18
Reads are triggered by DC1.	4 6 9 10 12 13 15 16

TABLE 2-11. ATC TERMINAL TYPES AND CHARACTERISTICS

Characteristics	Terminal Types
Page-block mode data transfers supported.	10 12 13
Formfeed characters changed to linefeed.	0 4
<u>ESCAPE</u> : enables echo; <u>ESCAPE</u> ; disables echo.	0 - 6 9 10 12 13 15 16 18
<u>CONTROL</u> T dumps the input buffer to the device.	
<u>ESCAPE</u> A, <u>ESCAPE</u> B, <u>ESCAPE</u> C, <u>ESCAPE</u> D, <u>ESCAPE</u> E, <u>ESCAPE</u> H, <u>ESCAPE</u> I, and <u>ESCAPE</u> J deleted from the input stream.	9
Data Flow Control Characteristics	Terminal Types
ENQ/ACK Protocol:	
ENQ and ACK used as the protocol characters.	10 12 15 16
Blocks of 80 characters between ENQ's	10 12 15 16
ENQ/ACK timeout is 10 seconds.	10 12 15 16
ENQ/ACK Timeout Actions:	
Send more data.	10 12
Send ENQ; restart timer.	15 16
Report timeout to console.	
Delay issued after each Carriage Return, Linefeed, or Formfeed.	0 - 6 9
XON/XOFF protocol enabled.	0 - 6 9 10 12 13 15 16 18 19
Action upon receipt of XOFF:	
Wait indefinitely.	0 - 6 9 10 12 13 15 16 18
Perform serial printer status request and act upon response.	19
Start XON/XOFF timer; notify console if it expires.	

TABLE 2-11. ATC TERMINAL TYPES AND CHARACTERISTICS (cont'd)

Data Flow Control Characteristics	Terminal Types
Before each write is completed, device status is requested to ensure that the data is received without error.	19
Character Width Characteristics	Terminal Types
7-bits only.	19
7 or 8 bits	0 - 6 9 10 13 16 18
8-bits only.	12 15
Read Processing Characteristics	Terminal Types
Read echo initially enabled.	0 - 6 9 10 12 15 16 18 31
Additional Backspace Response:	
None.	9 10 12 18
Write and delete character.	
Write Line Feed.	5 6 15 16
Write Space and Second Backspace.	
Write EM character	4
Delete Line ((CONTROL)X) enabled.	0 - 6 9 10 12 13 15 16
DC1, DC3, and (CONTROL)Y removed from input data.	6 9 10 12 13 15 16 18
Linefeeds, Dels, and Nulls stripped from input data.	0 - 6 9 10 12 13 15 16 18
Reads are triggered by DC1.	0 - 6 9 10 12 13 15 16

NOTE

Each controller supports only a subset of the possible terminal types. See Table 2-8 to see which of the following terminal types are support by your particular controller.

TABLE 2-12. TERMINAL TYPE CHARACTERISTICS

	0	1	2	3	4	5
ECHO (on/off)	ON	ON	ON	ON	ON	ON
ECHO CNTL with Esc ;;	ON	ON	ON	ON	ON	ON
Char Size (0=7,1=8)	7-BIT	7-BIT	7-BIT	7-BIT	7-BIT	7-BIT
Default Parity Check	OFF	OFF	OFF	OFF	OFF	OFF
Write Default Parity	ODD	ODD	ODD	ODD	ODD	ODD
Read Default Parity	ODD	ODD	ODD	ODD	ODD	ODD
Block Mode Support	LINE\$PAGE	LINE\$PAGE	LINE\$PAGE	LINE\$PAGE	NONE	NONE
Backspace Response Code	NULL	NULL	NULL	NULL	EM	LF
Process CNTRL X	YES	YES	YES	YES	YES	YES
Process FF	YES	YES	YES	YES	NO	YES
Check 2631B status	NO	NO	NO	NO	NO	NO
XON/XOFF Flow Cntrl	ON	ON	ON	ON	ON	ON
Strip DC1/DC3 on Read	YES	YES	YES	YES	YES	YES
Strip EN on Read	YES	YES	YES	YES	YES	YES
Strip LF on Read	NO	NO	NO	NO	NO	NO
Device Has Init. String	NO	NO	NO	NO	NO	NO
Send DC3 Before CCTL	NO	NO	NO	NO	NO	NO
2631B Esc Seq Fix	OFF	OFF	OFF	OFF	OFF	OFF
Read Trigger Char	DC1	DC1	DC1	DC1	DC1	DC1
ENQ/ACK Block Size	80 CHAR	80 CHAR	80 CHAR	80 CHAR	0 CHAR	0 CHAR
ENQ Char	ENQ(%5)	ENQ(%5)	ENQ(%5)	ENQ(%5)	NULL(0)	NULL(0)
ACK Char	ACK(%6)	ACK(%6)	ACK(%6)	ACK(%6)	NULL(0)	NULL(0)
ENQ/ACK Flow Cntrl	ON	ON	ON	ON	OFF	OFF
ENQ Timeout	10 SEC	10 SEC	10 SEC	10 SEC	0 SEC	0 SEC
ACK Timeout Action	OFF	OFF	OFF	OFF	OFF	OFF
XOFF Timer Enabled	OFF	OFF	OFF	OFF	OFF	OFF
CR delay	NONE	NONE	NONE	NONE	.3 SEC	.3 SEC
LF delay	NONE	NONE	NONE	NONE	.3 SEC	.3 SEC
FF delay	NONE	NONE	NONE	NONE	.3 SEC	.3 SEC

Asynchronous Controllers and Modems

TABLE 2-12. TERMINAL TYPE CHARACTERISTICS (cont'd)

	6	7	8	9	10	11
ECHO (on/off)	ON	ON	ON	ON	ON	ON
ECHO CNTL with Esc ;;	ON	ON	ON	ON	ON	ON
Char Size (0=7,1=8)	7-BIT	7-BIT	7-BIT	7-BIT	7-BIT	7-BIT
Default Parity Check	OFF	OFF	OFF	OFF	OFF	OFF
Write Default Parity	ODD	ODD	ODD	ODD	ODD	ODD
Read Default Parity	ODD	ODD	ODD	ODD	ODD	ODD
Block Mode Support	NONE	LINE\$PAGE	LINE\$PAGE	NONE	LINE\$PAGE	LINE\$PAGE
Backspace Response Code	LF	NULL	NULL	NULL	NULL	NULL
Process CNTRL X	YES	YES	YES	YES	YES	YES
Process FF	YES	YES	YES	YES	YES	YES
Check 2631B status	NO	NO	NO	NO	NO	NO
XON/XOFF Flow Cntrl	ON	ON	ON	ON	ON	ON
Strip DC1/DC3 on Read	YES	YES	YES	YES	YES	YES
Strip EN on Read	YES	YES	YES	YES	YES	YES
Strip LF on Read	NO	NO	NO	NO	NO	NO
Device Has Init. String	NO	NO	NO	NO	NO	NO
Send DC3 Before CCTL	YES	NO	NO	NO	NO	NO
2631B Esc Seq Fix	OFF	OFF	OFF	OFF	OFF	OFF
Read Trigger Char	DC1	DC1	DC1	DC1	DC1	DC1
ENQ/ACK Block Size	0 CHAR	80 CHAR	80 CHAR	0 CHAR	80 CHAR	80 CHAR
ENQ Char	NULL(0)	ENQ(%5)	ENQ(%5)	NULL(0)	ENQ(%5)	ENQ(%5)
ACK Char	NULL(0)	ACK(%6)	ACK(%6)	NULL(0)	ACK(%6)	ACK(%6)
ENQ/ACK Flow Cntrl	OFF	ON	ON	OFF	ON	ON
ENQ Timeout	0 SEC	10 SEC	10 SEC	0 SEC	10 SEC	10 SEC
ACK Timeout Action	OFF	OFF	OFF	OFF	OFF	OFF
XOFF Timer Enabled	OFF	OFF	OFF	OFF	OFF	OFF
CR delay	NONE	NONE	NONE	NONE	NONE	NONE
LF delay	.3 SEC	NONE	NONE	NONE	NONE	NONE
FF delay	.3 SEC	NONE	NONE	NONE	NONE	NONE

TABLE 2-12. TERMINAL TYPE CHARACTERISTICS (cont'd)

	12	13	14	15	16	17
ECHO (on/off)	ON	OFF	ON	ON	ON	ON
ECHO CNTL with Esc ::	ON	ON	ON	ON	ON	ON
Char Size (0=7,1=8)	8-BIT	7-BIT	7-BIT	8-BIT	7-BIT	7-BIT
Default Parity Check	OFF	OFF	OFF	OFF	OFF	OFF
Write Default Parity	ODD	ODD	ODD	ODD	ODD	ODD
Read Default Parity	ODD	ODD	ODD	ODD	ODD	ODD
Block Mode Support	LINE\$PAGE	LINE\$PAGE	LINE\$PAGE	LINE\$PAGE	LINE\$PAGE	LINE\$PAGE
Backspace Response Code	NULL	NULL	NULL	LF	LF	NULL
Process CNTRL X	YES	YES	YES	YES	YES	YES
Process FF	YES	YES	YES	YES	YES	YES
Check 2631B status	NO	NO	NO	NO	NO	NO
XON/XOFF Flow Cntrl	ON	ON	ON	ON	ON	ON
Strip DC1/DC3 on Read	YES	YES	YES	YES	YES	YES
Strip EN on Read	YES	YES	YES	YES	YES	YES
Strip LF on Read	NO	NO	NO	NO	NO	NO
Device Has Init. String	NO	NO	NO	NO	NO	NO
Send DC3 Before CCTL	NO	NO	NO	NO	NO	NO
2631B Esc Seq Fix	OFF	OFF	OFF	OFF	OFF	OFF
Read Trigger Char	DC1	DC1	DC1	DC1	DC1	DC1
ENQ/ACK Block Size	80 CHAR	0 CHAR	80 CHAR	80 CHAR	80 CHAR	80 CHAR
ENQ Char	ENQ(%5)	NULL(0)	ENQ(%5)	ENQ(%5)	ENQ(%5)	ENQ(%5)
ACK Char	ACK(%6)	NULL(0)	ACK(%6)	ACK(%6)	ACK(%6)	ACK(%6)
ENQ/ACK Flow Cntrl	ON	OFF	ON	ON	ON	ON
ENQ Timeout	10 SEC	0 SEC	10 SEC	10 SEC	10 SEC	10 SEC
ACK Timeout Action	OFF	OFF	OFF	ON **	ON **	OFF
XOFF Timer Enabled	OFF	OFF	OFF	OFF	OFF	OFF
CR delay	NONE	NONE	NONE	NONE	NONE	NONE
LF delay	NONE	NONE	NONE	NONE	NONE	NONE
FF delay	NONE	NONE	NONE	NONE	NONE	NONE

** 0 - RESUME WRITE W/NO ENQ 2 - REQUEST STATUS
 1 - RESUME WRITE W/SINGLE ENQ 3 - REPORT TIMEOUT ERROR

TABLE 2-12. TERMINAL TYPE CHARACTERISTICS (cont'd)

	18	19	20	21	22
ECHO (on/off)	ON	OFF	OFF	OFF	OFF
ECHO CNTL with Esc ::	ON	OFF	OFF	OFF	OFF
Char Size (0=7,1=8)	7-BIT	7-BIT	8-BIT	7-BIT	8-BIT
Default Parity Check	OFF	ON	OFF	ON	OFF
Write Default Parity	ODD	ODD	ODD	ODD	ODD
Read Default Parity	ODD	ODD	ODD	ODD	ODD
Block Mode Support	NONE	NONE	NONE	NONE	NONE
Backspace Response Code	NULL	LF	LF	LF	LF
Process CNTRL X	YES	NO	NO	NO	NO
Process FF	YES	YES	YES	YES	YES
Check 2631B status	NO	YES	YES	YES	YES
XON/XOFF Flow Cntrl	ON	OFF	OFF	OFF	OFF
Strip DC1/DC3 on Read	YES	NO	NO	NO	NO
Strip EN on Read	YES	NO	NO	NO	NO
Strip LF on Read	NO	NO	NO	NO	NO
Device Has Init. String	NO	YES	YES	YES	YES
Send DC3 Before CCTL	NO	NO	NO	NO	NO
2631B Esc Seq Fix	OFF	OFF	OFF	ON	ON
Read Trigger Char	(0)NULL	(0)NULL	(0)NULL	(0)NULL	(0)NULL
ENQ/ACK Block Size	0 CHAR	0 CHAR	0 CHAR	0 CHAR	0 CHAR
ENQ Char	NULL(0)	NULL(0)	NULL(0)	NULL(0)	NULL(0)
ACK Char	NULL(0)	NULL(0)	NULL(0)	NULL(0)	NULL(0)
ENQ/ACK Flow Cntrl	OFF	OFF	OFF	OFF	OFF
ENQ Timeout	0 SEC	0 SEC	0 SEC	0 SEC	0 SEC
ACK Timeout Action	OFF	OFF	OFF	OFF	OFF
XOFF Timer Enabled	OFF	OFF	OFF	OFF	OFF
CR delay	NONE	NONE	NONE	NONE	NONE
LF delay	NONE	NONE	NONE	NONE	NONE
FF delay	NONE	NONE	NONE	NONE	NONE

INPUT MODES AND TERMINAL EDITING

Commands and data can be input to the computer in Character Mode or in Block Mode. The significant differences between Character Mode and Block Mode are summarized in Table 2-13. Record Separator or Group Separator are those characters typically defined by software to be End-of-Record characters in page block mode.

TABLE 2-13. COMPARISON OF CHARACTER AND BLOCK MODES

Feature	Character Mode	Page Block Mode
Standard End-of-Record Character	Carriage Return	Record Separator or Group Separator for HP Terminals
EOR Character with Transparent Editing	Character Defined in FCONTROL (25) and in FCONTROL (41).	Record Separator or Group Separator for HP Terminals
Pacing Methods	Input: DC1-data. Output: ENQ/ACK XON/XOFF	Input: (DC1-DC2-DC1)-data Output: ENQ/ACK XON/XOFF
Echo Facility	Full-Duplex: Enabled Half-Duplex: Disabled	Disabled
System Break	OK to Use	Should not be used. When the computer sees a break, it assumes the terminal is operating in Character Mode.
Subsystem Break	OK to Use	Should be used at the end of the data. If it is used in the middle of the data, it can cause the data to overrun the interface.

Standard Editing

In Character Mode, all of the keys listed in Table 2-14 can be used in terminal editing. However, do not include any of the editing characters in the input data stream when using input devices with speeds greater than 20 characters per second (independent of line speed) and note that AUTO LF can only be used with MPE V/E (version 6.00.00 or later) systems.

In Block Mode, all of the HP terminal editing keys can be used when preparing data for input. However, avoid embedding control characters within the data. Because bursts of data are sent to the computer, the interface frequently does not have time to interpret and respond to control characters embedded within the data, with resulting data overruns and I/O errors. The interface *may* be able to process one or two characters at the end of the data.

For both Character and Block Modes, do not transmit long strings of special characters with function keys. Avoid programming type N or T function keys with either a high density of special characters in a given string or more than two special characters in a row. This could cause data overruns and an I/O error.

TABLE 2-14. SPECIAL CONTROL FUNCTIONS--STANDARD EDITING

Key	Function
BACKSPACE or CONTROL H	Deletes previous character from the current input line. The response of the terminal depends on the TermType and the type of terminal. HP264x and HP262x terminals connected to the port with the TermType 10 backspace the cursor once each time the key is pressed.
BREAK	Requests system break, suspending current program and returning control to MPE. Will cause loss of some data if program is writing to terminal at the same time as the BREAK is pressed.
CONTROL A	On the system console, or where console has been moved (logical console) via the :CONSOLE command, it indicates that a console command follows.
CONTROL F (ACK)	The Acknowledge character for the Enquiry/Acknowledge handshake. HP terminals transmit it automatically.
CONTROL Q (DC1 or XON)	Causes the writing of output to the terminal to be resumed (after its suspension by CONTROL S).
CONTROL R (DC2)	Significant for terminals with Block Mode, only. Indicates that the terminal is ready to transmit a block of data. HP terminals strapped for Page Block Mode operation automatically send a DC2 when ENTER is pressed (or when RETURN , defined as the ENTER key, is pressed).
CONTROL S (DC3 or XOFF)	Causes writing of output to the terminal to be suspended. (CONTROL Q used to resume.)

TABLE 2-14. SPECIAL CONTROL FUNCTIONS--STANDARD EDITING (cont'd)

Key	Function
(CONTROL)X	Deletes all of current line being typed. The computer sends three exclamation points (!!!), followed by a Carriage Return and a Line Feed. You may enter a new line after deleting the old line.
(CONTROL)Y	Requests a subsystem break. (Use during execution of some part of a program to halt that execution and obtain a program prompt.) ATC only: If your terminal is in Tape Mode, (CONTROL)Y returns it to Normal Mode.
LINEFEED (LF) or (CONTROL)J	ADCC, ATC, and ATP: For MPE V/E, on terminals with a Line Feed key, pressing the key causes the computer to write a Carriage Return. This facility is primarily for those terminals that do not have an automatic line wrap-around feature. When input record is longer than width of terminal line, the LF character may be included so that input will be displayed on more than one line. In this way, the overstrike of characters in the last column position of the terminal will be avoided.
(RETURN) or (CONTROL)M	Normal end-of-record character. When echoed to terminal, causes cursor or typing head to return to the beginning of the line.
(CONTROL)R(RETURN) (two character sequence)	When embedded anywhere in the input stream, this character pair and all data up to and including the CR are stripped and a DC1 ((CONTROL)Q) is written to the terminal.
(ESCAPE) : (two character sequence)	Causes Echo to be turned on, so characters typed at terminal are echoed back to the terminal. DO NOT USE while your terminal is operating in Block Mode.
(ESCAPE) ; (two character sequence)	Causes Echo to be turned off, so characters typed at the terminal are not echoed back to the terminal. Echo should be turned off in Block Mode.

Binary Editing

In Binary Editing, no special characters are recognized, except **(CONTROL)A** on the console. All data you type in at your terminal (control characters or others) is passed by the interface to the user's Terminal Buffers. Your input is terminated by read timeout or the number of characters input, rather than by some control character (such as Carriage Return). Consult documentation on your program for more information.

Transparent Editing

Sometimes the program you are running will switch your port to Transparent Editing Mode. During Transparent Editing, all control characters except those produced by the keys listed in Table 2-15 are left in your input data stream (and hence, are not acted upon by the asynchronous interface).

TABLE 2-15. SPECIAL CONTROL FUNCTIONS--TRANSPARENT EDITING

Key	Function
(RETURN)	When Echo is enabled, it causes the cursor or typing head to return to the beginning of the same line. The character that indicates the end-of-record is defined programmatically. In Transparent Editing Mode, the Line Feed character is not sent to the terminal upon receipt of the Carriage Return character.
(CONTROL)F(ACK)	The Acknowledge character for the Enquiry/Acknowledge handshake, if enabled; otherwise, it is a data character.
(BREAK)	Causes a system break (when enabled) and transfers control to MPE. When :RESUME is entered, Transparent Editing is resumed.
(CONTROL)A	On system console, indicates that the next input will be a console command. When command execution is complete, Transparent Editing is restored.
(CONTROL)Q (DC1 OR XON)	The "Resume Output" character is the XON/XOFF handshake. This character is stripped from the input data.
(CONTROL)R (DC2)	When input as first character, it is stripped out. A DC1 ((CONTROL)Q) is then written to the terminal. When not input as the first character, DC2 is a data character.
(CONTROL)S (DC3 OR XOFF)	The "Halt Output" character of the XON/XOFF handshake. This character is stripped from the input data.

RECOMMENDED MODEMS

Hewlett-Packard does not recommend the use of half-duplex modems. Full-duplex modems are recommended at one of the (or equivalent) speeds shown in Table 2-16.

TABLE 2-16. RECOMMENDED ASYNCHRONOUS FULL-DUPLEX MODEMS

Modem	Baud Rate Supported	Notes
BELL 103J	ATP: 110, 300 ADCC: 150, 300 ATC: 110, 150, 300	Dial-up, auto-answer.
BELL 202T	ATP: 110, 300, 600, 1200 ADCC: 300, 600, 1200 ATC: 110, 150, 300, 600, 1200	4-wire leased line. For logon at 600 baud ADCC (HIOTERM0) ports must be configured Subtype 5 (speed-specified, full duplex modem port). Also, can log on at another speed and use :SPEED command to change to 600 baud.
BELL 212A	ATP: 110, 300, 1200 ADCC: 150, 300, 1200 ATC: 110, 150, 300, 1200	Dial-up, auto-answer. Use at 1200 baud with HS (High Speed) switch on; other baud rates with HS switch off.
HP 13265A	ATP: 110, 300 ADCC: 150, 300 ATC: 110, 150, 300	Dial-up. Compatible with the Bell 103 modem.
HP 35016A	ATP: 110, 300, 1200 ADCC: 150, 300, 1200 ATC: 110, 150, 300, 1200	Dial-up. Compatible with Bell 103, 212, and Racal-Vadic VA 3400 modems. At 1200 baud, the HS switch must be on. If ordering through Racal-Vadic, use model number VP3451PA.
HP 35141A (SUPPORT LINK)	ATP: 110, 300, 1200 ADCC: 150, 300, 1200 ATC: 110, 150, 300, 1200	Auto-dial/auto-answer. Compatible with Bell 103 and 212 modems. If ordering through Racal-Vadic, use model number VP212HA.

Asynchronous Controllers and Modems

TABLE 2-16. RECOMMENDED ASYNCHRONOUS FULL-DUPLEX MODEMS (con't)

Modems	Baud Rate Supported	Notes
HP 37212A	ATP: 110, 300, 1200 ADCC: 150, 300, 1200 ATC: 110, 150, 300, 1200	Dial-up, auto-answer. Compatible with Bell 103 and 212 modems, as well as CCITT V.22 protocol.
HP 92205A	ATP: 110, 300, 1200 ADCC: 150, 300, 1200 ATC: 110, 150, 300, 1200	Hayes Smartmodem 1200. Auto-dial and/or auto-answer. Compatible with Bell 103 and 212 modems.
VA 3400	ATP: 1200 ADCC: 1200 ATC: 1200	Dial-up or 2-wire leased line. NOT Bell compatible.
VADIC 34XX Series	ATP: 110, 300, 1200 ADCC: 150, 300, 1200 ATC: 110, 150, 300, 1200	Several modems available, each compatible with the VA 3400 modem. Most are compatible with either or both of Bell 103 and 212 modems.

When a dial-up modem is used, the terminal operator will not be able to change the baud rate after logging on. The use of the :SPEED command with dial-up modems is not recommended.

All of these modems (in Table 2-16) pass through any parity bits they receive. Refer to the appropriate modem manuals and local telephone company for strapping information. Refer to "Modem Options" for a summary of options for HP and Bell modems.

MODEM OPTIONS

Following are the recommended asynchronous modems and options to be used in conjunction with the ATC, ADCC, and ATP. For further definition of these options/modem capabilities refer to the appropriate Hewlett-Packard or Racal-Vadic modem reference manual, or to the relevant *Bell System Technical Reference* publication that is available from your local Bell System Representative.

HP MODEMS

HP 13265A

Direct connect, full duplex, originate only modem with 300 baud rate. Compatible with Bell 103/113 modems or equivalent. Cable is a 50-pin connector for use with HP 262X terminals. For HP 264X terminals, the 02640-60239 asynchronous datacomm board is required; order option 001 for the cable with a 30-pin hooded connector.

For more information, refer to the *HP 13265A User's Manual* (13265-90001).

HP35016A and VADIC 3451P/A

TABLE 2-17. RECOMMENDED HP, VADIC MODEM OPTIONS

Option	Description	Recommendation
A1	Attended Disconnect	ON
A2	Respond to Remote Test Enable	ON
A3 & A5	Character Length - 10 bits	A3 ON, A5 OFF
A4	103 Operation Enabled	ON
A6	Standard Options Mode Disabled	OFF
A7	Loss of Carrier Disconnect Disabled	OFF
B1	Remote DLB Select	ON
B2	Controlled by DTE	OFF
B3	Originate/Answer	OFF
B4	Maximum Data Rate 1205 BPS	OFF
B5	Auto Disconnect/Abort Timer Enabled	ON
B6	Data Timing Asynchronous	OFF
B7	Data Set Ready in Test DSR ON	OFF
W1-W5	Top Board Straps	OUT

HP 35141

This modem is provided with each HP 3000. For more information, refer to the *HP Support Link User's Guide* (35141-90001).

Operating Modes	Automatic or manual originate and/or answer.
Data Format	Serial, binary, asynchronous
Data Rate	212 Mode: 1170 to 1212 bps 103 Mode: 0 to 300 bps
Interface	RS-232-C

TABLE 2-18. STANDARD OPTION SETTINGS FOR HP 35141

Option No.	Name	Standard Setting	Code
01	Standard Options	Enabled	01*1
02	Data Format	Asynchronous	02*1
03	Data Rate Select	Modem control	03*2
04	103 Operation	212/103	04*1
05	Character Length	10 bits	05*3
06	Originate/Answer Mode	Originate/Answer	06*1
07	Slave Clock	Disabled	07*2
08	DTR Control	Terminal Control	08*2
09	Disconnect Control	Unattended	09*2
10	Carrier Disconnect	Enabled	10*1
11	Space Disconnect	Disabled	11*2
12	Space on Disconnect	Disabled	12*2
13	Abort Timer Disconnect	Enabled	13*1
14	Respond to Remote Test	Enabled	14*1
15	DSR Control	Forced ON	15*3
16	CXR Control	Forced ON	16*1
17	Linking	Enabled	17*1
18	ALB From Terminal	Disabled	18*3
19	Auto Answer	Enabled	19*1
20	Terminal Bell	Enabled	20*1
21	Local Copy	Enabled	21*1
22	Dial Mode	Auto Select	22*3
23	Blind Dialing	Disabled	23*2
24	Call Progress Detect	Enabled	24*1
25	Failed Call Delay	60 seconds	25*2
26	Auto Redial	Disabled	26*9

Bell Modems

Bell 103J and 113D Modems

0-300 Bits/sec, Asynchronous
Full duplex on 2-wire operation
Works with another 103/113 or equivalent modem, or with another
212A or equivalent modem.

TABLE 2-19. RECOMMENDED 103J/113D MODEM OPTIONS

Option	Description	Computer	Terminal
A1	Send Space Disconnect	X	X
B3	Receive Space Disconnect	X	X
C5	Loss of Carrier Disconnect	X	X
D7	Fail Safe State on CN Circuit OFF	X	X
E9	Auto Answer YES	X	

Bell 202S Modem

Asynchronous, half duplex, with Reverse Channel, in switched network applications.
 Speed 1200 bits per second.
 Not supported on an HP 3000/4X/6X.

TABLE 2-20. RECOMMENDED 202S MODEM OPTIONS

Option	Description	Computer	Terminal
A1 A2	Local copy on primary No local copy on primary	X	X
B3 B4	Local copy on Reverse No local copy on Reverse	(Note 1)	
C5	Telephone company engineer timing options	X	X
D8	Data Set Ready Interface lead OFF in Analog loopback test mode	X	X
E9 E10	Automatic Answer IN (Note 2) Automatic Answer OUT (Note 2)	X	X
F11	Signal ground connected to Frame Ground	X	X

1. If terminal has internal echo capability to provide local copy use B4, otherwise specify B3 for local copy.
2. Auto answer depends on application. Generally, the terminal is dialed manually, and the computer auto answers.

Asynchronous Controllers and Modems

Bell 202T-L1A Modem

Asynchronous Modem, provides Self Test, Analog Loopback and Remote Test capabilities.

Generally, used with HP 3000 at 1200 bits per second; full duplex on normal 3002 channel 4-wire service (no reverse channel).

Subtype 4 is preferred for configuration without speed sense. (Subtype 0 may also be used, however, when noisy line or power failure may cause potential trouble with speed sense.)

TABLE 2-21. RECOMMENDED 202T-L1A MODEM OPTIONS

Option	Description	Computer	Terminal
A2	No local copy on primary channel	X	X
B4	No local copy on reverse channel	X	X
C5	Telephone company engineer timing options	X	X
D7	Telephone company engineer control options	X	X
E10	Reverse channel not installed	X	X
F11	Signal Ground connected to Frame Ground	X	X

BELL 212A Modem

0-300 bits per second asynchronous

1200 bits per second asynchronous

Compatible with 103/113 type modem at 300 bits per second, and 212 type modem at 1200 bits/second full duplex type operation.

Use subtype 1 or 5.

TABLE 2-22. RECOMMENDED 212A MODEM OPTIONS

Option	Description	Computer	Terminal
A2	Customer selected disconnect options a. Send space disconnect b. Receive space disconnect c. Loss of carrier disconnect	IN OUT IN	OUT IN don't care
B3	Automatic Answer	YES	
C6	Customer selected EIA interface a. Data set ready (CC) indication for analog loop b. Clear to send (CB) and carrier (CF) indications c. Signal ground to frame d. Answer mode indication (CE) e. Interface speed indication f. Speed control g. Interface controlled DL h. CN & TM assignments	OFF COMMON IN OFF OUT HS OUT CN-25	OFF COMMON IN OFF OUT HS OUT CN-25
D8	Customer selected modes a. 1200 bps operation b. Character length c. Transmitter timing d. Speed mode e. Receiver responds to DL	ASYN 10 INT DUAL OUT	ASYN 10 INT DUAL don't care
E10	Make Busy/Analog Loop (CN) circuit disabled	OUT	OUT
F11	TELCO Option Table tip-ring make busy	don't care	IN

ATP/ADCC/ATC CABLES

Whether a device is connected directly or through a modem, the connection mode determines the kind of cabling that must be used. To directly connect an RS 232 device to the ATP, ADCC, or the ATC, three wires are needed; one for a transmit line, one for a receive line, and one for a ground line. To directly connect an ATP to an RS 422 interface connection requires two wires for transmission, two for reception, and one for grounding. Modem connections require cables that conform to the Hewlett-Packard implementation of the RS-232-C, V.21 or V.23 interface standards. To ensure proper performance, be sure to consult the manuals for the equipment you are connecting via cable. Check closely the specification for the maximum cable length.

Hewlett-Packard sell cables for all supported connections (refer to Table 2-23). Consult the *Computer User's Catalog* for ordering information. Hewlett-Packard does not guarantee the proper operation of devices connected through custom-built cables.

RS-232-C Cables

Refer to Figure 2-1 for diagrams of the connectors designated as 1M, 2F, 3 (M and F), 4 (M and F), 5, 6 (M and F) and 7 (M and F). In the tables below, the cable part numbers shown first are to be used to order replacement cables. For your reference, the part numbers given below in parenthesis are the numbers used when ordering the cable as part of a new system installation.

Cable Manufacturing Specifications

The specification establishes requirements for a 3 or 25 pin conductor external low voltage unshielded computer cable with overall jacket: U.L. style 2560. The maximum length for an RS-232-C specified cable is 50 feet.

Electrical

Voltage Rating 30V for Class 2 wiring systems only (220V rms test between conductors).

Mechanical

Singles	Three or twenty-five 26 (7 x 34) AWG tinned copper; tinned after stranding.
Insulation	PVC, seven-mil minimum wall thickness; rated at +60°C.
Cable Lay	Twist singles for flexibility.
Jacket	Fillers, cloth or nylon binding may be used for a smooth, round construction.
Color	PVC, 35-mil minimum wall thickness; rated at +60°C. Jade Gray per Visual Color Std., HP Part No. 6009-0021.

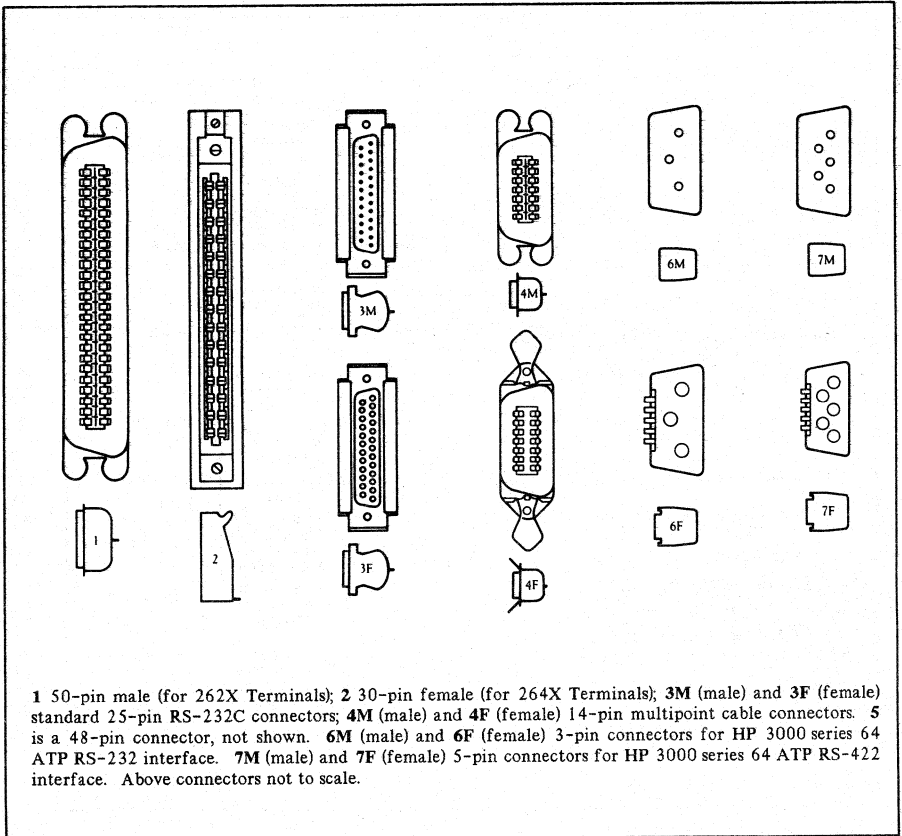
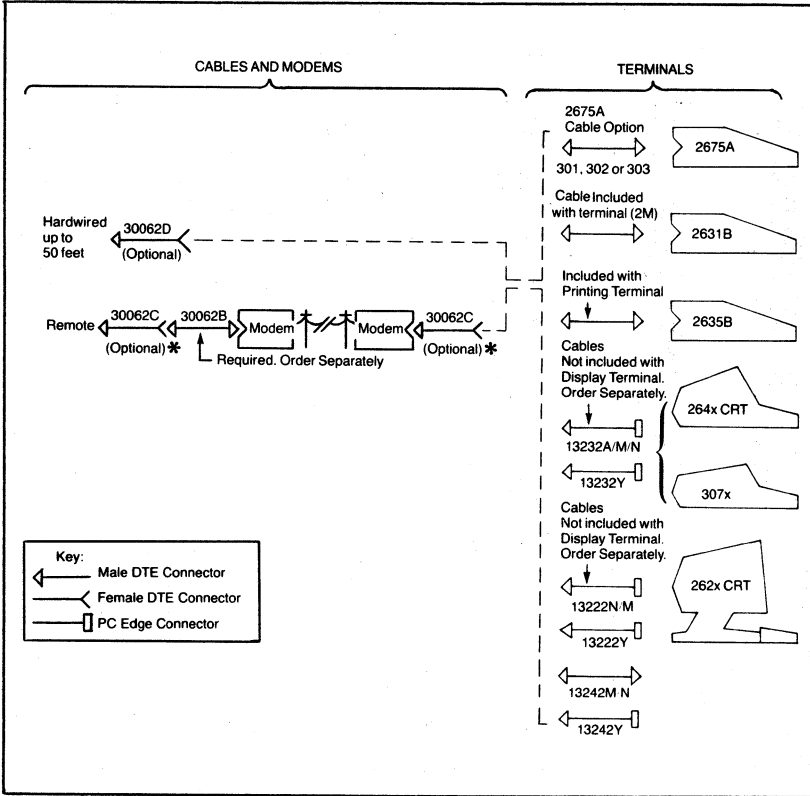


Figure 2-1. Diagrams of Common Cable Connectors

Asynchronous Controllers and Modems



*Only option 001 is supported for RS-232-C distance specifications.

Figure 2-2. Point-to-Point Cable Configurations

TABLE 2-23. HP 262X or HP 125 (Both Port 1) (Not for HP 2621, 2629L, 2382A)

Part Number	Length	Description
13222-60001 (13222N)	16.7 ft. (5 m)	Cable: 50-pin 1M to 25-pin 3M. Used with U. S. modems Bell 103A, 202C/D/S/T, 212A, and with Vadic 3400 signal compatible acoustic couplers. Also used with HP 1000 and HP 3000 System multiplexers.
92217A	50 ft. (15 m)	Longer 13222N cable.
13222-60002 (13222M)	16.7 ft. (5 m)	Cable: 50-pin 1M to 25-pin 3M. Used with European 103 or 202C type modems. Shielded.
92217B	50 ft. (15 m)	Longer 13222M cable.
13222-60003 (13222C)	6.6 ft. (2 m)	Cable: 50-pin 1M to 25-pin 3F. Used for standard RS-232-C communications.
92217C	50 ft. (15 m)	Longer 13222C cable.
13222-60005 (13222Y)	16.7 ft. (5 m)	Cable: 50-pin 1M to 25-pin 3M. Three-wire cable with EMP protection for terminal from lightning-induced transients.
92217E (13222X)	16.7 ft. (5 m)	Cable: 50-pin 1M to 25-pin 6M. Used as an RS-232-C interface cable for an HP 3000 Series 6X ATP.

TABLE 2-24. MODEM CABLES

Part Number	Length	Description
30062-60020 (30062B)	25 ft. (7.6 m)	Cable, 25-pin 3M to 25-pin 3M. Connects an HP 3000 to modem types Bell 103 and 202S.
30062-60061 (30062B, Opt. 001)	50 ft. (15 m)	Cable, 25-pin 3M to 25-pin 3M. Connects an HP 3000 to modem types Bell 103 and 202S.
5061-2403 (13232U)	5 ft. (1.5 m)	Modem Eliminator Cable: 25-pin 3F to 25-pin 3F. Bypasses modem and connects an HP 13232P cable to an HP 1000, to an HP 3000, or to another terminal. Unshielded.

Asynchronous Controllers and Modems

TABLE 2-25. HP 262X, HP 125 (Both Port 2), HP 2621,2629L,2382A,120,150

Part Number	Length	Description
13242-60001 (13242N)	16.7 ft. (5 m)	Cable: 25-pin 3M to 25-pin 3M. Used with HP 1000 or HP 3000 Systems, with U. S. modems Bell 103A, 202C/D/S/T, 212A, and with Vadic 3400 modems; acoustic couplers (signal compatible only). Shielded.
92218A	50 ft. (15 m)	Longer 13242N cable.
13242-60002 (13242M)	16.7 ft. (5 m)	Cable: 25-pin 3M to 25-pin 3M. Used with European 202C-type modems. Shielded.
92218A	50 ft. (15 m)	Longer 13242M cable.
13242-60005 (13242Y)	16.7 ft. (5 m)	Cable 25-pin 3M to 25-pin 3M. Three-wire cable with EMP protection for terminal from lightning-induced transients.
92218C	50 ft. (15 m)	Longer 13242Y cable.
92218D (13242X)	16.7 ft. (5 m)	Cable: 25-pin 3M to 3-pin 6M. Used as an RS-232-C interface cable for an HP 3000 Series 6X ATP.
13242-60010 (13242G)	16.7 ft. (5 m)	Cable: 25-pin 3M to 25-pin 3M. Used with RS-232-C compatible serial printers such as HP 2601/2631/2635. Shielded.
13242-60011 (13242H)	16.7 ft. (5 m)	Cable: 25-pin 3M to 25-pin 3F. Used with RS-232-C compatible serial printers. Shielded.
40242-60002 (40242Z)	16.7 ft. (5 m)	Cable: 25-pin 3F to 25-pin 3M. RFI-filtering modem bypass cable used for HP 2621B and HP 2629L terminals.
40242-60003 (40242C)	16.7 ft. (5 m)	Cable: 25-pin 3F to 25-pin 3M. RFI-filtering extender cable used with HP 2621B and HP 2629L terminals.
40242-60004 (40242M)	16.7 ft. (5 m)	Cable: 25-pin 3M to 25-pin 3M. RFI-filtering modem cable used with HP 2621B and HP 2629L terminals.

TABLE 2-26. HP 264X POINT-TO-POINT TERMINALS

Part Number	Length	Description
02640-60043 (13232A)	15 ft. (4.5 m)	Cable: 30-pin 2F to 25-pin 3M. Used with U. S. modems Bell 103A, and 202C/D/S/T; signal-compatible acoustic couplers. Also used with HP 1000 and HP 3000 System multiplexers.
92219A	50 ft. (15 m)	Longer 13232A cable.
02640-60131 (13232N)	15 ft. (4.5 m)	Cable: 30-pin 2F to 25-pin 3M. Used with U. S. modems Bell 103A, 202C/D/S/T, and 212A, and with Vadic 3400; signal-compatible acoustic couplers. Also used with HP 1000 and HP 3000 System multiplexers.
92219B	50 ft. (15 m)	Longer 13232N cable.
5061-2409 (13232M)	15 ft. (4.5 m)	Cable: 30-pin 2F to 25-pin 3M. Used with European 202C-type modems.
92219C	50 ft. (15 m)	Longer 13232M cable.
02640-60059 (13232C)	5 ft. (1.5 m)	Cable: 30-pin 2F to 25-pin 3F. Used with standard asynchronous direct connect to non-HP computer.
92219D	50 ft. (15 m)	Longer 13232C cable.
02640-60128 (13232Y)	15 ft. (4.5 m)	Cable: 30-pin 2F to 25-pin 3M. Three-wire cable with EMP protection for terminal from lightning-induced transients.
92219E	50 ft. (15 m)	Longer 13232Y cable.
92219F (13232X)	16.7 ft. (5 m)	Cable: 30-pin 2F to 3-pin 6M. Used as an RS-232-C interface cable for an HP 3000 Series 6X ATP.

TABLE 2-27. RS-232-C EXTENSION CABLES.

Part Number	Length	Description
17355A	9 ft. (2.3 m)	Cable: 25-pin 3M to 25-pin 3M. Pins 1-25 wired end-to-end.
31391A (30062C)	16.7 ft. (5 m)	Cable: 25-pin 3F to 25-pin 3M.
31391B	33.4 ft. (10 m)	Longer 30062C cable.
31391C (30062C, Opt. 001)	50 ft. (15 m)	Longer 30062C cable.
30062-60012 (30062C, Opt. 002)	100 ft. (30 m)	Cable: 25-pin 3F to 25-pin 3M. Pins 1-25 wired end-to-end, unshielded.
92219G	12.5 ft. (3.8 m)	Cable: 25-pin 3M to 25-pin 3M. Pins 1-8, 11, 12, 19, 20, 22, 23, 25 wired end-to-end.
30062-60018 (30062D)	25 ft. (7.6 m)	Cable: 25-pin 3F to 25-pin 3M. Hardwire extension; pins 2, 3, 7 wired end-to-end.
92215A	50 ft. (15 m)	Longer 30062D cable.
30152-60001 (30152A)	16.7 ft. (5 m)	Cable: 25-pin 3F to 3-pin 6M; the 3F is a <i>block</i> RS-232-C connector. Used as an adapter cable between an HP 3000 Series 64 ATP and an existing RS-232-C terminal cable.
30153-60001 (30153A)	50 ft. (15 m)	Cable: 3-pin 6F to 3-pin 6M. Used as an extension cable for an HP 3000 Series 6X ATP RS-232-C interface.

RS-422 Cables

5 Pin RS422 Hardwire or Extension Cable for ATP

The specification establishes requirement for a 5 conductor shielded cable - UL styles 2464 and 1061. The maximum length for an RS-422 cable is 4000 feet.

Electrical

Voltage Rating	300V for class 2 wiring system, rms @80oC (1000V rms between conductors and conductors to shield).
Conductor Resistance, DC	<30 ohms/1000 ft.
Mutual Pair Capacitance	<=22 pf between wires in pair.
Stray Capacitance	<=40 pf between one wire and all others (grounded)
Pair-to-Pair Balanced Crosstalk	>=40 dB of attenuation at 150KHz between any two pairs.

Mechanical

Singles	Two twisted pairs plus one single AWG 24(7X32) tinned, stranded copper.
Insulation	PVC
Colors	One conductor of each twisted pair - white; the other conductors - blk, brn. Single conductor - red.
Cable Lay	Twist the twisted pairs around the single.
Shield (Inner)	Metallized polyester; metalization facing outward
Shield (Outer)	Braid from AWG 36 tinned copper for 85% minimum coverage.
Jacket	PVC, 35 mil minimum wall thickness.
Color	Pearl Gray cabinet per HP Visual Color Standard 6009-0108.

TABLE 2-28. HP 3000 SERIES 6X ATP, RS-422 CABLES

Part Number	Length	Description
30154-60001 (30154A)	100 ft. (30 m)	Cable: 5-pin 7M to 5-pin 7F. Extender cable for connecting an HP 3000 Series 6X ATP and an RS-422 interface cable.
92216A (13222P)	16.7 ft. (5 m)	Cable: 50-pin 1M to 5-pin 7M. Used with HP 262X terminals. Five-wire cable for terminal to an HP 3000 Series 6X ATP, RS-422.
92216B (13232I)	16.7 ft. (5 m)	Cable: 30-pin 2F to 5-pin 7M. Used with HP 264X terminals. Five-wire cable for terminal to an HP 3000 Series 6X ATP, RS-422.
92216C	16.7 ft. (5 m)	Cable: 37-pin 5M to 5-pin 7M. Used with HP2688 printer. Five-wire cable for printer to an HP 3000 Series 6X ATP, RS-422.
13242P	16.7 ft. (5 m)	Cable: 5-pin 7M to 25-pin 3M. Used with 293x printers, 2686A printer, and 2392A terminal.

Cable Construction

Construction instructions for cable assemblies for the ATP are in the *Point-to-Point Workstation I/O Reference Manual*, (Appendix D). Recommended tools, parts ordering information, pin diagrams, assembly procedures, and testing information are included. The following cable assemblies are covered:

- Three-pin male ATP to 25-pin female RS-232-C adapter cable,
- Three-pin male ATP to three-pin female RS-232-C extension cable,
- Five-pin male to five-pin female RS-422 extension cable.

NOTE

For more information, refer to the *Data Terminals Cabling Manual (P/N 02640-90185)*

U. S. Modem Cable (30-pin 2F to 25-pin 3M)

COMPUTER OR MODEM (DCE)		TERMINAL (DTE)
(BA) SEND DATA	-2 ← 2	-SEND DATA (BA)
(BB) RECEIVE DATA	-3 → 3	-RECEIVE DATA (BB)
(CA) REQUEST TO SEND	-4 ← 4	-REQUEST TO SEND (CA)
(CB) CLEAR TO SEND	5 → 5	CLEAR TO SEND (CB)
(CC) DATA SET READY	-6 → 6	-DATA SET READY (CC)
(AB) COMMON RETURN	-7 ← 7	-COMMON RETURN (AB)
(CF) CARRIER DETECT	-8 → 8	-CARRIER DETECT (CF)
(SCF) SECONDARY CARRIER DETECT	-12 → 12	SECONDARY CARRIER -DETECT (SCF)
(SDA) SECONDARY REQUEST TO SEND	-19 ← 19	SECONDARY REQUEST -TO SEND (SCA)
(CD) DATA TERMINAL READY	-20 ← 20	-DATA TERMINAL READY (CD)
(CH) FREQUENCY SELECT	-23 → 23	-FREQUENCY SELECT (CH)
	MALE	FEMALE

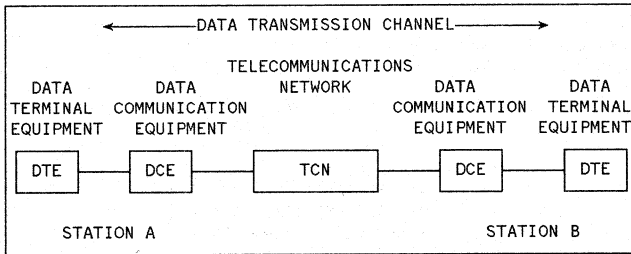
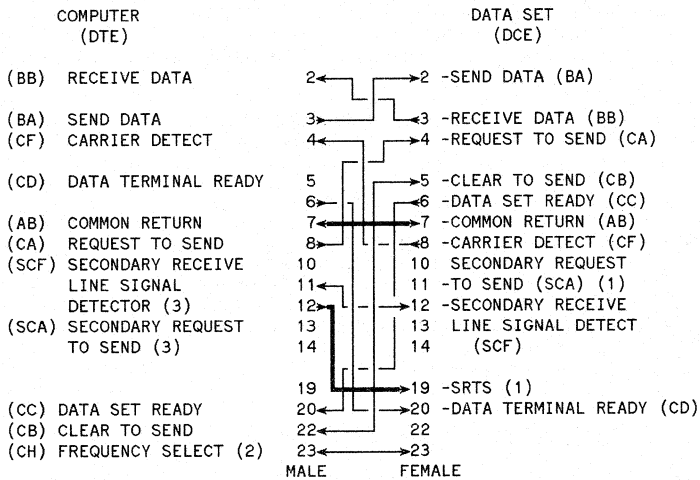


Figure 2-3. Communications Network Components

Modem Connect (25-pin 3M to 25-pin 3M)

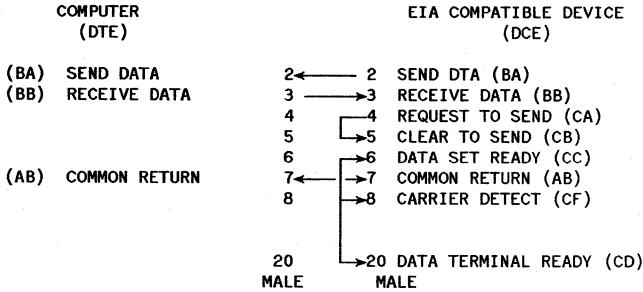


1. Required for 202S data sets only - physically strapped together in the modem. The DTE (refer to Figure 2-2) can control SCA from either pin 11 or pin 19.
2. European modems only.
3. For 202C modems; Pin 11 is Supervisory Transmitted Data (SBA) at the DCE. Pin 12 is Supervisory Receive Data (SBB) at the DCE. Cross connect pins 11-12 and 12-11.

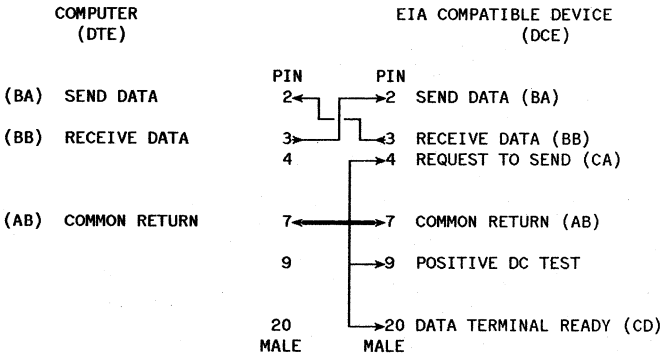
Asynchronous Controllers and Modems

Special Cables

For unsupported terminals directly connected on an ATC that need RS232C signals -- configure as subtype 4, and construct cable as follows:



To cable terminals on an ADCC 202T modem -- configure as subtype 0 and construct using the following special cable:



SELECTED MPE INTRINSICS**TABLE 2-29. FCONTROL CONTROL CODES**

Codes	Function
1	To cause a carriage control directive to be sent to the terminal or printer.
4	To set an FREAD timeout value.
10	To change device input speed.
11	To change device output speed.
12	To enable character echoing.
13	To disable character echoing.
14	To disable the System Break function.
15	To enable the System Break function.
16	To disable the Subsystem Break function.
17	To enable the Subsystem Break function.
18	To disable Tape Mode (Series II and III only).
19	To enable Tape Mode (Series II and III only).
20	To disable the timer that measures the duration of FREAD.
21	To enable the FREAD duration timer.
22	To read the results of an FCONTROL call made with a control code of 21.
23	To disable parity checking.
24	To enable parity checking.
25	To define line-termination characters for terminal input. Refer to Table 2-27.
26	To disable Binary Editing Mode.
27	To enable Binary Editing Mode.
28	To disable Block Mode processing by the user program.
29	To enable Block Mode processing by the user program.

TABLE 2-29. FCONTROL CONTROL CODES (cont'd)

Codes	Function
34	To print !!! at the terminal when an input line is deleted.
35	To block printing of !!! at the terminal when an input line is deleted.
36	On Series II/III, to enable parity generation, but not parity checking, by the port. On Series 3X/4X/6X, to determine the current parity. Refer to Table 2-28.
37	To allocate a non-:JOB and non-:DATA-accepting terminal.
38	To set the Terminal Type. You must call FDEVICECONTROL for a user-defined terminal type.
39	To determine the current Terminal Type. On Series 3X/4X/6X, MPE V or later, a value of 0 is returned for user-defined terminal types.
40	To determine the current device output speed.
41	To enable Transparent Editing Mode.
43	To abort a pending NO-WAIT I/O request.

A large majority of FCONTROL codes affect all files open on a device. Consequently, when you close the file named in one of these calls, the action of the FCONTROL call will still be in effect for the other files. Only five apply to the file whose file number was used in the call. Table 2-26 shows the scope of each of the FCONTROL control codes:

TABLE 2-30. AFFECTS OF CONTROL CODES

FCONTROL Codes Affecting <i>all</i> Files on the Device	FCONTROL Codes Affecting <i>only</i> the File Specified in the FCONTROL Call
4, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 34, 35, 36, 37, 38, 39, 40, 41, 43	25, 26, 27, 28, 29

When the device is closed, all parameters are reset to defaults. (Refer to "Actions on FCLOSE" for device close actions.)

The following characters may not be defined as alternate End-of-Record characters for devices attached to any of the port controllers:

TABLE 2-31. UNRECOGNIZED ALTERNATE EOR CHARACTERS

ASCII Character	Terminal Keys	Octal Code
NUL (Null)	CONTROL @	%0
BS (Backspace)	CONTROL H	%10
LF (Line Feed)	CONTROL J	%12
CR (Carriage Return)	CONTROL M	%15
DC1 (XON)	CONTROL Q	%21
DC2	CONTROL R	%22
DC3 (XOFF)	CONTROL S	%23
CAN (Cancel)	CONTROL X	%30
EM (End of Medium)	CONTROL Y	%31
ES (Escape)	CONTROL[	%33
DEL (Rubout)		%177

In addition, when you are working at the console, **CONTROL**A cannot be defined as an EOR character.

TABLE 2-32. RESULTS OF parity' parm -- FCONTROL(36).

Code	ATP ADCC (MPE V/E)	ADCC (MPE IV or MPE V/P)	ATC
0	Input: Even parity checked, if enabled. Output: Bit 8 set to 0, if enabled.	Input: Even parity checked, if enabled. Output: Even parity generated, if enabled.	Input: No checking -- bit 8 set to 0. Output: All 8 bits transmitted.
1	Input: Odd parity checked, if enabled. Output: Bit 8 set to 1, if enabled.	Input: Odd parity checked, if enabled. Output: Odd parity generated, if enabled.	Input: No checking -- bit 8 set to 0. Output: Bit 8 set to 1.
2	Input: Even parity checked, if enabled. Output: Even parity generated, if enabled.	Input: Even parity checked, if enabled. Output: Even parity generated, if enabled.	Input: Even parity checked, if enabled. Output: Even parity generated if bit 8 of the character to be output is 0. Odd parity generated if bit 8 of the character to be output is 1.
3	Input: Odd parity checked, if enabled. Output: Odd parity generated, if enabled.	Input: Odd parity checked, if enabled. Output: Odd parity generated, if enabled.	Input: Odd parity checked, if enabled. Output: Odd parity generated, if enabled.

FCHECK Status and Error Codes

The following File System error codes could result from an error during a terminal or printer related intrinsic call; Table 2-33 shows the status codes returned by the driver in the Terminal "IOQ" and the corresponding File System code (in decimal) that is returned in the *errorcode* parameter.

TABLE 2-33. FCHECK STATUS AND ERROR CODES

Status	FS Code	Meaning
0	--	Operation not completed or not started.
1	--	Operation completed normally.
2	0	End of file reached.
4	20	Invalid operation requested by program (e.g. "set Terminal Type to -24").
13	21	Parity error occurred during read.
23	22	Read Limit Timer set by user expired. (Timer set via FCONTROL(4).)
53	24	Terminal or printer not ready (not on line, modem Data Set Ready signal not "high," line disconnected.)
24	27	Block Mode Read Timer (set by terminal driver) expired. Timer expires if the driver never receives the RS character. A data overrun at the port controller or a problem with the terminal's function keys could prevent the driver from receiving the EOR character.
34	28	Timing error--device was not serviced in time, or a data overrun occurred.
11	31	Read of line ended on an alternate end-of-record character. (A character defined via FCONTROL(25).)
33	32	Input/output operation aborted by the ABORTIO command (or some other program-external action).
43	33	Data lost, no buffer was available, or a tapemode (PTAPE) record of too great a length was sent.
173	95	The read was halted because the terminal operator hit (BREAK) . The File System will automatically re-start the read when the operator enters the :RESUME command.
153	97	The terminal operator typed (CONTROL)Y (requesting a Subsystem Break), but no (CONTROL)Y PIN exists.
163	98	User attempted to set an expiration value for the Read Limit Timer greater than the maximum allowable value of 32767 seconds.

Functions of FDEVICECONTROL

There are a number of items available through FDEVICECONTROL, which are specified in Table 2-34. The table shows you the item number, along with the type of access and the type of variable for that item.

NOTE

Byte and byte arrays are accessed through integers and integer arrays to make all accesses through word addresses. Single bytes are stored in the right half of the integer; byte arrays are stored packed beginning in the left half of the first word of the integer array. Items listed as a logical word are set based on bit 15 of the words passed. The returned values are -1 if the value is true and 0 if the value is not true.

TABLE 2-34. FDEVICECONTROL ITEM NUMBER.

Item #	Access	Type	Function
1	R/W	IA	Terminal type file name
11	R/W	L	Parity checking and generation enabled
12	R/W	I	Type of parity (refer to Table 2-28.)
15	R/W	I	Unedited mode characters: the returned value has the following format: bits (0:8) = subsystem break character bits (8:8) = special EOR character
17 ¹	R/W	I	Enquiry character
18 ¹	R/W	I	Acknowledge character
19 ¹	R/W	I	Enq/Ack block size
20 ¹	R/W	I	ACK timeout option
22 ²	R/W	I	Carriage Return (CR) delay (in tenths of a second)
23 ²	R/W	I	Line Feed (LF) delay (in tenths of a second)
24 ²	R/W	I	Form Feed (FF) delay (in tenths of a second)
26	R/W	I	Device originated XON/XOFF enabled. 0=Disabled 1=Enabled
27	R/W	I	XOFF timer value (zero is disabled)
28	R/W	I	Block mode types supported: 0=Neither 1=Line Block 2=Page Block 3=Both
29 ¹	R/W	I	Block mode alert character
30 ¹	R/W	I	Block mode trigger character
32	R/W	I	Read trigger character (zero is no read trigger)
35 ²	R/W	I	Console attention character
36	R/W	I	Backspace character
37	R/W	I	Cancel line character
39	R/W	IA	Type 1 EOR characters

TABLE 2-34. FDEVICECONTROL ITEM NUMBER (cont.)

Item #	Access	Type	Function
40	R/W	IA	Type 2 EOR characters
41	R/W	IA	Subsystem break characters
43 ¹	R/W	L	XON/XOFF stripped
44 ¹	R/W	L	Subsystem break stripped
45 ¹	R/W	L	Console attention stripped
46 ¹	R/W	IA	Stripped characters
52 ¹	R/W	L	Form Feed (FF) allowed in output data
53 ¹	R/W	I	Form Feed (FF) replacement character
54 ¹	R/W	L	Line Feed (LF) wraparound enabled
55 ¹	R/W	I	Backspace response action: 1=Nothing 2=Control-Y 3=Linefeed 4=Slash 5=Erase Character
56	R/W	I	Data bits per character (only 7 or 8 bits supported)
57	R	I	Last subsystem break character accepted.

¹ Programmatic control of these parameters may not be available on future versions of the HP 3000 system. Control via user defined terminal types will be available.

² Future terminal I/O controllers will not support this feature.

Actions on FCLOSE

On any FCLOSE, the following actions are taken:

- Clear tape mode
- Re-enable CONTROLX Echo
- Disable read timeout
- Reset parity to logon
- Clear transparent mode
- Disable read duration timer
- Clear Subsystem break
- Return TBUF's

When the last file opened against the terminal is closed, a "device close" is issued by the file system. The actions taken on a device close (or modem disconnect) are:

- Clear all parity
- Clear ENQ/ACK wait
- Clear XON wait
- Perform FCLOSE
- Return EOF-saved TBUF's flush I/O
- Clear tape mode
- Turn Echo on
- Disable System Break
- Disable Break
- Clear logon termtype
- Hang up modem, if connected to modem
- Disable ENQ/ACK protocol
- Clear DC2 received
- Clear Break mode and Console mode
- Clear printer information
- Clear logon parity
- Set to default termtype
- Initialize half-duplex mode and full-duplex mode
- Start idle read waiting for speed-sense

ATP ERROR MESSAGES

The messages listed in Table 2-35 occur during ATP initialization (ATPINIT). ATP must be in control (up and running) to receive these messages.

Some of these messages are followed by a system failure, which results in a system failure message (shown in Table 2-37), followed by a halt. When a halt occurs, a software dump should be initiated.

TABLE 2-35. ATP MESSAGES

Message	Recovery
ATP MESSAGE (1) The data segment size needed for DRT <i>nn</i> is <i>mm</i> words too large. The number of terminal buffers and/or the number of units must be reduced for the DRT.	Sysdump the system and reduce the number of terminal buffers first.
ATP MESSAGE (2) No disc space available for the data segment for the DRT <i>nn</i> . Hence, all units for this DRT will be inoperative.	Attempt a RECOVER LOST DISC SPACE operation. If this fails, something is probably wrong with the disc. Contact your HP Representative.
ATP MESSAGE (3) No memory available for the data segment for the DRT <i>nn</i> . Hence, all units for this DRT will be inoperative.	Verify that the AVAILABLE MEMORY specifies at least 512 kb. If not, there is a serious system fault. Contact your HP Representative.
ATP MESSAGE (4) Can't lock the data segment for the DRT <i>nn</i> in memory. Hence, all units for this DRT will be inoperative.	Attempt a COLDSTART. If the problem persists, call your local HP Representative.
ATP MESSAGE (5) Due to an error reported earlier, the console can not be set to the proper state. Hence, it is not possible to continue.	Attempt a COLDSTART. If the problem persists, call your local HP office. Note, this is followed by S.F. #703. See Table 2-37 for the recovery to be taken.
ATP MESSAGE (6) Cannot load the ATP software. Hence, it is not possible to continue.	The ATP driver may be missing. Perform an UPDATE with the latest Installation Tape (IT).
ATP MESSAGE (7) Channel for DRT <i>nn</i> is not responding. Hence, all units for this DRT will be inoperative.	The Synchronous Interface Board (SIB) is not responding. Contact your HP Representative.
ATP MESSAGE (8) Inconsistent internal tables. Hence, it is not possible to continue.	Attempt a reload as it suspected that MPE was not loaded properly. If the problem continues, contact your HP Representative for assistance.
ATP MESSAGE (9) Unexpected hardware error on channel for DRT <i>nn</i> . This situation could cause problems in the future.	Possible ATP problem. Contact your HP Representative. However, the ATP subsystem is still considered operational.

TABLE 2-35. ATP MESSAGES (Cont'd)

Message	Recovery
ATP MESSAGE (10) Asynchronous Interface Board (AIB) <i>nn</i> for DRT <i>m</i> does not respond. Hence, units <i>pp</i> thru <i>qq</i> will be inoperative.	The AIB indicated a hardware problem. Contact your HP Representative. NOTE: The units should be marked BROKEN and UNFIXABLE when you execute the BROKEN command in ATPDSM. If they are just marked BROKEN, then attempt a reset of the ports using the RESET command.
ATP MESSAGE (11) Unable to set the console to the proper state. Hence, it is not possible to continue.	The system is attempting to come up for the first time or it is attempting to recover from a Power Failure. Verify that the console is operational. If it is, then you should attempt a COOLSTART. If the problem persists, contact your HP Representative.
ATP MESSAGE (12) No data segment is available for DRT <i>nn</i> . Hence, all units for the this DRT will be inoperative.	There is a possible problem when loading MPE, therefore, a COLDLOAD, or RELOAD must be performed. If the problem persists, contact your HP Representative.
ATP MESSAGE (14) Unable to access the system configuration file. Hence, the default number of terminal buffers per port (<i>nn</i>) will be used for the data segment for the DRT <i>mm</i> .	This situation could cause problems elsewhere in the system operations. If you receive this message when the next system is loaded, you should have it investigated by your account System Engineer.
ATP MESSAGE (15) Invalid speed (in characters per second) specified for unit <i>nn</i> (DRT <i>mm</i>). Hence, the default speed (<i>pp</i>) will be used.	Verify I/O configuration for the proper speed specification. If it is not correct, start the system with a COOLSTART and correct the speed.
ATP MESSAGE (16) Unable to set unit <i>nn</i> (DRT <i>mm</i>) to the proper state. Hence, this unit will be inoperative.	Possible ATP hardware problem. Contact your HP Representative.
ATP MESSAGE (17) Unit <i>nn</i> for the DRT <i>mm</i> exceeds the highest allowable unit number <i>pp</i> . Hence, this unit will be inoperative.	The highest allowable UNIT # is 95. Verify the I/O configuration.
ATP MESSAGE (18) Subtype <i>nn</i> aspecified for the unit <i>mm</i> (DRT <i>pp</i>) is invalid. Hence, the default term type (<i>qq</i>) will be used.	The valid subtypes for the ATP subsystem are 0, 1, 9, 14, and 15. Verify that the I/O configuration is correct for this unit.
ATP MESSAGE (19) Term types <i>nn</i> specified for unit <i>mm</i> (DRT <i>p</i> invalid. Hence, the default term type (<i>qq</i>) will be used.	The valid terminal types for ATP are 6, 9, 10, 12, 13, 15, 16, 18, 19, 20, 21, and 22. Verify that the I/O configuration is correct for this unit.

TABLE 2-35. ATP MESSAGES (Cont'd)

Message	Recovery
ATP MESSAGE (20) Logical device <i>nn</i> specifies a previously defined physical unit. Hence, this logical device will be inoperative.	This situation could cause problems in the future. Verify the I/O configuration for errors.
ATP MESSAGE (21) Unable to perform I/O to the console. Hence, it is not possible to continue.	Verify that the console is operational. If so, then there is a problem with MPE. Perform a COLDSTART to clear the problem. If the console is bad, contact your HP Representative.
ATP MESSAGE (22) Device type for logical device <i>nn</i> and its assigned driver do not match (<i>mm</i> versus <i>pp</i>). Hence, it is not possible to continue.	There is a problem outside of the ATP that could involve memory hardware. This message will be followed by a S.F #710. Perform a software dump then attempt a COLDSTART. If the problem persists, contact your HP Representative.
ATP MESSAGE (23) Logical device <i>nn</i> specifies device type <i>mm</i> , however, the driver configured does not support devices of this type. Hence, this unit will be inoperative.	ATP subsystem has 2 driver names. HIOTERM1 for device type 16. HIOASLP0 for device type 32. Verify the I/O configuration for this LDEV.
ATP MESSAGE (24) The number of terminal buffers for DRT <i>nn</i> have been increased to the minimum number <i>mm</i> allowed for the <i>pp</i> unit.	The algorithm in the ATP initiation procedure requires a minimum number of TBUF's to be allocated. To correct this, increase the number of terminal buffers per port via SYSDUMP.
ATP MESSAGE (25) The junction panel for Asynchronous Interface Board (AIB) <i>nn</i> for DRT <i>mm</i> does not respond. Hence, every mode unit on this AIB will be inoperative.	It is possible to have these units operational by changing the subtype from 1 to 0 (direct connect). Otherwise, there is a hardware problem on the modem mother board that must be repaired in order to have these units operational as modem ports. Call your HP Representative.
ATP MESSAGE (25) The junction panel for Asynchronous Interface Board (AIB) <i>nn</i> for DRT <i>mm</i> does not support modem units. Hence, every direct connect unit on this AIB may not respond.	Units are probably still functional because only the MSC chip is suspected as being bad. MSC is required for modem connections. However, the board should be checked out. Contact your HP Representative.
ATP MESSAGE (26) The junction panel for Asynchronous Interface Board (AIB) <i>nn</i> for DRT <i>mm</i> does not support modem units. Hence, every modem unit on this AIB will be inoperative.	It is possible that an AIB was configured with the wrong subtype for a direct connect mother board. Verify that all modem units are configured for the correct AIB/mother board combination.

TABLE 2-35. ATP MESSAGES (Cont'd)

Message	Recovery
ATP MESSAGE (27) Self test failed on the Modem Controller Chip (MCC) for unit <i>nn</i> for DRT <i>mm</i> . Consequently, the state of the junction panel is not known. Hence, this direct connect unit may not respond.	Modem control is not required for direct connect units. Therefore, the system only considers this a warning. However, if this message repeats for units on the same Asynchronous Interface Board (AIB), there is probably a bad MCC chip on this AIB and the board should be repaired. Contact your HP Representative.
ATP MESSAGE (27) Self test failed on the Modem Controller Chip (MCC) on Asynchronous Interface Board (AIB) <i>nn</i> for DRT <i>mm</i> . Hence, every modem unit on this AIB will be inoperative.	Possible hardware problem on this AIB. To get the units operable, reconfigure these units as subtype 0 then call the local HP office for assistance in repairing AIB.
ATP MESSAGE (27) Self test failed on the Modem Controller Chip (MCC) for unit <i>nn</i> for DRT <i>mm</i> . Hence, this modem unit will be inoperative.	Run ATPDSM diagnostics against the entire AIB board to see if all units fail. If so, the AIB board is bad for modem ports. It could still be reconfigured for direct connect. Contact your HP Representative.
ATP MESSAGE (28) Self test failed on the Modem Scanner Chip (MSC) for unit <i>nn</i> for DRT <i>mm</i> . Hence, this modem unit will be inoperative.	ATP hardware problems on the Modem Mother board. Contact your HP Representative.
ATP MESSAGE (28) Self test failed on the Modem Scanner Chip (MSC) on the junction panel for Asynchronous Interface Board (AIB) <i>nn</i> for DRT <i>mm</i> . Hence, every modem unit on this AIB will be inoperative.	ATP hardware problems on the Modem Mother board. Contact your HP Representative.
ATP MESSAGE (29) The Port Controller Chips (PCCs) for each modem unit on Asynchronous Interface Board (AIB) <i>nn</i> for DRT <i>mm</i> are incompatible with the Modem Controller Chip (MCC) on this AIB. Hence, every modem unit on this AIB will be inoperative.	There are 2 possible revision levels for 6801 chips on AIB's. They can not be mixed on the same board. The AIB is inoperative. Contact your HP Representative.
ATP MESSAGE (30) Self test failed to complete on the Port Controller Chip (PCC) for unit <i>nn</i> for DRT <i>mm</i> . Hence, this unit will be inoperative.	There is probably a bad PCC chip for this unit. Contact your HP Representative for help in repairing the AIB board.
ATP MESSAGE (30) Self test failed to complete on the Port Controller Chip (PCC), Modem Controller Chip (MCC), and junction panel for unit <i>nn</i> for DRT <i>mm</i> . Hence, this modem unit will be inoperative.	There may be a problem outside of the ATP subsystem. However, to further verify this unit, reconfigure it as a direct connect port and repeat the test. If the problem persists, contact your HP Representative.

TABLE 2-35. ATP MESSAGES (Cont'd)

Message	Recovery
<p>ATP MESSAGE (30) Self test failed to complete on the Port Controller Chip (PCC), Modem Controller Chip (MCC), and the junction panel for unit <i>nn</i> for DRT <i>mm</i>. Hence, this direct connect unit may not respond.</p>	<p>Verify that the other units on the AIB, which this unit is on, are operational. If so, there is probably a bad PCC for this unit. Contact your HP Representative.</p>
<p>ATP MESSAGE (31) Self test failed on the Port Controller Chip (PCC) for unit <i>nn</i> for DRT <i>mm</i>. Hence, this unit will be inoperative.</p>	<p>This port is permanently disabled. However, the remainder of the ports should be operational. The AIB board must be repaired with a good PCC chip. Contact your HP Representative.</p>
<p>ATP MESSAGE (32) The junction panel for unit <i>nn</i> for DRT <i>mm</i> does not support modem units. Hence, this modem unit will be inoperative.</p>	<p>The AIB unit specified is probably physically hooked up to a direct connect mother board. Either reconfigure for a direct connect, or connect the AIB to a modem port.</p>
<p>ATP MESSAGE (33) The Port Controller Chip (PCC) and Modem Controller Chip (MCC) for unit <i>nn</i> for DRT <i>mm</i> are not compatible. Hence, this modem unit will be inoperative.</p>	<p>The AIB has different revisions of the 6801 chip on it. These chips must all be the same. Have the board repaired.</p>
<p>ATP MESSAGE (34) The console will not be set inoperative. This situation could cause problems in the future.</p>	<p>Ambiguous test results occurred during the ATP subsystem initialization. Call the local HP office for assistance; the ATP hardware should be verified.</p>
<p>(Unnumbered Messages)</p> <p>In order to continue, the total number of terminal buffers for this DRT (terminal buffers per unit time configured for the DRT) has been reduced from <i>nn</i> to <i>mm</i> terminal buffers. For your future information, each configured unit requires <i>pp</i> words, each terminal buffer requires <i>qq</i> words, and at least <i>rr</i> terminal buffers are required for the <i>ss</i> units configured.</p>	<p>The size of the extra data segment, required by the ATP subsystem, was too small to contain all the terminal buffers asked for. Therefore, the initialization procedure has reduced the number until all the buffers fit in the configured maximum extra data segment size. To avoid this message, either reduce the number of terminal buffers required, the number of units configured, or increase the maximum data segment size.</p>

ADCC (MPE V/E) ERROR MESSAGES

The messages listed in Table 2-36 occur during ADCC initialization (ADCCINIT). ADCC must be in control (up and running) to receive these messages.

Some of these messages are followed by a system failure, which results in a system failure message (shown in Table 2-37), followed by a halt. When a halt occurs, a software dump should be initiated.

TABLE 2-36. ADCC MESSAGES

Message	Recovery
ADCC MESSAGE (1) A data segment is not available for the ADCC terminal data segment. Hence, all ADCC devices will be inoperative.	There is a possible problem when loading MPE, therefore, a COLDLOAD, or RELOAD must be performed. If the problem persists, contact your HP Representative.
ADCC MESSAGE (2) No disc space is available for the ADCC terminal data segment. Hence, all ADCC devices will be inoperative.	Attempt a RECOVER LOST DISC SPACE operation. If this fails, something is probably wrong with the disc. Contact your HP Representative.
ADCC MESSAGE (3) Memory is not available for the ADCC terminal data segment. Hence, all ADCC devices will be inoperative.	Verify that the AVAILABLE MEMORY specifies at least 512 kb. If not, there is a serious system fault. Contact your HP Representative.
ADCC MESSAGE (4) Can't lock the ADCC terminal data segment. Hence, all ADCC devices will be inoperative.	Attempt a COLDSTART. If the problem persists, call your local HP office. Note, this is followed by S.F. #703.
ADCC MESSAGE (5) Due to an error reported earlier the console cannot be set to the proper state. Hence, it is not possible to continue.	The system is attempting to come up for the first time or it is attempting to recover from a Power Failure. Verify that the console is operational. If it is, then you should attempt a COOLSTART. If the problem persists, contact your HP Representative.
ADCC MESSAGE (6) The minimum ADCC terminal data needed is larger than the maximum allowable data segment. Hence, all ADCC devices will be inoperative.	Increase maximum data segment size.

TABLE 2-36. ADCC MESSAGES (cont'd)

Message	Recovery
ADCC MESSAGE (7) The ADCC terminal data segment needed is larger than the maximum allowable data segment. The total number of tbufs has been reduced from <i>n</i> to <i>m</i> . The ADCC devices may not operate correctly.	Sysdump the system and reduce the number of terminal buffers first.
ADCC MESSAGE (8) The number of ADCC terminal buffers has been increased to the minimum <i>n</i> per ADCC device.	The algorithm in the ATP initiation procedure requires a minimum number of TBUFs to be allocated. To correct this, increase the number of terminal buffers per port via SYSDUMP.
ADCC MESSAGE (9) Invalid speed for ldev <i>n</i> . Hence, then default speed <i>m</i> will be used.	Verify I/O configuration for the proper specification. If it is not correct, start the system with a COOLSTART and correct the speed.
ADCC MESSAGE (10) Invalid subtype for ldev <i>n</i> . Hence, the default subtype <i>m</i> will be used.	The valid subtypes for the ATP subsystem are 0,1,9,14 and 15. Verify the I/O configuration is correct for this unit.
ADCC MESSAGE (11) More than 64 ADCC devices are configured. Hence, all those devices will be inoperative.	Don't configure more than the maximum supported devices.
ADCC MESSAGE (12) It was not possible to set the console to the proper state. Hence, it is not possible to continue.	The system is attempting to come up for the first time or it is attempting to recover from a Power Failure. Verify that the console is operational. If it is, then you should attempt a COOLSTART. If the problem persists, contact your HP Representative.

TABLE 2-36. ADCC MESSAGES (cont'd)

Message	Recovery
ADCC MESSAGE (13) It was not possible to set ldev <i>n</i> to the correct state. Hence, this ldev will be inoperative.	This should never occur. Take a sysdump and contact your HP Representative.
ADCC MESSAGE (14) Incorrect driver configured for ldev <i>n</i> . Hence, it is not possible to continue.	Verify I/O configuration.
ADCC MESSAGE (15) File <i>n</i> for DRT <i>m</i> is invalid. Hence, then default termtyp <i>p</i> will be used.	Check user defined Termtyp file or perform update.
ADCC MESSAGE (16) Termtyp <i>n</i> specified for DRT <i>m</i> is invalid. Hence, the default code segment data will be used.	Check user defined Termtyp file or perform update.
ADCC MESSAGE (17) The code segment data base has been corrupted.	Check user defined Termtyp file or perform update.

TABLE 2-37. TERMINAL SYSTEM FAILURES.

System Failure	Cause	Recovery
#700	Initialize or power fail can not recover, because DB is not SYSDB.	Perform a memory dump of the system and send the dump and a service request to the Information Network Division (IND).
#701	The terminal subsystem cannot run on this system.	This should never happen unless an IMB Master Installation Tape (MIT) is loaded on an HP 3000 Series II/III system.
#703	The console I/O tables cannot be initialized.	Verify that the console has been configured correctly, otherwise perform a memory dump and submit the dump with a Service Request to IND.
#704	The console cannot be allocated (that is, the console initialized but the I/O function to the console has failed).	Dump the system and send the dump in with a Service Request to IND.
#705	An attempt was made to build the terminal data segment, and it failed.	Reboot the system. If the situation continues, dump the system, then call your HP Representative for assistance.
#706	The terminal software could not be loaded, frozen and locked in memory.	Verify that all the required terminal segments are present. If not, perform an UPDATE. If all the segments are present, perform a memory dump and attempt a reload. Submit the dump with a Service Request to IND.

TABLE 2-37. TERMINAL SYSTEM FAILURES (cont'd)

System Failure	Cause	Recovery
#708	LDT could not be locked and frozen in memory.	Reduce the # of terminal ports configured and/or reduce the system resources (i.e., # of CST's,DST's,TBUF) or perform a memory dump and submit the dump with a Service Request to Computer Systems Division (CSY).
#709	Invalid entry in LPDT.	Perform a memory dump and submit the dump with a Service Request to Computer Systems Division (CSY).
#710	Information in the I/O Tables for a particular LDEV is inconsistent.	Verify that the device type is appropriate for the driver configured. If it's ok, perform dump of the system, then attempt a RELOAD. If it still fails, start hardware troubleshooting outside of the terminal subsystem (that is, memory or CPU).
#711	There's a bad TBUF link pointer in the returned TBUFs.	Perform a memory dump of the system and submit it with a Service Request to IND.
#712	There's a bad TBUF head pointer to free list.	Perform a memory dump and submit the dump with a Service Request to IND.
#713	ATTACHIO returned an error on an I/O request for the console during system initialization.	Perform a memory dump of the system, then submit the dump with a Service Request after attempting to RELOAD the system.

TABLE 2-37. TERMINAL SYSTEM FAILURES (cont'd)

System Failure	Cause	Recovery
#714	A terminal hardware error was detected by the terminal subsystem.	Begin troubleshooting via off-line diagnostics.
#715	An terminal failure occured on the console.	Perform a memory dump and submit a Service Request after verifying that the console is alright.
#716	An I/O Instruction failure occured.	Troubleshoot the hardware outside of the terminal subsystem first.
#717	The disc copy of IMANAGER was corrupt; therefore the terminal type information could not be accessed.	Perform a Memory Dump, then Update or Cold Load from tape.
#719	Corrupt data stack.	Perform a Memory Dump.
#720	Invalid MPE tables.	This should never happen. Perform a Memory Dump.
#721	The wrong driver specified for the wrong controller.	Check the the driver name to match the controller. Perform a memory dump.

SUPPORTED TERMINALS AND PRINTERS**TABLE 2-38. TERMINALS SUPPORTED ASYNCHRONOUSLY**

Terminal	MPE Version	Device Type Subtype Terminal Type	EIA Interface Standard
120 Terminal Emulator 125 Terminal Emulator	C.00.20 or later	*	RS-232-C
150 Terminal Emulator	C.00.20 or later	*	RS-232-C
2382A	C.00.20 or later	*	RS-232-C
2621A/B/P 2622A 2623A 2624A/B 2625A 2626A/W 2627A 2628A 2629L	C.00.20 or later	*	RS-232-C RS-422-C (no RS-422-C on 2621A/B/P)
2635A/B	C.00.20 or later	16 ** 15 or 16	RS-232-C
2640A/B 2641A 2642A 2644A 2645A/K 2647A/F 2648A	C.00.20 or later	*	RS-232-C RS-422-C
3092/93A	C.00.20 or later	*	RS-232-C
9000 Series 200 Terminal Emulator (P/N 98790A for 9816, 9826, 9836 workstations)	G.00.00	*	RS-232-C

* Device Type 16
 Subtype 0,1,9 for ATP and ADCC(MPE V/E)
 0-5 for ADCC(MPE IV or V/P)
 0-7 for ATC
 Terminal Type 10

** ATP, ADCC(MPE V/E) : 0
 ADCC(MPE IV or V/P): 0, 4

Asynchronous Controllers and Modems

TABLE 2-39. PRINTERS SUPPORTED ASYNCHRONOUSLY

Printer	MPE Version	Device Type Subtype Terminal Type	Spooled?	EIA Interface Standard	Modem Support
2563A	C.01.02 or later*	32 14 19 or 22	Yes	RS-232-C	None
2601A 2602A	C.00.20 or later	32 14 18	No	RS-232-C	None
2631B	C.00.20 or later	32 14 or 15 19-22	Yes	RS-232-C	termtype 19 or 21 with subtype 15
2687A	G.00.00	32 14 18	Yes	RS-232-C RS-422-C	None
2932A** 2933A** 2934A**	C.00.20 or later*	32 14 or 15 19-22	Yes	RS-232-C RS-422-C	termtype 19 or 21 with subtype 15

*Not supported on HP 3000 Series II, III, 30, or 33

**HP 2631B switch must be on.

SYNCHRONOUS CONTROLLERS AND MODEMS

SECTION

3

CONTENTS	PAGE
References.....	3-2
HSI, SSLC, INP Descriptions.....	3-3
INP DSM Monitor.....	3-5
HSI Configuration Dialogue Summary.....	3-7
SSLC and INP Configuration Dialogue Summary.....	3-8
HSI Cabling.....	3-11
SSLC Cabling.....	3-12
INP Cabling.....	3-14
Bell Modems.....	3-22
HP Modems.....	3-38
HP Modem Self Tests.....	3-40

REFERENCES

For information about DSN/IMF for the HP 3000 refer to:

Computer Users Catalog (5953-2450D)

Guide to a Successful Installation (HP 3000 Computer Systems) (30000-90135)

HP 3000 Computer Systems Site Preparation Set (30000-60029)

Data Communications Guide Book (5955-1715)

Hardwired Serial Interface (HSI) Manuals

HP 30360A Hardwired Serial Interface (HSI) Installation and Service Manual (30360-90001)

Hardwired Serial Interface (HSI) Diagnostic Manual (D432) (30360-90007)

Synchronous Single-Line Controller (SSLC) Manuals

HP30055A Synchronous Single-Line Controller (SSLC) Installation and Service Manual(30055-90001)

SSLC I/O Detailed Diagram Set (DD-503)(30055-90003)

HP30055A SSLC Stand-Alone Diagnostic Manual (D334)(30055-90004)

HP30055A SSLC Stand-Alone Diagnostic Manual (D434A & D434B) (30055-90008)

Intelligent Network Processor (INP) Manuals

HP30010A DSN/Intelligent Network Processor (DSN/INP) Installation and Service Manual(30010-90001)

HP30010A DSN/Intelligent Network Processor (DSN/INP) Customer Engineer Handbook (30010-90006)

HP30020A DSN/Intelligent Network Processor (DSN/INP) Installation and Service Manual (30020-90001)

HP30020A DSN/Intelligent Network Processor (DSN/INP) Customer Engineer Handbook (30020-90009)

HP30020B DSN/Intelligent Network Processor (DSN/INP) Installation and Service Manual (30020-90005)

HP 30020B DSN/Intelligent Network Processor (DSN/INP) Customer Engineer Handbook (30020-90010)

HP 30010A/30020A/30020B DSN/Intelligent Network Processor (DSN/INP) Diagnostic Procedures Manual (30010-90002)

HSI, SSLC, INP DESCRIPTIONS

30360A Hardwired Serial Interface (HSI)

The HP 30360A is a controller interface which uses modified binary synchronous protocol for high speed asynchronous data communications between HP 3000 CPUs and/or the HP 1000 systems used with the DS/3000 subsystems. (RJE/3000 will also run using this controller between two HP 3000 Systems.) The connection between machines is via a pair of coaxial cables.

Basic Configuration

Hardwired Serial Interface Kit includes one PC board (30360-60001), cable connector panel (30360-60003), and one coaxial cable as follows:

Cable	Options
30220A.....25 ft.	001..... 100 ft. 002..... 250 ft. 003..... 500 ft. 004..... 1000 ft. 005..... 2000 ft.

30055A Synchronous Single Line Controller (SSLC)

The HP 30055A SSLC is a controller interface for high speed bit-serial synchronous devices. The controller can accommodate one modem device and is utilized with the RJE, DS, MRJE, and MTS subsystems. With MTS (Multipoint Terminal Software), the SSLC board may optionally be used for asynchronous transmissions. An SSLC may *not* be used for IMF, NRJE, Remote Data Link (MTS), HP 2608S printer, or HP 2333A Cluster Controller.

Basic Configuration

Synchronous Single Line Controller kit includes one PC board (30055-60001), cable assembly (30055-60008¹), and test connector (30055-60009). On previously installed systems, obsolete interface cable 30055-60003 and obsolete test connector 30055-60005 may be present. Within the United States this combination will work for synchronous testing. Outside the USA, only the 30055-60008¹ cable and 30055-60009 test connector combination is recommended for synchronous mode. The test connectors are designed for use with a particular cable and thus are not interchangeable. For asynchronous communication under MTS, use cable assembly 30055-60010. (Refer to "SSLC Cabling" for Wiring Diagrams).

¹ 30055-60011 replaces 30055-60008. Pin 23 (Modem speed) tied high on 60011 cable. (Always "ON")

30010A, 30020A/B Intelligent Network Processor (INP)

The Intelligent Network Processor (INP) is a communications interface which provides the HP 3000 with data communications capabilities in a high speed as well as a low speed environment. The HP 30010A is used with a Series II/III. The HP 30020A/B is used with Series 3X/4X/6X. An INP can accommodate one modem, or a test hood, or an INP-to-SSLC direct-connect cable, or an INP-to-INP direct-connect cable, or INP-PSI direct connect cable. An INP may be used with the RJE, DS, MRJE, NRJE, MTS, and IMF subsystems. With MTS an INP may optionally be used for asynchronous transmission.

Basic Configuration:

The standard HP 30010A INP consists of:

- One INP Microprocessor PCA board (30010-60001)
- One INP Data communications interface PCA board (30010-60002)
- One Flat Cable (ribbon cable for connecting the two INP PCA boards) (30000-93052)
- One Memory Power Jumper PCA board (30380-60033)
- One I/O Memory Power Cable (30380-60034)
- One I/O Memory Jumper Cable (30380-60035)

The standard HP 30020A INP consists of:

- One Intelligent Network Processor PCA board (30020-60001)
- One HP-IB ribbon cable (30090-60051).

The standard HP 30020B INP consists of:

- One Intelligent Network Processor PCA board (30020-60009).
- One HP-IB ribbon cable (30090-60051).

INP DIAGNOSTIC/SUPPORT MONITOR (DSM)

The Diagnostic/Support Monitor (DSM) is a software tool that can be used both for verification testing and for more detailed troubleshooting. Different levels or modes of interactive operation are provided to make DSM a useful aid to the computer user, as well as an installation and/or troubleshooting tool for the HP Customer Engineer (CE) or Systems Engineer (SE).

DSM includes a series of tests that exercise both the INP hardware and associated software. The DSM tests (listed in table 3-1) begin by testing the most basic functions of the INP and progressively become more inclusive and more detailed.

TABLE 3-1. DSM TESTS

Group No.	Test No.	Test Name
1	1.1	Mainframe Interconnect Driver Communication
	1.2	Native INP Communication
	1.3	Simple Interconnect
2	2.1	INP Self Test
	2.2	INP Microprocessor
3	3.1	INP RAM I (Memory Parity)
	3.2	INP RAM II (Disturbance)
	3.3	INP RAM III (Variable Checkerboard)
	3.4	INP RAM IV (Shifting Diagonal)
	3.5	INP RAM V (Walking Ones and Zeros)
4	4.1	System-Clock / Baud-Rate-Generator
	4.2	Memory-Mapped I/O
	4.3	Memory and I/O Timeouts
5	5.1	Extensive Mainframe Interconnect Driver
	5.2	Extensive Interconnect
	5.3	Extensive Synchronous USART
	5.4	Extensive SDLC
	5.5	Extensive Asynchronous USART
6	6.1	BISYNC Off-board Loopback
	6.2	SDLC Off-board Loopback
	6.3	Asynchronous Off-board Loopback
	6.4	ACU Off-board Loopback
7	7.1	BISYNC INP-to-INP
	7.2	SDLC INP-to-INP

Operational Overview

The INP Online Diagnostic/Support Monitor (DSM) is designed to run as either a job or a session. A customer user can invoke a DSM job from an MPE session and then review the standard test sequence results at the completion of the job. The support user may elect to run DSM as a job or as a session. Unlike the customer user, the support user has the ability to direct DSM execution by a series of commands. These commands may be entered either from the standard job/session input file or from a selected "DSM command" file. (Refer to the INP Modules of the *Datacomm CE Handbook* for further information). Either type of DSM user must have the MPE diagnostician capability (DS) in order to run DSM.

User inputs are accepted in either upper or lower case characters. Certain MPE commands can be executed during a DSM session by manually inserting the colon (:) prompt. Note that the Diagnostic/Support Monitor is dependent upon the MPE operating system. Therefore, if MPE is not functioning on the system with the INP to be tested, DSM is not operational.

Customer User Operation

Once you have created an MPE session, you can invoke the DSM job by entering:

```
RUN DSM.PUB.SYS (RETURN)
```

When DSM has verified that you have MPE diagnostician capability, it inspects the system tables to determine the logical device number of each INP in the system. If there is more than one INP, DSM displays each logical device number and asks you to indicate the INP to be tested. When the INP to be tested has been determined, DSM prompts for JOB CARD parameters (such as: job name, user/account names and passwords, etc.). DSM verifies that the Support Files are present on the system and that they are of the same version number as the DSM program. Any deviation is reported to the user, and DSM is aborted. With this input, the DSM session streams an MPE job that does the actual testing of the INP. You will then see:

```
#Jxxx  
INP DSM EXECUTION TIME IS APPROXIMATELY zz MINUTES  
  
END OF PROGRAM
```

where *xxx* is the job number assigned by MPE and *zz* is the number of minutes needed for complete execution of the DSM standard test sequence.

The streamed DSM job runs with the HIPRI job parameter to allow immediate execution. The \$STDLIST file should be checked to confirm that it is ready for the test summary. For example, check to see that no special forms are mounted. The DSM job lists all test results on the standard output file. Basically, the results include the test name and its pass or fail results.

HSI CONFIGURATION DIALOGUE SUMMARY

UNIT#? 0
 CHANNEL#? 0
 TYPE? 19
 SUBTYPE? 3
 PORTMASK? 8 (chan0)
 4 (chan1)
 2 (chan2) or
 1 (chan3)
 PROTOCOL? 1
 LOCAL MODE? 1
 TRANSMISSION CODE? 2
 RECEIVE TIMEOUT? 0-32000 or RETURN
 LOCAL TIMEOUT? 0-32000 or RETURN
 CONNECT TIMEOUT? 0-32000 or RETURN (300 recommended)
 SPEED CHANGEABLE? YES
 TRANSMISSION SPEED? 250000 or 125000
 TRANSMISSION MODE? 0
 PREFERRED BUFFER SIZE? 0-4095 (4095 recommended)
 DRIVER CHANGEABLE? NO
 DRIVER OPTIONS? 0
 DRIVER NAME? CSHBSCO

SSLC AND INP CONFIGURATION DIALOGUE SUMMARY

If several subsystems will use the SSLC or INP, it must be configured so as to be compatible for all. This table summarizes the configuration choices available for each subsystem when it is the *sole* user of the SSLC or INP. The user will need to select the choices that will permit his or her particular set of subsystems to use the SSLC or INP.

UNIT #? 0

SOFTWARE CHANNEL #? 0

TYPE? 17 (INP)
 18 (SSLC)

SUBTYPE? 0 or 1 (RJE, MRJE)
 0 1 3 or 7 (MTS)
 1 (IMF)
 0 1 or 3 (DS)
 1 or 3 (X.25)
 0 1 or 3 (NRJE)

 0 = Synchronous, switched line with a modem
 1 = Synchronous, nonswitched line with a modem
 3 = Synchronous hardwired line
 7 = Asynchronous line

PROTOCOL? 1 = Bisync

LOCAL MODE? 1 or 2 (DS, RJE)
 1 (MTS and IMF)

 (MRJE overrides this option)

 1 = Local is multipoint control or primary contention station.
 2 = Local is secondary contention station.

TRANSMISSION CODE? 1 2 or 3 (DS, RJE)

 (MRJE, MTS, and IMF override the response)

 1 = Automatic code sensing
 2 = ASCII
 3 = EBCDIC

RECEIVE TIMEOUT? (default = 20)
 0-32000 or RETURN (DS, X.25, RJE, MTS, IMF)

 (MRJE and NRJE override response)

LOCAL TIMEOUT? (default = 60)
0-32000 or RETURN (DS, RJE, MTS, IMF)
 (X. 25 doesn't use response)
 (MRJE and NRJE override response)

CONNECT TIMEOUT? (default = 900)
300 (Recommended for DS, X. 25, RJE, MTS)
900+ (Recommended for IMF)
 (MRJE and NRJE override response)

DIAL FACILITY? YES NO or LDEV# on INP-B, or RETURN
 (DS, X. 25, RJE, NRJE, and MTS use response)
 (MRJE and IMF don't use response)

ANSWER FACILITY? YES NO or RETURN
 (DS, X. 25, RJE, and MTS use response)
 (MRJE and IMF don't use response)

DUAL SPEED? YES or NO
 (DS, X. 25, RJE, MRJE, NRJE-YES for European modems only)
NO (MTS)
 (IMF doesn't use response)

HALF-SPEED? YES or NO
 (DS, X. 25, RJE, MRJE, NRJE use response)
 (MTS and IMF don't use response)

SPEED CHANGEABLE? YES or NO
 (Response overridden if modems that provide internal clocking are used.)

TRANSMISSION SPEED? Line Transmission Speed in characters per second:
250 300 600 900 1200 2400 3600 4800 7000
250 300 600 1200 (RJE and MRJE)
 (IMF and NRJE override response)

TRANSMISSION MODE? 0 Full duplex (Transmission facility, not protocol.)
1 Half duplex
 (NRJE overrides response)

PREFERRED BUFFER SIZE? 0-4095 (1024 words maximum for INP, 4095 maximum for SSLC.)
1024 (recommended for DS)
500 (recommended for MTS)
 (X. 25, MRJE, RJE, NRJE, and IMF override response)

Synchronous Controllers and Modems

DRIVER CHANGEABLE? YES (MRJE with SSLC, MTS with SSLC)
 NO (All other subsystems and configurations)

DRIVER OPTIONS? 0

DRIVER NAME? CSSBSCO (SSLC)
 IOINPO (INP)

PHONE LIST? YES or NO

(DS, X. 25, RJE, and MTS use response)
(MRJE, NRJE, and IMF override response)

LOCAL ID SEQUENCE? idsequence or RETURN

(DS uses response)
(X. 25, MTS, RJE, MRJE, NRJE, and IMF do not use response)

REMOTE ID SEQUENCE? idsequence or RETURN

(DS uses response)
(X. 25, MTS, RJE, MRJE, NRJE, and IMF do not use response)

DEVICE CLASSES? classname or RETURN

(DS, X. 25, MRJE, NRJE, MTS, IMF use response).
RJLINE
(RJE. Additional names are optional; refer to the *RJE Reference Manual*).

Note: The same class name may not be used for both the INP and the SSLC.

ADDITIONAL DRIVER YES (MRJE with SSLC, MTS with SSLC)
CHANGES? NO (All other subsystems and configurations.)

ADD DRIVERS? YES or NO

DRIVER NAME? CSSMRJE0 (MRJE WITH SSLC)
 CSSBSC1 (MTS with SSLC)

HSI CABLING

Refer to the *Hardwired Serial Interface Reference Manual* (30360-90001) for wiring diagrams and cable fabrication information.

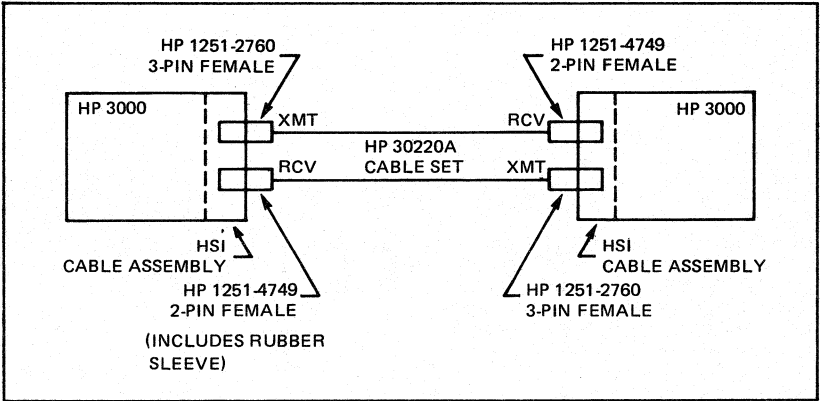


Figure 3-1. HSI Link -- HP 3000 to HP 3000

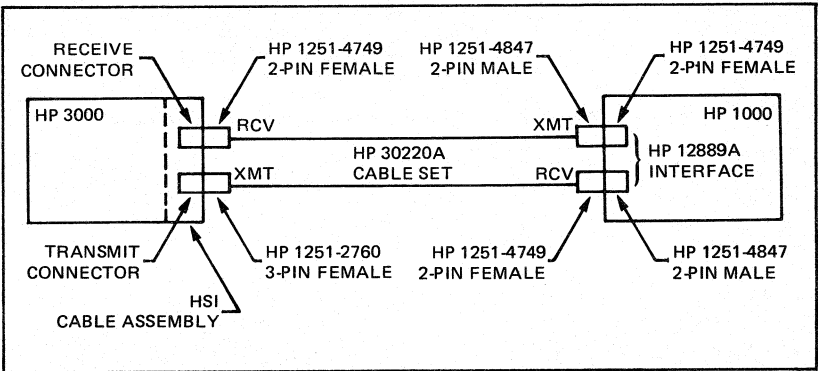


Figure 3-2. HSI Link -- HP 3000 to HP 1000

SSLC CABLING

Figure 3-3 shows the asynchronous cable used with MTS/3000 only.

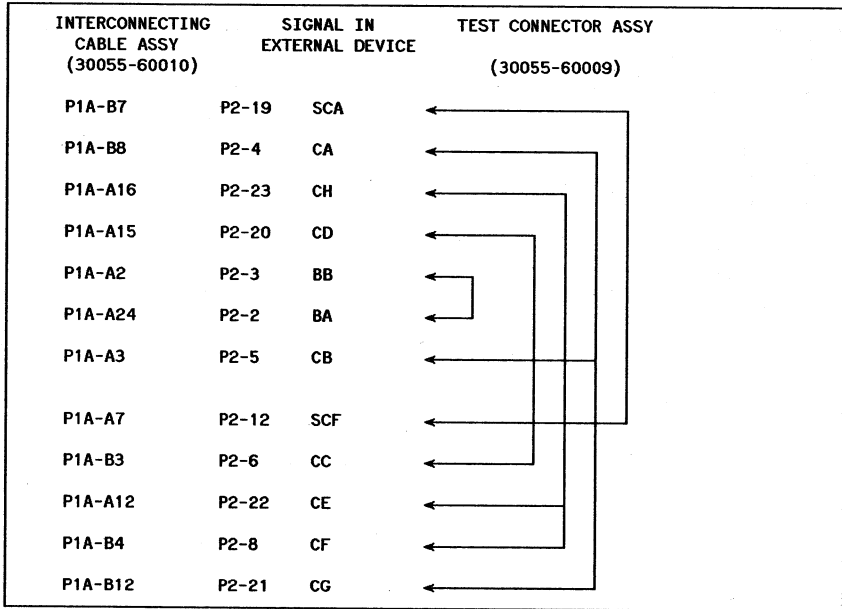


Figure 3-3. HP 30055-60010 Cable and Test Connector Wiring Diagram

Figure 3-4 shows the synchronous cable used for all products using synchronous modems.

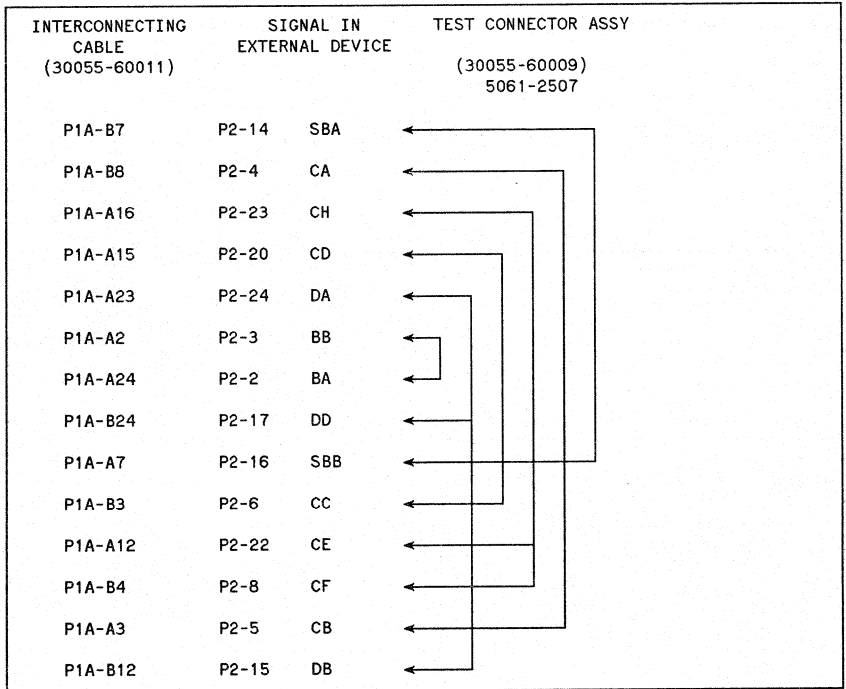


Figure 3-4. HP 30055-60011 Cable and Test Connector Wiring Diagram

- Obsolete SSLC cable (Part No. 30055-60003) has DA signal presented on pin 13.
- Obsolete test connector (Part No 30055-60005) has pins 13, 15, and 17 tied together.
- Obsolete SSLC cable 30055-60008 replaced by 30055-60011. An upgrade is only necessary if a dual speed modem is to be installed.
- Note pin 25 is tied high on 60011 cable.
- Connector Part No. 30055-60009 is the same as 5061-2507. Pins 12, 19, 21 are not shown and not required.

INP CABLING

TABLE 3-2. HP 3000 SERIES II/III TEST EQUIPMENT COMPATIBILITY

Description	Part Number	Used With Cable Product Number
Board Test Hood	5061-2527	30222A 30222B 30225A
	5061-2530	30224A
Cable Test Connector (See Note)	5061-2507	30222A 30222B
	5061-2512	30224L
	5061-2533	30224A
	5061-2536	30222F
	30225-60004	30225A

Note: Pins 2-3, 4-5-21, 6-20, 8-22-23, 12-14-16-19, 15-17-24.

TABLE 3-3. HP 3000 SERIES 3X/4X/6X EQUIPMENT COMPATIBILITY

Description	Part Number	Used With Cable Product Number
Board Test Hood	30020-60012	30221A 30221B 30221G 30225B
	5061-2522	30224B
Cable Test Connector (See Note)	5061-2507	30221A 30221B
	5061-2512	30224L
	5061-2533	30224B
	5061-2536	30221F
	30020-60013 30225-60004	30221G 30225B

Note: Pins: 2-3, 4-5-21, 6-20, 8-22-23, 12-14-16-19, 15-17-24.

NOTE

The board test hoods and cable test connectors listed in Tables 3-2 and 3-3 are included in the INP Product Support Package (30010-67801).

Synchronous Controllers and Modems

TABLE 3-4. HP 3000 SERIES II/III CABLE ASSEMBLIES FOR HP 30010A

Product No.	Option	Description	Part No.
30222A		RS232C Synchronous Modem Cable (10-meter)	30222-60001
30222B		RS232C Asynchronous Multipoint Cable (10-meter)	30222-60002
30222D		V. 35 High-speed Synchronous Modem Cable (10-meter)	30222-60004
30222F		HP 3000-to-1000 Direct-Connect Cable	30222-60006
30224A		INP-to-INP Direct-Connect Cable	5061-2524
30224L		External Interconnect Cable (10-meter)	30224-60001
30224L	001	External Interconnect Cable (25-meter)	30224-60002
30224L	002	External Interconnect Cable (50-meter)	30224-60003
30224L	003	External Interconnect Cable (100-meter)	30224-60004
30224L	004	External Interconnect Cable (250-meter)	30224-60005
30224L	005	External Interconnect Cable (500-meter)	30224-60006
30224L	006	External Interconnect Cable (1000-meter)	30224-60007
30225A		INP-to-SSLC Direct-Connect Cable (Modem Eliminator Cable) (5-meter)	30225-60004

TABLE 3-5. HP 3000 SERIES 3X/4X/6X CABLE ASSEMBLIES FOR 30020A/B

Product Number	Description	Part Number	
30221A	RS232 Synchronous Internal Cable	30221-60001	
	RS232 10-meter External Cable	5061-2514	
30221B	RS232 Asynchronous Internal Cable	30221-60002	
	RS232 10-meter External Cable	5061-2514	
30221D	High Speed Synchronous Modem Cable (V.35) Internal	30221-60010	
	V.35 10-meter External Cable	5061-2517	
30221F	HP 3000 to HP 1000 Direct Connect Cable (HP 1000 board is 1283A with 5061-3422 cable)	30221-60006	
30221G	AUTO CALL Modem Cable Internal	30221-60007	
	AUTO CALL Modem Cable, 10-meter External (INP-B only)	8120-3576	
30221H	X.21 Digital Network Direct-Connect Internal Cable	30221-60012	
	X.21 External Cable	5061-2535	
30224B	INP-to-INP Direct-Connect Internal Cable ¹	30224-60014	
30224L	External Interconnect Cable	30224-60001	
	Direct Connect 10 meter		
	25 meter		-60002
	50 meter		-60003
	100 meter		-60004
	250 meter		-60005
	500 meter		-60006
1000 meter	-60007		
30225B	INP-SSLC Direct-Connect (Modem Eliminator Cable) Internal	30221-60001	
	INP-SSLC 5-meter External Cable	30225-60006	

¹ INP-to-INP direct connection requires the use of a 30224L interconnect cable, part numbers 30224-60001 through 30224-60007. The cable lengths range from 10 through 1000 meters.

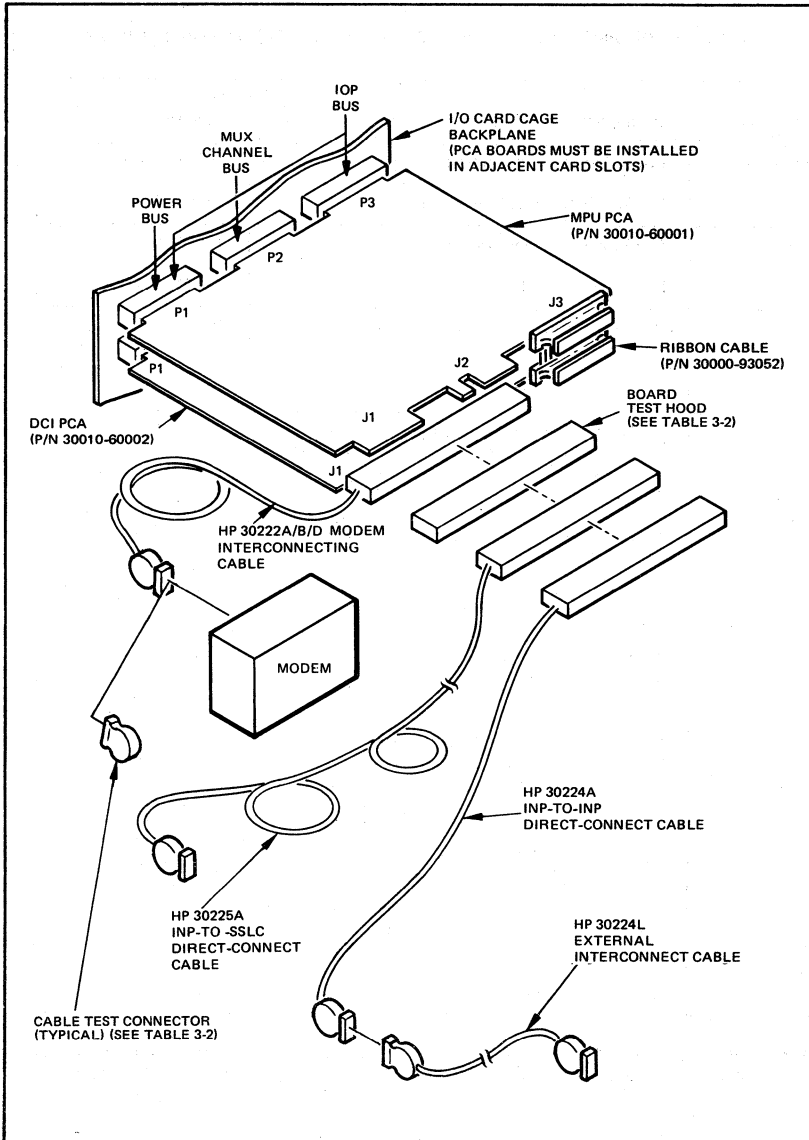


Figure 3-5. HP 30010A INP and Related Cabling for Series II/III

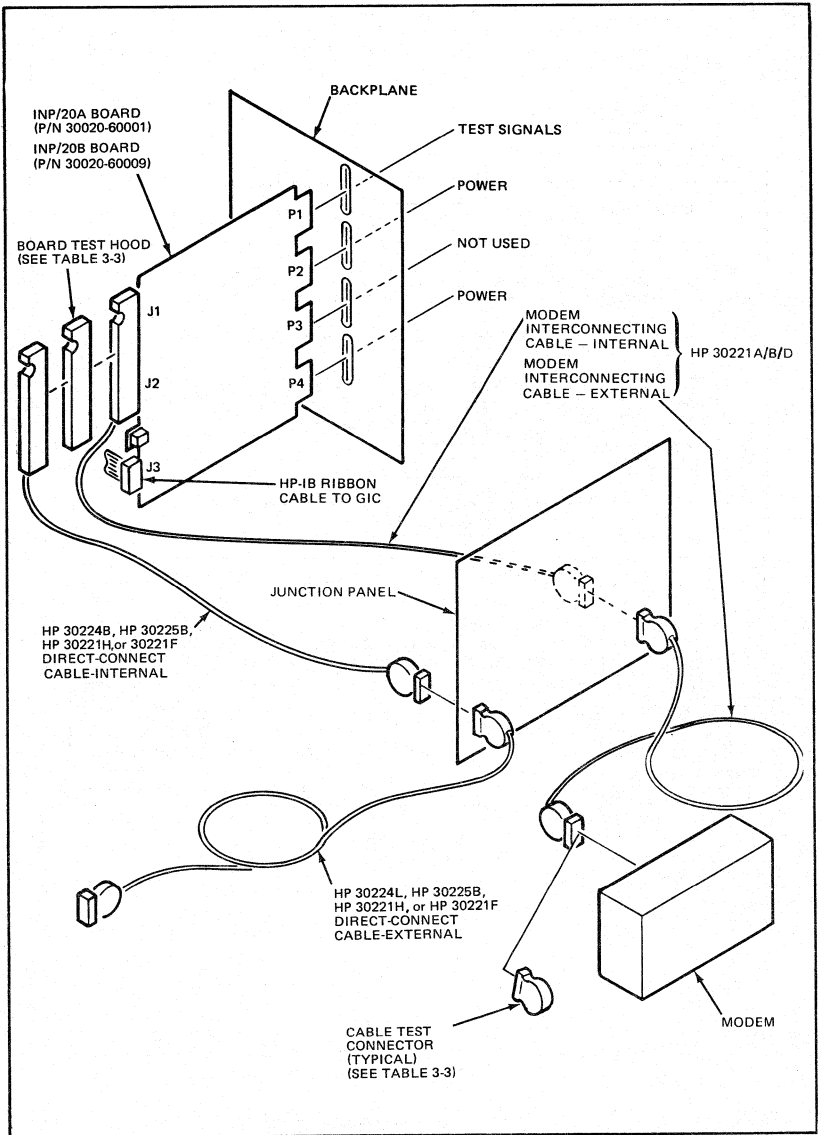
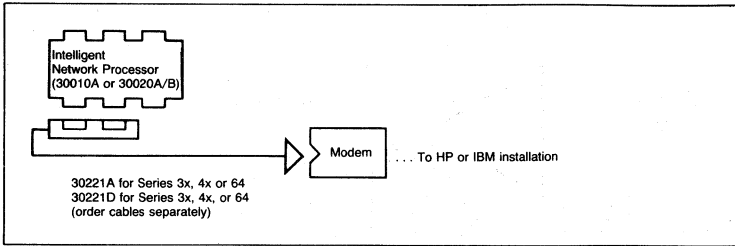


Figure 3-6. HP 30020A/B INP and Related Cabling for Series 3X/4X/6x

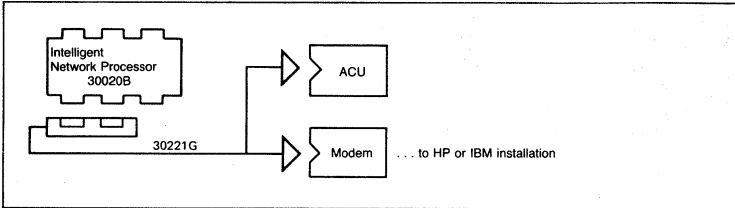
Synchronous Controllers and Modems

INP Modem Connection



Note: May be used for DS/3000, RJE/3000, MRJE 3000, IML 3000, or MTS 3000 synchronous modem communication.

INP Modem - Auto Call Unit Connection



Note: May be used for DS/3000, RJE/3000, MRJE 3000, IML 3000, or MTS 3000 synchronous modem communication.

DS/3000 INP-INP Direct Connection

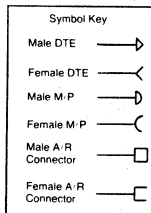
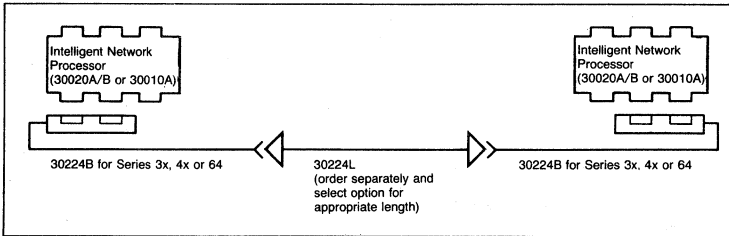
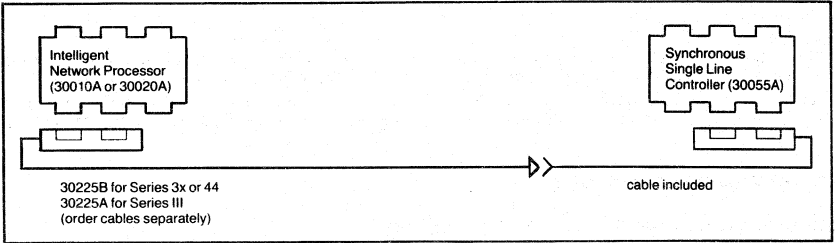
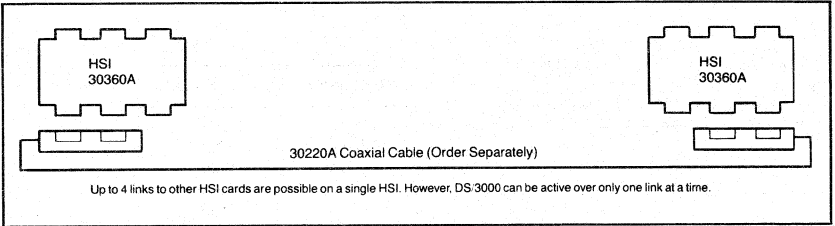


Figure 3-7. INP Cabling Diagrams

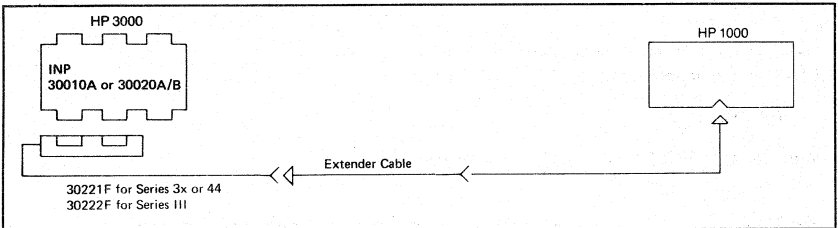
DS/3000 INP-SSLC Direct Connection



DS/3000 HSI-HSI Hardwired Connection (Available only on Series III)



DS/3000-DS/1000 Hardwired Connection



DS/3000-DS/1000 Modem Connection

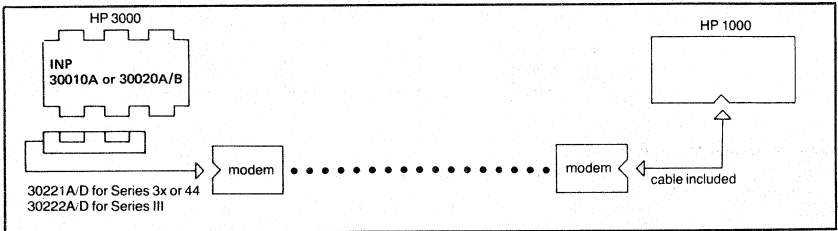


Figure 3-8. DS/3000 Cabling Diagrams

BELL MODEMS

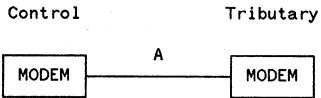
The following Synchronous modem recommendations and options are for use with the 30055A Synchronous Single Line Controller (SSLC) or 30010A/30020A/B Intelligent Network Processor. Further definition of these options and capabilities can be obtained from the relevant *Bell System Technical Reference* publication, which is available from your local Bell System Representative or CCITT reference.

Modem Configurations

Modems can be connected in one of two basic configurations:

Configuration A

Point-to-Point Connection (RJE, MRJE, DS, IMF*, MTS)

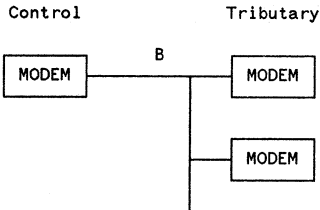


HP Modems	BELL Modems
37210T	201C
37220T	208A
37230A	208B
	209A
	2024A
	2048A
	2096A
	DDS

Public (Switched) or Private (Leased) Line
(* IMF must be leased.)

Configuration B

Multi-Point Connection (MTS, IMF - as tributary)



HP Modems	BELL Modems
37210T	201C
37230A	208A
	2024A
	2048A,C
	DDS

Private (leased) Multi-Point Line

Control = The site responsible for running diagnostics.

Tributary = All other sites.

BELL 201C Modem

Public Switched Line, Half Duplex, Point-to-point

Type of Modem	Bell System Type 201C Data Set (Also called DATAPHONE 2400)
Type of Line	Public Telephone Network (Switched Line)
Transmission Rate	2400 bits-per-second
HP Products	RJE (2780/3780), MRJE, NRJE, DS, and MTS - Configuration A.

The Bell 201C is fully compatible with CCITT V.26bis modems (Modulation Alternative B). In half duplex operation, this modem provides a 150 msec Request-to-Send - Clear-to-Send delay.

TABLE 3-6. BELL 201C MODEM OPTIONS

Option Number	Description	Comments
A1	Transmitter internally timed.	
B3 B4	Without 801 Automatic Calling Unit. With 801 Automatic Calling Unit.	See Note 1.
C5	EIA Interface.	
D8	With automatic answer.	
E9 E10	Automatic answer permanently wired. Automatic answer key-controlled.	Either

Note 1: Depends on whether auto-dialer on INP-B is used.

NOTE

Hewlett Packard does not recommend the use of half-duplex modems; they are not supported on HP 3000 Series 4X/6X.

Synchronous Controllers and Modems

BELL 201C Modem

Private Leased Line, Full Duplex, Point-to-Point

Type of Modem	Bell System Type 201C Data Set (Also called DATAPHONE 2400)
Type of Line	Public Telephone Network, Private Leased Line
Transmission Rate	2400 bits-per-second
HP Products	RJE (2780/3780), IMF, MRJE, NRJE DS, and MTS - Configuration A.

TABLE 3-7. BELL 201C MODEM OPTIONS

Option Number	Description	Comments
A1	EIA Interface.	
B3 B4	With alternate voice. Without alternate voice.	Customer Defined
C6	Without new synch.	Both MASTER and SLAVE
D8	4-wire circuit.	
E9	4-wire private line continuous carrier. 0 millisecond delay.	Both MASTER and SLAVE

BELL 201C Modem

Private Leased Line, Multi-Point

Type of Modem Bell System Type 201C Data Set (Also called DATAPHONE 2400).
 Type of Line Public Telephone Network Private Leased Line.
 Transmission Rate 2400 bits per second.
 HP Products NRJE

TABLE 3-8. BELL 201C MODEM OPTIONS

Option Number	Description	Comments
A1	EIA Interface.	
B3 B4	With alternate voice. Without alternate voice.	Customer Defined
C5 C6	With new synch. Without new synch.	MASTER: C5 SLAVE : C6
D8	4-wire circuit.	
E9 E10	4-wire private line continuous carrier. 0 msec delay. 4-wire private line switched carrier.	MASTER: E9 SLAVE : E10

BELL 201C-L1D Modem

Private Leased Line, Point-to-Point, Full Duplex

Type of Modem	Bell System Type 201C-L1D Data Set
Type of Line	Public Telephone Network, Private Leased Line.
Transmission Rate	2400 bits-per-second
HP Products	RJE (2780/3780), IMF, MRJE, NRJE, DS, MTS - Configuration A.

TABLE 3-9. BELL 201C MODEM OPTIONS

Option Number	Description
A1	Transmitter timing internal.
B3	Without new synch.
C6	Continuous carrier operation 4-wire, 0 millisecond Clear-to-Send delay.
D8	Continuous receiver, Bit clock.
E10	EIA Interface pin 18 provides receive symbol clock.
F12	Customer selected EIA Interface and ground options: A1 Status of Data Set Ready during local analog loopback - ON. B1 Frame ground connected to signal ground.

BELL 201C-L1D Modem

Private Leased Line, Multi-Point

Type of Modem	Bell System Type 201C-L1D Data Set
Type of Line	Public Telephone Network, Private Leased Line.
Transmission Rate	2400 bits-per-second
HP products	MTS, NRJE, IMF - Configuration B

TABLE 3-10. BELL 201C-L1D MODEM OPTIONS

Option Number	Description	Comments
A1	Transmitter timing internal.	Both MASTER and SLAVE
B3 B4	Without new synch. With new synch (with SSLC).	MASTER: B4 SLAVE : B3
C5 C6	Switched carrier operation 4-wire, 7 msec Clear-to-Send delay. Continuous carrier operation 4-wire, 7 millisecond Clear-to-Send delay.	MASTER: C6 SLAVE : C5
D8	Continuous receiver, Bit clock - OUT.	Both MASTER and SLAVE
E10	EIA Interface pin 18 provides receive symbol clock.	Both MASTER and SLAVE
F12	Customer selected EIA Interface and ground options: A1 Status of Data Set Ready during local analog loopback-ON B1 Frame ground connected to signal ground.	Both MASTER and SLAVE

BELL 208A Modem

Private Leased Line, Point-to-Point, Full Duplex

Type of Modem	Bell System Type 208A Data Set (Also called DATAPHONE 4800)
Type of Line	Private Leased Line
Transmission Rate	4800 bits-per-second
HP Products	RJE, MRJE, NRJE, DS, IMF, MTS - Configuration A

TABLE 3-11. BELL 208A MODEM OPTIONS

Option Number	Description
A1	Transmitter timing internal.
B3	Continuous carrier.
C6	Continuous Request-to-Send.
D7	One second holdover used.
E10	Without new synch.
F11	Continuous carrier ON when analog loop is present.

BELL 208A Modem

Private Leased Line, Multi-Point

Type of Modem Bell System Type 208A Data Set (Also called DATAPHONE 4800)
 Type of Line Private Leased Line
 Transmission Rate 4800 bits-per-second
 HP Products IMF, MTS - Configuration B

TABLE 3-12. BELL 208A MODEM, MULTIPOINT MODEM OPTIONS

Option Number	Description	Comments
A1	Transmitter internally timed.	Both MASTER and SLAVE
B3 B4	Continuous carrier. Switched carrier.	MASTER: B3 SLAVE: B4
C5 C6	Switched Request-to-Send. Continuous Request-to-Send.	MASTER: C6 SLAVE: C5
D7 D8	One-second holdover used. One-second holdover not used.	MASTER: D8 SLAVE: D7
E9 E10	With new synch (with SSLC). Without new synch.	MASTER: E9 SLAVE: E10
F11	Continuous carrier when analog loop is present.	Both MASTER and SLAVE

Synchronous Controllers and Modems

BELL 208B Modem

Switched Line, Half Duplex, Point-to-Point

Type of Modem Bell System Type 208B Data Set (Also called DATAPHONE 4800)
 Type of Line Public Telephone Network (Switched)
 Transmission Rate 4800 bits-per-second
 HP Products RJE, MRJE, NRJE, DS, IMF, MTS - Configuration A

TABLE 3-13. BELL 208B MODEM OPTIONS

Option Number	Description	Comments
A1	Transmitter internally timed.	
B3 B4	Without 801 Automatic Calling Unit With 801 Automatic Calling Unit.	See Note 1.
C6	Data Set Ready (CC) ON when analog loop is present.	
D8	With automatic answer.	
E9 E10	Desk mounting. Rack or cabinet mounting.	Either

Note 1: Switch controlled 50 or 150 msec Request-to-Send Clear-to-Send delay.

801 AUTO CALL UNIT OPTIONS

Description	Recommendation
Abandon Call Timer Control	Stop
Abandon Call Timer Options	56 seconds
Call Termination Control	Via Data Set
Signal Ground Option	Signal to Frame

BELL 209A Modem

Private Leased Line, Full Duplex, Point-to-Point

Type of Modem Bell System Type 209A Data Set (Also called DATAPHONE 9600)
 Type of Line Private Leased Line (3002 Type 4-wire) with D1 conditioning
 (No C conditioning.)
 Transmission Rate 9600 bits-per-second
 HP Products RJE, MRJE, NRJE, DS, IMF, MTS - Configuration A

Note that this modem will accept four simultaneous devices as long as their aggregate speed does not exceed 9600 bps.

TABLE 3-14. BELL 209A MODEM OPTIONS

Option Number	Description	Comments
A1	Transmitter timing supplied by data set.	
B3	Data Set Ready interface lead ON for Analog Loopback mode.	
C6	Transmitter timing <i>not</i> slaved by receiver.	
D8	Elastic Store option disabled (OUT).	
E9	Continuous carrier operation.	
	Grounding: Protective ground to signal ground.	AA to AB
	With alternate voice. Without alternate voice.	Either ¹

¹ The data set is normally supplied without a hand set.

Synchronous Controllers and Modems

BELL DATAPHONE II 2024A Modem

Private Leased Line, Point-to-Point, Full Duplex

Type of Modem	Bell System Type DPHI 2024A Data Set
Type of Line	Private Leased Line or Public Telephone Network (Dial Back-Up).
Transmission Rate	2400 bits-per-second
HP Products	RJE, MRJE, NRJE, DS, IMF, MTS - Configuration A

NOTE

For Dataphone II modems:

- Only one control on each line.
- C is usually the control computer site.
- T is usually the remote computer, host, or terminal site.
- C and T are for diagnostic purposes only.

TABLE 3-15. BELL 2024A MODEM OPTIONS

Option Number	Description	Comments
A1 A2	Point-to-point control. Point-to-point tributary or extended point-to-point tributary.	MASTER: A1 SLAVE : A2
B1	Internal timing (default).	Both MASTER and SLAVE
C5	Continuous carrier, continuous RTS.	Both MASTER and SLAVE
E5	Maximum address: 16.	MASTER
SA	RS-232 rise time.	Both MASTER and SLAVE
	Local address ¹	MASTER: 101 SLAVE : 011
	Network address	MASTER: 65 SLAVE : 01

¹ If rack mount, Level II or III, contact the Telephone Company marketing for assistance.

BELL DATAPHONE II 2024A Modem

Private Leased Line, Multi-Point

Type of Modem Bell System Type DPH 2024A Data Set
 Type of Line Private Leased Line or Public Telephone Network (Dial Back-Up).
 Transmission Rate 2400 bits-per-second
 HP Products IMF as a tributary, MTS - Configuration B

TABLE 3-16. BELL 2024A MULTIPOINT MODEM OPTIONS

Option Number	Description	Comments
A3 A4	Multipoint control. Multipoint tributary.	MASTER: A3 SLAVE : A4
B1	Internal timing (default).	Both MASTER and SLAVE
C5 C6	Continuous carrier. Switched carrier.	MASTER: C5 SLAVE : C6
D6 D8	Anti-stream timer: 27 seconds. Disable receive signal quality	MASTER: ¹ SLAVE : D6
E5 E6	Maximum address: 16. Maximum address: 32.	MASTER: ²
E7 E8	Disable diagnostic channel. Disable receive signal level.	MASTER: ¹
SA	RS-232 rise time.	Both MASTER and SLAVE
	³ Local address	MASTER: 101 SLAVE : 001
	Network address	MASTER: 65 SLAVES: 01, 02, . . .

¹ If rack mount, Level II or III, contact the Telephone Company marketing for addressing assistance.

² Use E7 if alarms are not desired during partially complete network conversion. Varying degrees of alarm suppression can be obtained by combinations of D8 and E8 instead of E7.

³ Use E5 for 1-16 remote modems; use E6 for 17-32.

Synchronous Controllers and Modems

BELL DATAPHONE II 2048A Modem

Private Leased Line, Point-to-Point, Full Duplex

Type of Modem Bell System Type DPH 2048A Data Set
 Type of Line Private Leased Line or Public Telephone Network (Dial Back-Up).
 Transmission Rate 4800 bits-per-second
 HP Products RJE, MRJE, NRJE, DS, IMF, MTS - Configuration A

TABLE 3-17. BELL 2048A MODEM OPTIONS

Option Number	Description	Comments
A1 A2	Point-to-Point Control Point-to-Point Tributary	MASTER: A1 SLAVE: A2
B1	Internal Timing (Default).	Both MASTER and SLAVE.
C5	Continuous Carrier.	Both MASTER and SLAVE.
E5	Maximum Address - 16	MASTER
SA	RS-232 Rise Time	Both MASTER and SLAVE.
	¹ Local Address.	MASTER: 101 SLAVE: 011
	Network Address	MASTER: 65 SLAVE: 01

¹ If rack mount, Level II or III, contact the Telephone Company marketing for addressing assistance.

BELL DATAPHONE II 2048A Modem

Private Leased Line, Multi-Point

Type of Modem Bell System Type DP11 2048A Data Set
 Type of Line Private Leased Line or Public Telephone Network (Dial Back-Up).
 Transmission Rate 4800 bits-per-second
 HP Products IMF as a tributary, MTS - Configuration B

TABLE 3-18. BELL 2048A MULTIPPOINT MODEM OPTIONS

Option Number	Description	Comments
A3 A4	Multipoint control. Multipoint tributary.	MASTER: A3 SLAVE: A4
B1	Internal timing (default).	Both MASTER and SLAVE
C5 C6	Continuous carrier. Switched carrier.	MASTER: C5 SLAVE: C6
D6 D8	Anti-stream timer: 27 seconds. Disable receive signal quality	MASTER: ¹ SLAVE: D6
E5 E6	Maximum address: 16. Maximum address: 32.	MASTER: ²
E7 E8	Disable diagnostic channel. Disable receive signal level.	MASTER: ¹
SA	RS-232 rise time.	Both MASTER and SLAVE
	³ Local address	MASTER: 101 SLAVE: 001
	Network address	MASTER: 65 SLAVES: 01, 02, . . .

¹ If rack mount, Level II or III, contact the Telephone Company marketing for addressing assistance.

² Use E7 if alarms are not desired during partially complete network conversion. Varying degrees of alarm suppression can be obtained by combinations of D8 and E8 instead of E7.

³ Use E5 for 1-16 remote modems; use E6 for 17-32.

BELL DATAPHONE II 2096A Modem

Private Leased Line, Point-to-Point, Full Duplex

Type of Modem	Bell System Type DP11 2096A Data Set
Type of Line	Private Leased Line or Public Telephone Network (Dial Back-Up).
Transmission Rate	9600 bits-per-second
HP Products	RJE, MRJE, NRJE, DS, IMF, MTS - Configuration A

TABLE 3-19. BELL 2096A MODEM OPTIONS

Option Number	Description	Comments
A1 A2	Point-to-Point Control Point-to-Point Tributary	MASTER: A1 SLAVE: A2
B1	Internal Timing (Default).	Both MASTER and SLAVE.
C5	Continuous Carrier.	Both MASTER and SLAVE.
E5	Maximum Address - 16	MASTER
SA	RS-232 Rise Time	Both MASTER and SLAVE.
	¹ Local Address.	MASTER: 101 SLAVE: 011
	Network Address	MASTER: 65 SLAVE: 01

¹ If rack mount, Level II or III, contact the Telephone Company marketing for addressing assistance.

BELL DATAPHONE Digital Service (DDS), Data Service Unit (DSU)

Private Leased Line, Point-to-Point or Multi-Point

Type of Modem Bell System 500B Type Data Service Unit (DSU)
 Type of Line Bell DATAPHONE Digital Service (DDS) Channel
 Transmission Rate 500B L1/2 2400 bits per second
 500B L1/2 4800 bits per second
 500B L1/2 9600 bits per second
 500B L1/2 56 kilobits per second

HP Products RJE, MRJE, IMF, DS, MTS - Configurations A and B

TABLE 3-20. BELL DATAPHONE DIGITAL SERVICE OPTIONS

Option Number	Description	Comments
A1 A2	Continuous Request-to-Send (Default Option). Switched Request-to-Send	MASTER: A1 SLAVE: A2
B3	Signal Ground to Frame Ground (Default Option)	Both MASTER and SLAVE
C5 C6	Loop-Back Switch and Indicator Lamps on Front (Default). Loop-Back Switch and Indicator Lamps on Rear.	Customer Choice
D7	Circuit Assurance Installed.	Both MASTER and SLAVE

¹ If rack mount, Level II or III, contact the Telephone Company marketing for addressing assistance.

² Use E7 if alarms are not desired during partially complete network conversion. Varying degrees of alarm suppression can be obtained by combinations of D8 and E8 instead of E7.

³ Use E5 for 1-16 remote modems; use E6 for 17-32.

HP MODEMS

Hewlett-Packard 37210T Modem

Type of Modem	Synchronous
Type of Line	Private Line, Switched Telephone Network.
Transmission Rate	4800 bits per second, 2400 bps fallback.

Options

Option 001: PTT Module (Private Line Isolation) ¹
Option 002: Two-wire Switched Line Isolation
Option 003: Auto Answer USA
Option 004: Secondary Channel
Option 005: Remote Command ²

¹ Not required in the USA.

² Four-wire Leased Lines only. Options 002 and 003 must be installed in modem.

Modem Configuration Recommendations

See "Modem Strapping Configuration Log" located inside the modem top cover. More comprehensive strapping information is to be found in the *Operating and Service Manual*, (37210-90000).

Hewlett-Packard 37220T Modem

Type of Modem	Synchronous
Type of Line	Private Line, D1 conditioning recommended.
Transmission Rate	9600 bits per second, 4800 bps fallback.

Options

Option 001: PTT Module (Private Line Isolation) ¹

¹ Not required in the USA.

Modem Configuration Recommendations

See "Modem Strapping Configuration Log" located inside the modem top cover. More comprehensive strapping information is to be found in the *Operating and Service Manual*, (37220-90000).

Hewlett-Packard 37230T Modem

Type of Modem	Synchronous
Type of Line	Four or two wire leased/private Lines. Must be unloaded metallic circuit.
Transmission Rate	19200/9600/4800/2400 bits per second.

Internal Strapping Options

Internal straps tailor modem operation to suit the particular installation. Full details of all internal straps and their recommended setting are contained in the *Operating and Installation Manual (37230-90000)*. The "Modem Strapping Configuration Log", located on the underside of the modem top cover, also contains details of all internal strapping and should be filled in at time of installation to document the actual modem strapping.

Options

Option 001: DTE Control of Loopback.

Allows the local data terminal equipment to control the loopback features on the local modem.

HEWLETT-PACKARD MODEM TESTS

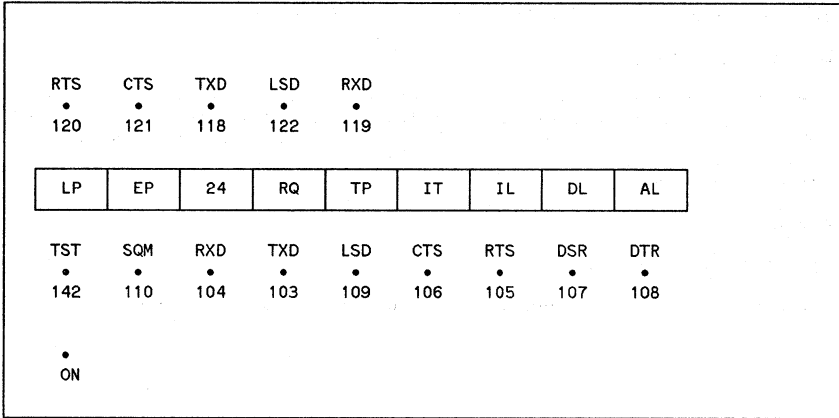


Figure 3-9. HP37210T Front Panel

Self Tests for 37210T Modems

The following self tests can be used by the customer or CE to determine if a data transmission problem exists between two modems, and to isolate the fault to either the modems or telephone lines.

- Tests 1 and 2 should be performed at all suspect modem sites.
- Test 3 should be performed on 4-wire installations only.
- Test 4 should be performed at all 2-wire installations.

NOTE

On modems fitted with option 005 the remote modem can be controlled from the local modem using the Remote Command Assembly.

Test 1. Lamp Test

1. Depress the LP pushbutton.
2. If any of the front panel indicators fails to illuminate, the modem is faulty.

Test 2. Local Analog Loopback Test

1. Depress the AL and TP pushbuttons (DL should not be depressed).
2. The LSD indicator should be fully on.
3. If the SQM indicator flickers on or remains on, the modem is faulty. The indicators should be observed for at least 30s.
4. Return the modem to normal operation by releasing the TP and AL pushbuttons.

Test 3. Remote Digital Loopback Test (4-wire installations only)

1. Depress the DL pushbutton at the remote modem.
2. Depress the TP pushbutton at the local modem.
3. The LSD indicators at both modems should turn on.
4. If the SQM indicator flickers on more often than 3 times per 30s period on average, the telephone lines are likely to be substandard.
5. Return both modems to normal operation by releasing the DL pushbutton at the remote modem and the TP pushbutton at the local modem.

Test 4. 2-Wire Receive Only Test

1. Press the RO pushbutton on the local modem.
2. Depress the TP pushbutton at the remote modem.
3. The LSD and RXD indicators at the local modem should turn on.
4. If the SQM indicator at the local modem flickers on, it indicates a telephone line disturbance. Frequent flickering on of the SQM indicator (more often than 3 times/30s period on average) indicates a substandard telephone line.
5. Repeat the test reversing the direction of transmission.

Remote Command Operation

In a point-to-point system remote commands can be sent from either modem to the other. In a multi-point system remote commands can only be sent from the master modem.

Procedure to send remote commands:

1. Set the ADDRESS thumbwheel to the address of the remote modem.
2. Set the Code thumbwheel to the appropriate code (refer to Table 3-21).
3. Momentarily depress the TX pushbutton to transmit the remote command. The TX indicator will light to indicate transmission of the remote command.

Synchronous Controllers and Modems

4. A message confirming receipt of the remote command is transmitted back to the master modem. Receipt of this message is indicated by the TX indicator turning OFF and the ABORT indicator not lighting.
5. If the ABORT indicator lights, no confirmatory message has been received by the master modem.
6. To resend a command it will be necessary to depress the TX indicator twice, once to clear the ABORT indication and once to transmit the command.

TABLE 3-21. REMOTE COMMAND CODES

Code Number	Function at Remote Modem
0	Depression of TP pushbutton.
1	Selects 2400 bps data rate.
2	No effect.
3	Depression of AL pushbutton.
4	Remote Command Module transmits 1020Hz tone. Remote Transmitter disabled.
5	Disables transmitter.
6	No effect.
7	Depression of DL pushbutton.
8 or 9	Resets/Clears remote commands.

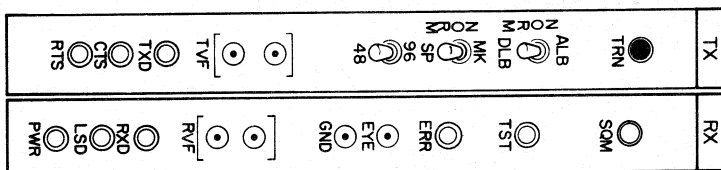


Figure 3-10.
HP 37220T Transmitter and Receiver Front Panels (front cover open)

Self Tests for 37220T Modems

The following self tests can be used by the customer or CE to determine if a data transmission problem exists between two modems and to isolate the fault to either the modem or telephone lines.

Test 1. Local Analog Loopback Test

Test 1 should be performed at all suspect modem sites.

1. Set the ALB-NORM-DLB switch to ALB.
2. Set the MK-NORM-SP switch to MK.
3. If the ERR indicator flickers on or remains on, the modem is faulty. The ERR indicator should be observed for at least 30s.
4. Set the MK-NORM-SP switch to SP and repeat step 3.
5. Check that the TXD and RXD indicators both light when the MK-NORM-SP switch is set to SP, and both go out when MK is selected.

Test 2. Remote Digital Loopback Test

1. Set the ALB-NORM-DLB switch on the remote modem to DLB.
2. Set the MK-NORM-SP switch on the local modem to SP.
3. Check that LSD turns on steady at the local modem within 9s. If LSD fails to turn on, the phone lines are faulty.
4. If the SQM indicator at the local modem flickers on more often than 3 times every 30s on average, the telephone lines are likely to be substandard.
5. Set the MK-NORM-SP switch to MK and repeat step 4.

Remote Control of Loopback

The 37220T modem has a facility whereby a local modem can control loopback on the remote modem. The loopback returns signals received over the telephone lines either by looping the received phone line signal directly to the transmit phone lines (analog loopback) or by looping the output of the receiver back to the transmitter input (digital loopback).

Only one of these two remote loopback modes can be selected. See *Operating and Service Manual* for details.

Depression of the TRN pushbutton at the local modem for greater than 3s will cause the remote modem to enter the remote loopback mode. The TST indicators at both modems will also light.

To remove the remote modem from the remote loopback mode, press TRN at approximately 1s intervals. The TST indicators at both modems should extinguish provided both test switches are in the NORM position.

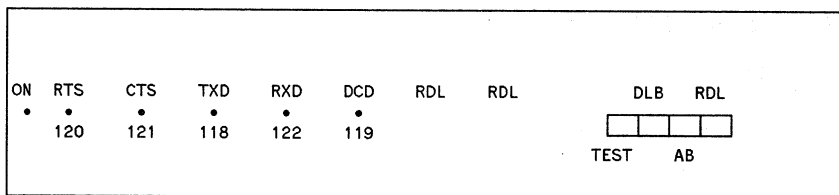


Figure 3-11. HP37230T Front Panel

Self Tests for HP 37230A

Analog Loopback Test

Should be performed at each modem to check local transmit/receive functions. Failure of this test indicates a faulty modem.

1. Depress the ALB and TEST pushbuttons on the modem front panel. Ensure all other pushbuttons are not depressed.
2. Check that the ERR lamp is off. If ERR is on or flashes on, the modem is faulty.
3. Return the modem to normal operation by releasing both pushbuttons.

Digital Loopback Test (Modems connected by 4-wire only)

Checks out the ability of two modems to transmit and receive data over the telephone network. In a multidrop network this test can be performed only between the master modem and a slave modem. It cannot be performed between two slave modems. Failure of this test and a pass for both modems in the Analog Loopback Test indicates a faulty phone line connection.

1. Depress the DLB pushbutton on the far end modem. Ensure all other pushbuttons are not depressed.

2. Depress the TEST pushbutton on the local modem. Ensure all other pushbuttons are not depressed
3. Each time an error is detected in the data received at the local modem, ERR will flash on. Occasional flashing on of ERR is acceptable. However, if ERR flashes on frequently or stays on for long periods, a faulty phone line connection is indicated.
4. Return both modems to normal mode by releasing both pushbuttons.

2-Wire Test (Modems connected by 2-wire lines only)

This test checks out the phone line connection between two modems operating in a 2-wire network.

1. At the local modem remove the wire links between the rear panel TX and RX terminals. Ensure that the 2-wire telephone line is connected to the RX terminals on the modem.
2. Depress the TEST pushbuttons on both the local and far end modems. Ensure all other pushbuttons are not depressed.
3. Each time an error is detected in the data received at the local modem, ERR will flash on. Occasional flashing of ERR is acceptable. However, if ERR flashes on frequently or stays on for long periods, a faulty phone line connection is indicated.
4. Release both TEST pushbuttons and reconnect the wire links between the TX and RX terminals on the local modem.

Remote Control of Digital Loopback

This facility, available only when two modems are connected in a point-to-point arrangement via a 4-wire line, allows an operator at one of the modems to command the far end modem to enter the digital loopback mode.

1. Depress the RDL pushbutton on the local modem to command the far end modem to enter the digital loopback mode.
2. Check that the RDL indicator turns on at the local modem within 6s. If RDL fails to light and ERR turns on, digital loopback at the far end modem is not guaranteed.
3. Releasing the RDL pushbutton at the local modem removes the digital loopback from the far end modem.

CS TRACE FACILITY AND ERROR MESSAGES

SECTION

4

CONTENT	PAGE
CS Trace File.....	4-2
LIST File.....	4-3
CSDUMP Program.....	4-4
Invoking and Revoking the Trace Facility.....	4-5
Protocol Driver Trace Entry Types (Table).....	4-7
Interconnect Driver Trace Entry Types (Table).....	4-8
Trace Dump Analysis.....	4-10
Line Information Display.....	4-11
COPTIONS.....	4-13
AOPTIONS.....	4-14
DOPTIONS.....	4-15
CS Errors.....	4-19
Irrecoverable CS Errors.....	4-19
Recoverable CS Errors.....	4-27
System Failure Codes in CS.....	4-28
Data Communications File System Error Codes.....	4-28
:CLINE, :CRESET, and :SHOWCOM.....	4-39
CCONTROL Control Codes (Table).....	4-31
INP Dump Facility.....	4-35
CSLIST.....	4-36

CSTRACE FILE

May be utilized by any subsystem that uses the CS drivers. Provides a recorded file of events that have occurred on the communications line.

System Default File Name: CSTRACE

Table 4-1. CSTRACE FILE PARAMETERS AND VALUES

Parameter	Value
formal file designator	CSTRACE
FOPTIONS (14:2) (13:1) (10:3) (8:2) (7:1) (6:1) (5:1) (0:5)	00 (new file) 0 (binary file) 0 (use actual file designator) 0 (fixed length records) 0 (no carriage control) 0 1 (disallow file equation) 0
AOPTIONS (12:4) (11:1) (10:1) (8:2) (0:8)	4 (input/output access) 0 (no multi-record option) 0 (disallow dynamic locking/unlocking) 0 (exclusive access) 0
blockfactor	1

User Defined File Name: FILE CSTRACE=*oldfile name*

- The trace file is opened for variable length records because each line using it may have different record size requirements.
- A new permanent file will be opened in the system domain each time TRACE is requested.
- If an error occurs when trying to open the trace file, the particular COPEN or CCONTROL intrinsic call will fail.
- If the trace file becomes full, the EOF marker will be moved to the top of the file, and all previous trace information is lost.
- If the system fails while tracing is enabled, the trace file will be closed. Some of the last entries may be lost.

- If a line being closed is the last one using the trace file, the CS/3000 trace facility issues an FCLOSE intrinsic call with the following parameters:

Parameter	Value
filenum	trace filenum
disposition	1 (save)
SECCODE	(0) unrestricted access

LIST FILE

The formal file designator for formatted trace dump output is LIST. The default output file is \$STDLIST. To divert formatted output elsewhere, such as to device class LP, use the following file equation:

```
:FILE LIST;DEV=LP
```

There may be a large volume of output generated by the CSDUMP program. You can control the list file output priority, keeping it below the outence value, and examine selected portions of spooled output by using the supported MPE utility SPOOK.

CSDUMP PROGRAM

Formats and lists the CSTRACE file. It is invoked through:

```
:RUN CSDUMP.PUB.SYS[,OCTAL][,HEX] [ ; PARM={ 0  
1  
2 } ]
```

The secondary entry point OCTAL allows you to specify that all raw data will be output in octal, otherwise it will be output in hexadecimal. (The entry point HEX, allowing you to specify hexadecimal for the output, has been retained for backward compatibility to the time when the default was octal.) If you specify PARM=0 or 1 all entries will be output by time; however, if you specify PARM=2 only CS/3000 intrinsics will be output by time.

Various conditions can cause this program to abort. These are indicated in an information error message, and in parameter values of the QUIT intrinsic.

Parameter	Meaning
1	Illegal dump format request
2	Open failure on trace file
3	Open failure on list file
4	Trace file access error
5	Open failure on temporary file
6	Temporary file access error
7	List file access error

INVOKING AND REVOKING THE TRACE FACILITY

- RJE/3000

```
:CLINE RJELINE;TRACE=[ALL] [mask] [entries] [WRAP]
;:RJE
#RJLINE...
      or
:RJE
```

```
#RJLINE{2780
        3780};TRACE=ON,<trace options>
```

When you stop using RJE tracing will stop.

- MRJE/3000

```
:MRJECONTROL START [hostid];TRACE,ON [trace options]
:MRJECONTROL TRACE [hostid],ON [trace options]
      or
:MRJECONTROL TRACE [hostid],OFF
```

- DS/3000

```
:DSCONTROL dsdevice;OPEN;TRACE,ON [trace options]
: DSCONTROL dsdevice;TRACE,ON [trace options]
      or
: DSCONTROL dsdevice;TRACE,OFF
```

- MTS/3000

```
{:MPLINE
 {dev,TRACE,ON[<trace options>]}}
```

```
{:MPLINE
 {dev,TRACE,OFF}}
```

- IMF/3000

```
:IMFCONTROL START,configfile,TRACE,ON [trace options]
:IMFCONTROL TRACE,configfile,ON [trace options]
      or
:IMFCONTROL TRACE,configfile,OFF
      or
:IMFMGR
>CONFIGURATION FILE configfile
>TRACE on [trace options]
>TRACE OFF
```

- X.25/3000

```
:DSCONTROL X.25device;OPEN,TRACE,ON [trace options]
: DSCONTROL X.25device;TRACE,ON [trace options]
: DSCONTROL X.25device;TRACE,OFF
```

TRACE OPTIONS

Syntax

```
[ALL] [mask] [numentries] [WRAP] [filename]
```

Parameters

ALL means that all activity is to be traced. Its omission means that only I/O errors are to be traced.

mask indicates the type of activities to be traced, as follows:

- %000, or omitted, means use the driver default mask.
- %001=generate PSTX entries ¹
- %002=generate PSCT,PPOL,PSEL entries ¹
- %004=generate PRTX entries ¹
- %010=generate PRCT entries ¹
- %020=generate POPR and PEDT entries ^{1, 2}
- %040=generate PSTN entries
- %100=generate INP interconnect entries
- %200=generate IMF (bisync only) control unit state transition entries.
- PCMP entries are generated automatically. ³

¹ This is a default value for the BSC and MRJE protocol; also for HPDLC-I protocol except for POPR and PEDT entries are not applicable and do not appear in the trace file.

² For IMF/SDLC %020 does not generate POPR and PEDT. Rather, it causes the suppression of PSTX, PSCT, PRTX, PRCT, and PSTN entries when the line is idly transmitting RR's. If %020 is omitted, line state has no bearing on tracing.

³ When tracing IMF BSC use mask of %277. When tracing IMF SDLC use mask of %77.

numentries The value of entries is used to derive the size of trace file record. Trace entries are deposited in a record in a circular manner. A driver dependent default of 24 will be used if the parameter is omitted. The maximum value that may be specified is 248. You must specify *numentries*=16 for X.25. On an INP the maximum is 24. (If *numentries*>24 is requested when tracing on an INP, a warning message will be printed and the maximum default of 24 will be used.)

WRAP Specifies that if the trace record is full for a given CS intrinsic, previous entries are overlaid. Its absence indicates that succeeding entries will be flushed. This parameter does not affect the EOF marker of the file.

filename Trace output will be sent to a specified file name which has been previously built. If a file name is not specified, the default destination depends on the communications software product being used. If a trace file exists it will be purged, and a new trace file will be created.

TABLE 4-2. PROTOCOL DRIVER TRACE ENTRY TYPES

Mnemonic	Entry Type	Definition
POPR	Operation	This type of trace entry is generated each time the physical driver is called upon to perform an operation. The POPR trace entry tells what operation is to be performed. ¹
PSTN	State Transition Entry	This type of trace entry is generated each time the driver transfers from one internal state to another. The PSTN trace entry tells what event just happened and what action is about to be performed.
PEDT	Editor Entry	This type of trace entry is generated each time a text message or control character sequence is received from the remote station. In the case of a text message, the PEDT trace entry shows the first 13 (for HSI) or 14 (for SSLC or INP) words of the user's buffer; control characters, pad characters and CRC parity sequences are omitted. In case of a control character sequence, the PEDT dtrace entry supplies a mnemonic phase telling what was received. ¹
PRCT	Receive Control Sequence Entry	This type of trace entry is generated each time a control character sequence is received from the remote station. The PRCT trace entry shows (in octal or hexadecimal) byte-for-byte exactly what was received. ²
PSCT	Send Control Sequence Entry	This type of trace entry is generated each time the driver sends a control character sequence to the remote station. The PSCT trace entry shows (in octal or hexadecimal) byte-for-byte exactly what was sent. ²
PRTX	Receive Text Entry	This type of trace entry is generated each time a text message is received from the remote station. The PRTX trace entry shows (in octal or hexadecimal) byte-for-byte exactly what was received. ³
PSTX	Send Text Entry	This type of trace entry is generated each time the driver sends a text message to the remote station. The PSTX entry shows (in octal or hexadecimal) byte-for-byte exactly what was sent. ³

TABLE 4-2. PROTOCOL DRIVER TRACE ENTRY TYPES (cont'd)

PCMP	User Request Completed	This type of trace entry is generated each time a user request (i.e., a CREAD, CWRITE, driver-performed CCONTROL, or CCLOSE intrinsic call) is completed. The PCMP trace entry summarizes the number of text messages sent and received and the number of errors that have occurred, etc.
PPOL	Send Polling Sequence Entry	This type of trace entry is generated each time the driver sends a polling sequence. The PPOL shows the sequence byte-for-byte.
PSEL	Send Selection Sequence Entry	This type of trace entry is generated each time the driver sends a selection sequence. The PSEL shows the sequence byte-for-byte.

¹This entry will not be generated by the SDLC or HPDLC-I protocol.

²For SDLC and HPDLC-I, this entry type is generated each time a frame is received from the remote station (PRCT) or sent to the remote station (PSCT). The PRCT or PSCT trace entry omits the Flag characters and Frame checking sequence (FCS) and shows the first 27 bytes of the I field maximum. One byte of the FCS may appear if the frame doesn't end on a word boundary.

³For SDLC and HPDLC-I, this entry type is generated only when the received frame (PRTX) or the sent frame (PSTX) is longer than 32 bytes. In this case PRTX or PSTX entries will be used to display the remainder of the I field that was not displayed in the entry. Trailing Flag and PCS bytes are omitted except when the frame does not end on a word boundary; then one byte of the FCS will appear.

TABLE 4-3. INTERCONNECT DRIVER TRACE ENTRY TYPES

Mnemonic	Entry Type	Definition
IDC	Driver Called	The entry is generated whenever the driver is called to perform an operation.
IDX	Driver Exited	This entry is generated whenever the driver completes an execution of the main control routines.
IADQ	Add to Queue	This entry is generated whenever the driver adds a request to one of its internal queues.
IRFQ	Remove From Queue	This entry is generated whenever the driver removes a request from one of its internal queues.
IDF	Data Frozen	This entry is generated whenever the driver requests a target data segment to be frozen in memory or to check if a previous request to freeze a data segment has been completed.

TABLE 4-3. INTERCONNECT DRIVER TRACE ENTRY TYPES (cont'd)

IUNF	Unfreeze Data	This entry is generated whenever driver wishes to unfreeze a previous frozen data segment or to insure that a data associated with a request is not frozen by the driver.
INR	New Request	This entry is generated each time the driver begins processing a new request.
IPR	Process Request	This entry is generated whenever the driver processes a request which may be completed immediately (i.e., requires no I/O to INP) or whenever a request requires some preprocessing before I/O is to be done.
IAR	Abort Request	This entry is generated whenever a request is to be hard absorbed.
ISTO	Start Timeout	This entry is generated whenever the driver starts a software timeout on a request.
ISS	Set Status	This entry is generated whenever the request completion status is set.
ICR	Complete Request	This entry is generated whenever a request has been fully completed by the driver and is released to the request initiator.
ICC	Check Completion	This entry is generated whenever the driver calls the physical driver to check I/O completion status and to check for software timeout completions.
IPM	Process Message	This entry is generated each time the power fail recovery routine is called.
IPFR	Power Fail Recovery	This entry is generated each time the power fail recovery routine is called.
ICD	Call Driver	This entry is generated each time the physical driver is called to perform an operation.
IDIO	DO I/O	This entry is generated each time the driver wishes to do an operation which sends a message to INP or moves data between requests
IRB	Illogical Condition	This entry is generated whenever the driver detects an illogical internal condition or receives an erroneous or illogical message from INP.

TRACE DUMP ANALYSIS

```
*** CS TRACE DUMP FACILITY *** TUE, JAN 6, 1977, 12:32 AM
TRACE FILE IS CSTRACE.CS30.DC
LAST OPENED ON TUE, JAN 6, 1977, 12:01 AM
SYSTEM ID=02.66
```

Figure 4-1. Example of a Trace Listing Header Message

At the start of the trace listing is a header message telling the date and time-of-day when the listing was printed and the fully-qualified name of the trace file being used. The meanings of the three remaining items in the header message (shown in Figure 5-1) are as follows:

LAST OPENED ON *date* This tells you the date and time-of-day when the trace was performed.
SYSTEM ID=*xx.yy* This tells you the version number (*xx*) and fix level (*yy*) of the MPE/3000 operating system that was being used when the trace was performed.
CS ID=*xx.yy* This tells you the version number (*xx*) and fix level (*yy*) of the CS/3000 subsystem that was being used when the trace was performed.

An example of a trace listing is shown in Figure 4-2. The meanings of the items in the trace listing are as follows:

BEGIN TRACING MESSAGE Specifies the device ldev number.

LINE NUMBER AFT entry.

LOGICAL DEV. NUMBER Number as specified during system configuration.

DEV. TYPE As specified during system configuration. INP=17, SSLC=18, HSI=19

SUBTYPE As specified during system configuration:
0 Point-to-point switch line (modem)
1 Point-to-point non-switched line (modem)
3 Point-to-point non-switched line (no modem)
7 Non-switched (hardwired) line with Async mode.

VER CS driver version number.

COPTIONS See "COPTIONS" later in this Section

AOPTIONS See "AOPTIONS" later in this Section

DOPTIONS See "DOPTIONS" later in this Section

NUMBUFFERS Total assigned to the line.

BUFFSIZE May differ from configured size due to subsystem requirements (i.e., RJE 3780 = 512 words, etc.).

INSPEED/OUTSPEED Line input/output speed in characters per second.

LINE INFORMATION DISPLAY

```

*****
* BEGIN TRACING FOR DEVICE 14 *
*****

-----L-I-N-E-----I-N-F-O-R-M-A-T-I-O-N-----D-I-S-P-L-A-Y-----
* LINE NUMBER: 3 LOGICAL DEV. NUMBER: 14 *
* DEV. TYPE: 17 SUATYPE: 7 VER: A.0A.C2 *
* 0123456789012345 *
* COPTIONS: 00010001000010 *
* AOPTIONS: 0000000100001101 *
* DOPTIONS: C10001000100000 *
* NUMRUFFERS: 1 BUFFSIZE: 1024 (WORDS) *
* INSPELD: 1200 OUTSPEED: 1200 *
* MISCARRAY: RECEIVE TIMEOUT: 20 SECS. *
* LOCAL TIMEOUT: 60 SECS. *
* CONNECT TIMEOUT: 900 SECS. *
* RESPONSE TIMEOUT: 300 MSEC. *
* LINE BID TIMEOUT: 60 SECS. *
* NO. ERROR RETRIES: 7 *
* CLEAR-TO-SEND DELAY: 0.3 SECS. *
* DATA-SET-READY DELAY: DISABLED. *
* TRANSMISSION MODE: HALF DUPLEX. *
* MMSTAT TRACE FACILITY: ENABLED. *
* POLL LOOP DELAY: 10 MSEC. *
* POLL REPEAT: 0 *
* POLL ENTRY DELAY: 10 MSEC. *
* DRIVERNAME: IOINPO (Binary value)
* DOWNLOAD FILE: CSOPTS.PUB.SYS
* TRACEINFO: ENTRIES=24 MASK=011111000
* TYPE OF TRACE = ALL, NOWRAP
* POLLIST: ENTRIES=3 INDEX=13
* 1 GRP = 1 2 GRP = 3
* 3 GRP = 4
* PHONELIST: ENTRIES=0 INDEX=0
* ICLIST: ENTRIES=0 INDEX=0
* SUPLIST: GROUPS=6 DESC=00000000
* JRP 1 STATIONS= 1 DESC=00000001
* { POLL ID = 4141 ASCII=AA EBCDIC=
* SEL ID = 6161 ASCII=aa EBCDIC= } Group Poll/Select
* GEN POLL ID = 2222 ASCII="" EBCDIC= } IDs (General)
* STA 1 COMPONENTS= 1 TYPE=0 (Hexadecimal
* CMP 0 POLL = 4141 ASCII=AA EBCDIC= value)
* SEL = 4141 ASCII=AA EBCDIC=
* GRP 2 STATIONS= 1 DESC=00000001
* POLL ID = 4242 ASCII=BB EBCDIC=11
* SEL ID = 6262 ASCII=bb EBCDIC=22
* GEN POLL ID = 2222 ASCII="" EBCDIC=
* { STA 1 COMPONENTS= 1 TYPE=0 Station/Device ID
* CMP 0 POLL = 4141 ASCII=AA EBCDIC= (Hexadecimal
* SEL = 4141 ASCII=AA EBCDIC= value)
* GRP 3 STATIONS= 1
* POLL ID = 4343 ASCII=CC EBCDIC=""
* SEL ID = 6363 ASCII=cc EBCDIC=33
* GEN POLL ID = 2222 ASCII="" EBCDIC=
* STA 1 COMPONENTS= 1 TYPE=0
* CMP 0 POLL = 4141 ASCII=AA EBCDIC=
* SEL = 4141 ASCII=AA EBCDIC=
* GRP 4 STATIONS= 1 DESC=00000001
* POLL ID = 4444 ASCII=DD EBCDIC=##
* SEL ID = 6464 ASCII=dd EBCDIC=44
* GEN POLL ID = 2222 ASCII="" EBCDIC=
* STA 1 COMPONENTS= 1 TYPE=0
* CMP 0 POLL = 4141 ASCII=AA EBCDIC=
* SEL = 4141 ASCII=AA EBCDIC=
* GRP 5 STATIONS= 1 DESC=00000001
* POLL ID = 4545 ASCII=EE EBCDIC=##
* SEL ID = 6565 ASCII=ee EBCDIC=#5
* GEN POLL ID = 2222 ASCII="" EBCDIC=
* STA 1 COMPONENTS= 1 TYPE=0
* CMP 0 POLL = 4141 ASCII=AA EBCDIC=
* SEL = 4141 ASCII=AA EBCDIC=
* GRP 6 STATIONS= 3 DESC=00000001
* POLL ID = 4646 ASCII=FF EBCDIC=XX
* SEL ID = 6666 ASCII=ff EBCDIC=66
* GEN POLL ID = 2222 ASCII="" EBCDIC=
* STA 1 COMPONENTS= 1 TYPE=0
* CMP 0 POLL = 4141 ASCII=AA EBCDIC=
* SEL = 4141 ASCII=AA EBCDIC=
* { STA 2 COMPONENTS= 1 TYPE=0 Stations in
* CMP 0 POLL = 4242 ASCII=BB EBCDIC=11 the Group
* SEL = 4242 ASCII=BB EBCDIC=11
* STA 3 COMPONENTS= 1 TYPE=0
* CMP 0 POLL = 4343 ASCII=CC EBCDIC=""
* SEL = 4343 ASCII=CC EBCDIC=""
* ERRORCODE: RECOVERABLE#0 IRECOVERABLE=201
* MSECNT: 1298 MGRFCO: 413
* RECOVERORS: 3 IRECOVERORS: 0
*****

```

Figure 4-2. An Example of a Trace Listing.

CS Trace Facility and Error Messages

MISCARRY The time out values may change during execution, and may not be operational depending on subsystem and function. MISCARRY format is:

- Logical array
 0 Number of words of parameter information following this word.
 1 Parameter type.
 2-n Parameter value

Repeat the last two fields for each parameter type to be specified, as follows:

TABLE 4-4. PARAMETER TYPES FOR MISCARRY

Type	Meaning of Value
0	Receive Timeout (seconds) Default = 20*
1	Local Timeout (seconds) Default = 60*
2	Connect Timeout (seconds) Default = 900*
3	Response Timeout (seconds) Default = 3*
4	Line Bid Timeout (seconds) Default = 60*
5	Number of Error Recovery Retries Default = 6
6	= 0 Clear-To-Send. Delay determined by modems <> Clear-To-Send. Delay value in tenths of seconds. On an INP this parameter defines the amount of time the driver will await the expected clear to send change before deciding the modem is broken. The default value is 300 milliseconds.
7	= 0 Data Set Ready. No stabilization time. = 1 Data Set Ready. 100 Msec stabilization time after it goes true.
8	= 0 Transmission mode = full duplex. = 1 Transmission mode = half duplex.
9	= 0 Disable MMSTAT trace facility. <> 0 Enable MMSTAT trace facility (Memory Management). (Not implemented for an INP.)
10	Poll Loop Delay. (.01 sec. each) Delay between iterations through Poll List (0=∞).
11	Poll Repeat. Number of iterations through Poll List (0=∞). Terminates when station responds or number of passes satisfied.
12	Poll Entry Delay. (.001 sec. each) Delay between polling entries in list. 0 disables timeout.

* A value of 0 will disable timeout.

COPTIONS

A word describing the communications options associated with the line.

- (0:1) inhibit timeout
 - = 0 allow timeout
 - = 1 disable all timeouts
- (1:1) ID Sequence Verification
 - = 0 allow the use of ID sequences (both user-supplied and configured defaults).
 - = 1 inhibit the use of ID sequences. Any user-supplied or configured default ID sequences will be ignored. (Applies to both local and remote ID sequences).
- (2:1) CS trace
 - = 0 do not invoke CS trace facility.
 - = 1 invoke CS trace facility. See also CTRACEINFO.
- (3:1) :CLINE override
 - = 0 allow CLINE command override
 - = 1 prohibit CLINE command override
- (4:2) Speed Select (European modems only)
 - = 0 use configured default setting
 - = 1 set speed to low speed
 - = 2 set speed to high speed
 - = 3 reserved for future use. Specifying this value causes a COPEN error.
- (6:4) Local Mode ("local" means the station at your end of the line).
 - = 0 use configured default setting
 - = 1 local is a primary contention station
 - = 2 local is a secondary contention station
 - = 3 local is a control station on a multipoint line
 - = 4 local is a secondary station on a multipoint line
 - = 5 local is an HPDLC.System acting as DTE.
 - = 6 local is an HPDLC.System acting as DCE.
 - = 7-15 reserved for HP use.

A COPEN error will result if local mode is not compatible with either COPEN parameters or configured line values.

- (10:6) Transmission code
 - = 0 use configured default setting
 - = 1 use automatic code sensing feature of driver
 - = 2 ASCII
 - = 3 EBCDIC
 - = 4-63 reserved for HP use

AOPTIONS

A word describing the access options associated with the line.

(0:8) Protocol

- = 0 use configured default protocol
- = 1 use BSC protocol
- = 2 use MRJE protocol (Conversational BSC)
- = 3 use HPDLC-I protocol
- = 4 255 reserved for HP use

A COPEN error will result if protocol is not compatible with configured line specification or driver capabilities.

(8:1) Allows the user to choose Alpha and Graphic characters in the phone number specified.

- = 0 only numeric and "-" are allowed. (default)
- = 1 allows Alpha, Numeric, and Graphic characters.

(9:1) Designates whether or not to delay the INP powerfail recovery. (Necessary for a series 64). No user control; set internally by CS.

- = 0 no delay (default)
- = 1 delay

(10:1) (reserved for future use.)

(11:1) Inhibit Console Error Message

- = 0 allow CS to print hardware error message of operator console.
- = 1 inhibit CS from printing hardware error message at operator console.

(12:2) Dial type

- = 0 dial on write connect; answer on read connect
- = 1 answer on write connect; dial on read connect
- = 2 dial on write connect; dial on read connect
- = 3 answer on write connect; answer on read connect

(14:1) :CLINE buffer override

- = 0 allow :CLINE override for *numbuffers* and *buffsize*.
- = 1 disallow buffer information override

(15:1) Wait mode

- = 0 perform all I/O using NCIO
- = 1 perform all I/O using CIO¹

¹ Only users executing in privileged mode may open a line with CIO and no buffering.

DOPTIONS

A word describing driver-related options. For the SSLC Drivers and BSC INP Driver, the format of DOPTIONS is as follows:

- (0:1) Reversed for future use.
- (1:1) Delay sequence wait.
 - = 0 wait on received WACK/TTD sequences.
 - = 1 Do not wait on received WACK/TTD sequences.
- (2:1) Poll termination sequence.
 - = 0 Before switching between stations, an RVI is transmitted to return the line to control mode.
 - = 1 Before switching between stations, an EOT is transmitted to return the line to control mode.
- (3:1) Control state listen mode.
 - = 0 While in control state and between user requests the driver listens for any control sequences from the remote.
 - = 1 While in control state and between user requests the driver ignores any control sequences from the remote.
- (4:2) Ending sequence:
 - = 0 Use BSC default (NSW=send EOT; SW=send DLE EOT)
 - = 1 send DLE EOT
 - = 2 send EOT
- (6:1) = 0 the remote will not send leading graphics
 - = 1 expect leading graphics from the remote
- (7:1) Value of USASCII block check character (bcc).
 - = 0 VRC/LRC (non-transparent mode or transparent with header).
CRC-16 (transparent mode with no header)
 - = 1 VRC/CRC-16 (non transparent mode)
CRC-16 (transparent mode)
- (8:1) = 0 automatic generation of WACK
 - = 1 no WACK will be sent
- (9:1) = 0 automatic generation of TTD
 - = 1 no TTD will be sent
- (10:1) = 0 Do not expect ITB sequences from the remote station.¹
 - = 1 Expect ITB sequence from the remote station.

¹ If an ITB sequence is received, the driver will require a retransmission to properly receive the message. The driver then sets this bit to a one.

CS Trace Facility and Error Messages

(11:2) Message Format Word (MFW)

- = 0 MFW will not be placed into received text nor expected in sent text. CS will use an implicit MFW of 000000 for sent text.
- = 1 MFW will not be placed into received text nor expected in sent text. CS will use an implicit MFW of 100000 for sent text.
- = 2 MFW will be placed into received text and expected in sent text.
- = 3 reserved for future use.

- (13:1) = 0 Multipoint primary station reselects a device for each write request.
= 1 Multipoint primary station will not reselect a device if a write request follows a read request.

- (14:2) Number of leading SYNs
- = 0 send four leading SYNs
 - = 1 send eight leading SYNs
 - = 2 send twelve leading SYNs
 - = 3 send sixteen leading SYNs

For the HSI Driver, the format of DOPTIONS is as follows:

- (0:1) Reserved for future use.

- (1:1) Delay sequence wait

- (2:1) Ignored

- (3:1) Control state listen mode
- = 0 while in control state and between user requests the driver listens for any control sequences from the remote. Receipt of a line bid causes the line to be placed into text state.
 - = 1 while in control state and between user requests the driver ignores any control sequences from the remote.

- (4:2) Ending sequence:

- = 0 use BSC default (NSW=send EOT; SW=send DLE EOT)
- = 1 send DLE EOT
- = 2 send EOT

- (7:1) Ignored

- (8:1) = 0 automatic generation of WACK. Enable.
= 1 no WACK will be sent. Disable.

- (9:1) = 0 automatic generation of TTD. Enable.
= 1 no TTD will be sent. Disable.

- (10:3) Ignored

- (13:1) Reserved for future use.

- (14:2) Ignored

Most of the remaining Line Information Display (Figure 4-2) entries are self-explanatory.

For the HPDLC-I INP driver the format of DOPTIONS is as follows:

(0:1) Looped back mode:

0 = normal.
1 = looped back.

(1.1) Satellite simulation mode:

0 = normal.
1 = simulate satellite delay.

(2:6) Reserved.

(8:8) Maximum number of outstanding frames. This is parameter K in the HPDLC-I protocol. Valid values are one through seven. (Default is seven).

CS Trace Facility and Error Messages

DOWNLOAD FILE	The file that is being downloaded
DRIVERNAME	The name of the line driver being used.
CTRACE INFO	
ENTRIES	The number of entries per record.
MASK	The binary specification of the events to be traced.
TYPE OF TRACE	Type of trace indicates whether ALL or I/O errors are to be traced, and whether the Trace file is to be overlaid, WRAP.
POLLIST	A set of multipoint station identifiers used for polling.
PHONELIST	A set of telephone numbers to be used to prompt for dialing a switched line connection.
IDLIST	A set of identification characters to be sent and to be received. RJE/3000 will send an ID sequence, but not receive them.
SUPLIST	The maximum set of groups, stations, and components which will be recognized on a multipoint line.
ERRORCODE	A specification of the type of error which occurred.
MSGSENT/MSGRECV	Number of blocks correctly received or sent and acknowledged.
RECOVERERRORS	Number of errors during entire TRACE duration.
IRRECOVERERRORS	Note the subsystem may fail due to satisfactory Bisync conditions which may abort the job, but still not be considered an irrecoverable error (i.e., receive a DLE EOT).

CS ERRORS

The CS error codes are returned in the *errorcode* parameter in a procedure call to CCHECK. Irrecoverable errors are returned in *errorcode(8:8)*, while recoverable errors are returned in *errorcode(0:8)*.

TABLE 4-5. IRRECOVERABLE ERRORS

Range	Description
0	Request completed successfully.
1-40	An error was found by the COPEN intrinsic.
41-50	The request was not initiated because of an error found by the CS intrinsics (including COPEN).
51-81	The request was not initiated because of an error found by the CS intrinsics (except COPEN).
84-109	A hardware error occurred or INP self test failed.
110-113	INP trace process detected error.
115-124	Main frame IC detected error.
151-200	An error or exceptional condition which resulted in the line being disconnected, which is driver dependent, occurred.
201-250	An error or exceptional condition occurred which did not result in the line being disconnected, which is driver dependent occurred.

Refer to Section 5, "Data Communications Troubleshooting Guide", for the causes and recovery for these error codes.

TABLE 4-6. CODE MEANING OF IRRECOVERABLE ERRORS

Code (Decimal)	Meaning
0	Request completed successfully.
1	None, or too many groups.
2	None, or too many stations.
3	None, or too many components.
4	Invalid poll or selection sequence length.
5	Not enough stack space for COPEN to process.
6	Invalid driver name.
7	Driver not found in system.
8	Driver not compatible with attributes of the line.
9	The line was not configured to allow for changeable drivers.
10	Undefined line device.
11	Line device not available.
12	Not a CS line device.
13	CS line device in use.
14	Invalid ID sequence length. It exceeds 16 characters.
15	Invalid buffer size. It exceeds configured device maximum.
17	Invalid telephone number length. It exceeds 20 characters.
18	Illegal character in telephone number. Only numerics or a hyphen character are allowed.
19	Local mode not compatible with line type.
20	Invalid information value in MISCARRAY.
21	Invalid information value in MISCARRAY.
23	Invalid entry in the poll list
24	Could not open trace file
25	Trace process unable to get, lock, or freeze extra data segment. [Trace file record size was too small] [Insufficient trace buffer space.]

TABLE 4-6. CODE MEANING OF IRRECOVERABLE ERRORS, (cont'd)

Code (Decimal)	Meaning
26	Invalid user capability. User does not have CS capability.
27	Invalid line designator.
28	No line designator or device specified.
29	Too many files or lines. Insufficient PCBX space.
31	Insufficient main memory space.
32	Driver failed to open
33	Local mode was control station, but the SUPLIST= <i>parameter</i> was not specified.
35	Down load file error.
38	Mainframe trace process not created or active.
39	Not enough INP buffer space.
40	Must have an INP with an autodialer.
41	Does not have autodial capability
47	Unable to lock code in memory.
48	No memory space available for tracing and/or buffering.
49	DB register not pointing at stack.
50	Process handling capability needed to trace.
51	Invalid line number. No such line.
52	Invalid parameter value.
53	Trace process detected a read error.
54	Autodialer detected errors.
55	No phone list exists.
56	Invalid buffer count parameter.
57	Console operator replied NO to a dial prompting message.

TABLE 4-6. CODE MEANING OF IRRECOVERABLE ERRORS, (cont'd)

Code (Decimal)	Meaning
58	No telephone number list for dial attempt.
59	System problem with dial message
60	Invalid array length parameter.
61	CCONTROL code value invalid.
62	The device must be an INP.
63	No I/O in progress to abort.
64	Abort ignored because I/O already completed or aborted.
65	Logical group number value is invalid
66	Logical station number value is invalid
67	Logical component number
68	Non-existent phone index specified.
69	Phone number specified is not the same length as the current phone number.
70	Maximum allowed outstanding writes exceeded.
71	Maximum allowed outstanding reads exceeded.
72	Current phone index doesn't exist.
73	Parameter bounds violation
74	No CS buffers remaining.
76	Required buffer parameter absent.
77	Too many I/O requests. IOWAIT needed. Or, concurrent I/O in progress.
78	No I/O pending for any file or line.
79	No I/O pending for specified file or line.
80	Illegal operation of INP device.
81	File system error in INP dump.
82	Unexpected INP Shutdown

TABLE 4-6. CODE MEANING OF IRRECOVERABLE ERRORS, (cont'd)

Code (Decimal)	Meaning
83	INP System failure
84	INP USYNRT failure with DMA.
85	INP parity error.
86	INP RAM software error
87	INP received invalid self-test control character.
88	INP DMA self-test error.
89	INP microprocessor (MC2) failure.
90	INP ROM failure.
91	INP RAM failure.
92	INP USART transmitter overrun.
93	INP USART parity error.
94	INP USART self-test receive error.
95	INP USYNRT self-test transmitter underrun.
96	INP USYNRT self-test receive error.
97	INP USYNRT self-test receive overrun.
98	INP USYNRT self-test receive aborted.
99	INP USART self-test received no data.
100	INP raised RTS but no CTS from modem. (SNA PU2 only)
101	Non-responding device.
102	Data transfer error
103	Data set not ready.
104	Carrier lost.
105	Data overrun
106	INP USYNRT received no data.

TABLE 4-6. CODE MEANING OF IRRECOVERABLE ERRORS, (cont'd)

Code (Decimal)	Meaning
107	INP USART failure with DMA
108	INP timer failure.
109	INP RAM parity error.
110	INP has no memory for trace buffers.
111	Illegal number of trace buffers requested for INP
112	Illegal start or stop requests for INP trace.
113	Illegal trace record size value specified for INP.
114	The device must be an INP
115	Power failure during down load.
116	Mainframe IC driver timed out.
117	Invalid interrupt.
118	Start or stop I/O program error.
119	Power failure recovery error.
120	Internal driver error.
121	ROM self test error
122	HP IB error.
123	GIC error
124	Reset while in RAM or ABORTIO. If an ABORTIO is successful, every <i>new</i> request will be completed with CSERR 124. Any <i>current</i> request will be completed with CSERR 201. If the driver is requested to reset the board when the board is downloaded, then every request will be completed with CSERR 124.
130	INP system failure. Highest value.
151	Connect timeout occurred.
152	Line bid not received.
153	Remote station rejected the connection.

TABLE 4-6. CODE MEANING OF IRRECOVERABLE ERRORS, (cont'd)

Code (Decimal)	Meaning
154	Power failure occurred.
155	Local timeout occurred.
156	An internal error was detected by the driver.
157	Remote station protocol error occurred.
158	Remote station sent shutdown sequence and disconnected.
159	Remote station sent shutdown sequence and disconnected before the I/O request was issued.
160	An internal error was detected by MPE.
161	Initialization timer expired.
201	Operation aborted.
202	Invalid request detected by the driver
203	Remote station is not ready to accept line bid. The remote station sent a NAK in sequence in response to the local line bid.
204	Remote station rejected the line bid.
205	Remote primary station bid for the line while.
206	Remote has requested to send. (An RVI sequence was received.)
207	Driver retry counter exhausted.
208	Unexpected text was received.
209	Receive timeout expired while waiting for text from the remote station.
210	Remote station sent end-of-transmission
211	Remote station sent end-of-transmission sequence, and disconnected before the I/O request was issued.
212	During the execution of a CWRITE conversational with the output buffer to be the input buffer also, the remote requested a resend of the output buffer; but, its contents had been modified while receiving from the remote.
213	Remote station sent an ACK in response to local CREAD acknowledgement.

TABLE 4-6. CODE MEANING OF IRRECOVERABLE ERRORS, (cont'd)

Code (Decimal)	Meaning
214	Remote station sent a NAK in response to a local CREAD acknowledgement.
215	Remote station sent an RVI sequence in response to a local CREAD acknowledgement.
216	Remote station requested a download sequence be initiated.
217	No line bid was received from the remote station; local station timed out.
218	Remote sent a delay sequence instead of the expected text or response.
219	The entries in the pollist were polled the required number of times and no station responded.
220	An EOT was received from the remote station before the last block of multiblock transmission was sent.
221	After an RVI was sent to the remote station, it responded with text instead of the expected EOT.
222	All stations on a multipoint line are down.
223	Too much data was transmitted by the remote station. Part of the data was lost. Buffer overflow.
224	All stations on a multipoint line are logically down.
225	Pollist Entry Set down after not responding for specified number of retries.
226	INP inactivity timeout. DSMonitor reissues CREAD if still alive.
230	Bad P2 parameter on a Write Request.
231	SNA Link attempted to send unsolicited XID to host.
250	Unable to lock code in memory.

TABLE 4-7. RECOVERABLE ERRORS

Code (Decimal)	Meaning
0	No recoverable error occurred.
1	Invalid ID sequence received
2	Received unintelligible sequence.
3	Block check character of field check sequence error.
4	Response timeout occurred.
5	Received incorrect acknowledgement.
6	Remote station attempted to bid for the line.
7	Remote station did not respond to the local line bid.
8	Received unintelligible sequence after sending text.
9	Received inquiry character after sending text.
10	Remote station requested a resend of the last local response.
11	Remote station requested a resend of the last text block.
12	Received end-of-transmission character while in control state.
13	Received text overflow.
14	Data overrun occured on SIO multiplexor.
15	Transfer error occurred on the SIO multiplexor.
17	Data underrun on INP interface board.
18	Host sent invalid data to 3270 station.
19	Requeue 3270 screen for transmit or IMF had to NAK Host Transmission.
20	Link Reset by Host SNRM.

CS Trace Facility and Error Messages

The recommended action for the following System Failure Codes (Table 4-8) is to perform a cold dump and forward it to HP for analysis.

TABLE 4-8. SYSTEM FAILURE CODES IN CS

Code (Decimal)	Meaning
900	I/O request no longer associated with process.
902	Unable to freeze or lock a code segment in main memory.
903	Unable to lock or unlock a segment in main memory.
904	Unable to increase a data segment size
905	Unable to decrease a data segment size.
906	Unable to unfreeze a code segment in main memory.
907	Unable to unlock a code segment in main memory.
909	Invalid pointer to poll list entry.
910	Invalid IO queue index value
911	IO queue value cleared after return from MMSTAT procedure

TABLE 4-9. DATA COMMUNICATIONS FILE SYSTEM ERRORS

201	Invalid ID sequence (FSERR 201)
202	Invalid telephone number (FSERR 202)
203	No telephone list specified (FSERR 203)

:CLINE, :CRESET, and :SHOWCOM

CLINE Parameters

NOTE

This command can only be issued against a datacomm subsystem which runs on the user's stack (such as RJE), not against one that runs as a system process.

<pre> <i>formaldesignator</i>= *<i>formaldesignator</i>1 DEV=<i>device</i> BUF=[<i>numbuffers</i>] [,<i>buffsize</i>] PROTO= BSC MRJE HPDLCI n CODE= SENSE ASCII EBCDIC n DUAL= LOW HIGH DIAL= W R BOTH NO LMODE= PRI SEC MPCNT MPSEC DTE DCE n DRIVER= <i>driverName</i> DOPTIONS=<i>n</i> SPEED= [<i>inspeed</i>] [,<i>outspeed</i>] LOCID= <i>idsequence</i> <i>idsequence</i>= { A "<i>string</i>" E "<i>string</i>" O <i>n</i> [,<i>n</i>...] H <i>n</i> [,<i>n</i>...] } REMID=<i>idseqlist</i> PHLIST= <i>telephonenumberList</i> MISC= <i>index, value...</i> DOWNFILE=<i>filename</i> </pre>	<pre> FORMALDESIG DEVICE NUMBUFFERS BUFFSIZE AOPTIONS.(0:8)=1 AOPTIONS.(0:8)=2 AOPTIONS.(0:8)=3 COPTIONS.(10:6)=1 COPTIONS.(10:6)=2 COPTIONS.(10:6)=3 COPTIONS.(4:2)=1 COPTIONS.(4:2)=2 AOPTIONS.(12:2)=0 AOPTIONS.(12:2)=1 AOPTIONS.(12:2)=2 AOPTIONS.(12:2)=3 COPTIONS.(6:4)=1 COPTIONS.(6:4)=2 COPTIONS.(6:4)=3 COPTIONS.(6:4)=4 COPTIONS.(6:4)=5 COPTIONS.(6:4)=6 DRIVERNAME DOPTIONS INSPEED OUTSPEED <i>local id's of IDLIST</i> <i>remote id's of IDLIST</i> PHONELIST MISCARRAY DWNLDFILE </pre>
---	--

CS Trace Facility and Error Messages

```
TRACE=      [ALL][mask][entries][WRAP]      CTRACEINFO
            mask %001 PSTX1
            %002 PSCT,PPOL,PSEL1
            %004 PRTX1
            %010 PRCT1
            %020 POPR and PEDT1
            %040 PSTN
            %100 mainframe interconnect entries
            %200 3270 STN
```

¹PCMP always default value for BSC and MRJE protocol

entries are per record and modulo 8

```
NOTRACE      CTRACEINFO absent
ID           COPTIONS.(1:1)=0
NOID        COPTIONS.(1:1)=1
TIMEOUTS    COPTIONS.(0:1)=1
SUPLIST=    SUPLIST
            generalSuplist=mpLineType,LSEL=ss,
            GRP=gdesc=ID={ps
                        ss},sdesc=type=n,bufferize
            cdesc=ps,ss
```

```
POLLID=      pollEntryList      POLLIST
            polEntry=G={grpNr
                       staNr
                       grpNr/compNr}
```

```
NETWORK'ID= n      NETWORK'ID
```

CRESET

```
:CRESET formaldesignator
```

NOTE

This command can only be issued against a datacomm subsystem which runs on the user's stack (such as RJE), not against one that runs as a system process.

SHOWCOM

```
:SHOWCOM ldev[;ERROR][;RESET]
```

- *ldev* is the logical device number of a communications controller. ERROR will produce a more detailed display of errors. RESET will clear totals.

Use of this command must be specifically allowed.

TABLE 4-10. CCONTROL CODES

Control Code	Parameter	Comments
0	0	aborts all outstanding I/O
0	-n	aborts the |n'th| oldest read request
0	+n	aborts the n'th oldest write request
1	none	reset the line from text state to control state. Send an EOT to the remote.
2	none	disconnect the line. Send an EOT, or a DLE EOT, depending on DOPTIONS.(4:2), and if CCONTROL (.258,) has been issued.
32	parameter	changes the index into the phone list to the parameter supplied.
33	parameter	inserts an entry into the poll list of a multipoint line. The parameter value is the entry to be inserted.
34	parameter	deletes all occurrences of the entry, parameter, from the pollist.
35	parameter	change poll list index value
36	0	reset dialing convention to dial on write connects; answer on read connect.
36	1	reset dialing convention to answer on write connect; dial on read connect
36	2	reset dialing convention to dial on write connect; dial on read connect
36	3	reset dialing convention to answer on write connect; answer on read connect
37	0	disable receive timeout
37	-1	set receive timeout to its default of 20 seconds
37	>0	set receive timeout to parameter value.
38	0	disable local timeout
8	-1	set local timeout value to its default of 60 seconds.
38	>0	set local timeout to parameter value.
39	0	disable connect timeout

TABLE 4-10. CCONTROL CODES (cont'd)

Control Code	Parameter	Comments
39	-1	set connect timeout value to its default of 900 seconds
39	>0	set connect timeout to parameter value
40	>0	change to number of driver error recovery retry attempts.
41	1	set local station to a primary contention station
41	2	set local station to a secondary contention station
41	3	set local station to a control station
41	4	set local station to a 3270 secondary contention station
41	5	set local station to DTE
41	6	set local station to DCE
42	result	read line state result.(0:8) reserved result.(8:8) = 0,unconnected 1,control 2,text
43	none	disable tracing
44	required	enable tracing parameter(0)=CTRACEINFO of COPEN parameter(1)=trace file designator first word
45	required	return current remote id sequence parameter(0)=length parameter(1)=remote id sequence . . .
46	0	change IO specification to NCIO
46	1	change IO specification to CIO
47	0	disable response time out
47	>0	set response time out, in hundredths of a second
48	0	disable line bid time out
48	>0	set line bid timeout value, in seconds

TABLE 4-10. CCONTROL CODES (cont'd)

Control Code	Parameter	Comments
49	0	disable MMSTAT trace
49	1	enable MMSTAT trace
50	result	current id in configured list result=-1, current ID not in configured list result=0, zero length current id not in configured list result=1, zero length current id is in configured list result=2, non-zero length current id is in configured list
51		setup all components of poll list
52		return last transmission log
53		dump INP RAM
54	result	find configured buffer size for multipoint
55	result	find amount of buffer space available on the INP board
56	result	return current ROM status of the INP board
57	required	send status and sense words down to the INP board for IML
256	p.(15:1)=0	disable automatic generation of WACK
256	p.(15:1)=1	enable automatic generation of WACK
256	p.(14:1)=0	disable automatic generation of TTD
256	p.(14:1)=1	enable automatic generation of WACK
257	0	set VRC/LRC for non-transparent, and CRC-16 for transparent text
257	1	set VRC/CRC-16 for non-transparent, and CRC-16 for transparent text
258	0	sent EOT for non-switched and DLE EOT for switched for disconnect
258	1	always send DLE EOT for disconnect
258	2	always send EOT for disconnect
259	0	do not expect ITB from remote station
259	1	expect to receive ITB from remote station

TABLE 4-10. CCONTROL CODES (cont'd)

Control Code	Parameter	Comments
260	0	CREAD will be executed normally
260	1	The next CREAD will use an RVI instead of an ACK0 or ACK1
260	2	The next CREAD will use a NAK instead of an ACK0 or ACK1
261	0	MFW will not be placed into received text nor expected in sent text. The implicit value will be 0.
261	1	MFW will not be placed into received text nor expected in sent text. The implicit value will be %100000.
261	2	An MFW will be placed into word 0 of the user input buffer, and expected in word 0 of the user output buffer.
262	0	disable download mode
262	1	enable download mode
263	result	read download byte into result.(8:8) and clear result.(0:8)
264	0	while in control state listen mode accept control sequences. Receipt of a line bid puts line into text state.
264	1	while in control state listen mode and between user requests ignore control sequences.
265		an IML screen is ready for transmission
266		the IML screen (printer) is busy
267		the IML-emulated printer device has finished
268		an IML-ready screen has been aborted

INP DUMP FACILITY

INP dump analysis is done only by factory level support personnel. The messages at the system console announcing board failure and dump are

```
INP BOARD FAILURE - LDEV xxx
```

where *xxx* is a logical device number.

```
INP RAM DUMPED IN INPLOGnn
```

```
STORE AND PURGE ALL INPLOGnn FILES
```

where *nn* identifies a dump file created in the PUB group of the SYS account.

Formatted output of an INP dump file, identified by the console messages above, is done as follows:

Omit the following to default output to \$STDLIST, or divert output to device class LP.

```
:FILE INPLIST;DEV=LP;CCTL
```

Identify the file to be formatted, such as the one indicated in a console message.

```
:FILE INPDUMP=INPLOGnn.PUB.SYS
```

Execute the dump file formatter.

```
:RUN INPDPAN.PUB.SYS,FULLDUMP
```

You can store all INP dump files with the following commands:

```
:FILE INPTAPE;DEV=TAPE :STORE INPLOG##.PUB.SYS;*INTAPE
```

Once you have finished using INPLOGnn dump files, remember to purge them, because their numbers are limited. The system can build up to 99 INP log files.

Refer to Section 2, "Asynchronous Controllers and Modems", for more information.

CSLIST

CSLIST allows the user to obtain a list of the version, update, and fix (VUF) of the installed CS modules. It also shows the VUF of the latest release of the CS modules to verify that the installed CS modules are current.

In addition, CSLIST allows the user to obtain information for the HP-Standard or user-designated INP download files. This information includes Download File Name, Protocol Type, Board Type, Compile Date, and four version numbers - IC, Protocol, Trace, and RamCP. The information for the HP-Standard download files is accessed through the normal processing of CSLIST. In order to input specific download files names, use the CSLIST entry point INP.

Operation

Standard User Mode

1. The program is executed by a `:RUN CSLIST.PUB.SYS` command. A header is printed out followed by a short explanation.
2. DO YOU WANT A COMPLETE LISTING OF INSTALLED VUFS? is asked. Possible responses:
 - YES (or Y) - A complete listing is produced.
 - NO (or N) - VUFs of only non-current modules are listed.
3. DO YOU WANT THE INP DOWNLOAD FILE INFORMATION? is asked. Possible responses:
 - YES (or Y) - A listing of the information for the HP-Standard download files is produced.
 - NO (or N) - No listing is produced.
4. SHOULD OUTPUT BE DIRECTED TO THE LP? is asked. Possible responses:
 - YES (or Y) - Output is directed to the system line printer (LP). If no `:FILE LP` equation exists, the file LP defaults to device class LP - i.e., `:FILE LP;DEV=LP` is assumed.
 - NO (or N) - Output is directed to `$STDLIST`.
5. The requested listings are now produced and sent to the correct output device. A total count of CS modules that do not have a current VUF is printed on `$STDLIST`. Any errors encountered while processing the download file information are printed to `$STDLIST` and to the LP, if output has been directed there (see **Error Messages** below).

Special Mode

Used to access information on specific download files.

1. The program is executed by a :RUN CSLIST.PUB.SYS,INP command. A short explanation is printed.
2. SHOULD OUTPUT BE DIRECTED TO THE LP? is asked. Possible responses:
 - YES (or Y) - Output is directed to the system line printer (LP). If no :FILE LP equation exists, the file LP defaults to device class LP - i.e., :FILE'LP;DEV=LP is assumed.
 - NO (or N) - Output is directed to \$STDLIST.
3. The prompt DOWNLOAD FILE NAME= is asked. Possible responses:
 - EXIT (or E, e, exit, //, or carriage return) - Program terminates.
 - *filename* - A listing of the information for this download file is produced on the requested device and the prompt is repeated.

Error Messages

These are produced during the search for download file information.

Most of the recoverable and irrecoverable errors possible when running this program are self-explanatory. However, the user should take note of the following messages:

INVALID ADDRESS ON (*filename*)

An invalid address was encountered while following the pointers around the download file to access the miscellaneous information. Probably this download file is not in a format compatible with CSLIST. Make sure the download file is from CS release 5.04 or later. Although some information may be printed, it may be incorrect if the file is not in the correct format.

FOPEN ERROR ON (*filename*)

The program was not able to open the designated file - probably because the file does not exist.

FILE (*filename*) INVALID TYPE

The designated file does not pass the download file verification tests.

DATA COMMUNICATIONS TROUBLESHOOTING GUIDE

SECTION

5

CONTENT	PAGE
References.....	5-2
The Basics.....	5-3
The Method.....	5-5
The Symptoms.....	5-6
Newly Installed.....	5-7
Changed Software.....	5-9
Changed Hardware.....	5-12
No Changes.....	5-15
The Causes and Tests.....	5-20
The Tools.....	5-24
Usage Tools.....	5-24
Protocol Tools.....	5-25
Digital Tools.....	5-26
Analog Tools.....	5-28
Tool Descriptions.....	5-29

Troubleshooting Guide

REFERENCES

Data Communications Testing, Hewlett-Packard Company, 1980

Data Communications Concepts, National Cash Register, 1978

Technical Aspects of Data Communication, J. E. McNamara, Digital Equipment Corporation, 1977

Guidebook to: DATA COMMUNICATIONS, Hewlett-Packard Company, 1977

Troubleshooting short- and long-haul analog lines, David Levin, Netcomm, Inc., *Data Communications*, November 1981

Various Hewlett-Packard HP 3000 manuals including:

- 2780/3780 Emulator Reference Manual*
- DSN/MTS Reference Manual*
- DSN/DS Reference Manual*
- DSN/IMF Reference Manual*
- DSN/MRJE Reference Manual*
- System Error Messages and Recovery Manual*
- COMMUNICATIONS HANDBOOK*
- Diagnostic Manual Set*

Various AT&T and Bell Technical References

THE BASICS

What is Needed in General

- The version of MPE that is on the system,
- The MPE I/O configuration,
- What hardware is being used,
- That the problem is not already listed in the Software Status Bulletin (SSB),
- That the product is right for the application,
- The *symptoms* of any operations that have been done,
- The results of any testing that has already been done, and
- Bring a tape copy of all debugging files (unformatted) back to the sales office.

What is Needed for the Specific Data Communications Products

DSN/DS (Distributed System)

- Versions and fix levels of DS and CS of both sides from CSLIST and DSLIST,
- Accurate description of the datacomm network on both sides including controller switch settings and cable numbers,
- Pertinent console messages from both sides,
- Error messages reported to the user, and
- Trace with ALL parameter.

DSN/X.25 for the HP 3000 (Distributed Systems)

- Versions and fix levels of X.25 and CSLIST of both sides from CSLIST and DSLIST,
- Accurate description of datacomm network on both sides including cable numbers and NETCONF configuration,
- Pertinent console messages from both sides,
- Error messages reported to the user,
- Trace messages with ALL parameter and *numentries=16*, and
- List of PDN specific diagnostic codes.

DSN/IMF (Interactive Mainframe Facility)

- Version numbers of modules from CSLIST,
- IMF configuration file,
- Description of screen or print file on real device,
- Host type,
- Trace with mask of %277 for BISYNC,
- Trace with mask of %77 for SDLC,
- MONDUM@.PUB.SYS file if IMF terminated abnormally, and
- INPLOG@.PUB.SYS file if INP board failure occurred.

Troubleshooting Guide

DSN/MRJE (Multileaving Remote Job Entry)

- Version numbers of modules from CSLIST,
- MRJE versions numbers from MRJECONTROL CHECK,
- MRJE configuration file,
- Copy of print banner (if applicable),
- Copy of MRJE message file,
- Copy of console messages,
- Host type, and
- Trace with ALL parameter.

DSN/MTS (Multipoint Terminal Software)

- Version number of MTS,
- Models of terminals and modems involved, and
- Complete description of network hardware.

DSN/RJE (Remote Job Entry)

- Version number of CS from CSLIST or RJINFO,
- Version number of RJE,
- Listing of command file and/or console session,
- RJINFO list,
- Remote or host type, and
- Trace with ALL parameter.

TERMIO (Terminal I/O)

- MPE version,
- TERMIO patches level applied,
- ATC, ADCC or ATP,
- 3-wire (RS-232-C), 5-wire (RS-449), or modem, and
- Terminal models.

Modems

- Manufacturer,
- Model,
- Speed,
- Synchronous or asynchronous,
- Type of phone line or wire, and
- Communications software.

THE METHOD

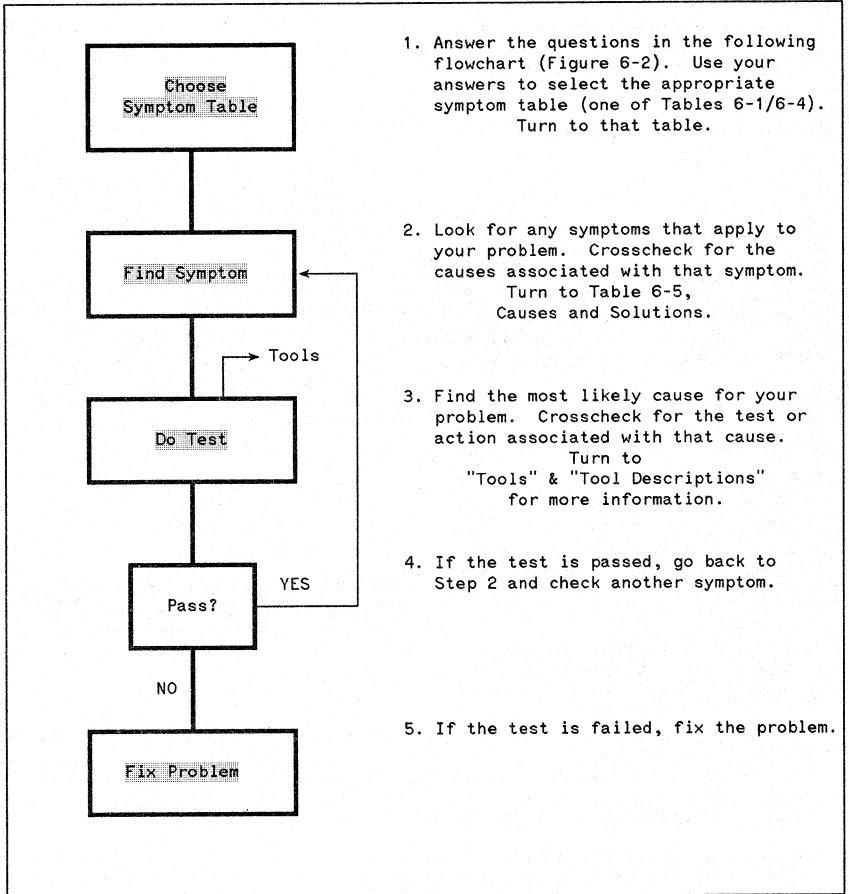


Figure 5-1. Symptomatic Troubleshooting Flowchart.

THE SYMPTOMS

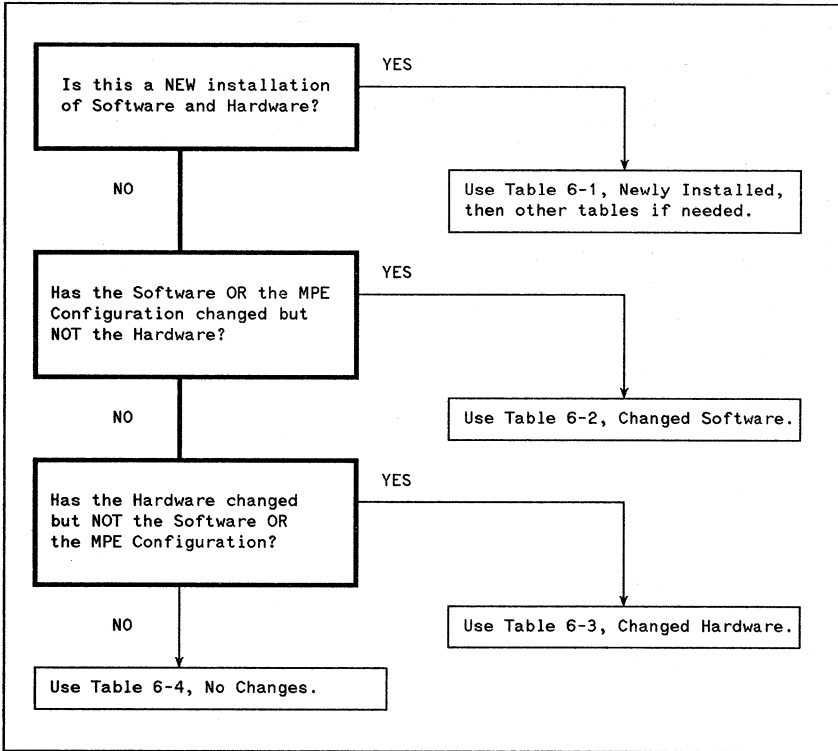


Figure 5-2. Questions to Help Choose a Symptom Table

The symptom tables begin on the next page and are listed in the following order:

Table 5-1. Symptoms for a New Installation	5-7
Table 5-2. Symptoms for a System with Changed Software	5-9
Table 5-3. Symptoms for a System with Changed Hardware	5-12
Table 5-4. Symptoms for a System with No Changes	5-14

Newly Installed Hardware and Software

Limited to symptoms encountered prior to getting the line open.

TABLE 5-1. SYMPTOMS FOR A NEW INSTALLATION

Product	Symptom	Possible Causes
DS	Console locked, hung console, System Failures	Software installation bad
	DSCONTROL command hangs	Configuration bad
X.25	DSCONTROL command hangs	Configuration bad
	CSERR 161	Cable problems, PDN or remote HP 3000 in hardwired connection not responding.
RJE	Aborts	MPE resource problem or user written procedure error
	Host shuts line	Line or modem problem, sign on procedure error, or host configuration
	Host will not take input	Line or modem problem, sign on procedure error
	Line closes	Line or modem problems
	No output	Host not sending data or sign on procedure error
	Poor response	Host busy, HP 3000 busy, or line problems
MRJE	Aborts	MPE resource problem or user written procedure error
	Host shuts line	Line or modem problems, sign on procedure error, or Host configuration
	Line closes	Line or modem problems
IMF	Cannot connect or sign on	Configuration files
	Printer problems	Host compatability
	Screens do not work	Screen design error
	Various problems	Configuration files, request aborted by Host, application wrong, IMF is not a 3270 Host configuration

TABLE 5-1. SYMPTOMS FOR A NEW INSTALLATION (cont'd)

Product	Symptom	Possible Causes
MTS	Cannot open line	Software bad, controller or modem problem
	Cannot open MPMON	MPE resource problem
	CS117	INP switches wrong, cable bad, or MPE config
TERMIO	Can only logon at one speed	MPE configuration, terminal switches or configuration
	Cannot logon	MPE configuration, terminal switches or configuration, cable or controller problem
	Remote spooled printer problem	MPE configuration, printer switches, modem or cable problems
	System failures or SF 700-701, 704-706, or 709	Software installation bad
	SF 703, 708, 710	Configuration bad

Changed Software

(The hardware is unchanged.)

TABLE 5-2. CHANGED SOFTWARE SYMPTOM TABLE

Product	Symptom	Possible Causes
CS	CSERR 6-7	Software or configuration problem
	CSERR 8-10	Configuration
	CSERR 11-13	Operator procedure
	CSERR 14-19	Configuration
	CSERR 57-58	Operator procedure
	CSERR 153	Operator procedure or remote device problem
	CSERR 154	Hardware
	CSERR 156	Software
	CSERR 157-159	Remote device
	CSERR 158	Operator procedure or remote device problem
	CSERR 201	Operator procedure
	CSERR 203-204	Remote device
	CSERR 205-207	Operator procedure
	CSERR 207-209	Hardware, line, or modem problems
	CSERR 207-217	Remote device
	CSERR 212-214	Hardware
CSERR 217	Hardware	
DS	DSCONTROL fails with CIERR 4152 or 4153	Software installation bad
	DSCOPY aborts	Software bad
	Line closes or poor response	Configuration problem

TABLE 5-2. CHANGED SOFTWARE SYMPTOM TABLE (cont'd)

Product	Symptom	Possible Causes
DS (cont'd)	Sessions hang	DSMON bad, programs not compatible with new, or MPE version
	System failures	Software installation bad
X.25	DSCONTROL fails with CIERR 4152 or 4153	Software installation bad
	DSCONTROL hangs	Configuration bad, NETCONF bad
RJE	Aborts	MPE resource problem or user written procedure error
	Cannot sign on	Sign on procedure
MRJE	Cannot open line.	Software installation bad
	Cannot sign on.	Configuration file
	Did not get host number back	Message modified, cannot read
	Job management does not work	Job log corrupted, did not get host number back, banner messed up, configuration file corrupted, RMT# changed or wrong.
	MRJE user errors	New user commands
	No input taken by host	User sign on procedure
	No output	User sign on procedure
	Only one input or output set	Host configuration changed
Printer problems	Out of disc space Spooler space problem	
IMF	Cannot connect or sign on	Configuration files
	Printer problems	Host compatibility
	Screens do not work	Screen design error
	Various problems	Configuration files, request aborted by host, application wrong, or IMF is not a host configuration

TABLE 5-2. CHANGED SOFTWARE SYMPTOM TABLE (cont'd)

Product	Symptom	Possible Causes
MTS	Cannot open line Poor response	Software installation bad or download file bad Configuration file or software error, or MPE buffer size.
TERMIO	Can only logon at one speed. Cannot change speed. Hang while running program. Remote spooled printer problems SF 700, 701, 705, 706 SF 708	MPE configuration MPE configuration Program busy or program changed terminal or MPE configuration. MPE configuration Software installation bad Configuration bad

Changed Hardware

(same software and configuration)

TABLE 5-3. SYMPTOMS FOR A SYSTEM WITH CHANGED HARDWARE

Product	Symptom	Possible Causes
CS	CSERR 84 - 109 CSERR 100 - 105 CSERR 117 CSERR 154 CSERR 207 - 209 CSERR 212 - 214 CSERR 217	HARDWARE
DS	Line closes Poor response REMOTE HELLO fails Remote system shuts line System failures	Modem or line problems Did not change configuration Line problems Line problems Configuration
X.25	CSERR 161	Cable problems or remote not responding
RJE	Cannot open line Cannot sign on Host shuts line Line closes No output Poor response	Controller or modem problems Host configuration or modem problems] Host configuration, modem, or line problems Line or modem problems Line problems Line problems

TABLE 5-3. SYMPTOMS FOR A SYSTEM WITH CHANGED HARDWARE (cont'd)

Product	Symptom	Possible Causes
MRJE	Cannot open line	Hardware problem
	Cannot sign on	Host configuration changed
	Did not get host number back	Hardware problem
	Host shuts line, Line closes, or Poor response	Line problems
IMF	CSERR 117	Hardware problem
	Host shuts line	Hardware problem
	Poor response	MPE configuration error
MTS	All but one remote drop is dead	Line, terminal, or modem problem
	Cannot logon	Terminal switches or configuration
	Cannot open line	Controller or modem problem
	Commands do not work	Terminal switches or configuration
	Poor response	Hardware problem or line overloaded
TERMIO	Can only logon at one speed	Terminal switches or configuration or MPE configuration
	Cannot change speed	MPE configuration
	Cannot logon	Port hung, DOWNed, REFUSEed, or terminal switches or configuration
	Hardwired worked, but modem will not work	Line or modem problems, cable bad, or port configured wrong
	Remote spooled printer problems	MPE configuration, line or modem problems, printer switches
	SF 208 (HP-IB only)	Nosiy modems or lines, using last port on main with modems

TABLE 5-3. SYMPTOMS FOR A SYSTEM WITH CHANGED HARDWARE (cont'd)

Product	Symptom	Possible Causes
	SF 209	Noisy modems or lines
	SF 211	ADCC hardware problem
	SF 709,715	Software bad
	SF 708,710	Configuration bad
	SF 714-716	Hardware problem

No Changes

TABLE 5-4. SYMPTOMS FOR A SYSTEM WITH NO CHANGES

Product	Symptom	Possible Causes
CS	CSERR 84-109, 154, 207-209, 212-214, 217	Hardware
	CSERR 11-13, 57-58, 103, 153, 158, 201, 205-207	User error
	CSERR 153, 157-159, 203-217	Remote device
DS	Console locked	Terminal or MPE problems (not DS)
	DSLINE fails	Line not open or open one-way
	DSCOPY aborts	Line errors
	DSCOPY fails	User error, wrong file type, or copy in wrong direction
	Hung session, can not abort	User errors, PTOP program logic, subsystem or application program problem
	Line closes	Line errors
	NFT errors 101-110	Resource or internal software errors
	Poor response	Line errors
	REMOTE command fails	User error, MPE problem, or lack of pseudodevice
	Remote system shuts line	Line problems or hardware failure
	System Failures	Software problems or missing patches or fixes. Take a memory dump.
Transfer only one-way	Remote configuration problem	

TABLE 5-4. SYMPTOMS FOR A SYSTEM WITH NO CHANGES (cont'd)

Product	Symptom	Possible Causes
RJE	Aborts	MPE resource or user written procedure problem
	Can not sign on	Sign on procedure, host configuration, or line problems
	Host shuts line	Sign on procedure, host configuration, line or modem problems
	Line closes	Line or modem problems
	No output	Host not sending data or line problems
	Poor response	Host or HP 3000 busy, or line problems
MRJE	Cannot get into console mode	Someone else has console
	Cannot sign on	Host configuration changed, user sign on procedure, or configuration file problems
	Did not get host number back	Message modified, cannot read, or hardware problems
	Host shuts line	Line problems
	Job management does not work	Job log corrupted, did not get host number back, banner messed up, configuration file corrupted, or RMT# changed or wrong
	Line closes	Line problems or host operator shut line
	MRJE console operator errors	File system problems
	MRJE user errors	User error
	No input taken by host	User sign on procedure
	No output	User sign on procedure, host went down, devices not open, or user command error
	Only one input or output set	Host configuration changed
	Poor response	Line problems or systems busy
Printer problems	Out of disc space, file equation error, spooler space problem, operator inhibited printouts, or printer not ready	

TABLE 5-4. SYMPTOMS FOR A SYSTEM WITH NO CHANGES (cont'd)

Product	Symptom	Possible Causes
IMF	Cannot connect	Line problems
	Cannot sign on	Configuration file
	CS errors (esp. CSERR 117),	Other problems
	Host shuts line	Mismatching config. Host applications does not implement error recovery
	IMF errors	Refer to IMF error numbers
	Line closes	Protocol error, line error
	Poor response	Overloaded line, busy system
	Printer problems	Host or IMF configuration problem
	System failures	Internal software error; take a memory dump
MTS	All but one remote drop is dead	Group DOWNed, or line, terminal or modem problems, or terminal switches or configuration
	Cannot logon	User error, terminal switches or configuration, or MPE resource problem
	Cannot open line	Software installation or download file bad, or modem or controller problem
	Commands do not work	User error or terminal switches or configuration file problem
	Dead terminals, no response	Line not open or line or modem problem
	Hung terminals	Terminal switches or configuration or program problem
	Line shuts	Line or modem problems
	No polling on any terminals	Line not OPENed
	No polling on some terminals	Terminals DOWNed, line or modem problems

TABLE 5-4. SYMPTOMS FOR A SYSTEM WITH NO CHANGES (cont'd)

Product	Symptom	Possible Causes
MTS (cont'd)	Polling, no prompts Polling, some prompts Poor response Read or write errors	Terminal switches or configuration, MPE resource problems or system busy Some terminals DOWNed Configuration file error, line overloaded, software error, terminal switches or configuration, modem problems, or MPE buffer size (TBUFs) Line problems
TERMIO	Can only logon at one speed Cannot get back into block mode Cannot logon Session logged off Hang while running program Hardwired worked; modem won't Remote spooled printer problems SF 208 (HP-IB only) SF 209 SF 211 SF 714, 716 SF 715	Terminal switches or configuration User hit break key Port hung, DOWNED, or REFUSED, or terminal switches or configuration, or MPE resource problem, or user procedure wrong Operator aborted session or BYE in UDC Program busy, program changed terminal configuration, user changed terminal switches, or terminal switches or configuration wrong Line or modem problems or cable bad Line or modem problems, printer switches, program problem, printer status not checked, or MPE resource problem (TBUFs) Noisy modems or lines, or using the last port on main with modems Noisy modems or lines ADCC hardware problem Hardware problem Console hardware problem

Once the symptoms are found and the possible causes are determined, the next step is to check to see which one is really the problem. The problems can generally be put into four groups.

Usage Problems are those arising from improper use of an otherwise working data communications network. For example:

Using wrong parameters
 Giving wrong reply to dial message
 Using wrong controller

Protocol problems involve the software that handles the link such as the CS subsystem, CSSBSC0, or the INP. These usually indicate a software or hardware error in the DTE. They may be caused by the user.

Digital problems are in the interface between the DTE and the DCE such as cables, connectors, RS-232-C pin usage, or modem options.

Analog problems are usually called impairments and dwell within the transmission facility. Transmission line impairments come in two types, fortuitous and systematic. The former is relatively similar to an 'acute illness,' it comes up suddenly, goes away quickly, and may come back when ever it pleases. Not much can be done about them except to redial the connection and let someone else have the problem. Some categories of fortuitous impairments are:

Noise	- electrical disturbances
Crosstalk	- interference from another channel
Echo	- reflected signals
Loss	- drop in signal power
Jitter	- instability in frequency shifts

The other type of transmission line problems is systematic. These impairments, called distortion, can be corrected by conditioning the line. The are:

Delay - frequencies arrive at different times
 Attenuation - loss of some frequencies

There are several important steps to checking these causes:

- Verify the results - what really happened?
- Verify the software and I/O configuration - coldloads and restores can cause accidental destruction of the I/O configuration or system software.
- Actual protocol errors, where there is a bug, may require more extensive testing. If your software is up to date, CSDUMP may show the problem.
- Test the data communications network, modems, and DTE.

Causes and Tests

The following 'Cause Table' lists the possible causes of problems along with the type of cause and the tests used to check them out. Remember, some tests may be as simple as asking someone what they did or checking version numbers.

TABLE 5-5. CAUSES

Cause	Test or Action
ADCC hardware problem	try another port run ADCC diagnostic
application program problem	check program
application wrong	IMF is not exactly a 3270
ATP problems	run ATPDSM
banner messed up	check banner & configuration file
BYE in UDC	examine UDC files
cable bad	check cable part number check cable continuity
configuration	check configuration
configuration file	check configuration file
configuration file corrupted	check configuration file restore configuration file
configuration file error	check configuration file
controller problem	run DSM
copy in wrong direction	check user procedures for attempts to copy wrong way
devices not open	check remote operator procedure
didn't change configuration	check configuration to be sure all changes were made
didn't get host number back	check host configuration
download file bad	restore from tape
DSMON bad	check version
file equation error	check user procedures
file system problems	check file error code
group DOWNed	check console log
hardware	run DSM run modem selftest run terminal selftest
hardware failure	run hardware diagnostics
hardware problem	run hardware diagnostics
host busy	retry later
host compatibility	check host specifications
host configuration	check configuration
host configuration changed	check changes in configuration
host not sending data	check host configuration for when host sends or terminates
host operator shut line	check remote operator procedure
host went down	call host operator
HP3000 busy	try again later
improper installation	check versions numbers reinstall software

TABLE 5-5. CAUSES (cont'd)

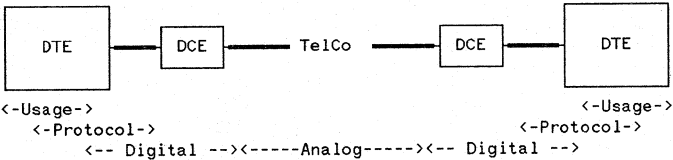
Cause	Test or Action
INP switches	check switches for correct setting
internal software errors	check SSB reinstall or coldload software
job log corrupted	check job log clean out job log
lack of psuedo-devices	check configuration add more devices
line not OPENned	check operator procedure
line not open	check operator procedure
line open one way	check remote operator procedure
line overloaded	check line traffic to speed ration
line problem	run modem diagnostics run terminal data comm tests run DSM loopbacks run MPTEST over lines
message modified, can't read	check host specifications
missing patches or fixes	check patch list in SYS
modem problem	run modem diagnostic run terminal data comm test run DSM loopbacks run MPTEST over lines
MPE buffer size	check configuration
MPE configuration	check configuration
MPE configuration error	check configuration
MPE problem, not DS	check SSB
MPE problem	check SSB
MPE resource problem	check configuration
MPE resource problem (TBUFS)	check configuration
new user commands	check user procedure
noisy lines	run modem selftests run modem remote tests
noisy modems	run modem selftests run modem remote tests
operator aborted session	check operator console log
operator inhibited printouts	do :SHOWOUT SP at console
operator procedure	check operator procedure
out of disc space	run FREE2
out of file space	do :LISTF,2 and run LISTEQ2
port DOWNned, REFUSEd	do SHOWDEV
port configured wrong	check configuration
port hung	run TABLE
printer not ready	check printer
printer status not checked	check program
printer switches	check printer switches
program busy	wait program to complete I/O, then check for hung terminal causes
program changed terminal configuration	check terminal switches/config.

TABLE 5-5. CAUSES (cont'd)

Cause	Test or Action
program problem	check program
program not compatible with new MPE	check SRB for changes to MPE
PTOP program logic	check program
remote configuration problem	check remote configuration
remote device	check remote device hardware
request aborted by host	check remote operations rcheck user sign on procedure check line
resource errors	check system resources
RMT# changed or wrong	check job card check host configuration
screen design error	check screen design with original
sign on procedure	check user sign on procedure
software bad	coldload from known good tape
software error	check SSB, call PICS
software installation bad	check versions reinstall software check modems check line
software problems	check SSB, call PICS
some terminals DOWNed	check configuration file UP terminals
someone else has console	check user procedure
spooler space problem	do :SHOWOUT SP at console check configuration
subsystem problem	try on hardwired terminal check SSB
system busy	retry later check system usage
terminal problem	run terminal selftest run MPTEST
terminal switches/configuration	check terminal switches/config.
terminals DOWNed	check configuration file UP terminals
user changed term switches	check terminal switches/config. check user procedure
user command error	check user procedure
user error	check user procedure
user hit break key	check user procedure
user procedure wrong	check user procedure
user sign on procedure	check user procedure check job files
user written procedure	check changes to MPE procedures
using last port on main	check terminal connections to last port on each main
wrong file type	check user procedures for attempts to copy data bases

THE TESTS

Data Communications Tests



Usage Tests

Verify user procedures
 Examine software tables
 versions
 configuration
 configuration files
 job card, files, logs
 SSB

Protocol Tests

Check software versions
 Analyze data stream
 Verify RS-232-C signals

Digital Tests

Controller software tests
 Cable tests
 Modem tests
 Terminal tests
 Hardware diagnostics

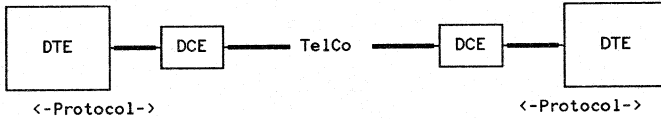
Analog Tests

Phase jitter
 Single frequency interference
 Frequency shift
 Return loss
 Envelope delay distortion
 Frequency response
 Noise
 Loss

Each of these test can be used to check out possible causes. Most of them can be done with software diagnostics available on the HP3000. Some require very specialized equipment that is generally used by Te1Co personnel. Different tests are performed by a different set of tools.

Protocol Tools

Protocol test tools provide a means for finding the source of problems in the software that handles the link. They may simply check that the right software is on the system or collect the data for the factory to resolve the problem.

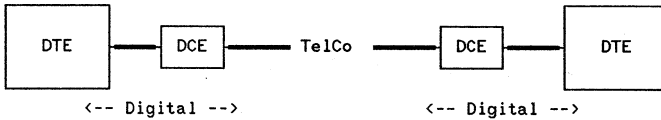


Check software versions
 HP1640 Data Analyzer
 CSDUMP
 DSTEST,DIAG
 HP4955A

Verifies what protocol is being used
 Displays protocol sequences
 Traces what protocol is being used
 Tests the DS protocol
 Protocol Analyzer

Digital Tools

Digital test tools are for testing the interface between the DTE and the DCE. They are usually devices or programs that test the hardware.



Controller software tests

DSM	
Interconnect	Groups 1, 5.1 & 5.2 test communication between INP and the HP 3000
Onboard	Groups 2, 4 and 5 test the USART chips Group 3 tests the memory, Group 2.1 causes the INP Self-Test, and Group 2.2 the microprocessor test.
Offboard	Groups 6 & 7 test the USART with cables or modems
INPDPAN	Processes the INP RAM dump showing protocol and errors
ATPDSM	Tests the ATP hardware and software

Cable tests

DSM loopback	Groups 6 and 7 test the INP with cables and modems
MPTEST	Will test the complete cabling network for MTS terminals
Breakout Box	Indicates which signals are passing through the cables
Multimeter	Used for continuity tests
Terminal data comm loopback	Test the cables attached to the terminals

Modem tests

Selftest	Hardware within the modem
Digital loopback	Digital interface connections
Analog loopback	Analog (TelCo) interface connections
Remote test	Modems as a set and the TelCo lines

Terminal tests

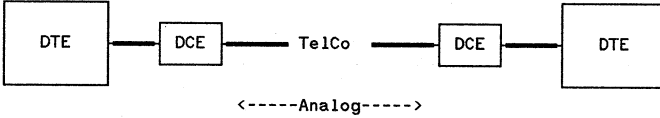
Selftest	Terminal hardware
Data comm board	Multipoint hardware within the terminal
Data comm loopback	Multipoint cable connections
MPTEST	Shows the strap setting and tests terminal I/O
Display functions	Shows what terminal is receiving
Monitor mode	Shows what is passing through the communications interface
Driver mode	Polls other terminals without computer

Hardware diagnostics

ADCC diagnostic	ADCC hardware
ATC diagnostic	ATC hardware
ATPDSM	ATP hardware
DSM	INP hardware
IOMAP	HP3000 HP-IB system hardware
SLEUTH	HP3000 Series II/III hardware
SSLC diagnostic	SSLC hardware
Data Link Tester	Shows the status of signals on the DATA LINK

Analog Tools

Analog test tools provide the capability to examine the quality of the TelCo line or any privately owned transmission facility. They do this by sending data across the line which is read by another device on the other end or looped back to the originator.



Analog TelCo line tests

Noise and Loss

BERT (HP1645)

MPTEST

DSM Offboard

Modem remote test

Terminal driver mode

TIMS (HP4943,4935)

Terminal data comm

loopback

Test of TelCo line and modems

Extended test of TelCo line

Extended test of TelCo line

Pass/fail test of TelCo line

Extended test of TelCo line

Many extended tests of TelCo
line quality

Pass/fail test of TelCo line

TOOL DESCRIPTIONS

This section includes an alphabetic list of tools. It tells what they do, when to use them, where to find them, and where they are documented.

ADCC diagnostic

- It is a set of diagnostics for the ADCC including tests for the IMB handshake logic thru the RS-232-C cable. After loading from the tape, specific tests can be selected. It requires a loopback hood and at least one good ADCC is needed for the console.
- Use it when a port problem is suspected and nothing else has helped.
- Find it on the DUS tape.
- Documented in the *Diagnostic Manual Set*, Vol. 2.

ATC diagnostic

- It is a set of offline diagnostics to verify the operation of the ATC ports. This simple test requires only the male-to-male cable that comes with your system.
- Use it when a port problem is suspected and nothing else has helped.
- Find it on the Non-CPU Diagnostic tape.
- Documented in the *ATC Diagnostic Manual*.

ATPDSM

- It is a diagnostic program that provides corrective capabilities for the ATP through easy commands.
- Use it when a port appears to be stuck or the LEDs remain ON after the AIB self test.
- Find it in PUB.SYS.
- Documented in the *ATP Diagnostic Manual*.

BERT (HP1645)

- It is a box for testing the quality of a phone line or modems by sending and receiving test data. One is placed on each end of the line or just one end with the other end in loopback.
- Use it when a line or modem problem is suspected or it is necessary to prove that one exists.
- Find it in HP and other supplier catalogs as HP1645A, Red Box, or BERT.
- Documented in manuals supplied with the device.

Troubleshooting Guide

Breakout Box

- It is a small box which fits in between two RS-232-C cables that allows monitoring and patching of signals
- Use it when there is doubt that a signal is getting through or a test is to be made prior to modifying a cable
- Find it on the HP parts list or in the International Data Sciences catalog or other catalogs as breakout box, traffic light, etc.
- Documented by instructions that come with it.

CSDUMP

- It is a program that analyzes the data collected by a TRACE process on one of the data communication lines. It expects to find the file CSTRACE.
- Use it when there is any question as to what is going over the line or you want to determine what a user is sending. It is usually required for factory involvement.
- Find it in PUB.SYS.
- Documented in the *RJE Reference Manual*, in Section 4 of the *Communications Handbook*, the *DS Network Administrator Manual* and the *X.25 Reference Manual*.

CSLIST

- It is a program to list the version, update and fix levels of the CS modules on the system.
- Use it when wrong software modules are suspected or you want to know what versions are on your system.
- Find it in PUB.SYS.
- Documented In Section 4 of the *Communications Handbook*.

CSTRACE

- It is the data file created by the TRACE process for an open line which contains a recent history of the data transmissions that have gone over the line.
- Use it when the subsystem in question is MTS, RJE or IMF; DS uses a file called DSTRCnnn and MRJE uses MRJETRCh, X.25 uses DSTRCnn, RJE uses RJETRCn, or RJETRCnn, or RJETRCnnn.
- Find it in PUB.SYS.
- Documented in the *RJE Reference Manual*, the *DS Reference Manual*, and in Section 4 of the *Communications Handbook*.

Data Analyzer (HP1640)

It is	a protocol analyzer device placed into the RS-232-C line to display the conversation between two devices or to simulate one of them. It also has the ability to trap timing conditions and sequences.
Use it when	the TRACE process does not show the needed information in content or time frame, or the problem is on an asynchronous terminal connection
Find it	in the HP catalog or at a local HP sales office
Documented	in the <i>Data Capture Manual</i> , the Operation Manual that comes with the device, and Application Notes 275. See also Table 5-6 which follows.

Protocol Analyzer (HP4955A)

It is	like an HP1640, but can save trace information on tape. More powerful simulation and monitoring tool than an HP1640.
Use it when	The TRACE process does not show the needed information in content or time frame, or the problem is on an asynchronous terminal connection.
Find it	in the HP catalog or at a local HP sales office
Documented	in the operation manual that comes with the device.

DPAN4

It is	a facility to analyze a memory dump tape. There is a job stream called DUMPJOB4 which collects additional data from the system such as the loadmap and I/O configuration.
Use it when	any communications subsystem aborts or the system fails
Find it	in PUB.SYS
Documented	in the <i>System Utilities Manual, Software Pocket Guide</i>

DSDUMP

It is	a CSTRACE analyzer program specifically for DS traces. It prints the DS conversation on alternate sides of the page at the high level of DS protocol.
Use it when	you are troubleshooting a DS problem and want to eliminate the bisync protocol of CS.
Find it	in PUB.SYS
Documented	in newer DS manuals and in data communications training materials for SEs

TABLE 5-6.
SELECTED HP 1640A/B SETTINGS

FORMAT	ATC	ATP/ADCC	ASYNC MTS	
DATA CODE	ASCII-7	ASCII-8 or ASCII-7	ASCII-7	
MODE	ASYNC-1	ASYNC-1	ASYNC-1	
CLK(3)				
BITS/SEC(1) SYNC CHAR(2)	line speed	line speed	line speed	
RESYNC ON(2)				
PLUS-- IDLES(2)				
ERROR CHECK	ODD	NONE OR EVEN (4)	ODD	
Mode: (defaults)	MONITOR	MONITOR	MONITOR	
TRIG SOURCE	TX DATA	TX DATA	TX DATA	
RUN MODE (exception)	CONT TIG or CONTINUOUS(3)	CONT TIG or CONTINUOUS	CONT TRIG or CONTINUOUS(3)	
TRIGGER	any	any	any	
SUPPRESS PLUS-- -- CHARACTERS	OFF n/a	OFF	OFF n/a	
Patch Panel	2:TX 3:RX 7:GND	2:TX 3:RX 7:GND	2:TX 3:RX 7:GND	

Notes:

- 1 = Asynchronous
- 2 = Synchronous
- 3 = Synchronous for HP 1640B
- 4 = None for ASCII 8. Even for ASCII-7
- 5 = Applies to 1640A; for 1640B - don't care

For asynchronous operation, CLEAR-TO-SEND must be "ON" for TRANSMIT DATA to be displayed. CARRIER DETECT must be "ON" for RECEIVED DATA to be displayed. The 1640A/B will set these lines "ON" automatically if pins are not used at positions 5 and 8 on the patch panel.

SSLC AND INP CONFIGURATION SUMMARY

	DS and Synchronous MTS	DS X.25	IME, MRJE, RJE (to host)
	ASCII-7	HEX-8	OTHER-8 (EBCDIC)
	SYNC	SYNC	SYNC
		EXT	EXT
	16,16 (5)	32,32 (5)	32,32 (5)
	FF (5)	FF (5)	FF (5)
	0	0	0
	ODD	SDLC	NONE
	MONITOR	MONITOR	MONITOR
	TX DATA	TIME INT	TX DATA
	CONT TRIG or CONTINUOUS	CONT TRIG	CONT TRIG or CONTINUOUS
	OFF n/a	SYNCS	OFF
	2:TX 3:RX 4:RTS 5:CTS 6:DSR 7:GND 8:CAR 15:SCT 17:SCR 20:DTR	2:TX 3:RX 4:RTS 5:CTS 6:DSR 7:GND 8:CAR 15:SCT 17:SCR 20:DTR	2:TX 3:RX 4:RTS 5:CTS 6:DSR 7:GND 8:CAR 15:SCT 17:SCR 20:DTR

Troubleshooting Guide

DSLIS

- It is a program to list versions of DS and X.25 modules
- Use it when DS or X.25 software versions are suspected
- Find it in PUB.SYS
- Documented in the *DS Reference Manual* and the *X.25 Reference Manual*

DSM Interconnect

- It is the INP diagnostic and test tool Groups 1 thru 5 which do extensive tests of the INP processor and memory
- Use it when the INP fails
- Find it in PUB.SYS
- Documented in the *INP Diagnostic Manual* supplied with the INP and in the help feature within the program

DSM Offboard

- It is the INP diagnostic and test tool Groups 6 and 7 which provide the capability to test the network external to the INP. It uses loopback connectors and modem loop-backs
- Use it when you want to test cables, modems, or a complete INP to INP connection
- Find it in PUB.SYS
- Documented in the *INP Diagnostic Manual* supplied with the INP and in the help feature within the program

DSM Onboard

- It is the INP diagnostic and test tool Groups 2 thru 5 which test the boards USART and other datacomm chips. It requires card edge loopback hoods.
- Use it when the INP is suspect and the Interconnect tests have passed
- Find it in PUB.SYS
- Documented in the *INP Diagnostic Manual* supplied with the INP and in the help feature within the program

DSTEST

It is a program to list versions of DS modules, list the I/O configuration pertaining to DS, and provide online diagnostics over the DS line

Use it when DS software versions are suspected, you are in doubt about the configuration, or you want to test the line and software

Find it in PUB.SYS

Documented in the *DS Reference Manual*

Data Link Tester

It is a small device used to test the Data Link cable at a connector box for continuity and proper wiring

Use it when you are installing a Data Link to test your connections and when the data link cable is suspected

Find it in the Data Link Installation Kit and HP parts list

Documented in the *Data Capture Manual*

EDITOR

It is the text editing facility of MPE

Use it when you need to look at an ASCII file such as UDCs or job streams

Find it in PUB.SYS

Documented in the *EDIT/3000 Reference Manual*

FREE2

It is a system utility to report on the current status of free disc space on the system

Use it when you are unsure of whether there is sufficient free disc space available to do your job

Find it in PUB.SYS

Documented in the *System Utilities Manual*

IMFMGR

It is a command for the Interactive Mainframe Facility sub-system which provides the manager of the facility with control over its use and the capability to verify configuration files.

Use it when it is necessary to confirm the contents of a configuration file

Troubleshooting Guide

Find it as :IMFMGR

Documented in the *IMF Reference Manual*

INPDPAN

It is an analyzer for the INP RAM dump. Except for 'status at time of failure,' reading these dumps is usually done by the factory.

Use it when the CS subsystem has created a RAM dump file for the INP and has notified the operator of its creation

Find it in PUB.SYS

Documented in Section 4 of the *Communications Handbook* and SE data communications training materials

IOMAP

It is a diagnostic to identify and checkout the basic I/O system hardware. This command driven program lists the hardware, channels and devices.

Use it when the exact I/O configuration is not known.

Find it on the DUS tape

Documented in the *Diagnostic Manual Set*

LISTEQ2

It is a program to list file equations and temporary files.

Use it when files don't seem to be going to the right place or in the right fashion.

Find it in PUB.SYS

Documented in the *System Utilities Manual*

MPCONFIG

It is a program to list, change and create MTS configuration files.

Use it when you want to view the contents of a configuration file

Find it in PUB.SYS

Documented in the *MTS Reference Manual*

MPMON

It is the MTS line supervisor. Running it will display the version number.

Use it when the version of MTS is unknown

Find it in PUB.SYS

Documented in the *MTS Reference Manual*

MPTEST

It is a testing facility for MTS lines and terminals. It will check terminal strap settings and perform read/write tests of the line, modems and terminals.

Use it when a new MTS line is installed to check the terminal straps or a line is not functioning properly.

Find it in PUB.SYS

Documented in the *MTS Reference Manual*

MRJECONTROL

It is a console operator command used to control the MRJE line. The *check* parameter will cause a list of version numbers to be listed.

Use it when the version numbers are unknown or are suspected of being wrong.

Find it as :MRJECONTROL

Documented in the *MRJE Reference Manual*

Modem Analog Loopback

It is a modem capability to connect the analog output and input parts of the modem together to read whatever is written. This tests about 80% of the modem.

Use it when testing data terminal equipment without going over the TelCo line (local test) or the local modem.

Find it as a button or switch somewhere on the modem

Documented in the modem manual. HP modem tests are in Section 2 of the *Communications Handbook*

Troubleshooting Guide

Modem Digital Loopback

It is	a modem capability to connect the digital output and input parts of the modem together to return whatever was received. This loopback is necessary to test a TelCo line and is set on the far end modem from either the computer or terminal.
Use it when	when testing data communications equipment by going over the TelCo line (remote test).
Find it	as a button or switch somewhere on the modem
Documented	in the modem manual. HP modem tests are in Section 2 of the <i>Communications Handbook</i>

Modem Remote Test

It is	a modem capability to send data to and receive it back from a remote modem. Some modems have the capability to tell the remote modem to go into loopback. It provides a pass/fail test of the hardware.
Use it when	the TelCo line and modems are being tested independently of the data terminal equipment.
Find it	as a switch or button on the modems
Documented	in the modem manual. HP modem tests are in Section 2 of the <i>Communications Handbook</i>

Modem Selftest

It is	a modem pass/fail test. It will determine if the modem is functioning within specifications.
Use it when	any time there is any doubt. Just push the button; it does the rest.
Find it	as a switch or button on the modem
Documented	in the modem manual, Bell and HP modem tests are in Section 2 of the <i>Communications Handbook</i>

Multimeter

It is	an electronic tool for testing volts and ohms. It can be used to test the continuity of a cable or connector when set to ohms.
Use it when	cables or connections are suspected of being faulty
Find it	in nearly any electronics store
Documented	in the manual that comes with it. Some cables are documented in the <i>DTD Cabling Manual</i> and Section 2 of the <i>Communications Handbook</i> .

SHOWCOM

- It is a console operator command to display the statistics generated for a data comm line such as CS errors, timeouts and retries.
- Use it when the line appears hung, an exceptional number of errors are being encountered, or the last CS error message for the line was lost.
- Find it as :SHOWCOM XX;ERRORS
- Documented in the *Console Operator's Guide* and in Section 4 of the *Communications Handbook*

SHOWME

- It is an MPE command to identify the session
- Use it when the current version of MPE is needed
- Find it as :SHOWME
- Documented in the *MPE Command Manual*

SLEUTH

- It is a diagnostic programming language useful in determining the exact I/O configuration on Series II/III computers.
- Use it when the exact I/O configuration is not known
- Find it on the Non-CPU Diagnostic tape
- Documented in the diagnostic manuals that come with the system

SSB

- It is the *Software Status Bulletin*, a publication containing a list of all known problems and enhancement requests. It may have the problem you are troubleshooting already listed with a fix or work around.
- Use it when you first encounter the problem to see if it is already known.
- Find it in the mail from your CSS or SSS contract
- Documented in the *Guide to a Successful Installation*

Troubleshooting Guide

SSLC diagnostics

- It is** a diagnostic useful in testing the SSLC, cables and modems in the same manner as DSM for the INP. It requires loopback hoods and cable connectors or modem loopbacks.
- Use it when** the modems, TelCo lines, or SSLC are not functioning properly
- Find it** on the Non-CPU Diagnostic tape
- Documented** in the diagnostic manuals that come with the system

SYSDUMP

- It is** the MPE configurator. When used with \$NULL as the tape file designator, it provides a quick method of finding the exact configuration as MPE sees it.
- Use it when** the exact configuration is not known
- Find it** as :SYSDUMP
- Documented** in the *Console Operator's Guide* and *System Manager Manual*

SYSINFO

- It is** a contributed program that analyzes the MPE I/O configuration and lists it in parts or whole. It gives a nice analysis of how each controller and supervisor is used.
- Use it when** the configuration is not known
- Find it** usually in PUB.SYS
- Documented** with an internal help facility

TABLE

- It is** an unsupported program that lists terminal DITs and other tables used by MPE. It is command driven and is useful for examining DITs at a time when a terminal appears hung.
- Use it when** a terminal appears hung
- Find it** usually in PUB.SYS
- Documented** in TABLEDOC on some systems or ask PICS for it

Terminal Datacomm Tests

- It is a terminal resident test of the data comm board, cables, cable connections, modems and TelCo lines. The loopback hood and connectors come with the terminal. Modem loopbacks are also used.
- Use it when any component of the MTS network is not functioning other than the computer.
- Find it as sequences on the terminal keyboard
- Documented in the terminal reference manual and the *MTS Reference Manual*

Terminal Display Functions

- It is a terminal capability to display all terminal escape sequences and functions rather than perform them. It is very useful in finding improper data being sent to terminals.
- Use it when a terminal is hanging while receiving data
- Find it as a key on the terminal keyboard
- Documented in the terminal reference manual

Terminal Driver Mode

- It is a capability of 2645 and 2626 terminals to poll other multipoint terminals over a line. It can be used to eliminate the computer from the list of possible problems.
- Use it when you are trying to determine whether the problem lies in the computer or not, or you want to test the TelCo line
- Find it as sequences on the terminal keyboard
- Documented in the terminal reference manuals

Terminal Monitor Mode

- It is a method of using the terminal to display the traffic on the MTS line.
- Use it when information is needed about what polling is being done.
- Find it as a key on the terminal keyboard
- Documented in the terminal reference manual and the *MTS Reference Manual*

Troubleshooting Guide

Terminal Selftest

- It is** a pass/fail test of the terminal hardware.
- Use it when** a terminal is not functioning properly or other tests are to be done using a terminal
- Find it** as a key on the terminal keyboard
- Documented** in the terminal reference manuals

TIMS (HP4943,4935)

- It is** a Transmission Impairment Test Set or similar device for analyzing the quality of a line or set of modems. It is a standard piece of TelCo equipment and is used by many companies with large data communications installations.
- Use it when** line quality is suspected as the cause of problems
- Find it** on the HP price list and in various catalogs
- Documented** in Telco manuals and accompanying literature

TRACE

- It is** a process created when the *trace* parameter is used with a communications subsystem
- Use it when** line activity is to be recorded to diagnose problems
- Find it** the Operator commands for DS, IMF, MRJE and MTS, or the RJLINE command of RJE
- Documented** in Section 4 of the *Communications Handbook*, in the *X.25 Reference Manual*, and in each subsystem reference manual

TABLE 5-7. PROBLEMS OPERATING PERIPHERAL DEVICES

Symptom	Cause	Recovery
<p>The screen is blank and the terminal does not respond.</p>	<ol style="list-style-type: none"> 1. The terminal is not plugged in. 2. The terminal is not powered on. 3. A terminal fuse has blown. 4. The terminal is not properly reset. 5. The terminal is malfunctioning. 	<ol style="list-style-type: none"> 1. Plug in the power cord. 2. Turn the power switch on. 3. Replace the fuse. 4. Do a full reset (press the RESET key twice quickly, CONTROL SHIFT RESET or CONTROL SHIFT BREAK) <li style="text-align: center;">-or- Power the terminal off, then power it on again. 5. Contact your HP Representative.
<p>The screen may not be blank, but no cursor is visible.</p>	<ol style="list-style-type: none"> 1. On an HP Graphics terminal, the alpha display may not be on. 2. The microcode is being reloaded from the CPU. 3. There is a terminal microcode error. 	<ol style="list-style-type: none"> 1. Turn the alpha display on. 2. Wait a few seconds until it's reloaded. 3. Do a full reset (press the RESET key twice quickly). <li style="text-align: center;">-or- Power the terminal off, then power it on again. <li style="text-align: center;">-or- Contact your HP Representative.
<p>The cursor does not travel across the full width of the screen.</p>	<p>The margins are indented from column 1 and/or column 80.</p>	<p>Reset the margins.</p> <p style="text-align: center;">-or-</p> <p>Perform a full (hard) reset of the terminal (press the RESET key twice).</p>

TABLE 5-7. PROBLEMS OPERATING PERIPHERAL DEVICES (cont'd)

Symptom	Cause	Recovery
<p>When you press (RETURN), the cursor or typing-head returns to the beginning of the same line but there is no response from the computer.</p>	<ol style="list-style-type: none"> 1. The computer is down. 2. The terminal is not in Remote Mode. 3. The terminal is in Block Mode. 4. You may have typed (CONTROL)S, sending an XOFF to the computer. 5. The cable or phone connection between your terminal and the computer may be broken. 6. The keyboard is locked. 7. Your program may not have finished processing (possibly due to a heavy system load). 8. Your program may be in an in finite loop. 9. The computer may be in an in finite loop (also referred to as "system hung"). 	<ol style="list-style-type: none"> 1. Contact your Console Operator. 2. Put the terminal into Remote Mode. 3. Press (ENTER) to trigger transmission. -or- Disable Block Mode, then press (RETURN). 4. Type (CONTROL)Q to re-enable output from the computer. 5. Check your terminal's data cable (at the back of the terminal and at the modem or computer). -or- Make sure your modem is still receiving a carrier signal from the remote modem (check the carrier indicator light). 6. Press RESET once. 7. Wait several minutes, in case the program has not finished processing. -or- Press (BREAK); if there is a significant lag to get a colon prompt the computer is heavily loaded. Type :RESUME to continue processing, or type :ABORT to halt the program. 8. Abort the program (by pressing (BREAK) and typing :ABORT). 9. Check with the Console Operator.

TABLE 5-7. PROBLEMS OPERATING PERIPHERAL DEVICES (cont'd)

Symptom	Cause	Recovery
<p>When you press (RETURN), the cursor or typing head returns to the beginning of the next line, but you get no other response from the computer.</p>	<ol style="list-style-type: none"> 1. AUTO LF is on and one of the conditions in the previous symptom (1-3), holds. 2. Your program may be awaiting additional input. 	<ol style="list-style-type: none"> 1. Same as 1-3 in the previous symptom. 2. Type in additional data, press (RETURN) or type in the input termination character.
<p>When you type, nothing appears on the screen, and the computer does not respond.</p>	<ol style="list-style-type: none"> 1. The keyboard cable is not connected properly to the back of your terminal. 2. Your terminal did not reset properly. 3. Your terminal is malfunctioning. 4. Your modem is malfunctioning. 5. The computer is down. 	<ol style="list-style-type: none"> 1. Check the connection for looseness, the wrong board, or for a loose Keyboard Interface PCA. 2. Do a full reset (press RESET twice). -or- Power the terminal off and back on again. 3. Press TEST and examine the results (consult the manual for interpretation). -or- Have the terminal serviced. 4. Make sure the modem is still receiving a carrier signal from the remote modem (check the carrier indicator light). 5. Check with the Console Operator.
<p>When you type, nothing appears on the screen, but you get the expected response from the computer.</p>	<p>Character Echo is turned off.</p>	<p>Obtain an MPE prompt (:), then type (ESCAPE) followed by a colon (:) to turn Echo on.</p>

TABLE 5-7. PROBLEMS OPERATING PERIPHERAL DEVICES (cont'd)

Symptom	Cause	Recovery
<p>The terminal appears hung; you are receiving no output, and you cannot input data.</p>	<ol style="list-style-type: none"> 1. The computer (terminal driver) may be in an "XON wait". 2. Your program may not be ready to output data yet. 3. The computer is down. 	<ol style="list-style-type: none"> 1. Type (CONTROL)Q to re-enable output to the terminal. 2. Press (BREAK) to see if you get a colon (:) prompt. If you do, the computer is still up. Type :RESUME to continue. 3. Check with the Console Operator.
<p>When you press (RETURN), the cursor returns to the beginning of the same line and prints out data.</p>	<ol style="list-style-type: none"> 1. AUTO LF may be enabled at the terminal. 2. Terminal Memory Lock may have been set at the bottom line of the screen. 3. The terminal port might be in Tape Mode (ATC only). 	<ol style="list-style-type: none"> 1. Disable AUTO LF. 2. Turn off Memory Lock. -or- Do a full reset of the terminal (press RESET twice). 3. Press (CONTROL)Y.
<p>While typing, or after pressing (RETURN), "garbage" is printed on your screen.</p>	<ol style="list-style-type: none"> 1. The terminal speed setting doesn't match the port speed setting. 	<ol style="list-style-type: none"> 1. Cycle through the terminal speeds trying them one at a time until you find the correct one. -or- If your port is configured for speed-sending (sub-types 0-3), log off and log on again. -or- Ask the Console Operator to perform an ABORTJOB command on your session in order to log you off.

TABLE 5-7. PROBLEMS OPERATING PERIPHERAL DEVICES (cont'd)

Symptom	Cause	Recovery
	<p>2. The modem speed doesn't match port and/or terminal speed.</p> <p>3. The terminal parity setting doesn't match what the port expects.</p> <p>4. The Keyboard Interface PCA may be loose if your terminal is an HP 264X.</p> <p>5. The wrong character set is enabled</p>	<p>2. If your port is configured as "speed-specified" (sub-types 4-7), make sure the modem is operating at the port's speed. If the problem persists, cycle through the terminal speeds, trying them one at a time, until you find the correct one.</p> <p>3. Change the terminal parity setting until you find the correct one. -or- If your port is on an ATC, you may log off and log on again to "re-synchronize" the parity settings. -or- If your port is on an ATP or ADCC, your terminal was probably set for EVEN or NONE parity at logon. Change the parity and try to log on again.</p> <p>4. Press the board into place.</p> <p>5. Press (CONTROL)N -or- Press (CONTROL)O -or- If you have a 262x terminal, go into the TERM CONFIG menu and make sure that the desired character sets are available.</p>
<p>Type in a known MPE command, and get an Unknown Command.</p>	<p>1. Terminal has "A" strap set. 2. (RETURN) has been redefined. 3. The terminal is transmitting parity and the computer (Command Interpreter) does not expect parity.</p>	<p>1. Disable strap A. 2. Use the appropriate "Carriage Return" key. 3. Disable parity on the terminal.</p>

TABLE 5-7. PROBLEMS OPERATING PERIPHERAL DEVICES (cont'd)

Symptom	Cause	Recovery
<p>When you press (RETURN), you receive the message "I/O Error on Input".</p>	<ol style="list-style-type: none"> 1. The computer (Command Interpreter) expects parity, but the terminal is not sending it or is sending the wrong parity. 2. A transmission error occurred. 	<ol style="list-style-type: none"> 1. Change the parity setting. 2. Retype the line and press (RETURN)
<p>On an HP 264x terminal, the cursor is in the home position, the keys are inoperative, and the TEST key does not work.</p>	<p>Keyboard Interface PCA is loose or defective.</p>	<p>Press the board into the backplane or replace the board.</p>
<p>Lines of typed data are duplicated ("echoed") on your terminal screen.</p>	<p>Your port is configured as "non-duplicative" when it should be "duplicative". (The Echo Facility would not cause this problem.)</p>	<p>Ask your Console Operator to check the configuration for your port. If the port is "non-duplicative", re-configure your terminal port.</p>

TABLE 5-8. PROBLEMS PROGRAMMING WITH PERIPHERAL DEVICES

Symptom	Cause	Recovery
Frequently "hung" Reads.	<ol style="list-style-type: none"> 1. For reads terminating on a byte count, your data may be overrunning the port controller, thus causing its input byte counter to be improperly adjusted. 2. For block mode reads, you may not have strapped the terminal correctly or enabled user handshaking. 	<ol style="list-style-type: none"> 1. See whether the control characters are embedded in the data stream. If so, disallow them. (Tell the terminal operator not to embed control characters within the data stream.) 2. Use the Read Limit Timer with your Reads. When this timer expires, the Read is terminated by the File system. -or- Use a lower terminal speed.
An unending stream of program prompts are being printed at the terminal.	An end-of-file condition is encountered at the device.	Modify the program to check the end-of-file condition before re-issuing the read.
Pressing (RETURN) on the terminal once causes a double Return.	<ol style="list-style-type: none"> 1. The Terminal Type is for full duplex operation and the terminal is set up for half-duplex (terminal echoes CR and controller echoes CR). 2. AUTO LF is enabled. 	<ol style="list-style-type: none"> 1. Disable the Echo Facility. 2. Switch the terminal to full-duplex or disable AUTO LF.
Pressing (RETURN) while in the MPE Command Interpreter does not generate a LF, or it garbles the colon (:) prompt.	AUTO LF may be enabled. This line from the terminal is clobbering the CR LF:DC1 from the computer.	Disable the AUTO LF key on the terminal.

TABLE 5-8. PROBLEMS PROGRAMMING WITH PERIPHERAL DEVICES (cont'd)

Symptom	Cause	Recovery
<p>Unexpected device behavior:</p> <ul style="list-style-type: none"> • Your reads are terminating earlier than what was expected. • The terminal speed is different from what was expected. • The behavior of Echo is opposite from what is expected. • The behavior of Subsystem Break is opposite from what you expected. • Parity errors seem to occur on every (or nearly every) transmission. • The behavior of CONTROLX is opposite from what you expected. • Most control characters do not function as expected. 	<ol style="list-style-type: none"> 1. Most FCONTROL calls affect all the files opened on a device. Perhaps your program issued an FCONTROL call against another file open on this device. 2. If several programs (even being run by other users) are accessing this device, someone else's program might be using FCONTROL to change the device characteristics "behind your back". 	<ol style="list-style-type: none"> 1. Add one or more FCONTROL calls to your program to set up the device characteristics you need. 2. Find out if other programs are accessing your device. Either implement an initialization scheme for each access period or modify all programs to use the same setting.

READER COMMENT SHEET

HP 3000 Computer Systems

FUNDAMENTAL DATA COMMUNICATIONS HANDBOOK

5957-4634 June 1984

We welcome your evaluation of this manual. Your comments and suggestions help us to improve our publications. Please explain your answers under Comments, below, and use additional pages if necessary.

Is this manual technically accurate?

Yes No

Are the concepts and wording easy to understand?

Yes No

Is the format of this manual convenient in size, arrangement, and readability?

Yes No

Comments:

This form requires no postage stamp if mailed in the U.S. For locations outside the U.S., your local HP representative will ensure that your comments are forwarded.

FROM:

Date _____

Name _____

Company _____

Address _____

FOLD

FOLD



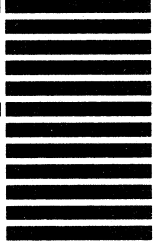
NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES

BUSINESS REPLY MAIL

FIRST CLASS PERMIT NO. 1070 CUPERTINO, CA

POSTAGE WILL BE PAID BY ADDRESSEE

Publications Manager
Hewlett-Packard Company
Information Networks Division
19420 Homestead Road
Cupertino, CA 95014



FOLD

FOLD

SALES & SUPPORT OFFICES

Arranged alphabetically by country



Product Line Sales/Support Key

- K** Key Product Line
- A** Analytical
- CM** Components
- C** Computer Systems Sales only
- CH** Computer Systems Hardware Sales and Services
- CS** Computer Systems Software Sales and Services
- E** Electronic Instruments & Measurement Systems
- M** Medical Products
- MP** Medical Products Primary SRO
- MS** Medical Products Secondary SRO
- P** Personal Computation Products
- *** Sales only for specific product line
- **** Support only for specific product line

IMPORTANT: These symbols designate general product line capability. They do not insure sales or support availability for all products within a line, at all locations. Contact your local sales office for information regarding locations where HP support is available for specific products.

HP distributors are printed in italics.

HEADQUARTERS OFFICES

If there is no sales office listed for your area, contact one of these headquarters offices.

NORTH/CENTRAL AFRICA

Hewlett-Packard S.A.
7, Rue du Bois-du-Lan
CH-1217 MEYRIN 2, Switzerland
Tel: (022) 83 12 12
Telex: 27835 hpse
Cable: HEWPACKSA Geneva

ASIA

Hewlett-Packard Asia Ltd.
6th Floor, Sun Hung Kai Centre
30 Harbour Rd.
G.P.O. Box 795

HONG KONG

Tel: 5-832 3211
After Jan. 1, 1984
47th Floor, China Resources Bldg.
26 Harbour Rd., Wanchai

HONG KONG

Tel: 66678 HEWPA HK
Cable: HEWPACK HONG KONG

CANADA

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
Telex: 610-492-4246

EASTERN EUROPE

Hewlett-Packard Ges.m.b.H.
Liebigasse 1
P.O. Box 72

A-1222 VIENNA, Austria
Tel: (222) 2365 110

NORTHERN EUROPE

Hewlett-Packard S.A.
Uilenstede 475
P.O. Box 999
NL-1180 AZ AMSTELVEEN
The Netherlands
Tel: 20 437771

SOUTH EAST EUROPE

Hewlett-Packard S.A.
7, Rue du Bois-du-Lan
CH-1217 MEYRIN 2, Switzerland
Tel: (022) 83 12 12
Telex: 27835 hpse
Cable: HEWPACKSA Geneva

OTHER EUROPE

Hewlett-Packard S.A.
P.O. Box
150, Rue du Nant-D'Avril
CH-1217 MEYRIN 2, Switzerland
Tel: (022) 83 8111
Telex: 22486 hpse
Cable: HEWPACKSA Geneva

MEDITERRANEAN AND MIDDLE EAST

Hewlett-Packard S.A.
Mediterranean and Middle East
Operations
Altrna Centre
32 Kilissias Ave.
Paradissos-Amaroussion, ATHENS
Greece
Tel: 682 88 11
Telex: 21-6588 HPAT GR
Cable: HEWPACKSA Athens

EASTERN USA

Hewlett-Packard Co.
4 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 258-2000

MIDWESTERN USA

Hewlett-Packard Co.
5201 Tolview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800

SOUTHERN USA

Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
ATLANTA, GA 30348
Tel: (404) 955-1500

WESTERN USA

Hewlett-Packard Co.
3939 Lankershim Blvd.
P.O. Box 3919

LOS ANGELES, CA 91604
Tel: (213) 506-3700

OTHER INTERNATIONAL

AREAS
Hewlett-Packard Co.
Intercontinental Headquarters
3495 Deer Creek Road
PALO ALTO, CA 94304
Tel: (415) 857-1501
Telex: 034-6300
Cable: HEWPACK

ANGOLA

Telexa
Empresa Técnica de Equipamentos
R. Barbosa Rodrigues, 41-1 DT.
Cana Postal 6487
LUANDA
Tel: 35515, 35516
E.P.

ARGENTINA

Hewlett-Packard Argentina S.A.
Avenida Santa Fe 2035
Marinez 1640 BUENOS AIRES
Tel: 798-5735, 792-1293
Telex: 17595 BIONAR
Cable: HEWPACKARG
A.E.CH.CS.P.

Biotron S.A.C.I.M. e I.
Av Paseo Colon 221, Piso 9
1399 BUENOS AIRES
Tel: 30-4846, 30-1851
Telex: 17595 BIONAR
M

AUSTRALIA

Adelaide, South Australia

Office
Hewlett-Packard Australia Ltd.
153 Greenhill Road
PARKSIDE, S.A. 5063
Tel: 272-5911
Telex: 82536
Cable: HEWPARD Adelaide
A*.CH,CM,E,MS,P

Brisbane, Queensland Office

Hewlett-Packard Australia Ltd.
10 Payne Road
THE GAP, Queensland 4061
Tel: 30-4133
Telex: 42133
Cable: HEWPARD Brisbane
A.CH,CM,E,M,P

Canberra, Australia

Capital Territory Office
Hewlett-Packard Australia Ltd.
121 Wolongong Street
FTSWICK, A.C.T. 2609
Tel: 80 4244
Telex: 62650
Cable: HEWPARD Canberra
CH,CM,E,P

Melbourne, Victoria Office

Hewlett-Packard Australia Ltd.
31-41 Joseph Street
BLACKBURN, Victoria 3130
Tel: 895-2895
Telex: 31-024
Cable: HEWPARD Melbourne
A.CH,CM,CS,E,MS,P

Perth, Western Australia

Office
Hewlett-Packard Australia Ltd.
261 Shirling Highway
CLAREMONT, W.A. 6010
Tel: 383-2188
Telex: 93859
Cable: HEWPARD Perth
A.CH,CM,E,MS,P

Sydney, New South Wales

Office
Hewlett-Packard Australia Ltd.
17-23 Talavera Road
P.O. Box 308
NORTH RYDE, N.S.W. 2113
Tel: 887-1611
Telex: 21561
Cable: HEWPARD Sydney
A.CH,CM,CS,E,MS,P

AUSTRIA

Hewlett-Packard Ges.m.b.H.
Grottenhofstrasse 94
A-8052 GRAZ
Tel: (0316) 291 5 66
Telex: 32375
CHE

Liebigasse 1

Hewlett-Packard Ges.m.b.H.
Liebigasse 1
P.O. Box 72
A-1222 VIENNA
Tel: (0222) 23 65 11-0
Telex: 134425 HEPA A
A.CH,CM,CS,E,MS,P

BAHRAIN

Green Salon
P.O. Box 557
Manama
BAHRAIN
Tel: 255503-255950
Telex: 84419
P

Wael Pharmacy

P.O. Box 648
BAHRAIN
Tel: 256123
Telex: 8550 WAEI BN
E.C.M.

BELGIUM

Hewlett-Packard Belgium S.A./N.V.
Bvd. de Woluwe, 100
Woluwe-la
B-1200 BRUSSELS
Tel: (02) 762-32-00
Telex: 23-494 palobn bru
A.CH,CM,CS,E,MP,P

BRAZIL

Hewlett-Packard do Brasil L.E.C. Ltda.
Alameda Rio Negro, 750
Alphaville
06400 BARUERI SP
Tel: (011) 421.1311
Telex: (011) 33872 HPBR-BR
Cable: HEWPACK Sao Paulo
A.CH,CM,CS,E,M,P

Hewlett-Packard do Brasil L.E.C. Ltda.

Avenida Epitacio Pessoa, 4664
22471 RIO DE JANEIRO-RJ
Tel: (02) 286 0237
Telex: 021-21905 HPBR-BR
Cable: HEWPACK Rio de Janeiro
A.CH,CM,E,MS,P*

ANAMED I.C.E.I. Ltda.

Rua Bago, 102
04012 SAO PAULO
Tel: (011) 570-5726
Telex: 021-21905 HPBR-BR
M

SALES & SUPPORT OFFICES

Arranged alphabetically by country

CANADA

Alberta

Hewlett-Packard (Canada) Ltd.
3030 3rd Avenue N.E.
CALGARY, Alberta T2A 6T7
Tel: (403) 235-3100
A.C.H.C.M.E.* M.S.P.*

Hewlett-Packard (Canada) Ltd.
11120A-178th Street
EDMONTON, Alberta T5S 1P2
Tel: (403) 486-6666
A.C.H.C.M.C.S.E.* M.S.P.*

British Columbia

Hewlett-Packard (Canada) Ltd.
10891 Shelburne Way
RICHMOND

British Columbia V6X 2W7
Tel: (604) 270-2277
Telex: 610-922-5059
A.C.H.C.M.C.S.E.* M.S.P.*

Manitoba

Hewlett-Packard (Canada) Ltd.
380-550 Century Street
WINNIPEG, Manitoba R3H 0Y1
Tel: (204) 786-6701
A.C.H.C.M.E.* M.S.P.*

Nova Scotia

Hewlett-Packard (Canada) Ltd.
P.O. Box 931
900 Windmill Road
DARTMOUTH, Nova Scotia B2Y 3Z6
Tel: (902) 469-7820
CH.C.M.C.S.E.* M.S.P.*

Ontario

Hewlett-Packard (Canada) Ltd.
3325 N. Service Rd., Unit 6
BURLINGTON, Ontario P3A 2A3
Tel: (416) 335-8644
CS.M*

Hewlett-Packard (Canada) Ltd.
552 Newbold Street
LONDON, Ontario N6E 2S5
Tel: (519) 686-9181
A.C.H.C.M.E.* M.S.P.*

Hewlett-Packard (Canada) Ltd.
6877 Goreway Drive
MISSISSAUGA, Ontario L4V 1M8
Tel: (416) 678-9430
A.C.H.C.M.C.S.E.* M.P.P.

Hewlett-Packard (Canada) Ltd.
2670 Queensview Dr.
OTTAWA, Ontario K2B 8K1
Tel: (613) 820-6463
A.C.H.C.M.C.S.E.* M.S.P.*

Hewlett-Packard (Canada) Ltd.
220 Yorkland Blvd., Unit #11
WILLOWDALE, Ontario M2J 1R5
Tel: (416) 499-9333
CH

Quebec

Hewlett-Packard (Canada) Ltd.
17500 South Service Road
Trans-Canada Highway
KIRKLAND, Quebec H9J 2M5
Tel: (514) 697-4232
A.C.H.C.M.C.S.E.* M.P.P.*

Hewlett-Packard (Canada) Ltd.
Les Galeries du Vallon
2323 Du Versant Nord
STE. FOY, Quebec G1N 4C2
Tel: (418) 687-4570
CH

CHILE

Jorge Calcagni y Cia. Ltda.
Isla 634 Santiago
Casilla 16475
SANTIAGO 9
Tel: 222-0222
Telex: Public Booth 440001
A.C.M.E.M

Olympia (Chile) Ltda.
Av. Rodrigo de Araya 1045
Casilla 256-V
SANTIAGO 21
Tel: (02) 22 55 044
Telex: 240-565 OLYMP CL
Cable: Olympanchile Santiagochile
CH.C.S.P.

CHINA, People's Republic of

China Hewlett-Packard Rep. Office
P.O. Box 418
1A Lane 2, Luchang St.
Beiwai Rd., Xuanwu District
BEIJING

Tel: 33-1947, 33-7426
Telex: 22601 CTSHP CN
Cables: 1920
A.C.H.C.M.C.S.E.P

COLOMBIA

Instrumentación
H. A. Langebaek & Kier S.A.
Carrera 4A No. 52A-26
Apartado Aereo 6287
BOGOTÁ 1, D.E.
Tel: 212-1466
Telex: 44400 INST CO
Cable: AARIS Bogota
C.M.E.M

Casa Humboldt Ltda.
Carrera 14, No. 98-60
Apartado Aereo 51283
BOGOTÁ 1, D.E.
Tel: 256-1686
Telex: 45403 CCAL CO.
A

COSTA RICA

Clintifica Costarricense S.A.
Avenida 2, Calle 5
San Pedro de Montes de Oca
Apartado 10159
SAN JOSE
Tel: 24-38-20, 24-08-19
Telex: 2367 GALGUR CR
C.M.E.M

CYPRUS

Telexia Ltd.
P.O. Box 4809
14C Stassinos Avenue
NICOSIA
Tel: 82698
Telex: 2894 LEVDO CY
E.M.P

DENMARK

Hewlett-Packard A/S
Datavej 52
DK-3460 BIRKEROD
Tel: (02) 81-96-40
Telex: 37409 hpas dk
A.C.H.C.M.C.S.E.* M.S.P.*
Hewlett-Packard A/S
Rokhedsvej 32
DK-8240 RISSKOV, Aarhus
Tel: (06) 17-60-00
Telex: 37409 hpas dk
C.M.E

DOMINICAN REPUBLIC

Microproq S.A.
Juan Tomás Mejía y Cotes No. 60
Arroyo Honda
SANTO DOMINGO
Tel: 565-6268
Telex: 4510 ARENTA DR (RCA) P

ECUADOR

CYEDE Cia. Ltda.
Avenida Eloy Alfaro 1749
Casilla 6423 CCI
QUITO
Tel: 450-975, 243-052
Telex: 2548 CYEDE ED
C.M.E.P
Hospitalar S.A.
Robles 625
Casilla 3590
QUITO
Tel: 545-250, 545-122
Telex: 2485 HOSPTL ED
Cable: HOSPITALAR-Quito
M

EGYPT

International Engineering Associates
24 Hussein Hegazi Street
Kasr-el-Ain
CAIRO
Tel: 23829, 21641
Telex: IEA UN 93830
CH.C.S.E.M

EGYPTOR

P.O. Box 2558
42 El Zakara Street
CAIRO, Egypt
Tel: 65 00 21
Telex: 93 337
P

EL SALVADOR

IPESA de El Salvador S.A.
29 Avenida Norte 1216
SAN SALVADOR
Tel: 26-6250, 26-6868
Telex: 20530 PESASAL
A.C.H.C.M.C.S.E.P

FINLAND

Hewlett-Packard Oy
Revontuliente 7
PL 24
SF-02101 ESPOO 10
Tel: (90) 4550211
Telex: 121563 hewpa sf
CH.C.M.C.S.P

Hewlett-Packard Oy
(Olarinuumi 7)
PL 24
02101 ESPOO 10
Tel: (90) 4521022
A.E.M.S

Hewlett-Packard Oy
Astoksenkatu 10-C
SF-40720-72 JYVASKYLA
Tel: (941) 216318
CH

Hewlett-Packard Oy
Kairuntie 1-C
SF-90140-14 OULU
Tel: (981) 338785
CH

FRANCE

Hewlett-Packard France
21 Mercure B
Rue Berthelot
F-13763 Les Milles Cedex
AIX-EN-PROVENCE
Tel: 16 (42) 59-41-02
Telex: 410770F
A.C.H.E.M.S.P.*

Hewlett-Packard France
64, rue Marchand Sallant
F-61000 ALENCON
Tel: 16 (33) 29 04 42
Hewlett-Packard France
Boite Postale 503
F-25026 BESANCON
28 rue de la République
F-25000 BESANCON
Tel: 16 (81) 83-16-22
CH.M

Hewlett-Packard France
13, Place Napoleon III
F-29000 BREST
Tel: 16 (96) 03-38-35

Hewlett-Packard France
F-25000 BESANCON
Boite Postale 162
F-69130 ECULLY Cedex (Lyon)
Tel: 16 (78) 833-81-25
Telex: 310617F
A.C.H.C.S.E.M

Hewlett-Packard France
Tour Loraines
Boulevard de France
F-91030 EVRY Cedex
Tel: 16 6 077-96-60
Telex: 692315F
E

Hewlett-Packard France
Parc d'Activite du Bos Briard
Ave. du Lac
F-91040 EVRY Cedex
Tel: 16 6 077-8383
Telex: 692315F
E

Hewlett-Packard France
5, avenue Raymond Chanas
F-38320 EYBENS (Grenoble)
Tel: 16 (76) 25-81-41
Telex: 980124 HP GRENOB EYBE
CH

Hewlett-Packard France
Centre d'Affaire Paris-Nord
Bâtiment Ampère 5 étage
Rue de la Commune de Paris
Boite Postale 300
F-93153 LE BLANC MESNIL
Tel: 16 (11) 865-44-52
Telex: 211032F
CH.C.S.E.M.S

Hewlett-Packard France
Parc d'Activités Cadera
Quartier Jean Mermoz
Avenue du Président J.F. Kennedy
F-33700 MERIGNAC (Bordeaux)
Tel: 16 (56) 34-00-64
Telex: 550105F
CH.E.M.S

Hewlett-Packard France
Immeuble "Les 3 B"
Nouveau Chemin de la Garde
ZAC de Bois Briard
F-44085 NANTES Cedex
Tel: 16 (40) 50-32-22
CH**

SALES & SUPPORT OFFICES

Arranged alphabetically by country

3



FRANCE (Cont'd)

Hewlett-Packard France
125, rue du Faubourg Bannier
F-45000 ORLEANS
Tel: 16 (36) 68 01 63

Hewlett-Packard France
Zone Industrielle de Courtaboeuf
Avenue des Tropiques
F-91947 Les Ulis Cedex ORSAY
Tel: (6) 907-78-25
Telex: 600048F
A,CH,CM,CS,E,MP,P

Hewlett-Packard France
Paris Porte-Maillot
15, Avenue de L'Amiral Bruix
F-75782 PARIS CEDEX 16
Tel: 16 (1) 502-12-20
Telex: 613663F
CH,MS,P

Hewlett-Packard France
124, Boulevard Tourasse
F-64000 PAU
Tel: 16 (59) 80 38 02

Hewlett-Packard France
2 Allée de la Bourgonnette
F-35100 RENNES
Tel: 16 (89) 51-42-44
Telex: 740912F
CH,CM,E,MS,P*

Hewlett-Packard France
98 Avenue de Bretagne
F-76100 ROUEN
Tel: 16 (35) 63-57-66
CH**CS

Hewlett-Packard France
4 Rue Thomas Mann
Boite Postale 56
F-67033 STRASBOURG Cedex
Tel: 16 (88) 28-56-46
Telex: 890141F
CH,E,MS,P*

Hewlett-Packard France
Le Péripole
20, Chemin du Pigeonnier de la
Cépière
F-31083 TOULOUSE Cedex
Tel: 16 (61) 40-11-12
Telex: 531639F
A,CH,CS,E,P*

Hewlett-Packard France
9, rue Baudin
F-26000 VALENCE
Tel: 16 (75) 42 76 16

Hewlett-Packard France
Carotot
ZAC de Bois Briand
F-57640 WIGY (Metz)
Tel: 16 (6) 771 20 22
CH

Hewlett-Packard France
Immeuble Péncentre
F-59658 VILLENEUVE D'ASCO Cedex
Tel: 16 (20) 91-41-25
Telex: 165124F
CH,E,MS,P*

GERMAN FEDERAL

REPUBLIC

Hewlett-Packard GmbH
Geschäftsstelle
Keitelsstrasse 2-4
D-1000 BERLIN 30
Tel: (030) 24-90-86
Telex: 018 3405 hpbin d
A,CH,E,MP

Hewlett-Packard GmbH
Geschäftsstelle
Herrenberger Strasse 130
D-7030 BOBLINGEN
Tel: (7031) 14-0

Telex:
A,CH,CM,CS,E,MP,P
Hewlett-Packard GmbH
Geschäftsstelle
Emanuel-Leuize-Strasse 1
D-4000 DUSSELDORF
Tel: (0211) 5971-1
Telex: 085/86 533 hpdd d

A,CH,CS,E,MS,P
Hewlett-Packard GmbH
Geschäftsstelle
Schleiersf. 28a
D-4600 DORTMUND-Aplerbeck
Tel: (0231) 45001

Hewlett-Packard GmbH
Vertriebszentrale Frankfurt
Berner Strasse 117
Postfach 560 140
D-6000 FRANKFURT 56*
Tel: (0611) 50-04-1
Telex: 04 13249 hpffm d

A,CH,CM,CS,E,MP,P
Hewlett-Packard GmbH
Geschäftsstelle
Aussenstelle Bad Homburg
Lousenstrasse 115
D-8380 BAD HOMBURG
Tel: (06172) 109-0

Hewlett-Packard GmbH
Geschäftsstelle
Kapstadtring 5
D-2000 HAMBURG 60
Tel: (040) 63804-1
Telex: 021 63 032 hpgh d

A,CH,CS,E,MS,P
Hewlett-Packard GmbH
Geschäftsstelle
Heidering 37-39
D-3000 HANNOVER 61
Tel: (0511) 5706-0
Telex: 092 3259

A,CH,CM,E,MS,P
Hewlett-Packard GmbH
Geschäftsstelle
Rossauer Weg 2-4
D-6800 MANNHEIM
Tel: (0621) 70050
Telex: 0462105

A,C,E
Hewlett-Packard GmbH
Geschäftsstelle
Messerschmittstrasse 7
D-7910 NEU ULM
Tel: 07910-70241
Telex: 0712816 HP ULM-D

A,C,E
Hewlett-Packard GmbH
Geschäftsstelle
Escherichstr. 13
D-8500 NURNBERG 10
Tel: (0911) 5205-0
Telex: 0623 860

CH,CM,E,MS,P
Hewlett-Packard GmbH
Geschäftsstelle
Eschensstrasse 5
D-8028 TAUFKIRCHEN
Tel: (089) 6117-1
Telex: 0524985

A,CH,CM,E,MS,P

GREAT BRITAIN

See United Kingdom

GREECE

Kostas Karayannis S.A.
8 Omirou Street
ATHENS 133
Tel: 32 30 303, 32 37 371
Telex: 215962 RKAR GR
A,CH,CM,CS,E,MP

PLAISO S.A.
G. Gerardos
24 Slounara Street
ATHENS
Tel: 36-11-160
Telex: 221871
P

GUATEMALA

IPESA
Avenida Reforma 3-4B, Zona 9
GUATEMALA CITY
Tel: 316627, 314786
Telex: 4192 TELTRO GU
A,CH,CM,CS,E,MP

HONG KONG

Hewlett-Packard Hong Kong, Ltd.
G.P.O. Box 795
5th Floor, Sun Hung Kai Centre
30 Harbour Road

HONG KONG
Tel: 5-8323211
Telex: 66678 HEWPA HX
Cable: HEWPAK HONG KONG
E,CH,CS,P

CET Ltd.
1402 Tung Wah Mansion
199-203 Hennessy Rd.
Wanchia, HONG KONG
Tel: 5-729376
Telex: 85148 CET HX
CM

Schmidt & Co. (Hong Kong) Ltd.
Wing On Centre, 28th Floor
Connaught Road, C.

HONG KONG
Tel: 5-455644
Telex: 74766 SCHUX HX
A,M

ICELAND

Eiking Trading Company Inc.
Hafnarfjorð: Tryggvagötu
P.O. Box 895
IS-REYKJAVIK
Tel: 1-58-20, 1-63-03
M

INDIA

Computer products are sold through
Blue Star Ltd. All computer repairs and
maintenance service is done through
Computer Maintenance Corp.

Blue Star Ltd.
Sabri Complex II Floor
24 Residency Rd.
BANGALORE 560 025
Tel: 55660
Telex: 0845-430
Cable: BLUESTAR
A,CH,CM,CS,E

Blue Star Ltd.
Band Box House
Prabhadew
BOMBAY 400 025
Tel: 422-3101
Telex: 011-3751
Cable: BLUESTAR
A,M

Blue Star Ltd.
Sahas
414/2 Vr Savarkar Marg
Prabhadew
BOMBAY 400 025
Tel: 422-6155
Telex: 011-4093
Cable: FROSTBLUE
A,CH,CM,CS,E,M

Blue Star Ltd.
Kalyan, 19 Vishwas Colony
Akapuri, BORODA, 390 005
Tel: 65235
Cable: BLUE STAR
A

Blue Star Ltd.
7 Hare Street
CALCUTTA 700 001
Tel: 12-01-31
Telex: 021-7655
Cable: BLUESTAR
A,M

Blue Star Ltd.
133 Kodambakkam High Road
MADRAS 600 034
Tel: 82057
Telex: 041-379
Cable: BLUESTAR
A,M

Blue Star Ltd.
Bhandari House, 7th/8th Floors
91 Nehru Place
NEW DELHI 110 024
Tel: 682547
Telex: 031-2463
Cable: BLUESTAR
A,CH,CM,CS,E,M

Blue Star Ltd.
15/16-C Wellesley Rd.
PUNE 411 011
Tel: 22775
Cable: BLUE STAR
A

Blue Star Ltd.
2-2-47/1108 Bolarum Rd.
SECUNDERABAD 500 003
Tel: 72057
Telex: 0155-459
Cable: BLUEFROST
A,E

Blue Star Ltd.
T.C. 7/603 Poornima
Maruthankuzhi
TRIVANDRUM 695 013
Tel: 85799
Telex: 0864-259
Cable: BLUESTAR
E

Computer Maintenance Corporation
Ltd.
115, Sarajini Devi Road
SECUNDERABAD 500 003
Tel: 310-184, 345-774
Telex: 031-2960
CH**



SALES & SUPPORT OFFICES

Arranged alphabetically by country

INDONESIA

BERCA Indonesia P.T.
P.O.Box 495/JKI
J. Abdul Muis 62
JAKARTA
Tel: 21-373009
Telex: 46748 BERSAL II
Cable: BERSAL JAKARTA P

BERCA Indonesia P.T.
P.O.Box 2497/JKI
Antara Bldg., 17th Floor
J. Medan Merdeka Selatan 17
JAKARTA-PUSAT
Tel: 21-344 181
Telex: BERSAL II
A.C.S.E.M

BERCA Indonesia P.T.
P.O. Box 174/SBY
J. Kelen No. 11
SURABAYA
Tel: 68172
Telex: 31146 BERSAL SB
Cable: BERSAL-SURABAYA
A.E.M.P

IRAQ

Hewlett-Packard Trading S.A.
Service Operation
Al Mansoor City 98/3/7
BAHRAIN
Tel: 551-49-73
Telex: 212-455 HEPARQA K
CH.CS

IRELAND

Hewlett-Packard Ireland Ltd.
82/83 Lower Leeson Street
DUBLIN 2
Tel: 0001 806800
Telex: 30439
A.C.H.C.M.C.S.E.M.P

Cardiac Services Ltd.
Kilmore Road
Artane
DUBLIN 5
Tel: (01) 35 1820
Telex: 30439
M

ISRAEL

Eidan Electronic Instrument Ltd.
P.O.Box 1270
JERUSALEM 9 1000
16, Ohelav St.
JERUSALEM 94467
Tel: 533 221, 533 242
Telex: 25231 ABPAKRD II
A

Electronics Engineering Division
Motorola Israel Ltd.
18 Kramenski Street
P.O. Box 25016
TEL-AVIV 61000
Tel: 3 88 388
Telex: 33569 MoM II
Cable: BASTEL Tel-Aviv
CH.CM.CS.E.M.P

ITALY

Hewlett-Packard Italiana S.p.A.
Traversa 59C
Via Guis Petroni, 19
I-70124 BARI
Tel: (080) 41-07-44
M

Hewlett-Packard Italiana S.p.A.
Via Martin Luther King, 36/II
I-40132 BOLOGNA
Tel: (051) 402384
Telex: 511630
CH.E.MS

Hewlett-Packard Italiana S.p.A.
Via Principe Nicola 43/GC
I-95126 CATANIA
Tel: (095) 37-10-87
Telex: 970291
C.P

Hewlett-Packard Italiana S.p.A.
Via G. Di Vittorio 9
I-20063 CERNUSCO SUL NAVIGLIO
(Milan)
Tel: (02) 923691
Telex: 334632
A.C.H.C.M.C.S.E.M.P.P

Hewlett-Packard Italiana S.p.A.
Via C. Colombo 49
I-20090 TREVIGLIO SUL NAVIGLIO
(Milan)
Tel: (02) 4450041
Telex: 322116
C.M

Hewlett-Packard Italiana S.p.A.
Via Nuova San Rocco a
Capodimonte, 62/A
I-80131 NAPOLI
Tel: (081) 74 13544
Telex: 710698
A.C.H.E

Hewlett-Packard Italiana S.p.A.
Viale G. Modugno 33
I-16156 GENOVA PEGLI
Tel: (010) 68-37-07
Telex: 215238
E.C

Hewlett-Packard Italiana S.p.A.
Via Pelizzo 15
I-35128 PADOVA
Tel: (049) 664888
Telex: 430315
A.C.H.E.MS

Hewlett-Packard Italiana S.p.A.
Viale C. Pavese 340
I-00144 ROMA EUR
Tel: (06) 54831
Telex: 610514
A.C.H.C.M.C.S.E.MS.P*

Hewlett-Packard Italiana S.p.A.
Via di Casellina 57/C
I-50018 SCANDICCI-FIRENZE
Tel: (055) 753863
Hewlett-Packard Italiana S.p.A.
Corso Svizzera, 185
I-10144 TORINO
Tel: (011) 74 4044
Telex: 221079
CH.E

JAPAN

Yokogawa-Hewlett-Packard Ltd.
152-1, Onna
ATSUGI, Kanagawa, 243
Tel: (C462) 28-0451
CH.C.E

Yokogawa-Hewlett-Packard Ltd.
Mei Seimei Bldg. 6F
3-1 Hon Chiba-cho
CHIBA, 280
Tel: 472 25 7701
E.CH.CS

Yokogawa-Hewlett-Packard Ltd.
Yasuda-Seimei Hiroshima Bldg.
5-1, Hon-dori, Naka-ku
HIROSHIMA, 730
Tel: 82-241-0611

Yokogawa-Hewlett-Packard Ltd.
Towa Building
2-3, Kaigan-dori, 2 Chome Chuo-ku
KOBE, 650
Tel: (078) 392-4791
C.E

Yokogawa-Hewlett-Packard Ltd.
Kumagaya Asahi B2 Bldg.
3-4 Tsukuba
KUMAGAYA, Saitama 360
Tel: (0485) 24-6563
CH.C.M.E

Yokogawa-Hewlett-Packard Ltd.
Aashi Shinbun Daichi Seimei Bldg.
4-7, Hanabata-cho
KUMAMOTO, 860
Tel: (0963) 54-7311
CH.E

Yokogawa-Hewlett-Packard Ltd.
Shin-Kyoto Center Bldg.
614, Higashi-Shokoji-cho
Karasuma-Nishiru
Shokoji-dori, Shimogyo-ku
KYOTO, 600
Tel: 075-343-0921
CH.C.M.E

Yokogawa-Hewlett-Packard Ltd.
Mito Mitsui Bldg.
4-73, Sanno-maru, 1 Chome
MITO, Ibaraki 310
Tel: (0292) 25-7470
CH.C.M.E

Yokogawa-Hewlett-Packard Ltd.
Samtomo Seimei 14-9 Bldg.
Meiki-Minami, 2 Chome
Nakamura-ku
NAGOYA, 450
Tel: (052) 571-5171
CH.CM.CS.E.MS

Yokogawa-Hewlett-Packard Ltd.
Chuo Bldg.
4-20 Nishinakajima, 5 Chome
Yodogawa-ku
OSAKA, 532
Tel: (06) 304-8021
Telex: YHPOSA 523-3624
A.C.H.C.M.C.S.E.M.P*

Yokogawa-Hewlett-Packard Ltd.
27-15, Yabe, 1 Chome
SAGAMIHARA Kanagawa, 229
Tel: 0427 59-1311

Yokogawa-Hewlett-Packard Ltd.
Daichi Seimei Bldg.
7-1, Hishi Shanjuku, 2 Chome
Shinjuku-ku, TOKYO 160
Tel: 03-348-4611
CH.E

Yokogawa-Hewlett-Packard Ltd.
29-21 Takaide-Higashi, 3 Chome
Sugnam-ku TOKYO 168
Tel: (03) 331-6111
Telex: 232-2024 HPTOK
A.C.H.C.M.C.S.E.M.P*

Yokogawa-Hewlett-Packard Ltd.
Daichi Asano Building
2-8, Odori, 5 Chome
UTSUNOMIYA, Tochigi 320
Tel: (0286) 25-7155
CH.CS.E

Yokogawa-Hewlett-Packard Ltd.
Yasuda Seimei Hishiguchi Bldg.
30-4 Tsunaya-cho, 3 Chome
YOKOHAMA 221
Tel: (045) 312-1252
CH.C.M.E

JORDAN

Mouscher Cousins Company
P.O. Box 1387
AMMAN
Tel: 24907, 39907
Telex: 21456 SABCO JO
CH.E.M.P

KENYA

ADCOM Ltd., Inc., Kenya
P.O. Box 30070
NAIROBI
Tel: 331955
Telex: 22639
E.M

KOREA

Samsung Electronics HP Division
12 Fl. Kinam Bldg.
San 75-31, Yeoksam-Dong
Kangnam-ku
Yongpung P.O. Box 72
SEOUL
Tel: 555-7555, 555-5447
Telex: K27364 SAMSAN
A.C.H.C.M.C.S.E.M.P

KUWAIT

Al-Khadiya Trading & Contracting
P.O. Box 830 Safat
KUWAIT
Tel: 42-4910, 41-1726
Telex: 22481 Areeg KI
CH.E.M

Photo & Cine Equipment
P.O. Box 270 Safat
KUWAIT
Tel: 42-2946, 42-3801
Telex: 22247 Malm KI
P

LEBANON

G.M. Dolmudjian
Achrallah
P.O. Box 165 167
BEIRUT
Tel: 290293
M.P.*

Computer Information Systems
P.O. Box 11-6274
BEIRUT
Tel: 89 40 73
Telex: 22259
C

LUXEMBOURG

Hewlett-Packard Belgium S.A./N.V.
 Blvd de la Woluwe, 100
Woluwedaj
B-1200 BRUSSELS
Tel: (02) 762-32-00
Telex: 23-494 paloben br
A.C.H.C.M.C.S.E.M.P.P

MALAYSIA

Hewlett-Packard Sales (Malaysia)
Sdn. Bhd.
1st Floor, Bangunan British
American
Jalan Semantan, Damansara Heights
KUALA LUMPUR 23-03
Tel: 943022
Telex: MMS1011
A.C.H.E.M.P.*

SALES & SUPPORT OFFICES

Arranged alphabetically by country

5



MALAYSIA (Cont'd)

Protel Engineering
P.O. Box 1917
Lot 682A, Section 64
23/4 Pending Road
Kuching, SARAWAK
Tel: 36299
Telex: MA 70904 PROMAL
Cable: PROTELENG
A.E.M.

MALTA

Philp Toledo Ltd.
Notable Rd
MNEHEL
Tel: 447 47, 455 66
Telex: Media MW 649
E.P.

MEXICO

Hewlett-Packard Mexicana, S.A.
de C.V.
Av. Periferico Sur No. 6501
Tesepan, Xochimilco
16020 MEXICO D.F.
Tel: 6-76-46-00
Telex: 17-74-507 HEWPACK MEX
A.CH.CS.E.M.S.P

Hewlett-Packard Mexicana, S.A.
de C.V.
Ave. Colonia del Valle 409
Col. del Valle
Municipio de Garza Garcia
MONTERREY, Nuevo Leon
Tel: 78 42 41
Telex: 038 410
CH

ECISA
José Vasconcelos No. 218
Col. Condesa Deleg. Cuauhtémoc
MEXICO D.F. 06140
Tel: 553-1206
Telex: 17-72755 ECE ME
M

MOROCCO

Dobbeu
81 rue Karatchi
CASABLANCA
Tel: 3041-82, 3068-38
Telex: 23051, 22822
E

Gerp
2 rue d'Agadir
Boite Postale 156
CASABLANCA
Tel: 272063, 272095
Telex: 23 739
P

NETHERLANDS

Hewlett-Packard Nederland B.V.
Van Heuven Goedhartlaan 121
NL 1181 KM AMSTELVEEN
P.O. Box 667
NL 1180 AR AMSTELVEEN
Tel: (020) 47-20-21
Telex: 13 216 HEPA NL
A.CH.CM.CS.E.M.P
Hewlett-Packard Nederland B.V.
Bongerd 2
NL 2906 YK CAPELLE A/D IJSEL
P.O. Box 41
NL 2900 AA CAPELLE A/D IJSEL
Tel: (10) 51-64-44
Telex: 21261 HEPAC NL
A.CH.CS.E

Hewlett-Packard Nederland B.V.
Pastoor Petersstraat 134-136
NL 5612 LV EINDHOVEN
P.O. Box 2342
NL 5600 CH EINDHOVEN
Tel: (040) 326911
Telex: 51484 hepae nl
A.CH * . E.M

NEW ZEALAND

Hewlett-Packard (N.Z.) Ltd.
5 Owens Road
P.O. Box 26-189
Epsom, AUCKLAND
Tel: 687-159
Cable: HEWPACK Auckland
CH.CM.E.P*

Hewlett-Packard (N.Z.) Ltd.
4-12 Cruckshank Street
Kilburne, WELLINGTON 3
P.O. Box 9443
Courtenay Place, WELLINGTON 3
Tel: 877-199
Cable: HEWPACK Wellington
CH.CM.E.P

Northrop Instruments & Systems Ltd.
369 Khyber Pass Road
P.O. Box 8602
AUCKLAND
Tel: 794-091
Telex: 60605
A.M

Northrop Instruments & Systems Ltd.
110 Manville St.
P.O. Box 8388
CHRISTCHURCH
Tel: 486-928
Telex: 4203
A.M

Northrop Instruments & Systems Ltd.
Sturdee House
85-87 Gzuznee Street
P.O. Box 2406
WELLINGTON
Tel: 850-091
Telex: NZ 3380
A.M

NORTHERN IRELAND

See United Kingdom

NORWAY

Hewlett-Packard Norge A/S
Folke Bernadottes vei 50
P.O. Box 3558
N-5033 FYLLINGSDALEN (Bergen)
Tel: 0047/5116 55 40
Telex: 16621 hpnas n
CH.CS.E.MS

Hewlett-Packard Norge A/S
Østendalen 16-18
P.O. Box 34
N-1345 ØSTERS
Tel: 0047/217 11 80
Telex: 16621 hpnas n
A.CH.CM.CS.E.M.P

OMAN

Khumi Ramdas
P.O. Box 19
MUSCAT
Tel: 722225, 745601
Telex: 3269 BROKER MB MUSCAT
P
Suhai & Saud Bahwan
P.O. Box 169
MUSCAT
Tel: 734 201-3
Telex: 3274 BAHWAN MB

PAKISTAN

Mushko & Company Ltd.
1-B, Street 43
Sector F-8/1
ISLAMABAD
Tel: 51071
Cable: FEMUS Rawalpindi
A.E.M

Mushko & Company Ltd.
Osman Chambers
Abdullah Haroon Road
KARACHI 0302
Tel: 524131, 524132
Telex: 2694 MUSKO PK
Cable: COOPERATOR Karachi
A.E.M.P*

PANAMA

Electrónico Balboa, S.A.
Calle Samuel Lewis, Ed. Alfa
Apartado 4929
PANAMA 5
Tel: 63-8613, 63-6748
Telex: 3483 ELECTRON PG
A.CH.E.M.P

PERU

Cia Electro Médica S.A.
Los Flamencos 145, San Isidro
Calle 1030
LIMA 1
Tel: 41-4325, 41-3703
Telex: Pub. Booth 25306
C.M.E.M.P

PHILIPPINES

The Online Advanced Systems Corporation
Rico House, Amoroso Cor. Herrera Street
Legaspi Village, Makati
P.O. Box 1510
Metro MANILA
Tel: 85-35-81, 85-34-91, 85-32-21
Telex: 3274 ONLINE
A.CH.CS.E.M

Electronic Specialists and Proponents Inc.
690-B Epitacio de los Santos Avenue
Cubao, QUEZON CITY
P.O. Box 2649 Manila
Tel: 98-96-81, 98-96-82, 98-96-83
Telex: 40018; 42000 ITI GLOBE
MACKAY BOOTH
P

PORTUGAL

Mundinter
Intercambio Mundial de Comércio
S.A.R.L.
P.O. Box 2761
Av. Antonio Augusto de Aguiar 138
P-LISSBOA
Tel: (19) 53-21-31, 53-21-37
Telex: 16691 munter p
M
Soquimica
Av. da Liberdade, 220-2
1298 LISBOA Codex
Tel: 56 21 812/3
Telex: 13316 SABASA
P

Telectra-Empresa Técnica de Equipamentos Eléctricos S.A.R.L.
Rua Rodrigo da Fonseca 103
P.O. Box 2531
P-LISSBOA 1
Tel: (19) 68-60-72
Telex: 12598
CH.CS.E.P

PUERTO RICO

Hewlett-Packard Puerto Rico
Ave. Muñoz Rivera #101
Esq. Calle Ochoa
HATO REY, Puerto Rico 00918
Tel: (809) 754-7800
Hewlett-Packard Puerto Rico
Calle 272 Edificio 203
Urb. Country Club
RIO Piedras, Puerto Rico
P.O. Box 4407
CAROLINA, Puerto Rico 00628
Tel: (809) 762-7255
A.CH.CS

QATAR

Computerbarba
P.O. Box 2750
DOHA
Tel: 883555
Telex: 4806 CHPARB
P
Eastern Technical Services
P.O. Box 4747
DOHA
Tel: 329 993
Telex: 4156 EASTEC DH
Nasser Trading & Contracting
P.O. Box 1563
DOHA
Tel: 22170, 23539
Telex: 4439 NASSER DH
M

SAUDI ARABIA

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 22015
Thuobah
AL-KHOBAR
Tel: 895-1760, 895-1764
Telex: 6711 106 HPMEEK SJ
Cable: ELECTA AL-KHOBAR
CH.CS.E.M

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 1228
Reda Plaza, 6th Floor
JEDDAH
Tel: 644 38 48
Telex: 4027 12 FARNAS SJ
Cable: ELECTA JEDDAH
CH.CS.E.M

Modern Electronic Establishment
Hewlett-Packard Division
P.O. Box 22015
RIYADH
Tel: 491-97 15, 491-63 87
Telex: 202049 MEERYD SJ
CH.CS.E.M

Abdul Ghani El Ajou
P.O. Box 78
RIYADH
Tel: 40 41 717
Telex: 200 932 EL AJOU
P

SCOTLAND

See United Kingdom

SINGAPORE

Hewlett-Packard Singapore (Sales)
Pte.
#108-00 Inhcapac House
450-2 Alexandra Road
P.O. Box 58 Alexandra Rd. Post Office
SINGAPORE, 9115
Tel: 631788
Telex: HPSISO RS 34209
Cable: HEWPACK, Singapore
A.CH.CS.E.M.S.P



SALES & SUPPORT OFFICES

Arranged alphabetically by country

SINGAPORE (Cont'd)

Dynamar International Ltd.
Unit 05-11 Block 6
Kolan Ayer Industrial Estate
SINGAPORE 1334
Tel: 747-6188
Telex: RS 26283
CH

SOUTH AFRICA

Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 120
Howard Place CAPE PROVINCE 7450
Pine Park Center, Forest Drive,
Pinelands.
CAPE PROVINCE 7405
Tel: 53-7954
Telex: 57-20006
A,CH,CM,CS,E,MS,P
Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 37099
92 Overport Drive
DUNBAM 4067
Tel: 28-4178, 28-4179, 28-4110
Telex: 6-22354
CH,CM

Hewlett-Packard So Africa (Pty.) Ltd.

6 Linton Arcade
511 Cape Road
Linton Grange
PORT ELIZABETH 6000
Tel: 041-302148
CH

Hewlett-Packard So Africa (Pty.) Ltd.
P.O. Box 33345

Glenshanie 0010 TRANSVAAL
1st Floor East
Constanzia Park Ridge Shopping
Centre
Constanzia Park
PIETORIA
Tel: 982043
Telex: 32163
CH,E

Hewlett-Packard So Africa (Pty.) Ltd.

Private Bag Wendywood
SANDTON 2144
Tel: 802-5111, 802-5125
Telex: 4-20877
Cable: HEWPACK Johannesburg
A,CH,CM,CS,E,MS,P

SPAIN

Hewlett-Packard Española S.A.
Calle Entenza, 321
E-BARCELONA 29
Tel: 322.24.51, 321.73.54
Telex: 52603 hpbee
A,CH,CS,E,MS,P
Hewlett-Packard Española S.A.
Calle San Vicente S/No
Edificio Albia II
E-BILBAO 1
Tel: 423.83.06
A,CH,E,MS

Hewlett-Packard Española S.A.
Ctra. de la Corona, Km. 16, 400
Las Rozas
E-MADRID
Tel: (1) 637.00.11
CH,CS,M

Hewlett-Packard Española S.A.
Avda. S. Francisco Javier, S/no
Planta 10. Edificio Sevilla 2,
E-SEVILLA 5
Tel: 64.44.54
Telex: 72933
A,CS,MS,P

Hewlett-Packard Española S.A.
Calle Ramon Gordo, 1 (Enfo. 3)
E-VALENCIA 10
Tel: 361-1354
CH,P

SWEDEN

Hewlett-Packard Sverige AB
Sunnanvagen 14K
S-22226 LUND
Tel: (046) 13-69-79
Telex: (854) 17886 (via Spånga
office)
CH

Hewlett-Packard Sverige AB
Östra Tulgatan 3
S-21128 MALMÖ
Tel: (040) 70270
Telex: (854) 17886 (via Spånga
office)
CH

Hewlett-Packard Sverige AB
Västra Vintergatan 9
S-70344 ÖREBRO
Tel: (19) 10-48-80
Telex: (854) 17886 (via Spånga
office)
CH

Hewlett-Packard Sverige AB
Skalhögsgatan 9, Kista
Box 19
S-16393 SPÅNGA
Tel: (08) 750-2000
Telex: (854) 17886

Telex: (08) 7527781
A,CH,CM,CS,E,MS,P
Hewlett-Packard Sverige AB
Frötällsgatan 30
S-42132 VÄSTRA-FRÖLUNDA
Tel: (031) 49-09-50
Telex: (854) 17886 (via Spånga
office)
CH,E,P

SWITZERLAND
Hewlett-Packard (Schweiz) AG
Clarastrasse 12
CH-4058 BASEL
Tel: (61) 33-59-20
A

Hewlett-Packard (Schweiz) AG
7, rue du Bois-du-Lan
Case Postale 365
CH-1217 MEYRIN 2
Tel: (0041) 22-83-11-11
Tel: 27333 HPAG CH
CH,CM,CS

Hewlett-Packard (Schweiz) AG
Almend 2
CH-8967 WIDEN
Tel: (0041) 57 31 21 11
Cable: HPAG CH
A,CH,CM,CS,E,MS,P

SYRIA
General Electronic Inc.
Nuri Basha Annual Ebn Kayn Street
P.O. Box 5781
DAMASCUS
Tel: 33-24-27
Telex: 411 215
Cable: ELECTROBOR DAMASCUS
E

Middle East Electronics
P.O. Box 2308
Abu Rummaneh
DAMASCUS
Tel: 33 4 5 92
Telex: 411 304
M

TAIWAN
Hewlett-Packard Far East Ltd.
Kaohsiung Office
2/F 68-2, Chung Cheng 3rd Road
KAOSHIUNG
Tel: (07) 241-2318
CH,CS,E
Hewlett-Packard Far East Ltd.
Taiwan Branch
8th Floor
337 Fu Hsing North Road
TAIPEI
Tel: (02) 712-0404
Telex: 24439 HEWPACK
Cable: HEWPACK Taipei
A,CH,CM,CS,E,M,P
Ing Lih Trading Co.
3rd Floor, 7 Jen-Ai Road, Sec. 2
TAIPEI 100
Tel: (02) 3948191
Cable: INGLIH TAIPEI
A

THAILAND
Unimesa
30 Pailong Ave., Suriwong
BANGKOK 5
Tel: 235-5727
Telex: 84439 Simonco TH
Cable: UNIMESA Bangkok
A,CH,CS,E,M
Bangkok Business Equipment Ltd.
5/5-6 Dejo Road
BANGKOK
Tel: 234-8670, 234-8671
Telex: 87669-BEQUPT TH
Cable: BUSIQUPT Bangkok
P

TRINIDAD & TOBAGO
Caribbean Telecoms Ltd.
50/A Jerningham Avenue
P.O. Box 732
PORT-OF-SPAIN
Tel: 62-44213, 62-44214
Telex: 235,272 HUGCO WG
OM,E,M,P

TUNISIA
Tunisie Electronique
31 Avenue de la Liberté
TUNIS
Tel: 280-144
E.P.
Corema
1 ter. Av. de Carthage
TUNIS
Tel: 253-821
Telex: 12319 CABAM TN
M

TURKEY
Tekrim Company Ltd.
Iran Caddesi No. 7
Kavaklıdere, ANKARA
Tel: 275800
Telex: 42155 TKOM TR
E

E.M.A.

Medna Eldem Sokak No 41/6
Yüksel Caddesi
ANKARA
Tel: 175 622
Telex: 42 591
M

UNITED ARAB EMIRATES

Emiac Ltd.
P.O. Box 2711
ABU DHABI
Tel: 92 04 19 20
Cable: EMITAC ABUDHABI
Emiac Ltd.
P.O. Box 1641
SHARJAH
Tel: 591 181
Tel: 68136 Emiac Sh
CH,CS,E,M,P

UNITED KINGDOM

GREAT BRITAIN
Hewlett-Packard Ltd.
Traffalgar House
Navigation Road
ALTRINGHAM
Cheshire WA14 1NU
Tel: 061 928 6422
Telex: 668068
A,CH,CS,E,MS,P
Hewlett-Packard Ltd.
Elstree House, Elstree Way
BOREHAMWOOD, Herts WD6 1SG
Tel: 01 207 5000
Telex: 8952716
E,CH,CS,P

Hewlett-Packard Ltd.
Oakfield House, Oakfield Grove
Clifton BRISTOL, Avon BS8 2BN
Tel: 0272 736806
Telex: 444302
CH,CS,E,P

Hewlett-Packard Ltd.
Bridewell House
Bridewell Place
LONDON EC4V 6BS
Tel: 01 583 6565
Telex: 298163
CH,CS,P

Hewlett-Packard Ltd.
Fouise House
257-263 High Street
LONDON COLNEY
Herts. AL2 1HA, St. Albans
Tel: 1-8952716
CH,CS

Hewlett-Packard Ltd.
Portliffact Road
NORMANTON, West Yorkshire WF6 1RN
Tel: 0924 895566
Telex: 557355
CH,CS,P

Hewlett-Packard Ltd.
The Quadrangle
106-118 Station Road
REDFHILL, Surrey RH1 1PS
Tel: 0737 68655
Telex: 947234
CH,CS,E,P

SALES & SUPPORT OFFICES

Arranged alphabetically by country



GREAT BRITAIN (Cont'd)

Hewlett-Packard Ltd.
Avon House
435 Stratford Road
Shirley, SOLIHULL, West Midlands
B90 4BL
Tel: 021 745 8800
Telex: 339105
CH,CS,E,P

Hewlett-Packard Ltd.
West End House
41 High Street, West End
SOUTHAMPTON
Hampshire SO3 300
Tel: 04218 6767
Telex: 477138
CH,CS,P

Hewlett-Packard Ltd.
Eskdale Rd
Winnersh, WOKINGHAM
Berkshire RG11 5DZ
Tel: 0734 696822
Telex: 848884
E

Hewlett-Packard Ltd.
King Street Lane
Winnersh, WOKINGHAM
Berkshire RG11 5AR
Tel: 0734 784774
Telex: 847176
A,CH,CS,E,M,MP,P
Hewlett-Packard Ltd.
Nine Mile Ride
Easthampstead, WOKINGHAM
Berkshire, RG11 3LL
Tel: 0344 773100
Telex: 848805
CH,CS,E,P

IRELAND

NORTHERN IRELAND

Hewlett-Packard Ltd.
Cardiac Services Building
95A Finaghy Road South
BELFAST BT10 0BY
Tel: 0232 625-566
Telex: 747626
CH,CS

SCOTLAND

Hewlett-Packard Ltd
SOUTH QUEENSFERRY
West Lothian, EH30 9TG
Tel: 031 331 1188
Telex: 72682
CH,CM,CS,E,M,P

UNITED STATES

Alabama

Hewlett-Packard Co.
700 Century Park South, Suite 128
BIRMINGHAM, AL 35226
Tel: (205) 822-6802
A,CH,M

Hewlett-Packard Co.
420 Wynn Drive
HUNTSVILLE, AL 35805
P.O. Box 7700
HUNTSVILLE, AL 35807
Tel: (205) 830-2000
CH,CM,CS,E,M*

Arizona

Hewlett-Packard Co.
8080 Pimble Parkway West
PHOENIX, AZ 85044
Tel: (602) 273-8000
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
2424 East Aragon Road
TUCSON, AZ 85706
Tel: (602) 889-4631
CH,E,MS**

California

Hewlett-Packard Co.
99 South Hill Dr.
BRISBANE, CA 94005
Tel: (415) 330-2500
CH,CS

Hewlett-Packard Co.
P.O. Box 7830 (93747)
5060 E. Clinton Avenue, Suite 102
FRESNO, CA 93727
Tel: (209) 252-9652
CH,CS,MS

Hewlett-Packard Co.
P.O. Box 4230
1430 East Orangefhorpe
FULLERTON, CA 92631
Tel: (714) 870-1000
CH,CM,CS,E,MP

Hewlett-Packard Co.
320 S. Kellogg, Suite B
OAKLETA, CA 93117
Tel: (805) 967-3405
CH

Hewlett-Packard Co.
5400 W. Rosecrans Boulevard
LAWNDALE, CA 90260
P.O. Box 92105
LOS ANGELES, CA 90009
Tel: (213) 970-7500
Telex: 910-325-6606
CH,CM,CS,MP

Hewlett-Packard Co.
3155 Porter Oaks Drive
PALO ALTO, CA 94304
Tel: (415) 857-8000
CH,CS,E

Hewlett-Packard Co.
4244 So. Market Court, Suite A
P.O. Box 15976
SACRAMENTO, CA 95852
Tel: (916) 929-7222
A*,CH,CS,E,MS

Hewlett-Packard Co.
9606 Aero Drive
P.O. Box 23333
SAN DIEGO, CA 92139
Tel: (619) 279-3200
CH,CM,CS,E,MP

Hewlett-Packard Co.
2305 Camino Ramon -C*
SAN RAMON, CA 94583
Tel: (415) 838-5900
CH,CS

Hewlett-Packard Co.
3005 Scott Boulevard
SANTA CLARA, CA 95050
Tel: (408) 988-7000
Telex: 910-338-0586
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
5703 Corsa Avenue
WESTLAKE VILLAGE, CA 91362
Tel: (213) 706-6800
E*,CH*,CS*

Colorado

Hewlett-Packard Co.
24 Inverness Place, East
ENGLEWOOD, CO 80112
Tel: (303) 649-5000
A,CH,CM,CS,E,MS

Connecticut

Hewlett-Packard Co.
47 Barnes Industrial Road South
P.O. Box 5007
WALLINGFORD, CT 06492
Tel: (203) 265-7801
A,CH,CM,CS,E,MS

Florida

Hewlett-Packard Co.
2901 N.W. 62nd Street
P.O. Box 24210
FORT LAUDERDALE, FL 33307
Tel: (305) 973-2600
CH,CS,E,MP

Hewlett-Packard Co.
6177 Lake Elenor Drive
P.O. Box 13910
ORLANDO, FL 32859
Tel: (305) 859-2900
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
5750B N. Hoover Blvd., Suite 123
P.O. Box 15200
TAMPA, FL 33614
Tel: (813) 884-3282
A*,CH,CM,CS,E*,M*

Georgia

Hewlett-Packard Co.
2000 South Park Place
P.O. Box 105005
ATLANTA, GA 30348
Tel: (404) 855-1500
Telex: 8 10-788-6990
A,CH,CM,CS,E,MP

Hawaii

Hewlett-Packard Co.
Kawaiahaio Plaza, Suite 190
567 South King Street
HONOLULU, HI 96813
Tel: (808) 526-1555
A,CH,E,MS

Illinois

Hewlett-Packard Co.
304 Etkorado Road
P.O. Box 1607
BLOOMINGTON, IL 61701
Tel: (309) 662-9411
CH,MS**

Hewlett-Packard Co.
1100 31st Street, Suite 100
DOWNS GROVE, IL 60515
Tel: (312) 960-5760
CH,CS

Hewlett-Packard Co.
5201 Tollview Drive
ROLLING MEADOWS, IL 60008
Tel: (312) 255-9800
Telex: 910-687-1066
A,CH,CM,CS,E,MP

Indiana

Hewlett-Packard Co.
7301 No. Shadeland Avenue
P.O. Box 50807
INDIANAPOLIS, IN 46250
Tel: (317) 842-1000
A,CH,CM,CS,E,MS

Iowa

Hewlett-Packard Co.
1776 22nd Street, Suite 1
WEST DES MOINES, IA 50265
Tel: (515) 224-1435
CH,MS**

Kansas

Hewlett-Packard Co.
7804 East Funston Road, #203
WICHITA, KS 67207
Tel: (316) 684-8491
CH

Kentucky

Hewlett-Packard Co.
10300 Linn Station Road, #100
LOUISVILLE, KY 40223
Tel: (502) 426-0100
A,CH,CS,MS

Louisiana

Hewlett-Packard Co.
160 James Drive East
ST. ROSE, LA 70087
P.O. Box 1449
KENNER, LA 70065
Tel: (504) 487-4100
A,CH,CS,E,MS

Maryland

Hewlett-Packard Co.
3701 Koppers Street
BALTIMORE, MD 21227
Tel: (301) 844-5800
Telex: 710-882-1943
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
2 Choke Cherry Road
ROCKVILLE, MD 20850
Tel: (301) 948-6370
A,CH,CM,CS,E,MP

Massachusetts

Hewlett-Packard Co.
1775 Mutemoran Road
ANDOVER, MA 01810
Tel: (617) 682-1500
A,C,CH,CS,CM,E,MP,P*

Hewlett-Packard Co.
32 Hartwell Avenue
LXINGTON, MA 02173
Tel: (617) 861-9960
CH,CS,E

Michigan

Hewlett-Packard Co.
4326 Cascade Road S.E.
GRAND RAPIDS, MI 49506
Tel: (616) 957-1970
CH,CS,MS

Hewlett-Packard Co.
1771 W. Big Beaver Road
TROY, MI 48064
Tel: (313) 643-6474
CH,CS

Minnesota

Hewlett-Packard Co.
2025 W. Larpenteur Ave.
ST. PAUL, MN 55113
Tel: (612) 644-1100
A,CH,CM,CS,E,MP

Missouri

Hewlett-Packard Co.
11131 Colorado Avenue
KANSAS CITY, MO 64137
Tel: (816) 763-8000
A,CH,CM,CS,E,MS

Hewlett-Packard Co.
13001 Hollenberg Drive
BRIDGETON, MO 63044
Tel: (314) 344-5100
A,CH,CS,E,MP



SALES & SUPPORT OFFICES

Arranged alphabetically by country

UNITED STATES (Cont'd)

Nebraska
Hewlett-Packard
10824 Old Mill Rd., Suite 3
OMAHA, NE 68154
Tel: (402) 334-1813
CH,MS

New Jersey
Hewlett-Packard Co.
120 W. Century Road
PARAMUS, NJ 07652
Tel: (201) 265-5000
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
60 New England Av. West
PISCATAWAY, NJ 08854
Tel: (201) 981-1199
A,CH,CM,CS,E

New Mexico
Hewlett-Packard Co.
11300 Lomas Blvd., N.E.
P.O. Box 11634
ALBUQUERQUE, NM 87112
Tel: (505) 292-1330
CH,CS,E,MS

New York
Hewlett-Packard Co.
5 Computer Drive South
ALBANY, NY 12205
Tel: (518) 458-1550
A,CH,E,MS

Hewlett-Packard Co.
9600 Main Street
P.O. Box AC
CLARENCE, NY 14031
Tel: (716) 759-8621
CH

Hewlett-Packard Co.
200 Cross Keys Office Park
FAIRPORT, NY 14450
Tel: (716) 223-9950
CH,CM,CS,E,MS

Hewlett-Packard Co.
7641 Henry Clay Blvd.
LIVERPOOL, NY 13088
Tel: (315) 451-1820
A,CH,CM,E,MS

Hewlett-Packard Co.
No. 1 Pennsylvania Plaza
55th Floor
34th Street & 8th Avenue
MANHATTAN NY 10119
Tel: (212) 971-0800
CH,CS,E,"M"

Hewlett-Packard Co.
250 Westchester Avenue
WHITE PLAINS, NY 10604
Tel: (914) 684-6100
CM,CH,CS,E

Hewlett-Packard Co.
3 Crossways Park West
WOODBURY, NY 11797
Tel: (516) 921-0300
A,CH,CM,CS,E,MS

North Carolina
Hewlett-Packard Co.
5605 Roanoke Way
P.O. Box 26500
GREENSBORO, NC 27420
Tel: (919) 852-1800
A,CH,CM,CS,E,MS

Ohio
Hewlett-Packard Co.
9920 Carver Road
CINCINNATI, OH 45242
Tel: (513) 891-9870
CH,CS,MS

Hewlett-Packard Co.
16500 Sprague Road
CLEVELAND, OH 44130
Tel: (216) 243-7300
A,CH,CM,CS,E,MS
Hewlett-Packard Co.
962 Cnupper Ave.
COLUMBUS, OH 43229
Tel: (614) 436-1041
E/F, Nov. 25, 1983
675 Brookside Blvd.
WESTERVILLE, OH 43081
CH,CM,CS,E*

Hewlett-Packard Co.
330 Progress Rd.
DAYTON, OH 45449
Tel: (513) 859-8202
A,CH,CM,E,"MS"

Oklahoma
Hewlett-Packard Co.
304 N. Meridian, Suite A
P.O. Box 75609
OKLAHOMA CITY, OK 73147
Tel: (405) 946-9499
A,"CH,CS,E,MS"

Oregon
Hewlett-Packard Co.
3840 S. 103rd E. Avenue, #100
TULSA, OK 74153
Tel: (918) 665-3300
A,"CH,CS,E,MS"

Oregon
Hewlett-Packard Co.
9255 S. W. Pioneer Court
P.O. Box 328
WILSONVILLE, OR 97070
Tel: (503) 682-8000
A,CH,CS,E,"MS"

Pennsylvania
Hewlett-Packard Co.
111 Zela Drive
PITTSBURGH, PA 15238
Tel: (412) 782-0400
A,CH,CS,E,MP

Hewlett-Packard Co.
2750 Monroe Boulevard
P.O. Box 713
WALLEY FORGE, PA 19482
Tel: (215) 666-9000
A,CH,CM,E,M

South Carolina
Hewlett-Packard Co.
Brookside Park, Suite 122
1 Harbor Way
P.O. Box 21708
COLUMBIA, SC 29221
Tel: (803) 732-0400
CH,E,MS

Hewlett-Packard Co.
Koger Executive Center
Chesterfield Bldg., Suite 124
GREENVILLE, SC 29615
Tel: (803) 297-4120
CH,E,MS

Tennessee
Hewlett-Packard Co.
224 Peters Road, Suite 102
P.O. Box 22490
KNOXVILLE, TN 37922
Tel: (615) 691-2371
A,"CH,MS"

Hewlett-Packard Co.
3070 Deereboro Row
MEMPHIS, TN 38131
Tel: (901) 346-8370
A,CH,MS

Texas
Hewlett-Packard Co.
4171 North Mesa
Suite C-110
EL PASO, TX 79902
Tel: (915) 533-3555
CH,E,"MS"

Hewlett-Packard Co.
10535 Harwin Drive
P.O. Box 42816
HOUSTON, TX 77042
Tel: (713) 776-6400
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
930 E. Campbell Rd.
P.O. Box 1270
RICHARDSON, TX 75080
Tel: (214) 231-5101
A,CH,CM,CS,E,MP

Hewlett-Packard Co.
1020 Central Parkway South
P.O. Box 32993
SAN ANTONIO, TX 78216
Tel: (512) 494-9336
CH,CS,E,MS

Utah
Hewlett-Packard Co.
3530 W. 2100 South
SALT LAKE CITY, UT 84119
Tel: (801) 974-1700
A,CH,CS,E,MS

Virginia
Hewlett-Packard Co.
4305 Cox Road
GLEN ALLEN, VA 23060
P.O. Box 9699
RICHMOND, VA 23228
Tel: (804) 747-7750
A,CH,CS,E,MS

Washington
Hewlett-Packard Co.
15815 S.E. 37th Street
BELLEVUE, WA 98006
Tel: (206) 643-4000
A,CH,CM,CS,E,MP
Hewlett-Packard Co.
Suite A
708 North Argonne Road
SPOKANE, WA 99212
Tel: (509) 922-7000
CH,CS

West Virginia
Hewlett-Packard Co.
4604 MacConkie Ave.
P.O. Box 4297
CHARLESTON, WV 25304
Tel: (304) 925-0492
A,MS

Wisconsin
Hewlett-Packard Co.
150 S. Sunny Slope Road
BROOKFIELD, WI 53005
Tel: (414) 784-8800
A,CH,CS,E,"MP"

URUGUAY

Pablo Ferrando S.A.C. e I.
Avenida Italia 2877
Casilla de Correo 370
MONTEVIDEO
Tel: 80-2586
Telex: Public Booth 901
A,C,LE,M

VENEZUELA
Hewlett-Packard de Venezuela C.A.
3RA Transversal Los Ruices Norte
Edificio Sede 1, 2 & 3
Apartado 50533
CARACAS 1071
Tel: 239-4133
Telex: 251046 HEWPACK
A,CH,CS,E,MS,P

Hewlett-Packard de Venezuela C.A.
Calle 72-Ernie 3H y 3T, No. 3H-40
Edificio Ada Evelyn, Local B
Apartado 2646
4001, MARACAIBO, Estado Zulia
Tel: (061) 80.304
C,E*

Hewlett-Packard de Venezuela C.A.
Calle Vargas Rondón
Edificio Seguros Carabobo, Piso 10
VALENCIA
Tel: (041) 51.385
CH,CS,P

Bioelectronica Medica C.A.
Calle Buen Pastor
Estr. Cole Mill-Piso 2 y Sem. Solano 1
Edificio Norte
Apartado 50710 CARACAS 1050A
Tel: 239 84 41
Telex: 265 18

ZIMBABWE

Field Technical Sales
45 Kelvin Road, North
P.B. 3458
SALISBURY
Tel: 705 231
Telex: 4-122 RH
C,E,MP

July 1983 5952 6900

Indicates man office

HP distributors are printed in *italics*.