M/E/F-Series Computer Systems

CE HANDBOOK

M/E/F-Series Computer Systems

CE HANDBOOK

HEWLETT PACKARD

HEWLETT-PACKARD COMPANY
Data Systems Division
11000 Wolfe Road
Cupertino, California 95014

MANUAL PART NO. 5950-3767
Printed in U.S.A. July 1984
E0784

PRINTING HISTORY

New editions are complete revisions of the manual. Update packages contain replacement pages or write-in instructions to be merged into the manual by the customer. Manuals will be reprinted as necessary to incorporate all prior updates. A reprinted manual is identical in content (but not in appearance) to the previous edition with all updated incorporated. No information is incorporated into a reprinting unless it appears as a prior update. The edition does not change.

First Edition ..... Oct 1977
Second Edition ..... Jul 1984

TABLE OF CONTENTS

This information contained in this handbook has been compiled in quick-reference form to aid the Customer Engineer in maintaining HP equipment. The contents do not define HP policies, procedures, or specifications.

COMMON DATA

PROGRAMMING DATA

DIAGNOSTIC DATA

LOADERS

COMPATIBILITY

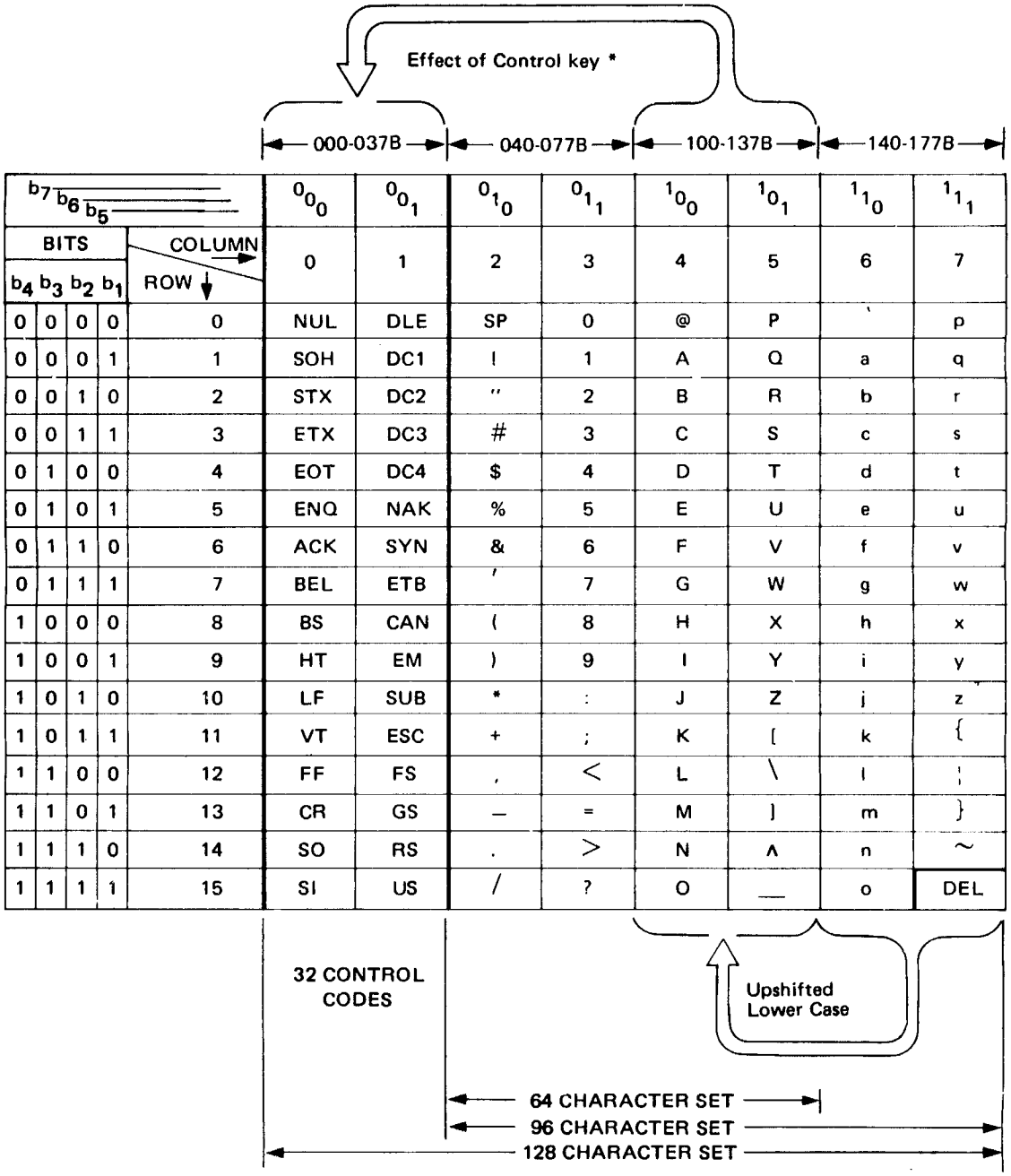
SERVICE NOTES

ABBREVIATIONS USED IN THIS HANDBOOK

ABBREVIATION	MEANING
ASYNC	— asynchronous
BATT	— battery
BCS	— basic control system
BD	— board
BUFF	— buffered
CONTRL	— controller
CPU	— Central Processing Unit
CRT	— Cathode Ray Tube
CTL	— control
DCL	— Data Code List
DCPC	— Dual-Channel Port Controller
DMA	— Direct Memory Access
DMI	— Dynamic Mapping Instructions
DOS	— Disc Operating System
DS	— Distributed System
DUP	— duplex
EIG	— Extended Instruction Group
EXP	— expansion
EXT	— extender
EXT'D	— extended
FAB	— Firmware Accessory Board
FC	— Fault Control
FEM	— Firmware Expansion Module
FFP	— Fast FORTRAN Processor
FL.PT	— floating point
FLEX	— flexible
FPP	— Floating Point Processor
FRMWR	— firmware
GEN	— generator
HD	— high density
HP-IB	— Hewlett-Packard Interface Bus
HS	— high speed
I/O	— input/output
IF	— interface
INTRPT	— interrupt
IPS	— inches per second
KB	— kilobyte
KW	— kiloword
LCPS	— low cost power supply
LDR	— loader
LSC	— lower select code
MAG	— magnetic
MEM	— memory
MICROCKT	— microcircuit
MOD	— module
MPP	— microprocessor port
MTRS	— Magnetic Tape Reformatting System
MULTIPT	— multipoint
MUX	— multiplexer
OB	— obsolete
OP	— operating
ORIG	— original

ABBREVIATION	MEANING
PNL	— panel
PREREG	— preregulator
PRIV	— privileged
PROG	— programmable
PROM	— Programmable Read-Only Memory
PS	— power supply
REG	— register
ROM	— Read-Only Memory
RPL	— Remote Program Load
SIS	— Scientific Instruction Set
STD	— standard
SYNC	— synchronous
TTY	— teletype
UCS	— User Control Store
USC	— upper select code
VIS	— Vector Instruction Set
WCS	— Writable Control Store

HP CHARACTER SET



$b_7 b_6 b_5$ / BITS $b_4 b_3 b_2 b_1$	COLUMN → / ROW ↓	0_{0_0}	0_{0_1}	0_{1_0}	0_{1_1}	1_{0_0}	1_{0_1}	1_{1_0}	1_{1_1}
	0	1	2	3	4	5	6	7	
0 0 0 0	0	NUL	DLE	SP	0	@	P	`	p
0 0 0 1	1	SOH	DC1	!	1	A	Q	a	q
0 0 1 0	2	STX	DC2	"	2	B	R	b	r
0 0 1 1	3	ETX	DC3	#	3	C	S	c	s
0 1 0 0	4	EOT	DC4	$	4	D	T	d	t
0 1 0 1	5	ENQ	NAK	%	5	E	U	e	u
0 1 1 0	6	ACK	SYN	&	6	F	V	f	v
0 1 1 1	7	BEL	ETB	'	7	G	W	g	w
1 0 0 0	8	BS	CAN	(	8	H	X	h	x
1 0 0 1	9	HT	EM	)	9	I	Y	i	y
1 0 1 0	10	LF	SUB	*	:	J	Z	j	z
1 0 1 1	11	VT	ESC	+	;	K	[	k	{
1 1 0 0	12	FF	FS	,	<	L	\	l	|
1 1 0 1	13	CR	GS	–	=	M	]	m	}
1 1 1 0	14	SO	RS	.	>	N	^	n	~
1 1 1 1	15	SI	US	/	?	O	_	o	DEL

EXAMPLE: The representation for the character "K" (column 4, row 11) is.

	b_7	b_6	b_5	b_4	b_3	b_2	b_1
BINARY	1	0	0	1	0	1	1
OCTAL	1		1			3	

* Depressing the Control key while typing an upper case letter produces the corresponding control code on most terminals. For example, Control-H is a backspace.

9206

HP CHARACTER SET (Cont'd)

The left and right byte columns show the octal patterns in a 16-bit word when the character occupies bits 8 to 14 (left byte) or 0 to 6 (right byte) and the rest of the bits are zero. To find the pattern of two characters in the same word, add the two values. For example, "AB" produces the octal pattern 040502. (The parity bits are zero in this chart.)

The octal values 0 through 37 and 177 are control codes. The octal values 40 through 176 are character codes.

Decimal Value	Octal Values		Mnemonic	Graphic[1]	Meaning
	Left Byte	Right Byte			
0	000000	000000	NUL	$^{N}_{U}$	Null
1	000400	000001	SOH	$^{S}_{H}$	Start of Heading
2	001000	000002	STX	$^{S}_{X}$	Start of Text
3	001400	000003	ETX	$^{E}_{X}$	End of Text
4	002000	000004	EOT	$^{E}_{T}$	End of Transmission
5	002400	000005	ENQ	$^{E}_{Q}$	Enquiry
6	003000	000006	ACK	$^{A}_{K}$	Acknowledge
7	003400	000007	BEL	🔔	Bell, Attention Signal
8	004000	000010	BS	$^{B}_{S}$	Backspace
9	004400	000011	HT	$^{H}_{T}$	Horizontal Tabulation
10	005000	000012	LF	$^{L}_{F}$	Line Feed
11	005400	000013	VT	$^{V}_{T}$	Vertical Tabulation
12	006000	000014	FF	$^{F}_{F}$	Form Feed
13	006400	000015	CR	$^{C}_{R}$	Carriage Return
14	007000	000016	SO	$^{S}_{O}$	Shift Out } Alternate
15	007400	000017	SI	$^{S}_{I}$	Shift In } Character Set
16	010000	000020	DLE	$^{D}_{L}$	Data Link Escape
17	010400	000021	DC1	D_1	Device Control 1 (X-ON)
18	011000	000022	DC2	D_2	Device Control 2 (TAPE)
19	011400	000023	DC3	D_3	Device Control 3 (X-OFF)
20	012000	000024	DC4	D_4	Device Control 4 ($\overline{\text{TAPE}}$)
21	012400	000025	NAK	$^{N}_{K}$	Negative Acknowledge
22	013000	000026	SYN	$^{S}_{Y}$	Synchronous Idle
23	013400	000027	ETB	$^{E}_{B}$	End of Transmission Block
24	014000	000030	CAN	$^{C}_{N}$	Cancel
25	014400	000031	EM	$^{E}_{M}$	End of Medium
26	015000	000032	SUB	$^{S}_{B}$	Substitute
27	015400	000033	ESC	$^{E}_{C}$	Escape[2]
28	016000	000034	FS	$^{F}_{S}$	File Separator
29	016400	000035	GS	$^{G}_{S}$	Group Separator
30	017000	000036	RS	$^{R}_{S}$	Record Separator
31	017400	000037	US	$^{U}_{S}$	Unit Separator
127	077400	000177	DEL	■	Delete, Rubout[3]

Notes: 1. This is the standard HP display representation.
2. Escape is the first character of a special control sequence.
3. Delete may be displayed as "—", "@", or space.

HP CHARACTER SET (Cont'd)

Decimal Value	Octal Values		Character	Meaning
	Left Byte	Right Byte		
32	020000	000040		Space, Blank
33	020400	000041	!	Exclamation Point
34	021000	000042	"	Quotation Mark
35	021400	000043	#	Number Sign, Pound Sign
36	022000	000044	$	Dollar Sign
37	022400	000045	%	Percent
38	023000	000046	&	Ampersand, And Sign
39	023400	000047	'	Apostrophe, Acute Accent
40	024000	000050	(	Left (opening) Parenthesis
41	024400	000051	)	Right (closing) Parenthesis
42	025000	000052	*	Asterisk, Star
43	025400	000053	+	Plus
44	026000	000054	,	Comma, Cedilla
45	026400	000055	-	Hyphen, Minus, Dash
46	027000	000056	.	Period, Decimal Point
47	027400	000057	/	Slash, Slant
48	030000	000060	0	Digits, Numbers
49	030400	000061	1	
50	031000	000062	2	
51	031400	000063	3	
52	032000	000064	4	
53	032400	000065	5	
54	033000	000066	6	
55	033400	000067	7	
56	034000	000070	8	
57	034400	000071	9	
58	035000	000072	:	Colon
59	035400	000073	;	Semicolon
60	036000	000074	<	Less Than
61	036400	000075	=	Equals
62	037000	000076	>	Greater Than
63	037400	000077	?	Question Mark

HP CHARACTER SET (Cont'd)

Decimal Value	Octal Values		Character	Meaning
	Left Byte	Right Byte		
64	040000	000100	@	Commercial At
65	040400	000101	A	Upper Case Alphabet, Capital Letters
66	041000	000102	B	
67	041400	000103	C	
68	042000	000104	D	
69	042400	000105	E	
70	043000	000106	F	
71	043400	000107	G	
72	044000	000110	H	
73	044400	000111	I	
74	045000	000112	J	
75	045400	000113	K	
76	046000	000114	L	
77	046400	000115	M	
78	047000	000116	N	
79	047400	000117	O	
80	050000	000120	P	
81	050400	000121	Q	
82	051000	000122	R	
83	051400	000123	S	
84	052000	000124	T	
85	052400	000125	U	
86	053000	000126	V	
87	053400	000127	W	
88	054000	000130	X	
89	054400	000131	Y	
90	055000	000132	Z	
91	055400	000133	[	Left (opening) Bracket
92	056000	000134	\	Backslash, Reverse Slant
93	056400	000135	]	Right (closing) Bracket
94	057000	000136	^ ↑	Caret, Circumflex, Up Arrow[4]
95	057400	000137	_ ←	Underline, Back Arrow[4]

Note: 4. Normally, the caret and underline are displayed. Some devices substitute the up arrow and back arrow.

HP CHARACTER SET (Cont'd)

Decimal Value	Octal Values		Character	Meaning
	Left Byte	Right Byte		
96	060000	000140	`	Grave Accent[5]
97	060400	000141	a	
98	061000	000142	b	
99	061400	000143	c	
100	062000	000144	d	
101	062400	000145	e	
102	063000	000146	f	
103	063400	000147	g	
104	064000	000150	h	
105	064400	000151	i	
106	065000	000152	j	
107	065400	000153	k	
108	066000	000154	l	
109	066400	000155	m	
110	067000	000156	n	Lower Case Letters[5]
111	067400	000157	o	
112	070000	000160	p	
113	070400	000161	q	
114	071000	000162	r	
115	071400	000163	s	
116	072000	000164	t	
117	072400	000165	u	
118	073000	000166	v	
119	073400	000167	w	
120	074000	000170	x	
121	074400	000171	y	
122	075000	000172	z	
123	075400	000173	{	Left (opening) Brace[5]
124	076000	000174	|	Vertical Line[5]
125	076400	000175	}	Right (closing) Brace[5]
126	077000	000176	~	Tilde, Overline[5]

Note: 5. Some devices upshift lower case letters and symbols (through ~) to the corresponding upper case character (@ through). For example, the left brace would be converted to a left bracket.

RTE SPECIAL CHARACTERS

Mnemonic	Octal Value	Use
SOH (Control A)	1	Backspace (TTY)
EM (Control Y)	31	Backspace (2600)
BS (Control H)	10	Backspace (TTY, 2615, 2640, 2644, 2645)
EOT (Control D)	4	End-of-file (TTY 2615, 2640, 2644, 2645)

9206-1D

INSTRUCTION CODE IN OCTAL

Memory Reference

ADA	04(0XX)---
ADB	04(1XX)---
AND	01(0XX)---
CPA	05(0XX)---
CPB	05(1XX)---
IOR	03(0XX)---
ISZ	03(1XX)---
JMP	02(1XX)---
JSB	01(1XX)---
LDA	06(0XX)---
LDB	06(1XX)---
STA	07(0XX)---
STB	07(1XX)---
XOR	02(0XX)---

↑ Binary

Shift-Rotate

ALF	001700
ALR	001400
ALS	001000
ARS	001100
BLF	005700
BLR	005400
BLS	005000
BRS	005100
CLE	000040
ELA	001600
ELB	005600
ERA	001500
ERB	005500
NOP	000000
RAL	001200
RAR	001300
RBL	005200
RBR	005300
SLA	000010
SLB	004010

Alter-Skip

CCA	003400
CCB	007400
CCE	002300
CLA	002400
CLB	006400
CLE	002100
CMA	003000
CMB	007000
CME	002200
INA	002004
INB	006004
RSS	002001
SEZ	002040
SLA	002010
SLB	006010
SSA	002020
SSB	006020
SZA	002002
SZB	006002

Input/Output

CLC	1067--
CLF	1031--
CLO	103101
HLT	1020--
LIA	1025--
LIB	1065--
MIA	1024--
MIB	1064--
OTA	1026--
OTB	1066--
SFC	1022--
SFS	1023--
SOC	102201
SOS	102301
STC	1027--
STF	1021--
STO	102101

Extended Arithmetic

ASL	1000(01X)-
ASR	1010(01X)-
DIV	100400
DLD	104200
DST	104400
LSL	1000(10X)-
LSR	1010(10X)-
MPY	100200
RRL	1001(00X)-
RRR	1011(00X)-

↑ Binary

*Assuming: no indirect addressing
no combined instructions
shifts taken in first position only
hold flag after I/O execution

Refer to preceding page for octal combining tables

Ext. Inst. Group

ADX	105746
ADY	105756
CAX	101741
CAY	101751
CBS	105774
CBT	105766
CBX	105741
CBY	105751
CMW	105776
CXA	101744
CXB	105744
CYA	101754
CYB	105754
DSX	105761
DSY	105771
ISX	105760
ISY	105770
JLY	105762
JPY	105772
LAX	101742
LAY	101752
LBT	105763
LBX	105742
LBY	105752
LDX	105745
LDY	105755
MBT	105765
MVW	105777
SAX	101740
SAY	101750
SBS	105773
SBT	105764
SBX	105740
SBY	105750
SFB	105767
STX	105743
STY	105753
TBS	105775
XAX	101747
XAY	101757
XBX	105747
XBY	105757

Floating Point

FAD	105000
FDV	105060
FIX	105100
FLT	105120
FMP	105040
FSB	105020

Dynamic Mapping System

DJP	105732
DJS	105733
JRS	105715
LFA	101727
LFB	105727
MBF	105703
MBI	105702
MBW	105704
MWF	105706
MWI	105705
MWW	105707
PAA	101712
PAB	105712
PBA	101713
PBB	105713
RSA	101730
RSB	105730
RVA	101731
RVB	105731
SJP	105734
SJS	105735
SSM	105714
SYA	101710
SYB	105710
UJP	105736
UJS	105737
USA	101711
USB	105711
XCA	101726
XCB	105726
XLA	101724
XLB	105724
XMA	101722
XMB	105722
XMM	105720
XMS	105721
XSA	101725
XSB	105725

ALPHABETICAL INDEX OF INSTRUCTION CODES

ADA	Add to A
ADB	Add to B
ADX	Add Memory to X
ADY	Add Memory to Y
ALF	Rotate A Left Four
ALOG	Natural Logarithm
ALOGT	Common Logarithm
ALR	A Left Shift, Clear Sign
ALS	A Left Shift
AND	"And" to A
ARS	A Right Shift
ASL	Arithmetic Shift Left (32)
ASR	Arithmetic Shift Right (32)
ATAN	Arctangent.
BLF	Rotate B Left Four
BLR	B Left Shift, Clear Sign
BLS	B Left Shift
BRS	B Right Shift
CAX	Copy A to X
CAY	Copy A to Y
CBS	Clear Bits
CBT	Compare Bytes
CBX	Copy B to X
CBY	Copy B to Y
CCA	Clear and Complement A
CCB	Clear and Complement B
CCE	Clear and Complement E
CLA	Clear A
CLB	Clear B
CLC	Clear Control
CLE	Clear E
CLF	Clear Flag
CLO	Clear Overflow
CMA	Complement A
CMB	Complement B
CME	Complement E
CMW	Compare Words
COS	Cosine
CPA	Compare to A
CPB	Compare to B
CXA	Copy X to A
CXB	Copy X to B
CYA	Copy Y to A
CYB	Copy Y to B
DBLE	Single Floating Point to Extended Floating Point
DDINT	Extended Floating Point to Double Integer
DIV	Divide
DLD	Double Load
DPOLY	Polynomial Evaluation
DST	Double Store
DSX	Decrement X and Skip if Zero
DSY	Decrement Y and Skip if Zero
ELA	Rotate E Left with A
ELB	Rotate E Left with B
ERA	Rotate E Right with A
ERB	Rotate E Right with B
EXP	E to the Power X
FAD	Floating Point Add
FDV	Floating Point Divide
FIX	Floating Point to Integer
FLT	Integer to Floating Point
FMP	Floating Point Multiply
FSB	Floating Point Subtract
HLT	Halt
INA	Increment A
INB	Increment B
IOR	"Inclusive Or" to A
ISX	Increment X and Skip if Zero
ISY	Increment Y and Skip if Zero
ISZ	Increment and Skip if Zero
JLY	Jump and Load Y
JMP	Jump
JPY	Jump Indexed by Y
JSB	Jump to Subroutine
LAX	Load A Indexed by X
LAY	Load A Indexed by Y
LBT	Load Byte
LBX	Load B Indexed by X
LBY	Load B Indexed by Y
LDA	Load A
LDB	Load B
LDX	Load X from Memory
LDY	Load Y from Memory
LIA	Load Input to A
LIB	Load Input to B
LSL	Logical Shift Left (32)
LSR	Logical Shift Right (32)
MBT	Move Bytes
MIA	Merge Into A
MIB	Merge Into B
MPY	Multiply
MVW	Move Words
NOP	No Operation
OTA	Output A
OTB	Output B
RAL	Rotate A Left
RAR	Rotate A Right
RBL	Rotate B Left
RBR	Rotate B Right
RRL	Rotate Left (32)
RRR	Rotate Right (32)
RSS	Reverse Skip Sense
SAX	Store A Indexed by X
SAY	Store A Indexed by Y
SBS	Set Bits
SBT	Store Byte
SBX	Store B Indexed by X
SBY	Store B Indexed by Y
SEZ	Skip if E is Zero
SFB	Scan For Byte
SFC	Skip if Flag Clear
SFS	Skip if Flag Set
SIN	Sine
SLA	Skip if LSB of A is Zero
SLB	Skip if LSB of B is Zero

ALPHABETICAL INDEX OF INSTRUCTION CODES (Cont'd)

SNGL	Extended Floating Point to Single Floating Point
SOC	Skip if Overflow Clear
SOS	Skip if Overflow Set
SQRT	Square Root
SSA	Skip if Sign of A is Zero
SSB	Skip if Sign of B is Zero
STA	Store A
STB	Store B
STC	Set Control
STF	Set Flag
STO	Set Overflow
STX	Store X to Memory
STY	Store Y to Memory
SZA	Skip if A is Zero
SZB	Skip is B is Zero
TAN	Tangent
TANH	Hyperbolic Tangent
TBS	Test Bits
XAX	Exchange A and X
XAY	Exchange A and Y
XBX	Exchange B and X
XBY	Exchange B and Y
XOR	"Exclusive Or" to A
.BLE	Single Floating Point to Double Floating Point
.CFER	Transfer Complex or Double Floating Point .....
.DAD	Double Integer Add .....
.DCO	Double Integer Compare .....
.DDE	Double Integer Decrement ....
.DDI	Double Integer Divide .....
.DDIR	Double Integer Divide Reverse .
.DDS	Double Integer Decrement and Skip if Zero .....
.DFER	Transfer Extended Floating Point
.DIN	Double Integer Increment .....
.DIS	Double Integer Increment and Skip if Zero .....
.DMP	Double Integer Multiply .....
.DNG	Double Integer Negate .....
.DSB	Double Integer Subtract .....
.DSBR	Double Integer Subtract Reverse
.ENTP	Transfer Parameter Addresses
.ENTR	Transfer Parameter Addresses
.FIXD	Floating Point to Double Integer
.FLTD	Double Integer to Floating Point
.FLUN	Unpack Floating Point Quantity
.FPWR	Exponentiation
.GOTO	Transfer Control
.NGL	Double Floating Point to Single Floating Point
.PACK	Normalize Floating Point Quantity
.PWR2	X Times 2 to the Power N
.TADD	Double Floating Point Add
.TDIV	Double Floating Point Divide
.TFTD	Double Integer to Double Floating Point
.TFTS	Single Integer to Double Floating Point
.TFXD	Double Floating Point to Double Integer
.TFXS	Double Floating Point to Single Integer
.TMPY	Double Floating Point Multiply
.TPWR	Exponentiation
.TSUB	Double Floating Point Subtract
.XADD	Extended Floating Point Add
.XCOM	Complement Extended Floating Point
.XDIV	Extended Floating Point Divide
.XFER	Transfer Extended Floating Point
.XFTD	Double Integer to Extended Floating Point
.XFTS	Single Integer to Extended Floating Point
.XFXD	Extended Floating Point to Double Integer
.XFXS	Extended Floating Point to Single Integer
.XMPY	Extended Floating Point Multiply
.XPAK	Normalize and Pack Extended Floating Point
.XSUB	Extended Floating Point Subtract
..DCM	Complement and Normalize Extended Floating Point
..FCM	Compliment and Normalize Single Floating Point
..MAP	Compute Array Element Address
..TCM	Complement and Normalize Double Floating Point
/ATLG	(1−X)/(1+X)
$SETP	Set a Table

ALPHABETICAL INDEX OF VECTOR INSTRUCTIONS

VABS/DVABS	Vector Absolute Value
VADD/DVADD	Vector Add
VDIV/DVDIV	Vector Divide
VDOT/DVDOT	Vector Dot Product
VMAB/DVMAB	Vector Maximum Absolute Value
VMAX/DVMAX	Vector Maximum Value
VMIB/DVMIB	Vector Minimum Absolute Value
VMIN/DVMIN	Vector Minimum Value
VMOV/DVMOV	Vector Move
VMPY/DVMPY	Vector Multiply
VNRM/DVNRM	Vector Norm
VPIV/DVPIV	Vector Pivot
VSAD/DVSAD	Scalar-Vector Add
VSDV/DVSDV	Scalar-Vector Divide
VSMY/DVSMY	Scalar-Vector Multiply
VSSB/DVSSB	Scalar-Vector Subtract
VSUB/DVSUB	Vector Subtract
VSUM/DVSUM	Vector Sum
VSWP/DVSWP	Vector Swap

ALPHABETICAL INDEX OF DYNAMIC MAPPING SYSTEM INSTRUCTIONS*

DJP	Disable MEM and JMP
DJS	Disable MEM and JSB
JRS	Jump and Restore Status
LFA	Load Fence From A
LFB	Load Fence From B
MBF	Move Bytes From Alternate Map
MBI	Move Bytes Into Alternate Map
MBW	Move Bytes Within Alternate Map
MWF	Move Words From Alternate Map
MWI	Move Words Into Alternate Map . .
MWW	Move Words Within Alternate Map
PAA	Load/Store Port A Map per A
PAB	Load/Store Port A Map per B
PBA	Load/Store Port B Map per A
PBB	Load/Store Port B Map per B
RSA	Read Status Register Into A
RSB	Read Status Register Into B
RVA	Read Violation Register Into A
RVB	Read Violation Register Into B
SJP	Enable System Map and JMP
SJS	Enable System Map and JSB
SSM	Store Status Register Into Memory
SYA	Load/Store System Map per A
SYB	Load/Store System Map per B
UJP	Enable User Map and JMP
UJS	Enable User Map and JSB
USA	Load/Store User Map per A
USB	Load/Store User Map per B
XCA	Cross Compare A
XCB	Cross Compare B
XLA	Cross Load A
XLB	Cross Load B
XMA	Transfer Maps Internally per A
XMB	Transfer Maps Internally per B
XMM	Transfer Maps or Memory . . . .
XMS	Transfer Maps Sequentially
XSA	Cross Store A
XSB	Cross Store B

*Standard on HP 2117F Computer, optional on HP 2111F.

MACHINE INSTRUCTIONS

MEMORY REFERENCE

Jump and Increment-Skip

ISZ	m [,I]	(m) + → m: then if (m) = 0, execute P + 2 otherwise execute P + 1
JMP	m [,I]	Jump to m; m → P
JSB	m [,I]	Jump subroutine to m: P + 1 → m; m + 1 → P

Add, Load and Store

ADA	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	(m) + (A) → A
ADB	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	(m) + (B) → B
LDA	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	(m) → A
LDB	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	(m) → B
STA	m [,I]	(A) → m
STB	m [,I]	(B) → m

Logical

AND	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	(m) ∧ (A) → A
XOR	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	(m) ∀ (A) → A
IOR	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	(m) ∨ (A) → A
CPA	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	If (m) ≠ (A), execute P + 2, otherwise execute P + 1
CPB	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	If (m) ≠ (B), execute P + 2, otherwise execute P + 1

Word Processing

MVW	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	Move (m) words from array (A) → array (B)
CMW	$\left\{\begin{matrix} \text{m [,I]} \\ \text{lit} \end{matrix}\right\}$	Compare (m) words of array (A) against (m) words of array (B); if the two arrays are equal, execute P + 3, if array (A) is less than array (B), execute P + 4, if array (A) is greater than array (B), execute P + 5

MACHINE INSTRUCTIONS (Cont'd)

Byte Processing

LBT		B contains a 16-bit byte address; ((B))→A_{0-7}; o's to A_{8-15}
SBT		B contains a 16-bit byte address; (A_{0-7})→(B)
MBT	{ m [,I] / lit }	A and B contain 16-bit byte addresses; move (m) bytes from array (A)→array (B)
CBT	{ m [,I] / lit }	A and B contain 16-bit byte addresses; compare (m) bytes of array (A) against (m) bytes of array (B); if the two arrays are equal, execute P + 3; if array (A) is less than array (B), execute P + 4; if array (A) is greater than array (B), execute P + 5
SFB		A_{0-7} contain the test byte, A_{8-15} contain the termination byte, and B contains a 16-bit byte address; scan array (B); if test byte found, execute P + 1, B contains address of test byte; if termination byte found, execute P + 2, B contains address of termination byte; if neither is found, execute P + 2, B contains zero

Bit Processing

TBS	{ m [,I] / lit }	n [,I]	Compare all "set" bits in (m) against corresponding bits in (n); if all bits tested are set, execute P + 3; if any of the bits tested are clear, execute P + 4
SBS	{ m [,I] / lit }	n [,I]	Set all bits in (n) which correspond to "set" bits in (m)
CBS	{ m [,I] / lit }	n [,I]	Clear all bits in (n) which correspond to "set" bits in (m)

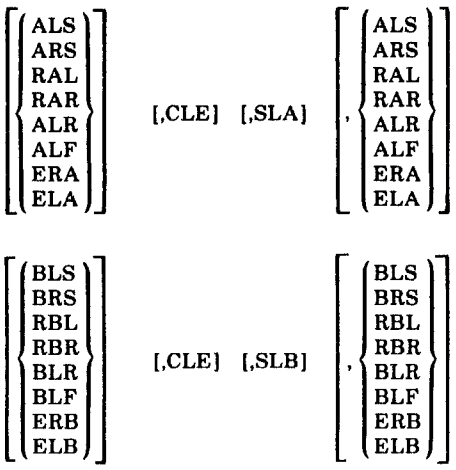
REGISTER REFERENCE

Shift-Rotate

CLE	0→E
ALS	Shift (A) left one bit, 0→A_0, A_{15} unaltered
BLS	Shift (B) left one bit, 0→B_0, B_{15} unaltered
ARS	Shift (A) right one bit, (A_{15})→A_{14}
BRS	Shift (B) right one bit, (B_{15})→B_{14}
RAL	Rotate (A) left one bit
RBL	Rotate (B) left one bit
RAR	Rotate (A) right one bit
RBR	Rotate (B) right one bit
ALR	Shift (A) left one bit, 0→A_{15}
BLR	Shift (B) left one bit, 0→B_{15}
ERA	Rotate E and A right one bit
ERB	Rotate E and B right one bit
ELA	Rotate E and A left one bit
ELB	Rotate E and B left one bit
ALF	Rotate A left four bits
BLF	Rotate B left four bits
SLA	If (A_0) = 0, execute P + 2, otherwise execute P + 1
SLB	If (B_0) = 0, execute P + 2, otherwise execute P + 1

MACHINE INSTRUCTIONS (Cont'd)

Shift-Rotate instructions can be combined as follows:



No-Operation

NOP	Execute P + 1

Alter-Skip

CLA	0's → A
CLB	0's → B
CMA	$\overline{(A)} \rightarrow A$
CMB	$\overline{(B)} \rightarrow B$
CCA	1's → A
CCB	1's → B
CLE	0 → E
CME	$\overline{(E)} \rightarrow E$
CCE	1 → E
SEZ	If (E) = 0, execute P + 2, otherwise execute P + 1
SSA	If $(A_{15}) = 0$, execute P + 2, otherwise execute P + 1
SSB	If $(B_{15}) = 0$, execute P + 2, otherwise execute P + 1
INA	(A) + 1 → A
INB	(B) + 1 → B
SZA	If (A) = 0, execute P + 2, otherwise execute P + 1
SZB	If (B) = 0, execute P + 2, otherwise execute P + 1
SLA	If $(A_0) = 0$, execute P + 2, otherwise execute P + 1
SLB	If $(B_0) = 0$, execute P + 2, otherwise execute P + 1
RSS	Reverse sense of skip instructions. If no skip instructions precede, execute P + 2

MACHINE INSTRUCTIONS (Cont'd)

Alter-Skip instructions can be combined as follows:

[{CLA / CMA / CCA}] [,SEZ] [,{CLE / CME / CCE}] [,SSA] [,SLA] [,INA] [,SZA] [,RRS]

[{CLB / CMB / CCB}] [,SEZ] [,{CLE / CME / CCE}] [,SSB] [,SLB] [,INB] [,SZB] [,RSS]

INDEX REGISTER

CAX		(A)→X
CBX		(B)→X
CAY		(A)→Y
CBY		(B)→Y
CXA		(X)→A
CXB		(X)→B
CYA		(Y)→A
CYB		(Y)→B
XAX		(A)→X and (X)→A
XBX		(B)→X and (X)→B
XAY		(A)→Y and (Y)→A
XBY		(B)→Y and (Y)→B
ISX		(X) + 1→X, then test new (X); if (X) = 0, execute P + 2, otherwise execute P + 1
ISY		(Y) + 1→Y, then test new (Y); if (Y) = 0, execute P + 2, otherwise execute P + 1
DSX		(X) - 1→X, then test new (X); if (X) = 0, execute P + 2, otherwise execute P + 1
DSY		(Y) - 1→Y, then test new (Y); if (Y) = 0, execute P + 2, otherwise execute P + 1
LDX	m [,I] lit	(m)→X
LDY	m [,I] lit	(m)→Y
STX	m [,I]	(X)→m
STY	m [,I]	(Y)→m
LAX	m [,I]	(m + (X))→A
LBX	m [,I]	(m + (X))→B
LAY	m [,I]	(m + (Y))→A
LBY	m [,I]	(m + (Y))→B
SAX	m [,I]	(A)→m + (X)
SBX	m [,I]	(B)→m + (X)
SAY	m [,I]	(A)→m + (Y)
SBY	m [,I]	(B)→m + (Y)
ADX	m [,I] lit	(m) + (X)→X
ADY	m [,I] lit	(m) + (Y)→Y
JLY	m [,I]	Jump to m; P + 2→Y
JPY	m	Jump to m + (Y)

MACHINE INSTRUCTIONS (Cont'd)

INPUT/OUTPUT, OVERFLOW, AND HALT

Input/Output

STC	sc [,C]	Set control bit_{sc}, enable transfer of one element of data between $device_{sc}$ and $buffer_{sc}$
CLC	sc [,C]	Clear control bit_{sc}. If sc = 0 clear all control bits
LIA	sc [,C]	$(buffer_{sc}) \rightarrow A$
LIB	sc [,C]	$(buffer_{sc}) \rightarrow B$
MIA	sc [,C]	$(buffer_{sc})$ $(A) \rightarrow A$
MIB	sc [,C]	$(buffer_{sc})$ $(B) \rightarrow B$
OTA	sc [,C]	$(A) \rightarrow buffer_{sc}$
OTB	sc [,C]	$(B) \rightarrow buffer_{sc}$
STF	sc	Set flag bit_{sc}. If sc = 0, enable interrupt system. sc = 1 sets overflow bit.
CLF	sc	Clear flag bit_{sc}. If sc = 0, disable interrupt system. If sc = 1, clear overflow bit.
SFC	sc	If (flag bit_{sc}) = 0, execute P + 2, otherwise execute P + 1. If sc = 1, test overflow bit.
SFS	sc	If (flag bit_{sc}) = 1, execute P + 2, otherwise execute P + 1. If sc = 1, test overflow bit.

Overflow

CLO		0 → overflow bit
STO		1 → overflow bit
SOC	[C]	If (overflow bit) = 0, execute P + 2, otherwise execute P + 1
SOS	[C]	If (overflow bit) = 0, execute P + 2, otherwise execute P + 1

Halt

HLT	[sc [,C]]	Halt computer

MACHINE INSTRUCTIONS (Cont'd)

EXTENDED ARITHMETIC UNIT

MPY	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	(A) x (m)→($B_{\pm msb}$ and A_{lsb})
DIV	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	($B_{\pm msb}$ and A_{lsb})/(m)→A, remainder→B
DLD	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	(m) and (m + 1)→A and B
DST	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	(A) and (B)→m and m + 1
ASR	b	Arithmetically shift (BA) right b bits, B_{15} extended
ASL	b	Arithmetically shift (BA) left b bits, B_{15} unaltered, 0's to A_{lsb}
RRR	b	Rotate (BA) right b bits
RRL	b	Rotate (BA) left b bits
LSR	b	Logically shift (BA) right b bits, 0's to B_{msb}
LSL	b	Logically shift (BA) left b bits, o's to A_{lsb}

FLOATING POINT

FMP	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	(AB) x (m, m + 1)→AB
FDV	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	(AB)/(m, m + 1)→AB
FAD	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	(m, m + 1) + (AB)→AB
FSB	$\left\{\begin{matrix}m\ [,I] \\ lit\end{matrix}\right\}$	(AB) - (m, m + 1)→AB
FIX		(AB) converted from floating-point to fixed-point; result→A
FLT		(A) converted from fixed-point to floating-point; result→AB

MACHINE INSTRUCTIONS (Cont'd)

MEMORY EXPANSION

DJP	m [,I]	Disable MEM and jump to m; m → P
DJS	m [,I]	Disable MEM and jump subroutine to m; P + 1 → m; m + 1 → P
JRS	m_1 [,I] m_2 [,I]	Jump and restore status
LFA		A → fence
LFB		B → fence
MBF		Move bytes from alternate map. X ← 0; A ← A + no. bytes moved; B ← B + no. bytes moved.
MBI		Move bytes into alternate map. X ← 0; A ← A + no. bytes moved; B ← B + no. bytes moved.
MBW		Move bytes within alternate map. X ← 0; A ← A + no. bytes moved; B ← B + no. bytes moved.
MWF		Move words from alternate map. X ← 0; A ← A + no. words moved; B ← B + no. words moved.
MWI		Move words into alternate map. X ← 0; A ← A + no. words moved; B ← B + no. words moved.
MWW		Move words within alternate map. X ← 0; A ← A + no. words moved; B ← B + no. words moved.
PAA		If A(15) = 0, Port A map ← memory; if A(15) = 1, Port A map → memory.
PAB		If B(15) = 0, Port A map ← memory; if B(15) = 1, Port A map → memory.
PBA		If A(15) = 0, Port B map ← memory; if A(15) = 1, Port B map → memory.
PBB		If B(15) = 0, Port B map ← memory; if B(15) = 1, Port B map → memory.
RSA		A ← status register
RSB		B ← status register
RVA		A ← violation register
RVB		B ← violation register

MACHINE INSTRUCTIONS (Cont'd)

MEMORY EXPANSION (CONT)

SJP	m [,I]	Enable System map and jump to m
SJS	m [,I]	Enable System map and jump subroutine to m
SSM	m [,I]	m ← status register
SYA		If A(15) = 0, System map ← memory; if A(15) = 1, System map → memory.
SYB		If B(15) = 0, System map ← memory; if B(15) = 1, System map → memory.
UJP	m [,I]	Enable User map and jump to m
UJS	m [,I]	Enable User map and jump subroutine to m
USA		If A(15) = 0, User map ← memory; if A(15) = 1, User map → memory.
USB		If B(15) = 0, User map ← memory; if B(15) = 1, User map → memory.
XCA	m [,I]	Compare A with m; if A = m, execute P = 1; if A ≠ m, execute P + 2.
XCB	m [,I]	Compare B with m; if B = m, execute P + 1; if B ≠ m, execute P + 2.
XLA	m [,I]	A ← m
XLB	m [,I]	B ← m
XMA		If A(15) = 0 and A(0) = 0, Port A map ← System map. If A(15) = 0 and A(0) = 1, Port B map ← system map. If A(15) = 1 and A(0) = 0, Port A map ← User map. If A(15) = 1 and A(0) = 1, Port B map ← User map.
XMB		If B(15) = 0 and B(0) = 0, Port A map ← System map. If B(15) = 0 and B(0) = 1, Port B map ← System map. If B(15) = = 1 and B(0) = 0, Port A map ← User map. If B(15) = 1 and B(0) = 1, Port B map ← User map.
XMM		A = register no., B = memory address, X = no. of registers. If X > 0, Maps ← memory; if X < 0, Memory ← maps.
XMS		A = first register no., B = first page no., X = positive no. of registers. First register is loaded with the page number indicated in B, the second register is loaded with that value + 1, and so forth.
XSA	m [,I]	A → m
XSB	m [,I]	B → m

INSTRUCTION SET CROSS-REFERENCE GUIDE

The following list contains the July 1981 list of RP's for 2100, 1000-M, E, and both old and new F-Series CPU's. The list is sorted by octal opcode. Order of entry point name...ie, $SETP first followed by the entry points that start with periods...etc.

The SIGNAL/1000 (92835A) entry point are shown. Since this product occupies the user-control addresses, a failure of one of these opcodes must be followed by whether the user has SIGNAL/1000 or user developed microcode installed.

RTE6 has two sets of special firmware for E/F-Series (none for M-Series). The first is VMA or Virtual Memory Arrays. This set occupies the exact same addresses as EMA but performs different functions and cannot be enabled under RTE4. The second is the opsystem firmware that improves the system throughput. This set is required in order to boot RTE6 on E/F cpu's. There are no software equivalents for VMA or opsystem firmware for E/F cpu's. Note that the opcodes 105354 thru 105357 are marked as "double use" opcodes. This means that the microcode performs a different function if executed from a trap cell versus anywhere else.

The opcode description is for non-trap cell execution. The RTE6 opsystem ROM self test is a 105355 and will show X = Rev code (will be 1 at initial release), and the Y-register will contain the RPL switch settings. In addition, the contents of the loader ROM's can be read by executing the self test opcode in a program where B-REG = loader ROM address (0-1023 for the 4 ROMs @ 8 bits per ROM address) and the A-REG will return the ROM contents. This could be done with a front panel program such as:

ADDR	DATA	OPCODE
100	006400	CLB
101	105255	OCT 105355
102	000000	NOP
103	006004	INB
104	024101	JMP *-3

The loader ROMs are 8 bits so that the 64 words per ROM will have to be read with 128 steps. Since the self test will do a 102077 halt automatically, this program can be single stepped via the RUN switch.

The columns marked for different CPUs can be used to determine if the firmware package is a standard part of the CPU's normal configuration (SIS, FPP...), or optional (12907, 13306...). It can also serve to isolate a failing opcode to a particular portion of the CPU.

OPCODE PROBLEMS

All firmware options are first mapped through the base set and then into the individual ROMS on the FAB, UCS, WCS, or FEM boards. Thus, a failing FFP opcode could be due to a faulty Base Set.

Another problem is that an unimplemented opcode (ie, 105054 in a 1000-M CPU) will execute as a NOP. Unfortunately, the next word is usually an address — not an instruction. The value at that location could send the program anywhere in memory. Thus, an MP error or DM error may point to an opcode that executes incorrectly, or to a location that was never intended to be executed (ie, data or addresses).

Another symptom is an illegal opcode (ie, 101260). This actually maps into the middle of the HALT opcode and manifests itself as a running HALT...different than the new version of the base set where Forced Cold Load was implemented. You detect this condition with being able to select registers with the RUN lamp on, or by hitting the HALT button on the front panel. What happened is that the microcode to reset the RUN lamp was bypassed with this illegal opcode. In essence, there is no guaranteed method to discover illegal or uninstalled opcodes except by tracing the program execution.

INSTRUCTION SET CROSS-REFERENCE GUIDE (Cont'd)

In some cases, a program can run 'incorrectly' with firmware and 'correctly' with the software version. This usually proves to be a program bug (typically, invalid array subscripts) that is not working correctly anyway, but the manner in which an illegal array reference is handled in software may differ in firmware.

Some Diagnostic Notes:

The old F-Series CPUs could use the E-Series Fast FORTRAN (the 2-part version) for FFP tests, whereas the new F-Series would fail on the XADD series of tests. To get around this, there are now three diagnostics that apply. Use the old 2-set diagnostic for M/E CPUs and the new 1926+ diagnostic (DSN+101121) for all F-Series CPUs.

A basic problem is the deletion of 'old' diagnostics from various revisions of the offline diagnostic package 24396. After 1835 rev, various diagnostics began disappearing (such as 2644 CRT, 2883 disk, old F-Series diagnostics, etc). The best solution is to create a cumulative diagnostic tape in order to sevice some of these 'older' products. The Neely Santa Clara TSE's have created such a tape and will be glad to copy it onto a 600' magtape reel (1600 or 800 bpi). Included will be a list of the diagnostics, DSN's and description. !DISK and !DSKUP are both included with their own DSN. Be sure to look at the Utilities manual concerning !MTLDR when a customer doesn't have a magtape loader ROM. This tape will have all the files run through an absolute code compactor routine which reduces the tape required by over 60%! You can store the files from the tape onto CTUs with similar savings in tape and loading time.

The DMI chips can be 'quick tested' by executing a 101701 or 105701 opcode. If the chips are in place, P will increment and the A-register (101701) will complement into 076076, and the B-register contents will likewise be complemented for the 105701 opcode. Note that this is not a test of DMI capability, only their presence and strapping is correct. This works at the RTE-4 upgrade level.

SORTED BY OPCODE VALUE

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
.MPY	=	100200	Integer Multiply	STD	STD	STD	STD	STD
.DIV	=	100400	Integer Divide	STD	STD	STD	STD	STD
.VECT	=	101460	Word 1 for 2-word VIS Opcodes in %VLIB	N/A	N/A	N/A	12824	12824
VPIV	=	101461	VIS: Pivot Routine for Array Processing	N/A	N/A	N/A	12824	12824
VABS	=	101462	VIS: Absolute Value for an Array	N/A	N/A	N/A	12824	12824
VSUM	=	101463	VIS: Sum an Array's Elements	N/A	N/A	N/A	12824	12824
VNRM	=	101464	VIS: Sum Absolute Value of Array	N/A	N/A	N/A	12824	12824
VDOT	=	101465	VIS: Dot Product of an Array	N/A	N/A	N/A	12824	12824
VMAX	=	101466	VIS: Find Largest Element in an Array	N/A	N/A	N/A	12824	12824
VMAB	=	101467	VIS: Find Largest Absolute Value in Array	N/A	N/A	N/A	12824	12824
VMIN	=	101470	VIS: Find Smallest Element in an Array	N/A	N/A	N/A	12824	12824
VMIB	=	101471	VIS: Find Smallest Absolute Value	N/A	N/A	N/A	12824	12824
VMOV	=	101472	VIS: Copy an Array into another Array	N/A	N/A	N/A	12824	12824
VSWP	=	101473	VIS: Exchange Elements in two Arrays	N/A	N/A	N/A	12824	12824
.ERES	=	101474	VIS: Calc 2 word offset for EMA Array	N/A	N/A	N/A	12824	12824
.ESEG	=	101475	Set Multiple Map registers	N/A	N/A	N/A	12824	12824
.VSET	=	101476	VIS: Calc Map Table from .ERES info	N/A	N/A	N/A	12824	12824
.....	=	101701	DMI Quick Selftest = CMA Instruction	N/A	N/A	DMI	DMI	DMI
.DLD	=	104200	Double Load (A/B)	STD	STD	STD	STD	STD
.DST	=	104400	Double Store (A/B)	STD	STD	STD	STD	STD
.FAD	=	105000	Floating Point Add	12901	STD	STD	HFP	HFP
.XADD	=	105001	3 word Float Add (F-cpu's only)	N/A	N/A	N/A	STD	STD
.TADD	=	105002	4-word Double Precision Add	N/A	N/A	N/A	FPP	FPP
.....	=	105004	Floating Point Processor Selftest	N/A	N/A	N/A	STD	STD
.DAD	=	105014	Double Integer Add	N/A	N/A	N/A	N/A	DBI

.FSB	= 105020	Float Point Subtract	12901	STD	STD	HFP	HFP
.XSUB	= 105021	3 word Float Subtract (F-cpu's only)	N/A	N/A	N/A	STD	STD
.TSUB	= 105022	4-word Double Precision Subtract	N/A	N/A	N/A	FPP	FPP
.DSB	= 105034	Double Integer Subtract	N/A	N/A	N/A	N/A	DBI
.FMP	= 105040	Float Point Multiply	12901	STD	STD	HFP	HFP
.XMPY	= 105041	3 word Float Multiply (F-cpu's only)	N/A	N/A	N/A	STD	STD
.TMPY	= 105042	4-word Double Precision Multiply	N/A	N/A	N/A	FPP	FPP
.DMP	= 105054	Double Integer Multiply	N/A	N/A	N/A	N/A	DBI
.FDV	= 105060	Float Point Divide	12901	STD	STD	HFP	HFP
.XDIV	= 105061	3 word Float Divide (F-cpu's only)	N/A	N/A	N/A	STD	STD
.TDIV	= 105062	4-word Double Precision Divide	N/A	N/A	N/A	FPP	FPP
.DDI	= 105074	Double Integer Divide	N/A	N/A	N/A	N/A	DBI
IFIX	= 105100	Float to Integer	12901	STD	STD	STD	STD
.DINT	= 105101	Same as .XFXS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.XFXS	= 105101	3 word Float to 1 word Integer (.DINT)	N/A	N/A	N/A	FPP	FPP
.TINT	= 105102	Same as .TXFS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.TFXS	= 105102	4-word Double to 1-word Integer (.TINT)	N/A	N/A	N/A	FPP	FPP
.FIXD	= 105104	2 word Float to 2 word Integer	N/A	N/A	N/A	FPP	FPP
.XFXD	= 105105	3 word Float to 2 word Integer	N/A	N/A	N/A	FPP	FPP
.TFXD	= 105106	4-word Double to 2-word Integer	N/A	N/A	N/A	FPP	FPP
.DSBR	= 105114	Double Subtract Reversed (Y-X VS. X-Y)	N/A	N/A	N/A	N/A	DBI
FLOAT	= 105120	Integer to Float	12901	STD	STD	STD	STD
.IDBL	= 105121	Same as .XFTS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.XFTS	= 105121	1 word Integer to 3 word Float (.IDBL)	N/A	N/A	N/A	FPP	FPP
.TFTS	= 105122	1-word Integer to 4-word Double	N/A	N/A	N/A	FPP	FPP

SORTED BY OPCODE VALUE

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
.ITBL	=	105122	Same as .TFTS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.FLTD	=	105124	2 word Integer to 2 word Float	N/A	N/A	N/A	FPP	FPP
.XFTD	=	105125	2 word Integer to 3 word Float	N/A	N/A	N/A	FPP	FPP
.TFTD	=	105126	2-word Integer to 4-word Double	N/A	N/A	N/A	FPP	FPP
.DDIR	=	105134	Double Divide Reverse (Y/X VS. X/Y)	N/A	N/A	N/A	N/A	DBI
.....	=	105200	Fast Fortran Selftest	N/A	N/A	N/A	FFP	FFP
DBLE	=	105201	2 word Float to 3 word Float Precision	12907	12977	13306	FFP	FFP
SNGL	=	105202	3 word Float to 2 word Float Precision	12907	12977	13306	FFP	FFP
.XMPY	=	105203	3 word Float Multiply (non-F CPU's)	12907	12977	13306	N/A	N/A
.DNG	=	105203	Double Integer Negation (Change sign)	N/A	N/A	N/A	N/A	DBI
.DCO	=	105204	Double Integer Compare	N/A	N/A	N/A	N/A	DBI
.XDIV	=	105204	3 word Float Divide (non-F CPU's)	12907	12977	13306	N/A	N/A
.DFER	=	105205	Copy 3 word (DEFS = ADDR)	12907	12977	13306	FFP	FFP
.XPAK	=	105206	Create Normalized 3 word Floating point	N/A	12977	13306	FFP	FFP
.BLE	=	105207	2-word Real to 4-word Double	N/A	N/A	N/A	N/A	FPP
XADD	=	105207	Entry Point for HP-FTN to use .XADD	12907	12977	13306	N/A	N/A
.DIN	=	105210	Double Integer Increment	N/A	N/A	N/A	N/A	DBI
XSUB	=	105210	Entry Point for HP-FTN to use .XSUB	12907	12977	13306	N/A	N/A
.DDE	=	105211	Double Integer Decrement	N/A	N/A	N/A	N/A	DBI
XMPY	=	105211	Entry Point for HP-FTN to use .XMPY	12907	12977	13306	N/A	N/A
.DIS	=	105212	Double Increment ans Skip on Zero	N/A	N/A	N/A	N/A	DBI
XDIV	=	105212	Entry Point for HP-FTN to use .XDIV	12907	12977	13306	N/A	N/A
.DDS	=	105213	Double Decrement and Skip on Zero	N/A	N/A	N/A	N/A	DBI
.XADD	=	105213	3 word Float Add (non-F CPU's)	12907	12977	13306	N/A	N/A
.NGL	=	105214	4-word Double to 2-word Real	N/A	N/A	N/A	N/A	FPP

.XSUB	= 105214	3 word Float Subtract (non-F CPU's)	12907	12977	13306	N/A	N/A
.XCOM	= 105215	Complement a 3 word Float (Unpacked)	N/A	12977	13306	FFP	FFP
..DCM	= 105216	Complement a 2 word Floating point	N/A	12977	13306	FFP	FFP
DDINT	= 105217	Truncate 2 word Float to Integer	N/A	12977	13306	FFP	FFP
.XFER	= 105220	Copy 3 words (A/B REG = Address)	12907	12977	13306	FFP	FFP
.GOTO	= 105221	Computed GOTO	12907	12977	13306	FFP	FFP
..MAP	= 105222	Compute 2/3 dimensional Array addresses	12907	12977	13306	FFP	FFP
.ENTR	= 105223	Compute true ADDR for params, return	12907	12977	13306	FFP	FFP
.ENTP	= 105224	Same as .ENTR for Privileged Programs	12907	12977	13306	FFP	FFP
.PWR2	= 105225	Y = X*2**N(X is 2-word Float, N=integer)	N/A	12977	13306	FFP	FFP
.FLUN	= 105226	Unpack 2 word Float Mantissa and Exponent	N/A	12977	13306	FFP	FFP
$SETP	= 105227	Setup Table of Ascending Numbers	12907	12977	13306	FFP	FFP
.PACK	= 105230	Create Normalized 2-word Floating point	N/A	12977	13306	FFP	FFP
.CFER	= 105231	Copy 4 words to another Address	N/A	N/A	Note1	FFP	FFP
..FCM	= 105232	Complement 2-word Real Number	N/A	N/A	N/A	N/A	FPP
..TCM	= 105233	Complement 4-word Double	N/A	N/A	N/A	N/A	FPP
.EMIO	= 105240	EMA I/O (Assures Buffer is in Window)	N/A	N/A	EMA	EMA	EMA
.PMAP	= 105240	VMA: Maps VMA page to map registers	N/A	N/A	VMA	VMA	VMA
MMAP	= 105241	Map Physical into Logical Address	N/A	N/A	EMA	EMA	EMA
$LOC	= 105241	VMA: Memresident node - Load on call	N/A	N/A	VMA	VMA	VMA
.....	= 105242	EMA Selftest	N/A	N/A	EMA	EMA	EMA
.....	= 105242	VMA Selftest	N/A	N/A	VMA	VMA	VMA
.....	= 105243	VMA: Swap A and B registers	N/A	N/A	VMA	VMA	VMA
.....	= 105244	VMA: (Part of 105243 code for old EMA)	N/A	N/A	VMA	VMA	VMA
.....	= 105245	VMA: (Part of 105243 code for old EMA)	N/A	N/A	VMA	VMA	VMA
.MYAD	= 105246	VMA: multiply 2 signed integers	N/A	N/A	VMA	VMA	VMA

SORTED BY OPCODE VALUE

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
.UMAP	=	105247	VMA: Performs AREG*(P+1,I)+BREG	N/A	N/A	VMA	VMA	VMA
.IMAP	=	105250	VMA: FTN4X integer array calc and map	N/A	N/A	VMA	VMA	VMA
.IMAR	=	105251	VMA: Integer subscript calculation	N/A	N/A	VMA	VMA	VMA
.JMAP	=	105252	VMA: Double integer array calc & map	N/A	N/A	VMA	VMA	VMA
.JMAR	=	105253	VMA: Double integer subscript compute	N/A	N/A	VMA	VMA	VMA
.LPXR	=	105254	VMA: 32 bit DEF pointer add and map	N/A	N/A	VMA	VMA	VMA
.LPX	=	105255	VMA: ABREG pointer + offset and map	N/A	N/A	VMA	VMA	VMA
.LBPR	=	105256	VMA: 16 bit DEF pointer map	N/A	N/A	VMA	VMA	VMA
.EMAP	=	105257	EMA Element Mapping	N/A	N/A	EMA	EMA	EMA
.LBP	=	105257	VMA: map pointer in ABREG	N/A	N/A	VMA	VMA	VMA
.....	=	105304	DS/1000 Selftest for 1000-E or F only	N/A	91740	N/A	N/A	N/A
TAN	=	105320	Tangent	N/A	N/A	N/A	SIS	SIS
SQRT	=	105321	Square Root	N/A	N/A	N/A	SIS	SIS
ALOG	=	105322	Natural Logarithm (Base E)	N/A	N/A	N/A	SIS	SIS
ATAN	=	105323	Arc Tangent	N/A	N/A	N/A	SIS	SIS
COS	=	105324	Cosine	N/A	N/A	N/A	SIS	SIS
SIN	=	105325	Sine	N/A	N/A	N/A	SIS	SIS
EXP	=	105326	Raise E to 2 word Float power	N/A	N/A	N/A	SIS	SIS
ALOGT	=	105327	Common Logarithm (Base 10)	N/A	N/A	N/A	SIS	SIS
TANH	=	105330	Hyperbolic Tangent	N/A	N/A	N/A	SIS	SIS
DPOLY	=	105331	4-word Polynomial Evaluator (was TRNL)	N/A	N/A	N/A	N/A	SIS
/CMRT	=	105332	4-word Common Range Reduction	N/A	N/A	N/A	N/A	FPP
/ATLG	=	105333	4-word Computation of (1-X) (1+X)	N/A	N/A	N/A	N/A	SIS
.FPWR	=	105334	2-word Float to 1-word +Power	N/A	N/A	N/A	N/A	SIS
.TPWR	=	105335	4-word Double to 1-word +Power	N/A	N/A	N/A	N/A	SIS

.....	= 105337	Scientific Instruction Set (SIS) Selftest	N/A	N/A	N/A	SIS	SIS
.LIBR	= 105340	$LIBR sequence in microcode.	N/A	N/A	RTE6	RTE6	RTE6
.LIBX	= 105341	$LIBX sequence in microcode	N/A	N/A	RTE6	RTE6	RTE6
.TICK	= 105342	TBG tick interrupt handler	N/A	N/A	RTE6	RTE6	RTE6
.TNAM	= 105343	Find ID segment that matches a name	N/A	N/A	RTE6	RTE6	RTE6
.STIO	= 105344	Configure I/O for drivers	N/A	N/A	RTE6	RTE6	RTE6
.FNW	= 105345	Compare words with variable increment	N/A	N/A	RTE6	RTE6	RTE6
.IRT	= 105346	Interrupt return processing	N/A	N/A	RTE6	RTE6	RTE6
.LLS	= 105347	Search a linked list	N/A	N/A	RTE6	RTE6	RTE6
.SIP	= 105350	Skip if interrupt pending	N/A	N/A	RTE6	RTE6	RTE6
.YLD	= 105351	.SIP completion return point	N/A	N/A	RTE6	RTE6	RTE6
.CPM	= 105352	Compare words without register mods	N/A	N/A	RTE6	RTE6	RTE6
.ETEQ	= 105353	Setup base page EQT values	N/A	N/A	RTE6	RTE6	RTE6
.ENTN	= 105354	Double use opcode, similar to .ENTR	N/A	N/A	RTE6	RTE6	RTE6
.....	= 105355	Double use opcode, RTE6 ROM selftest	N/A	N/A	RTE6	RTE6	RTE6
.ENTC	= 105356	Double use opcode, similar to .ENTP	N/A	N/A	RTE6	RTE6	RTE6
.STU	= 105357	Double use opcode, fill with a constant	N/A	N/A	RTE6	RTE6	RTE6
.DVCT	= 105460	VIS: Similar to .VECT for 2-word Opcodes	N/A	N/A	N/A	12824	12824
DVPIV	= 105461	VIS: Pivot for 4-word Real Arrays	N/A	N/A	N/A	12824	12824
DVABS	= 105462	VIS: Absolute Value for 4-word Arrays	N/A	N/A	N/A	12824	12824
DVSUM	= 105463	VIS: Sum 4-word Array Elements	N/A	N/A	N/A	12824	12824
DVNRM	= 105464	VIS: Sum Absolute Value OF 4-word Array	N/A	N/A	N/A	12824	12824
DVDOT	= 105465	VIS: Dot Product for 4-word Arrays	N/A	N/A	N/A	12824	12824
DVMAX	= 105466	VIS: Return Largest Element in Array	N/A	N/A	N/A	12824	12824
DVMAB	= 105467	VIS: Find Largest ABS Value in Array	N/A	N/A	N/A	12824	12824

SORTED BY OPCODE VALUE

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
DVMIN	=	105470	VIS: Return Smallest Value in Array	N/A	N/A	N/A	12824	12824
DVMIB	=	105471	VIS: Find Smallest ABS Value in Array	N/A	N/A	N/A	12824	12824
DVMOV	=	105472	VIS: Copy a 4-word Array to another Array	N/A	N/A	N/A	12824	12824
DVSWP	=	105473	VIS: Exchange a 4-word Array with another	N/A	N/A	N/A	12824	12824
.....	=	105477	VIS: Vector Instruction Set Selftest	N/A	N/A	N/A	12824	12824
.....	=	105524	DS/1000 Selftest for 1000-M only	N/A	91740	N/A	N/A	N/A
BITRV	=	105600	SIGNAL/1000 Swap 2 elements in array	N/A	N/A	N/A	N/A	92835
BTRFY	=	105601	SIGNAL/1000 Butterfly algorithm	N/A	N/A	N/A	N/A	92835
UNSCR	=	105602	SIGNAL/1000 Unscramble for phasor MPY	N/A	N/A	N/A	N/A	92835
PRSCR	=	105603	SIGNAL/1000 Unscramble for phasor MPY	N/A	N/A	N/A	N/A	92835
BITR1	=	105604	SIGNAL/1000 Swap 2 elements, alt. format	N/A	N/A	N/A	N/A	92835
BTRF1	=	105605	SIGNAL/1000 Butterfly algorithm	N/A	N/A	N/A	N/A	92835
.CADD	=	105606	SIGNAL/1000 Complex Number Addition	N/A	N/A	N/A	N/A	92835
.CSUB	=	105607	SIGNAL/1000 Complex number subtract	N/A	N/A	N/A	N/A	92835
.CMPY	=	105610	SIGNAL/1000 Complex Number Multiply	N/A	N/A	N/A	N/A	92835
.CDIV	=	105611	SIGNAL/1000 Complex Number Division	N/A	N/A	N/A	N/A	92835
CONJG	=	105612	SIGNAL/1000 Opcode (F-cpu with VIS only)	N/A	N/A	N/A	N/A	92835
..CCM	=	105613	SIGNAL/1000 Opcode (F-cpu with VIS only)	N/A	N/A	N/A	N/A	92835
AIMAG	=	105614	SIGNAL/1000 Return imaginary part	N/A	N/A	N/A	N/A	92835
CMPLX	=	105615	SIGNAL/1000 Form complex number	N/A	N/A	N/A	N/A	92835
.....	=	105616	SIGNAL/1000 Reserved opcode	N/A	N/A	N/A	N/A	92835
.....	=	105617	SIGNAL/1000 Selftest opcode	N/A	N/A	N/A	N/A	92835
.....	=	105701	DMI Quick Selftest = CMB Instruction	N/A	N/A	DMI	DMI	DMI
.LBT	=	105763	Load Byte	N/A	EIG	EIG	EIG	EIG
.SBT	=	105764	Store Byte	N/A	EIG	EIG	EIG	EIG

.MBT = 105765 Move Bytes	N/A	EIG	EIG	EIG	EIG
.CBT = 105766 Compare Bytes	N/A	EIG	EIG	EIG	EIG
.SFB = 105767 Scan for Bytes	N/A	EIG	EIG	EIG	EIG
.SBS = 105773 Set Bits	N/A	EIG	EIG	EIG	EIG
.CBS = 105774 Clear Bits	N/A	EIG	EIG	EIG	EIG
.TBS = 105775 Test for Set Bits	N/A	EIG	EIG	EIG	EIG
.CMW = 105776 Compare words	N/A	EIG	EIG	EIG	EIG
.MVW = 105777 Move words	N/A	EIG	EIG	EIG	EIG

SORTED BY ENTRY POINT NAME

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
$LOC	=	105241	VMA: Memresident node - load on call	N/A	N/A	VMA	VMA	VMA
$SETP	=	105227	Setup Table of Ascending Numbers	12907	12977	13306	FFP	FFP
.....	=	101701	DMI Quick Selftest = CMA Instruction	N/A	N/A	DMI	DMI	DMI
.....	=	105004	Floating Point Processor Selftest	N/A	N/A	N/A	STD	STD
.....	=	105200	Fast Fortran Selftest	N/A	N/A	N/A	FFP	FFP
.....	=	105242	EMA Selftest	N/A	N/A	N/A	EMA	EMA
.....	=	105242	VMA Selftest	N/A	N/A	N/A	VMA	VMA
.....	=	105243	VMA: Swap A and B registers	N/A	N/A	N/A	VMA	VMA
.....	=	105244	VMA: (Part of 105243 code for old EMA)	N/A	N/A	VMA	VMA	VMA
.....	=	105245	VMA: (Part of 105243 code for old EMA)	N/A	N/A	VMA	VMA	VMA
.....	=	105337	Scientific Instruction Set (SIS) Selftest	N/A	N/A	N/A	SIS	SIS
.....	=	105355	Double use opcode, RTE6 ROM selftest	N/A	N/A	RTE6	RTE6	RTE6
.....	=	105477	VIS: Vector Instruction Set Selftest	N/A	N/A	N/A	12824	12824
.....	=	105304	DS/1000 Selftest for 1000-E or F only	N/A	N/A	91740	91740	91740
.....	=	105524	DS/1000 Selftest for 1000-M only	N/A	N/A	91740	91740	91740
.....	=	105616	SIGNAL/1000 Reserved opcode	N/A	N/A	N/A	N/A	92835
.....	=	105617	SIGNAL/1000 Selftest opcode	N/A	N/A	N/A	N/A	92835
.....	=	105701	DMI Quick Selftest = CMB Instruction	N/A	N/A	DMI	DMI	DMI
..CCM	=	105613	SIGNAL/1000 Opcode (F-cpu with VIS only)	N/A	N/A	N/A	N/A	92835
..DCM	=	105216	Complement a 2 word Floating point	N/A	12977	13306	FFP	FFP
..FCM	=	105232	Complement 2-word Real Number	N/A	N/A	N/A	N/A	FPP
..MAP	=	105222	Compute 2/3 dimensional Array addresses	12907	12977	13306	FFP	FFP
..TCM	=	105233	Complement 4-word Double	N/A	N/A	N/A	N/A	FPP
.BLE	=	105207	2-word Real to 4-word Double	N/A	N/A	N/A	N/A	FPP
.CADD	=	105606	SIGNAL/1000 Complex Number Addition	N/A	N/A	N/A	N/A	92835

.CBS	= 105774	Clear Bits	N/A	EIG	EIG	EIG	EIG
.CBT	= 105766	Compare Bytes	N/A	EIG	EIG	EIG	EIG
.CDIV	= 105611	SIGNAL/1000 Complex Number Division	N/A	N/A	N/A	N/A	92835
.CFER	= 105231	Copy 4 words to another Address	N/A	N/A	Note1	FFP	FFP
.CMPY	= 105610	SIGNAL/1000 Complex Number Multiply	N/A	N/A	N/A	N/A	92835
.CMW	= 105776	Compare words	N/A	EIG	EIG	EIG	EIG
.CPM	= 105352	Compare words without register mods	N/A	N/A	RTE6	RTE6	RTE6
.CSUB	= 105607	SIGNAL/1000 Complex number subtract	N/A	N/A	N/A	N/A	92835
.DAD	= 105014	Double Integer Add	N/A	N/A	N/A	N/A	DBI
.DCO	= 105204	Double Integer Compare	N/A	N/A	N/A	N/A	DBI
.DDE	= 105211	Double Integer Decrement	N/A	N/A	N/A	N/A	DBI
.DDI	= 105074	Double Integer Divide	N/A	N/A	N/A	N/A	DBI
.DDIR	= 105134	Double Divide Reverse (Y/X VS. X/Y)	N/A	N/A	N/A	N/A	DBI
.DDS	= 105213	Double Decrement and Skip on Zero	N/A	N/A	N/A	N/A	DBI
.DFER	= 105205	Copy 3 word (DEFS = ADDR)	12907	12977	13306	FFP	FFP
.DIN	= 105210	Double Integer Increment	N/A	N/A	N/A	N/A	DBI
.DINT	= 105101	Same as .XFXS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.DIS	= 105212	Double Increment ans Skip on Zero	N/A	N/A	N/A	N/A	DBI
.DIV	= 100400	Integer Divide	STD	STD	STD	STD	STD
.DLD	= 104200	Double Load (A/B)	STD	STD	STD	STD	STD
.DMP	= 105054	Double Integer Multiply	N/A	N/A	N/A	N/A	DBI
.DNG	= 105203	Double Integer Negation (Change sign)	N/A	N/A	N/A	N/A	DBI
.DSB	= 105034	Double Integer Subtract	N/A	N/A	N/A	N/A	DBI
.DSBR	= 105114	Double Subtract Reversed (Y-X VS. X-Y)	N/A	N/A	N/A	N/A	DBI
.DST	= 104400	Double Store (A/B)	STD	STD	STD	STD	STD
.DVCT	= 105460	VIS: Similar to .VECT for 2-word Opcodes	N/A	N/A	N/A	12824	12824

SORTED BY ENTRY POINT NAME

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
.EMAP	=	105257	EMA Element Mapping	N/A	N/A	EMA	EMA	EMA
.EMIO	=	105240	EMA I/O (Assures Buffer is in Window)	N/A	N/A	EMA	EMA	EMA
.ENTC	=	105356	Double use opcode, similar to .ENTP	N/A	N/A	RTE6	RTE6	RTE6
.ENTN	=	105354	Double use opcode, similar to .ENTR	N/A	N/A	RTE6	RTE6	RTE6
.ENTP	=	105224	Same as .ENTR for Privileged Programs	12907	12977	13306	FFP	FFP
.ENTR	=	105223	Compute true ADDR for params, return	12907	12977	13306	FFP	FFP
.ERES	=	101474	VIS: Calc 2 word offset for EMA Array	N/A	N/A	N/A	12824	12824
.ESEG	=	101475	VIS: Set Multiple Map registers	N/A	N/A	N/A	12824	12824
.ETEQ	=	105353	Setup base page EQT values	N/A	N/A	RTE6	RTE6	RTE6
.FAD	=	105000	Floating Point Add	12901	STD	STD	HFP	HFP
.FDV	=	105060	Float Point Divide	12901	STD	STD	HFP	HFP
.FIXD	=	105104	2 word Float to 2 word Integer	N/A	N/A	N/A	FPP	FPP
.FLTD	=	105124	2 word Integer to 2 word Float	N/A	N/A	N/A	FPP	FPP
.FLUN	=	105226	Unpack 2 word Float Mantissa and Exponent	N/A	12977	13306	FFP	FFP
.FMP	=	105040	Float Point Multiply	12901	STD	STD	HFP	HFP
.FNW	=	105345	Compare words with variable increment	N/A	N/A	RTE6	RTE6	RTE6
.FPWR	=	105334	2-word Float to 1-word +Power	N/A	N/A	N/A	N/A	SIS
.FSB	=	105020	Float Point Subtract	12901	STD	STD	HFP	HFP
.GOTO	=	105221	Computed GOTO	12907	12977	13306	FFP	FFP
.IDBL	=	105121	Same as .XFTS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.IMAP	=	105250	VMA: FTN4X integer array calc and map	N/A	N/A	VMA	VMA	VMA
.IMAR	=	105251	VMA: Integer subscript calculation	N/A	N/A	VMA	VMA	VMA
.IRT	=	105346	Interrupt return processing	N/A	N/A	RTE6	RTE6	RTE6
.ITBL	=	105122	Same as .TFTS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.JMAP	=	105252	VMA: Double integer array calc & map	N/A	N/A	VMA	VMA	VMA

.JMAR	= 105253	VMA: Double integer subscript compute	N/A	N/A	VMA	VMA	VMA
.LBP	= 105257	VMA: map pointer in ABREG	N/A	N/A	VMA	VMA	VMA
.LBPR	= 105256	VMA: 16 bit DEF pointer map	N/A	N/A	VMA	VMA	VMA
.LBT	= 105763	Load Byte	N/A	EIG	EIG	EIG	EIG
.LIBR	= 105340	$LIBR sequence in microcode.	N/A	N/A	RTE6	RTE6	RTE6
.LIBX	= 105341	$LIBX sequence in microcode	N/A	N/A	RTE6	RTE6	RTE6
.LLS	= 105347	Search a linked list	N/A	N/A	RTE6	RTE6	RTE6
.LPX	= 105255	VMA: ABREG pointer + offset and map	N/A	N/A	VMA	VMA	VMA
.LPXR	= 105254	VMA: 32 bit DEF pointer add and map	N/A	N/A	VMA	VMA	VMA
.MBT	= 105765	Move Bytes	N/A	EIG	EIG	EIG	EIG
.MPY	= 100200	Integer Multiply	STD	STD	STD	STD	STD
.MVW	= 105777	Move words	N/A	EIG	EIG	EIG	EIG
.MYAD	= 105246	VMA: multiply 2 signed integers	N/A	N/A	VMA	VMA	VMA
.NGL	= 105214	4-word Double to 2-word Real	N/A	N/A	N/A	N/A	FPP
.PACK	= 105230	Create Normalized 2-word Floating point	N/A	12977	13306	FFP	FFP
.PMAP	= 105240	VMA: Maps VMA page to map registers	N/A	N/A	VMA	VMA	VMA
.PWR2	= 105225	Y = X*2**N(X is 2-word Float, N=integer)	N/A	12977	13306	FFP	FFP
.SBS	= 105773	Set Bits	N/A	EIG	EIG	EIG	EIG
.SBT	= 105764	Store Byte	N/A	EIG	EIG	EIG	EIG
.SFB	= 105767	Scan for Bytes	N/A	EIG	EIG	EIG	EIG
.SIP	= 105350	Skip if interrupt pending	N/A	N/A	RTE6	RTE6	RTE6
.STIO	= 105344	Configure I/O for drivers	N/A	N/A	RTE6	RTE6	RTE6
.STU	= 105357	Double use opcode, fill with a constant	N/A	N/A	RTE6	RTE6	RTE6
.TADD	= 105002	4-word Double Precision Add	N/A	N/A	N/A	FPP	FPP
.TBS	= 105775	Test for Set Bits	N/A	EIG	EIG	EIG	EIG
.TDIV	= 105062	4-word Double Precision Divide	N/A	N/A	N/A	FPP	FPP
.TFTD	= 105126	2-word Integer to 4-word Double	N/A	N/A	N/A	FPP	FPP

SORTED BY ENTRY POINT NAME

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
.TFTS	=	105122	1-word Integer to 4-word Double	N/A	N/A	N/A	FPP	FPP
.TFXD	=	105106	4-word Double to 2-word Integer	N/A	N/A	N/A	FPP	FPP
.TFXS	=	105102	4-word Double to 1-word Integer (.TINT)	N/A	N/A	N/A	FPP	FPP
.TINT	=	105102	Same as .TXFS (HP-FTN Interface)	N/A	N/A	N/A	FPP	FPP
.TICK	=	105342	TBG tick interrupt handler	N/A	N/A	RTE6	RTE6	RTE6
.TMPY	=	105042	4-word Double Precision Multiply	N/A	N/A	N/A	FPP	FPP
.TNAM	=	105343	Find ID segment that matches a name	N/A	N/A	RTE6	RTE6	RTE6
.TPWR	=	105335	4-word Double to 1-word +Power	N/A	N/A	N/A	N/A	SIS
.TSUB	=	105022	4-word Double Precision Subtract	N/A	N/A	N/A	FPP	FPP
.UMAP	=	105247	VMA: Performs AREG*(P+1,I)+BREG	N/A	N/A	VMA	VMA	VMA
.VECT	=	101460	VIS: Word 1 for 2-word VIS Opcodes	N/A	N/A	N/A	12824	12824
.VSET	=	101476	VIS: Calc Map Table from .ERES info	N/A	N/A	N/A	12824	12824
.XADD	=	105213	3 word Float Add (non-F CPU's)	12907	12977	13306	N/A	N/A
.XADD	=	105001	3 word Float Add (F-cpu's only)	N/A	N/A	N/A	STD	STD
.XCOM	=	105215	Complement a 3 word Float (Unpacked)	N/A	12977	13306	FFP	FFP
.XDIV	=	105061	3 word Float Divide (F-cpu's only)	N/A	N/A	N/A	STD	STD
.XDIV	=	105204	3 word Float Divide (non-F CPU's)	12907	12977	13306	N/A	N/A
.XFER	=	105220	Copy 3 words (A/B REG = Address)	12907	12977	13306	FFP	FFP
.XFTD	=	105125	2 word Integer to 3 word Float	N/A	N/A	N/A	FPP	FPP
.XFTS	=	105121	1 word Integer to 3 word Float (.IDBL)	N/A	N/A	N/A	FPP	FPP
.XFXD	=	105105	3 word Float to 2 word Integer	N/A	N/A	N/A	FPP	FPP
.XFXS	=	105101	3 word Float to 1 word Integer (.DINT)	N/A	N/A	N/A	FPP	FPP
.XMPY	=	105041	3 word Float Multiply (F-cpu's only)	N/A	N/A	N/A	STD	STD
.XMPY	=	105203	3 word Float Multiply (non-F CPU's)	12907	12977	13306	N/A	N/A
.XPAK	=	105206	Create Normalized 3 word Floating point	N/A	12977	13306	FFP	FFP

.XSUB	= 105021	3 word Float Subtract (F-cpu's only)	N/A	N/A	N/A	STD	STD
.XSUB	= 105214	3 word Float Subtract (non-F CPU's)	12907	12977	13306	N/A	N/A
.YLD	= 105351	.SIP completion return point	N/A	N/A	RTE6	RTE6	RTE6
/ATLG	= 105333	4-word Computation of (1-X) (1+X)	N/A	N/A	N/A	N/A	SIS
/CMRT	= 105332	4-word Common Range Reduction	N/A	N/A	N/A	N/A	FPP
AIMAG	= 105614	SIGNAL/1000 Return imaginary part	N/A	N/A	N/A	N/A	92835
ALOG	= 105322	Natural Logarithm (Base E)	N/A	N/A	N/A	SIS	SIS
ALOGT	= 105327	Common Logarithm (Base 10)	N/A	N/A	N/A	SIS	SIS
ATAN	= 105323	Arc Tangent	N/A	N/A	N/A	SIS	SIS
BTRF1	= 105605	SIGNAL/1000 Butterfly algorithm	N/A	N/A	N/A	N/A	92835
BITR1	= 105604	SIGNAL/1000 Swap 2 elements, alt. format	N/A	N/A	N/A	N/A	92835
BITRV	= 105600	SIGNAL/1000 Swap 2 elements in array	N/A	N/A	N/A	N/A	92835
BTRFY	= 105601	SIGNAL/1000 Butterfly algorithm	N/A	N/A	N/A	N/A	92835
CMPLX	= 105615	SIGNAL/1000 Form complex number	N/A	N/A	N/A	N/A	92835
CONJG	= 105612	SIGNAL/1000 Opcode (F-cpu with VIS only)	N/A	N/A	N/A	N/A	92835
COS	= 105324	Cosine	N/A	N/A	N/A	SIS	SIS
DBLE	= 105201	2 word Float to 3 word Float Precision	12907	12977	13306	FFP	FFP
DDINT	= 105217	Truncate 2 word Float to Integer	N/A	12977	13306	FFP	FFP
DPOLY	= 105331	4-word Polynomial Evaluator (was TRNL)	N/A	N/A	N/A	N/A	SIS
DVABS	= 105462	VIS: Absolute Value for 4-word Arrays	N/A	N/A	N/A	12824	12824
DVDOT	= 105465	VIS: Dot Product for 4-word Arrays	N/A	N/A	N/A	12824	12824
DVMAB	= 105467	VIS: Find Largest ABS Value ia Array	N/A	N/A	N/A	12824	12824
DVMAX	= 105466	VIS: Return Largest Element in Array	N/A	N/A	N/A	12824	12824
DVMIB	= 105471	VIS: Find Smallest ABS Value in Array	N/A	N/A	N/A	12824	12824

SORTED BY ENTRY POINT NAME

Entry		Opcode	Description of the Entry Point Function	2100	1000M	1000E	F-cpu early	F-cpu 1920+
DVMIN	=	105470	VIS: Return Smallest Value in Array	N/A	N/A	N/A	12824	12824
DVMOV	=	105472	VIS: Copy a 4-word Array to another Array	N/A	N/A	N/A	12824	12824
DVNRM	=	105464	VIS: Sum Absolute Value OF 4-word Array	N/A	N/A	N/A	12824	12824
DVPIV	=	105461	VIS: Pivot for 4-word Real Arrays	N/A	N/A	N/A	12824	12824
DVSUM	=	105463	VIS: Sum 4-word Array Elements	N/A	N/A	N/A	12824	12824
DVSWP	=	105473	VIS: Exchange a 4-word Array with another	N/A	N/A	N/A	12824	12824
EXP	=	105326	Raise E to 2 word Float power	N/A	N/A	N/A	SIS	SIS
FLOAT	=	105120	Integer to Float	12901	STD	STD	STD	STD
IFIX	=	105100	Float to Integer	12901	STD	STD	STD	STD
MMAP	=	105241	Map Physical into Logical Address	N/A	N/A	EMA	EMA	EMA
PRSCR	=	105603	SIGNAL/1000 Unscramble for phasor MPY	N/A	N/A	N/A	N/A	92835
SIN	=	105325	Sine	N/A	N/A	N/A	SIS	SIS
SNGL	=	105202	3 word Float to 2 word Float Precision	12907	12977	13306	FFP	FFP
SQRT	=	105321	Square Root	N/A	N/A	N/A	SIS	SIS
TAN	=	105320	Tangent	N/A	N/A	N/A	SIS	SIS
TANH	=	105330	Hyperbolic Tangent	N/A	N/A	N/A	SIS	SIS
UNSCR	=	105602	SIGNAL/1000 Unscramble for phasor MPY	N/A	N/A	N/A	N/A	92835
VABS	=	101462	VIS: Absolute Value for an Array	N/A	N/A	N/A	12824	12824
VDOT	=	101465	VIS: Dot Product of an Array	N/A	N/A	N/A	12824	12824
VMAB	=	101467	VIS: Find Largest Absolute Value in Array	N/A	N/A	N/A	12824	12824
VMAX	=	101466	VIS: Find Largest Element in an Array	N/A	N/A	N/A	12824	12824
VMIB	=	101471	VIS: Find Smallest Absolute Array Value	N/A	N/A	N/A	12824	12824
VMIN	=	101470	VIS: Find Smallest Element in an Array	N/A	N/A	N/A	12824	12824
VMOV	=	101472	VIS: Copy an Array into another Array	N/A	N/A	N/A	12824	12824
VNRM	=	101464	VIS: Sum Absolute Value of an Array	N/A	N/A	N/A	12824	12824

VPIV	= 101461	VIS: Pivot Routine for Array Processing	N/A	N/A	N/A	12824	12824
VSUM	= 101463	VIS: Sum an Array's Elements	N/A	N/A	N/A	12824	12824
VSWP	= 101473	VIS: Exchange Elements in two Arrays	N/A	N/A	N/A	12824	12824
XADD	= 105207	Entry Point for HP-FTN to use .XADD	12907	12977	13306	N/A	N/A
XDIV	= 105212	Entry Point for HP-FTN to use .XDIV	12907	12977	13306	N/A	N/A
XMPY	= 105211	Entry Point for HP-FTN to use .XMPY	12907	12977	13306	N/A	N/A
XSUB	= 105210	Entry Point for HP-FTN to use .XSUB	12907	12977	13306	N/A	N/A

MEMORY-STATUS, VIOLATIONS, PARITY ERRORS

MEM Status Register Format

BIT	SIGNIFICANCE
15	0 = MEM disabled at last interrupt 1 = MEM enabled at last interrupt.
14	0 = System map selected at last interrupt 1 = User map selected at last interrupt
13	0 = MEM disabled currently 1 = MEM enabled currently
12	0 = System map selected currently 1 = User map selected currently
11	0 = Protected mode disabled currently 1 = Protected mode enabled currently
10	0 = Portion mapped*
9	Base page fence bit 9
8	Base page fence bit 8
7	Base page fence bit 7
6	Base page fence bit 6
5	Base page fence bit 5
4	Base page fence bit 4
3	Base page fence bit 3
2	Base page fence bit 2
1	Base page fence bit 1
0	Base page fence bit 0

*Bit 10	Mapped Address (M)
0	Fence $\leq$ M $<$ 2000_8
1	1 $<$ M $<$ Fence

Note: The base page fence separates the reserved (mapped) memory from the shared (unmapped) memory. Bit 10 specifies which area is reserved (mapped). (Refer to LFA and LFB instructions contained in paragraph 4-6.)

MEM Violation Register Format

BIT	SIGNIFICANCE
15	Read violation*
14	Write violation*
13	Base page violation*
12	Privileged instruction violation*
11	Reserved
10	Reserved
9	Reserved
8	Reserved
7	0 = ME bus disabled at violation 1 = ME bus enabled at violation
6	0 = MEM disabled at violation 1 = MEM enabled at violation
5	0 = System map enabled at violation 1 = User map enabled at violation
4	Map address bit 4
3	Map address bit 3
2	Map address bit 2
1	Map address bit 1
0	Map address bit 0

*Significant when associated bit is set.

MEMORY-STATUS, VIOLATIONS, PARITY ERRORS (Cont'd)

Read or write violations will interrupt to SC5. A DMS violation can be distinguished from a memory protect violation by executing an SFS05. If the strip occurs, DMS is in violation, otherwise it is a memory protect violation.

STC 05	Enable memory protect (disables interrupt)
OTA/OTB 05	Load fence register from A/B register
LIA/LIB 05	Load violation register into A/B

A parity error is distinguished from a memory protect error after the LIA/LIB 05 instruction execution by bit 15 of the selected register where a logic 1 is a parity error. The remaining bits contains the logical address of the error location.

Memory protect violations

1. DST ISZ JLY JMP JPY JSB
   MVB MVW SAX SAY SBX SBY
   STA STB STX STY

2. Location 00002 is normally the lower boundary. JMP, JLY, and JPY may not reference A or B.

3. Any I/O instruction (including Halt 01) except those referencing I/O select code 01.

After the third level of indirect addressing a pending interrupt is allowed.

MEMORY-STATUS, VIOLATIONS, PARITY ERRORS (Cont'd)

RTE-II/III/IV DETECTED PARITY ERRORS

Beginning with revision 1604 of RTE-III (92060A) and revision 1602 of RTE-II (92001A), the system detects parity errors. If a parity error is found, the system halts with T = 102005 and the B-register set the violation address (the memory location where the error occurred). When the system is RTE-III, the address refers to a logical address. The logical address usually falls within either the system map or the user map. The physical address (which points to a specific memory module) is found by examing the proper map and doing some elementary calculations as follows:

1. Determine whether the violation address is in the user map or the system map. A good guess is to assume the user map is enabled at the time of the interrupt. If the violation address is above the starting address for disc resident partitions then this is a good guess. (It could also be from high memory in the system map which is not included in the user map.) An accurate method is to examine location $MEU, which is located in RTIOCM. Upon receiving an interrupt, the system stores the MEM status register in $MEU. If bit 14 of $MEU is 0, then the system map was enabled at time of interrupt: if bit 14 of $MEU is 1, then the user map was enabled at the time.

2. Represent the violation address as a five digit octal number of the form MNXXX. Compute the index into the map as

   I = 4 * M = N/2 (0 <= I <= 31) ;N = Integer

   Convert I to octal.

3. Select the M-register. Set the M-register to look at the register I within the proper map. Set the bits in M as below but do not press STORE!

   Bits 15, 14 = On
   Bit 5 = On if User Map, else off
   Bits 4,0 = Octal value of I found above.

4. Select the T-register. The contents displayed is the physical page in memory where the violation address was reported.

Each memory module has 8 pages (8K module) or 16 pages (16K module).

Remember that a parity error can be due to a cause other than a defective memory module, e.g., a defective memory controller.

If a parity error is found, a halt 102005 occurs, and the error address will be loaded into the violation register of the memory protect logic. It is accessible by programming an LIA 05 or LIB 05 instruction. The RTE-IV Parity Error Module PERR4 loads the A-register with the physical page number and the B-register with the logical parity error address.

The parity indicator will light and remain lit until PRESET is pressed. Switch A1S1 on the CPU can enable or disable the halt.

Note

Soft parity errors cause a message to be displayed giving the logical parity error address and the DMS status register contents at the time of interrupt.

MEMORY-STATUS, VIOLATIONS, PARITY ERRORS (Cont'd)

RTE-6/VM PARITY ERROR MESSAGES

HARD PARITY ERROR MESSAGE	(reproducible):
PE PG# nnnnn BAD	(physical page # of parity error)
ABE aaaaaa bbbbbb e	(A,B, and E registers)
XYO xxxxxx yyyyyy o	(X,Y, and O registers)
PE ppppp mmmmmm ppppp ABORTED	(program name and logical memory address of parity error)
SOFT PARITY ERROR MESSAGE	(not reproducible):
SOFT PE PG# nnnnn	(physical page # of parity error)
ABE aaaaaa bbbbbb e	(A,B, and E registers
XYO xxxxxx yyyyyy o	(X,Y, and O registers)
PE ppppp mmmmmm	(program name and logical memory address of parity error)

INTERRUPT AND I/O CONTROL SUMMARY

INST	S.C. 00	S.C. 01	S.C. 02	S.C. 03
STC	NOP	NOP	Prepares DCPC channel 1 to receive and store the block length in 2's complement form.	Prepares DCPC channel 2 to receive and store the block length in 2's complement form.
CLC	Clears all Control FF's from S.C. 06 and up; effectively turns off all I/O devices.	NOP	Prepares DCPC channel 1 to receive and store the direction of data flow and the starting memory address.	Prepares DCPC channel 2 to receive and store the direction of data flow and the starting memory address.
STF	Turns on interrupt system.	STO sets overflow bit.	NOP	NOP
CLF	Turns off interrupt system except power fail (S.C. 04) and parity error (S.C. 05).	CLO clears overflow bit.	NOP	NOP
SFS	Skip if interrupt system is on.	SOS	NOP	NOP
SFC	Skip if interrupt system is off.	SOC	NOP	NOP
LIA/B	Loads A/B register with all zeros. (Equivalent to CLA/B instruction.)	Loads display register contents into A/B register.	Loads present contents of DCPC channel 1 word count register into A/B register.	Loads present contents of DCPC channel 2 word count register into A/B register.
MIA/B	Equivalent to a NOP.	Merges display register contents into A/B register.	Merges present contents of DCPC channel 1 word count register into A/B register.	Merges present contents of DCPC channel 2 word count register into A/B register.
OTA/B	NOP	Outputs A/B register contents into display register.	1. Outputs to DCPC channel 1 the block length in 2's complement form (previously prepared by an STC 02 instruction). 2. Outputs to DCPC channel 1 the direction of data flow and the starting memory address (previously prepared by a CLC 02 instruction).	1. Outputs to DCPC channel 2 the block length in 2's complement form (previously prepared by an STC 03 instruction). 2. Outputs to DCPC channel 2 the direction of data flow and the starting memory address (previously prepared by a CLC 03 instruction).

INTERRUPT AND I/O CONTROL SUMMARY

S.C. 04	S.C. 05	S.C. 06	S.C. 07	S.C. 10-77
Re-initializes power-fail logic and restores interrupt capability to lower priority functions.	Turns on memory protect.	Sets Control FF on DCPC channel 1 (activates DMA).	Sets Control FF on DCPC channel 2 (activates DMA).	Sets PCA Control FF and turns on device on channel specified by S.C.
Re-initialize power-fail logic and restores interrupt capability to lower priority functions.	NOP	Clears Control FF on DCPC channel 1 (reestablishes priority with STF; does not turn off DCPC).	Clears Control FF on DCPC channel 2 (reestablishes priority with STF; does not turn off DCPC).	Clears PCA Control FF and turns off device.
Flag FF sets automatically when power comes up. (No program control possible.)	Turns on parity error interrupt capability.	Aborts DCPC channel 1 data transfer.	Aborts DCPC channel 2 data transfer.	Sets PCA Flag FF.
Flag FF clears automatically when power fail occurs. (No program control possible.)	Turns off parity error interrupt capability and clears violation register bit 15.	Clears Flag FF on DCPC channel 1.	Clears Flag FF on DCPC channel 2.	Clears PCA Flag FF.
NOP	Skip if Dynamic Mapping System (DMS) interrupt.	Tests if DCPC channel 1 data transfer is complete.	Skip if DCPC channel 2 data transfer is complete.	Skip if I/O channel Flag FF is set.
Skip if power fail has occurred.	Skip if memory protect interrupt.	Tests if DCPC channel 1 data transfer is still in progress.	Skip if DCPC channel 2 data transfer is still in progress.	Skip if I/O channel Flag FF is clear.
Loads contents of central interrupt register (S.C. of last interrupting device) into least-significant bits of A/B register.	Loads contents of violation register into A/B register: Bit 15 = 1 = PE Bit 15 = 0 = MPV	Loads A/B register with all ones. (Equivalent to CCA/CCB instruction.)	Loads A/B register with all ones. (Equivalent to CCA/CCB instruction.)	Loads contents of PCA data buffer into A/B register.
Merges contents of central interrupt register into least-significant bits of A/B register.	Merges contents of violation register into A/B register.	Same as LIA/B 06 above.	Same as LIA/B 07 above.	Merges contents of PCA data buffer into A/B register.
NOP	Outputs first address of unprotected memory to fence register.	Outputs to DCPC channel 1 the S.C. of I/O channel. Specify STC after each word; CLC after block.	Outputs to DCPC channel 2 the S.C. of I/O channel. Specify STC after each word; CLC after block.	Outputs data from A/B register into PCA data buffer.

DIAGNOSTIC REFERENCE TABLES

DIAGNOSTIC REFERENCE TABLE FOR HP 24396 PRODUCTS

DSN	DESIGNATION	REQ MEM SIZ	SINGLE FILE PAPER TAPE			MULTIPLE FILES						
			BINARY	D.C.	MANUAL	PAPER TAPE BINARIES	D.C.	2644/45 CARTRIDGE BINARIES	D.C.	DISC/MAG TAPE BINARIES	D.C.	MANUAL VOL.
000200	DIAGNOSTIC CONFIGURATOR	4K	24296-60001	1627	02100-90157	24296-60001	1627	THE DIAGNOSTIC CONFIGURATOR IS THE FIRST FILE ON EVERY CARTRIDGE TAPE, DISC AND MAG TAPE.				
101100	MEMORY REFERENCE INSTRUCTION GROUP	4K	24315-16001	1624	02100-90218							
101001	ALTER SKIP INSTRUCTION GROUP	4K	24316-16001	1431	02100-90211							
101002	SHIFT ROTATE INSTRUCTION GROUP	4K	24317-16001	1431	02100-90212	24396-12001	1644					
102200	CORE MEMORY (2100/16/15/14)	4K	24323-16001	1624	02100-90219							
102104	SEMICONDUCTOR MEMORY (21MX)	4K	24395-16001	1644	24395-90001							
101004	EAU INSTRUCTION GROUP	4K	24319-16001	1431	02100-90214							24396-14001
101207	FLOATING POINT INSTRUCTION GROUP	4K	24320-16001	1551	24320-90001	24396-12002	1901	24396-13301	1901			
102305	MEM PROT/PARITY ERROR (2100/21MX)	4K	12892-16001	1705	12892-90005							
101206	POWER FAIL AUTO RESTART	4K	24321-16001	1635	02100-90216							
141203	I/O INSTR-GROUP I/O CHANNEL EXTENDER	8K	24318-16001	1810	02100-90213							
143300	GENERAL PURPOSE REGISTER	4K	24391-16001	1813	24391-90001	24396-12003	1901					
101220	DIRECT MEMORY ACCESS (2100/21MX)	4K	24322-16002	1705	24322-90002							
101011	EXT. INSTR. GROUP (INDEX)	4K	12943-16002	1432	12943-90004							
101112	EXT. INSTR. GROUP (WORD,BYTE,BIT)	4K	12943-16001	1728	12943-90004							
101110	2100 FAST FORTRAN PACKAGE	4K	12907-16003	1632	12907-90003							
101213	M/E-Series FAST FORTRAN PACKAGE 1	4K	12977-16004	1822	12977-90002			24396-13302	1926			
101114	M/E-Series FAST FORTRAN PACKAGE 2	4K	12977-16005	1632	12977-90002							
101121	F-Series FPP/SIS/FFP	16K	12740-16001	1926	12740-90004							
102103	MEMORY EXPANSION UNIT	16K	12929-16001	1830	12929-90003							24396-14002
102006	SEMICOND MEMORY, MICROCODED F.21MX	4K	24395-16002	1644	24395-90003							
103301	TIME BASE GENERATOR	4K	12539-16001	1830	12539-90011					7900 DISC:		
103115	12936 PRIVILEGED INTERRUPT	4K	12936-16001	1643	12936-90003					24396-13001	1928	
103105	12908/12978 WCS 256 W.	4K	12908-16001	1502	12908-90013			24396-13303	1830			
103023	13197 WCS 1024 W.	4K	13197-16002	1640	13197-90002					7905 DISC:		
103207	12889 HARDWIRED SERIAL INTERFACE	4K	24335-16001	1717	02100-90169					24396-13101	1928	
103122	59310 INTERF. BUS INTERFACE	4K	59310-16001	1728	59310-90061							
103003	12587 ASYN. DATA SET INTERF.	8K	12587-16001	1552	12587-90013					7970B MAG TAPE:		
103110	12920 ASYN. MULTIPLEXER (DATA)	4K	12920-16001	1805	12920-90009					24396-13501	1928	
103011	12920 ASYN. MULTIPLEXER (CNTL)	4K	12920-16002	1444	12920-90009					7970E MAG TAPE:		
103012	12621 SYNC. DATA SET (RECEIVE)	4K	12621-16001	1532	12621-90008					24396-13601	1928	
103013	12622 SYNC. DATA SET (SEND)	4K	12622-16001	1532	12622-90006			24396-13304	1928			
103116	12967 SYNC. INTERFACE	4K	12967-16001	1438	12967-90001							
103017	12966 ASYN. DATA SET	8K	12966-16001	1519	12966-90004							24396-14003
103121	12968 ASYN. COMM. INTERFACE	4K	12968-16001	1602	12968-90003							
103024	12821 ICD DISC INTERFACE	8K	12821-16001	1928	12821-90002							
105102	2607 LINE PRINTER	4K	24340-16001	1446	12987-90004							
145103	2613/17/18 LINE PRINTER	4K	02618-16001	1633	02618-90006							
105106	2631 PRINTER	8K	02631-16001	1913	02631-90906							
105107	2635 PRINTING TERMINAL	8K	02635-16001	1913	02635-90906			24396-13305	1913			
105105	2608 LINE PRINTER	8K	02608-16001	1835	02608-90906							
105104	9866 LINE PRINTER	4K	12998-16001	1541	12998-90001							
111104	12732 FLEXIBLE DISC SUBSYSTEM	8K	12732-16003	1708	12732-90003							
151302	7900/01 CARTRIDGE DISC	8K	12960-16001	1805	12960-90003							
151403	7905/06/20/25 DISC	16K	12962-16001	1805	12962-90001			24396-13306	1901			
104117	92900 TERMINAL SUBSYS (3070,40280)	8K	92900-16001	1814	92900-90003							
112100	9-TRACK MAG TAPE (7970, 13181/3)	8K	13181-16001	1629	13181-90095							
112102	7/9 TRACK MAG TAPE (13184 INTF)	8K	13184-16001	1629	13184-90008							
010000	DIAGNOSTIC CROSS LINK	4K	24296-16003	1627	02100-90157							24396-14004
011000	7900/05/20 DISC INITIALIZATION	4K	24296-16002	1627	02100-90157							
146200	PAPER TAPE READER-PUNCH	4K	12597-16001	1725	12597-90031							
107000	DIG. PLOTTER INTERFACE (CALCOMP)	4K	12560-16001	1540	12560-90029			24396-13307	1901			
113100	2892 CARD READER	4K	12924-16001	1537	12924-90006							
113001	2894 CARD READER PUNCH	8K	12989-16001	1728	12989-90001							
104003	TELEPRINTER	4K	12531-16001	1509	12531-90042							
104007	2615 VIDEO TERMINAL	4K	24351-16001	1347	02615-90002							
103006	12909B PROM WRITER	4K	24360-16001	1420	24360-90001							

DIAGNOSTIC REFERENCE TABLES (Cont'd)

DIAGNOSTIC REFERENCE TABLE FOR 24998 PRODUCTS

DSN	DESIGNATION*	REQ MEM SIZ	SINGLE FILE PAPER TAPE			MULTIPLE FILES	
			BINARY	D.C.	MANUAL	2645 CARTRIDGE BINARIES	D.C.
000200	DIAGNOSTIC CONFIGURATOR	4K	24296-60001	1627	02100-90157	THE DIAGNOSTIC CONFIGURATOR IS THE FIRST FILE ON EVERY CARTRIDGE TAPE.	
101100	MEMORY REFERENCE INSTRUCTION GROUP	4K	24315-16001	1624	02100-90218		
101001	ALTER SKIP INSTRUCTION GROUP	4K	24316-16001	1431	02100-90211		
101002	SHIFT ROTATE INSTRUCTION GROUP	4K	24317-16001	1431	02100-90212		
102104	SEMICONDUCTOR MEMORY (21MX)	4K	24395-16001	1644	24395-90001		
101004	EAU INSTRUCTION GROUP	4K	24319-16001	1431	02100-90214		
101207	FLOATING POINT INSTRUCTION GROUP	4K	24320-16001	1551	24320-90001		
102305	MEM PROT/PARITY ERROR (2100/21MX)	4K	12892-16001	1705	12892-90005	24998-13301	1926
101206	POWER FAIL AUTO RESTART	4K	24321-16001	1635	02100-90216		
141203	I/O INSTR GROUP I/O CHANNEL/EXTENDER	8K	24318-16001	2226	02100-90213		
143300	GENERAL PURPOSE REGISTER	4K	24391-16001	1813	24391-90001		
101220	DIRECT MEMORY ACCESS (2100/21MX)	4K	24322-16002	1705	24322-90002		
101011	EXT. INSTR. GROUP (INDEX)	4K	12943-16002	1432	12943-90004		
101112	EXT. INSTR. GROUP (WORD,BYTE,BIT)	4K	12943-16001	1728	12943-90004		
101213	M/E-Series FAST FORTRAN PACKAGE 1	4K	12977-16004	1822	12977-90002		
101114	M/E-Series FAST FORTRAN PACKAGE 2	4K	12977-16005	1632	12977-90002		
101121	F-Series FPP/SIS/FFP	16K	12740-16001	1926	12740-90004		
102103	MEMORY EXPANSION UNIT	16K	12929-16001	1830	12929-90003		
102006	SEMICOND MEMORY, MICROCODED F.21MX	4K	24395-16002	1644	24395-90003	24998-13302	1926
103301	TIME BASE GENERATOR	4K	12539-16001	1830	12539-90011		
103023	13197 WCS 1024 W.	4K	13197-16002	1640	13197-90002		
103110	12920 ASYN. MULTIPLEXER (DATA)	4K	12920-16001	1805	12920-90009		
103011	12920 ASYN. MULTIPLEXER (CNTL)	4K	12920-16002	1444	12920-90009		
103012	12621 SYNC. DATA SET (RECEIVE)	4K	12621-16001	1532	12621-90008		
103013	12622 SYNC. DATA SET (SEND)	4K	12622-16001	1532	12622-90008		
103116	12967 SYNC. INTERFACE	4K	12967-16001	1438	12967-90001	24998-13303	1928
103017	12966 ASYN. DATA SET	8K	12966-16001	1519	12966-90004		
104003	TELEPRINTER	4K	12531-16001	1509	12531-90042		
103207	12889 HARDWIRED SERIAL INTERFACE	4K	24335-16001	1717	02100-90169		
103122	59310 INTERF. BUS INTERFACE	4K	59310-16001	1728	59310-90061		
103024	12821 ICD DISC INTERFACE	8K	12821-16001	1928	12821-90002		
105102	2607 LINE PRINTER	4K	24340-16001	1446	12987-90004		
145103	2613/17/18 LINE PRINTER	4K	02618-16001	1633	02618-90006		
105106	2631 PRINTER	8K	02631-16001	1913	02631-90906	24998-13304	1913
105107	2635 PRINTING TERMINAL	8K	02635-16001	1913	02631-90906		
105105	2608 LINE PRINTER	8K	02608-16001	1835	02608-90906		
105104	9866 LINE PRINTER	4K	12996-16001	1541	12996-90001		
111104	12732 FLEXIBLE DISC SUBSYSTEM	8K	12732-16003	1708	12732-90003		
151302	7900/01 CARTRIDGE DISC	8K	12960-16001	1805	12960-90003	24998-13305	1822
151403	7905/06/20/25 DISC	16K	12962-16001	1805	12962-90001		
104117	92900 TERMINAL SUBSYS (3070,40280)	8K	92900-16001	1814	92900-90003		
112100	9-TRACK MAG TAPE (7970, 13181/3)	8K	13181-16001	1629	13181-90095		
146200	PAPER TAPE READER-PUNCH	4K	12597-16001	1725	12597-90031		
113100	2892 CARD READER	4K	12924-16001	1537	12924-90006	24998-13306	1901
010000	DIAGNOSTIC CROSS LINK	4K	24296-16003	1627	02100-90157		
011000	7900/05/20 DISC INITIALIZATION	4K	24298-16002	1627	02100-90157		

Note: Part no. 24998-14002 consists of the 6 cartridge tapes 24998-13301, 24998-13302, 24998-13303, 24998-13304, 24998-13305 and 24998-13306 plus all manuals listed in the table.

*The diagnostics and control programs listed in this reference table are stored on the appropriate media in the sequence specified by the table. This does not imply that a specific system delivered to a user is compatible with all the hardware listed in the table.

DIAGNOSTIC OPERATING PROCEDURES

The diagnostics listed should be executed in the order given.

The diagnostic serial number (DSN) is contained in memory location 126 (octal) of the program.

MEMORY REFERENCE INSTRUCTIONS DIAGNOSTIC

Paper Tape Binary 24315-16001

In order for the diagnostic to run, the HLT instruction must work. To check the HLT (and RUN) instructions, toggle-in and single step thru the following program beginning from memory location 10.

ADDRESS	CONTENTS	MNEMONIC		
10	102501	LP0	LIA	1
11	102000		HLT	0
12	102601		OTA	1
13	024010		JMP	LP0

1. Load diagnostic.
2. P-Reg = 100_8; S-Reg = 0.
3. Press PRESET, RUN. HALT 102077. (Refer to listing for HALT 10200_8.)
4. Switch option:
   Bit 12 — Loop on diagnostic.
5. Restart, P-Reg = 130_8, PRESET, RUN.

DIAGNOSTIC OPERATING PROCEDURES (CONT)

ALTER-SKIP INSTRUCTIONS DIAGNOSTIC

Paper Tape Binary 24316-16001. Date Code 1431.

1. Load diagnostic.
2. P-Reg = 100_8; S-Reg = Switch options.
3. Press PRESET, RUN.
4. Switch options:
   Bit 0 — Loop on failing instruction. HALT 102076 then press RUN.
   Bit 12 — Loop on diagnostic.

SHIFT-ROTATE INSTRUCTIONS DIAGNOSTIC

Paper Tape Binary 24317-16001

1. Load diagnostic.
2. P-Reg = 100_8; S-Reg = Switch options.
3. Press PRESET, RUN.
4. Switch options:
   Bit 0 — Loop on failing instruction. HALT 102076 then press RUN.
   Bit 12 — Loop on diagnostic.

EXTENDED ARITHMETIC INSTRUCTIONS DIAGNOSTIC

Paper Tape Binary 24319-16001. Date Code 1431.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. P-Reg = 100_8; S-Reg = Switch options.
4. Press PRESET, RUN.
5. Switch options:

BITS	MEANING WHEN SET
0-5	Reserved.
6	Set to suppress the number generator at the beginning of each instruction test. Clear to generate new arguments for each execution of an instruction test.
7	Suppress the indirect addressing portions of the instruction tests.
8	Reserved.
9	Break out of any test which finds an error.
10	Suppress non-error messages.
11	Suppress error messages.
12	Clear to halt the program at the end of a pass. (MDR = 102077_8) Set to loop on diagnostic.
13	Repeat current test (with new arguments if bit 6 is OFF).
14	Suppress error HALTS.
15	Halt the program at the end of a test. (102076_8 and A- and B-registers contain the octal test number.)

DIAGNOSTIC OPERATING PROCEDURES (CONT)

2100-21MX FLOATING POINT DIAGNOSTIC

Paper Tape Binary 24320-16001. Date Code 1551.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. P-Reg = 100_8; S-Reg = Switch options.
4. Press PRESET, RUN.
5. Restart, P-Reg = 2000_8.
6. Switch options:

BIT	MEANING IF SET	
15	Halt (102076) at the end of each test; the A-Register will contain the octal equivalent of the test just completed.	
14	Suppress Error Halts.	
13	Repeat last test-executed (loop on test).	
12	Repeat all selected tests after diagnostic run is complete without halting. The end of pass message "PASS XXXXXX" will be output before looping.	
11	Suppress error messages.	
10	Suppress non-error messages.	
9	Abort the current diagnostic execution and halt (102075); user may at this time specify a new set of tests in the A/B register, clear bit 9 of the Switch Register and press RUN.	
	A-REG BIT	**IF SET WILL EXECUTE**
	0	TST00 — FLOATING POINT TO INTEGER
	1	TST01 — INTEGER TO FLOATING POINT
	2	TST02 — FLOATING POINT ADD
	3	TST03 — FLOATING POINT SUBTRACT
	4	TST04 — FLOATING POINT MULTIPLY
	5	TST05 — FLOATING POINT DIVIDE
	6-15	NOT SIGNIFICANT
8-0	Reserved	

DIAGNOSTIC CONFIGURATOR (24296-60001)

Manual P/N 02100-90157

1. Load Diagnostic Configurator.
2. To execute Pretest before configuration:
   a. Set P-Reg = 2
   b. Set S-Reg:
      Bits 5-0 = SC of device to execute basic I/O test
      Bit 12 = Set to loop on Pretest. (Press HALT to exit loop.)

      NOTE

      Automatic configuration may also be selected at this time.

   c. Press PRESET, RUN. HALT 102077
3. To start configuration:
   a. Set P-Reg = 100
   b. Set S-Reg as indicated in Conversational or Automatic Configuration procedure.

CONVERSATIONAL CONFIGURATION

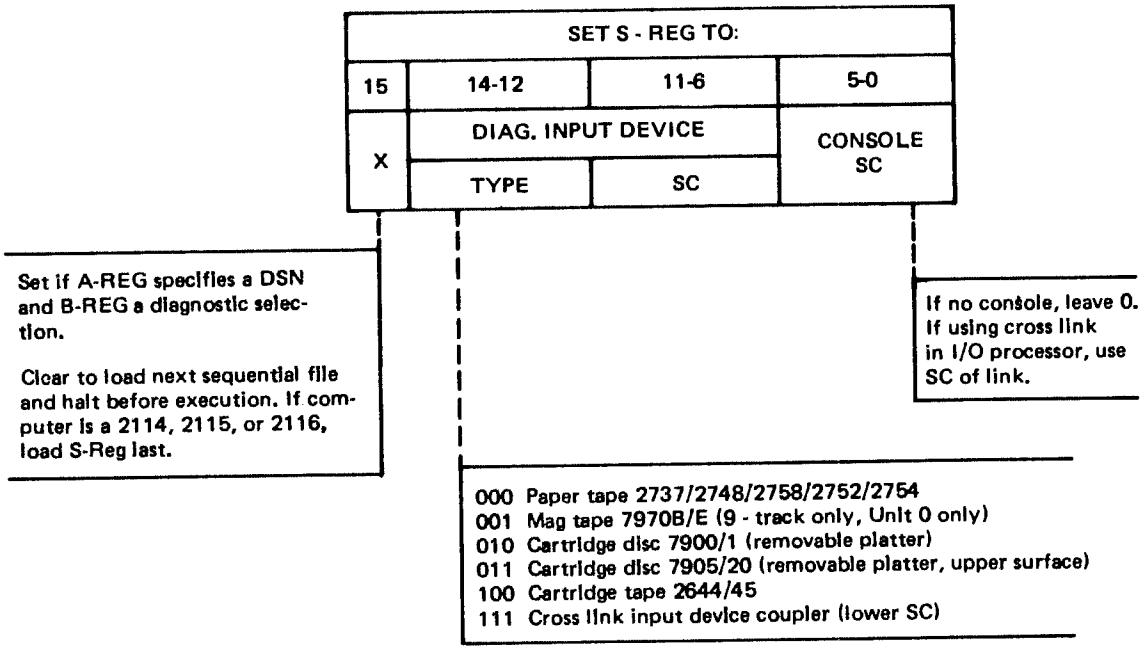
1. Set S-Reg:
   Bits 5-0 = Console SC
   Bits 15-6 = 0
2. Press PRESET, RUN. (Messages printed on the console.)

   NOTE

   If S- or A-Reg is flashing, memory protect has failed. Press HALT, PRESET, RUN.

AUTOMATIC CONFIGURATION

1. Set S-Reg as follows:



2. Press PRESET, RUN.

DIAGNOSTIC CONFIGURATOR HALT CODES

HALT CODE	REASON/RESPONSE
102000- 102004	Manual Configuration input halt. (Also Halt 102071)
102010	Illegal select code (< 10) for diagnostic input device or console was chosen. Restart at P = 100 for configuration or P = 2 for Pretest. (If halt occurs during disc initialization, there was no console specified and program cannot be run.)
102011	Checksum error during the loading of a binary file.
102022	Conversational or Automatic Configuration was selected and the console interface type could not be determined by the configurator from the select code input to the S-REG.
102033	The disc boot has been loaded and executed. During execution the boot could not find the DMA/DCPC control word in upper memory (for the select code). Load A-REG bits 5-0 with the disc select code and press RUN.
102044	Disc did not respond with a flag. Restart program.
102045	Disc not ready or a hardware failure has occurred. Press RUN to try operation again.
102055	Address violation during the loading of a binary file.
102066	Pretest failed. Refer to M-REG for memory location in Pretest and appendix D in the Diagnostic Configurator Reference Manual for program listing.
102077	End-of-operation.
106070	"End-of-Files" was reached during a diagnostic load operation. The specified DSN was not found. If a different diagnostic(s) selection on the current tape is desired: a. Load the A-REG with a new DSN. b. Clear the B-REG if sequential execution is not desired, otherwise set B-REG to appropriate sequential selection. c. Ready input device, set P-REG = 120, press PRESET and RUN. If the diagnostic(s) originally selected is on a different tape: a. Load the new tape (If a 2644/45 cartridge tape, manually file forward over the configurator.) b. If sequential execution was selected (B ≠ 0) set P-REG = N6500. c. Ready input device, press PRESET and RUN.
106071*	No console was specified during configuration. Press RUN to return to the program — but it should be noted that the request is in error.
106072*	No diagnostic input device was specified during Manual or Automatic configuration.

DIAGNOSTIC CONFIGURATOR HALT CODES (Cont'd)

HALT CODE	REASON/RESPONSE
106073*	This halt has two meanings as follows: a. During a transfer using the I/O processor loader link, an error was encountered. Restart the loader program in the I/O processor. b. The diagnostic memory size exceeded the available space.
106074*	Error on diagnostic input device (paper tape, magnetic tape, cartridge tape, or disc): a. Device not ready; ready device: Press RUN. b. Time-out on long paper tape leader: Press RUN. c. Incorrect SC or device type specified: Reconfigure Configurator. d. Data error on device: Restart loader in Configurator by setting P= 120, A-REG to DSN, and B-REG to serial execution.
106075*	All unused memory locations in the first 4K are loaded with halts 106075.
106076*	An output request to the line printer has been generated and the line printer was not ready. Ready the line printer and press RUN.
106077*	Trap cell halt. M-REG = trap cell address.

*These halts can occur during diagnostic execution.

BOOTSTRAP LOADER

```
20   1037xx   STC XX,C   }
21   1023xx   SFS XX     }  Read 1st char.
22   024021   JMP *-1    }
23   1025xx   LIA XX
24   001727   ALF, ALF      Pack
25   1037xx   STC XX     }
26   1023xx   SFS XX     }  Read 2nd char.
27   024026   JMP *-1    }
30   1024xx   MIA XX     }
31   170001   STA,1,I
32   006004   INB
33   024020   JMP 20B
```

xx = Paper tape reader select code.

Toggle in program, B-reg = *77700, S.A. = 20, load special bootstrap tape in reader, enable protected loader area. RUN. Press HALT.

***Loader Starting Addresses**

MEMORY SIZE	STARTING ADDRESS OF LOADER		
	For Paper Tape	For FH Disc	For MH Disc
4K	07700		
8K	17700	17760	17750
12K	27700	27760	27750
16K	37700	37760	37750
24K	57700	57760	57750
32K	77700	77760	77750

BOOTSTRAP LOADER GENERATOR (A008-22009)

BOOTSTRAP LOADER GENERATOR (A008-22009)
Load tape, S.A. = 2, Sw reg = SC of TTY, RUN. Follow directions printed on TTY.

LOADER LOADER (24353)

A. STARTUP FROM SCRATCH

1. Enter instructions shown in table 13-1 via switch register.
2. Place paper tape in reader (be it photoreader or teletype); set P to 3000_8.
3. Set switch register to indicate desired loader and select codes per table 13-2.
4. Press PRESET (External and Internal, if applicable), LOADER ENABLE, and RUN. Tape will be read in and new loader placed into top locations of memory.

B. IF PAPER TAPE LOADER EXISTS

Unwind paper tape to first section of blank tape and place paper tape into reader at this blank area. Load tape using existing paper tape loader. Set P to 100_8 and proceed as in steps 3 and 4 above.

LOADER LOADER (Cont'd)

C. PROGRAM HALTS

Memory Data	Meaning
102077	Program completed successfully.
102001	Select code is less than 10_8 (bad select code displayed in A-reg).
102002	Loader number not implemented yet.
102003	An instruction was not stored correctly – possibly caused by not enabling the loader.

After any program halt, the program may be restarted by resetting the switch register (if necessary) and pressing PRESET (External and Internal, if applicable), LOADER ENABLE, and RUN.

Instructions Entered Via Switch Register

Memory Location	Contents		Source Code	
2765	. . .	READ	BSS	1
2766	002500		CLA,CLE	
2767	1037XX		STC	RDR,C
2770	1023XX		SFS	RDR
2771	026770		JMP	*-1
2772	001626		ELA,ELA	
2773	001626		ELA,ELA	
2774	1024XX		MIA	RDR
2775	002040		SEZ	
2776	126765		JMP	READ,I
2777	026767		JMP	READ+2
3000	016765	START	JSB	READ
3001	073003		STA	*+2
3002	016765		JSB	READ

XX = paper tape reader select code

LOADER LOADER (CONT)

Switch Register Options

Loader	Switch Register		
	Bits 15-12	Bits 11-6	Bits 5-0
BBL	0000	Not used	Paper Tape Reader Select Code
BBDL	0001	Fixed-head Disc Select Code	Paper Tape Reader Select Code
BMDL-7900	0010	Moving-head Disc Select Code	Paper Tape Reader Select Code
BMDL-2883	0011	Moving-head Disc Select Code	Paper Tape Reader Select Code
BMDL-2870	0100	Moving-head Disc Select Code	Paper Tape Reader Select Code
BMDL-7905	0110	Moving-head Disc Select Code	Paper Tape Reader Select Code
MTRS	0101	Magnetic Tape Select Code	Not Used
ACCESS-IOP	0111	I.C.K. Select Code	Paper Tape Reader Select Code
BBL-2644	1000	HP 12966/8 Interface Select Code	Not Used
ABS MAG TP	1001	Magnetic Tape Select Code	Not Used
BBL-SCE/1	1010	I.F.C. Select Code	Not Used

Note: For interfaces with two select codes, the lower numbered code must be used.

BINARY LOADER

```
                ASMB,A,B,L,T
17700                ORG 17700B   DEPENDS ON CORE SIZE
17700 107700 LOAD    CLC 0,C      TURN OFF ALL DEVICES
17701 063770         LDA STAI
17702 106501         LIB 1        CHECK FOR OPTIONS
17703 004010         SLB          S-REG(0)=1?
17704 002400         CLA          YES: CHECKSUM OPTION
17705 006020         SSB          S-REG(15)=1?
17706 063771         LDA CPAI     YES: VERIFY CORE OPT.
17707 073736         STA OPTI     STORE OPTIONAL INST.
17710 006401         CLB,RSS      BYPASS EOT CHECK
17711 067773 CONT    LDB CM11     B=-11 FOR EOT CHECK
17712 006006 EOTCH   INB,SZB      END OF TAPE?
17713 027717         JMP LD1      NO: GET NEXT CHAR
17714 107700         CLC 0,C      TURN OFF ALL DEVICES
17715 102077         HLT 77B      END OF TAPE
17716 027700         JMP LOAD     START NEXT TAPE
17717 017762 LD1     JSB CHAR     GET A CHARACTER
17720 002003         SZA,RSS      IS IT THE WORD COUNT?
17721 027712         JMP EOTCH    NO: CHECK FOR EOT
17722 003104         CMA,CLE,INA   (2'S COMP WORD COUNT)
17723 073774         STA COUNT    SAVE WORD COUNT
17724 017762         JSB CHAR     SKIP NEXT CHAR
17725 017753         JSB WORD     GET STARTING ADDRESS
```

BINARY LOADER (Cont'd)

```
  17726 070001          STA 1         INITIALIZE CHECKSUM IN B
  17727 073775          STA ADDRS     ALSO IN ADDRESS
  17730 063775  LD2     LDA ADDRS     CHECK FOR ADDR>=LOADER
  17731 043772          ADA MAXAD
  17732 002040          SEZ           E-REG=0  OK
  17733 027751          JMP ADERR     BAD ADDRESS
  17734 017753          JSB WORD      NEXT WORD IN A-REG
  17735 044000          ADB 0         CONTINUE CHECKSUM
  17736 000000  OPTI    NOP           STA, CPA, OR NOP
  17737 002101          CLE,RSS       NORMALLY BYPASS HALT
  17740 102000          HLT 0B        DID NOT COMPARE
  17741 037775          ISZ ADDRS     INCREMENT ADDRESS
  17742 037774          ISZ COUNT     UPDATE WORD COUNT
  17743 027730          JMP LD2       NEXT WORD
  17744 017753          JSB WORD      END OF RECORD
  17745 054000          CPB 0         COMPARE CHECKSUMS
  17746 027711          JMP CONT      LOOK FOR END OF TAPE
  17747 102011          HLT 11B       CHECKSUM ERROR
  17750 027700          JMP LOAD      START OVER
  17751 102055  ADERR    HLT 55B      ILLEGAL ADDRESS
  17752 027700          JMP LOAD      START OVER
  17753 000000  WORD    NOP           READ ONE BYTE
  17754 017762          JSB CHAR      FIRST BYTE
  17755 001727          ALF,ALF       POSITION BYTE
  17756 073776          STA TEMP      SAVE IT
  17757 017762          JSB CHAR      SECOND BYTE
  17760 033776          IOR TEMP      MERGE BYTES
  17761 127753          JMP WORD,I    RETURN WITH WORD
  17762 000000  CHAR    NOP           READ BYTE FROM READER
‡17763 1037XX           STC RDR,C     INITIATE READ
‡17764 1023XX           SFS RDR       ** CHECK THESE IF  **
  17765 027764          JMP *-1       ** LOADER BOMBED   **
‡17766 1025XX           LIA RDR       GET BYTE
  17767 127762          JMP CHAR,I    HAVE BYTE A-REG(0-7)
  17770 173775  STAI    STA ADDRS,I   HAVE OPT1 FOR NORMAL LOAD
  17771 153775  CPAI    CPA ADDRS,I   OPT1 FOR VERIFY OPTION
†17772 1X0100   MAXAD   ABS -LDR      LOADER ADDRESS (2'S COMP)
  17773 177765  CM11    DEC -11       EOT CHAR COUNT
  17774 000000  COUNT   BSS 1         WORD COUNT
  17775 000000  ADDRS   BSS 1         ADDRESS LOCATION
  17776 000000  TEMP    BSS 1         HOLDS FIRST BYTE
  00013         RDR     EQU 13B       READER SELECT CODE
  17700         LDR     EQU 17700B    LOADER ADDRESS
*CHECK 17764,17765 IF LOADER IS BOMBED
*17763,17764,17766 DEPEND ON READER SELECT CODE
*17772 DEPENDS ON CORE SIZE
                      END
```

† X = Opcode varies depending on size of memory (see table at end of Disc Loader).

‡ XX = Select code of paper tape reader.

DISC LOADER

```
                ASMB,A,B,L,T
  17700         ORG 17700B  DEPENDS ON CORE SIZE
  17700 107700  START CLC 0,C
  17701 002401        CLA,RSS
  17702 063726  CONT  LDA M.17  FEED FRAME COUNTER
  17703 006700        CLB,CCE   SET E TO READ BYTE
  17704 017742        JSB READ  GET # OF CHAR
  17705 007306        CMB,CCE,INB,SZB   (2'S COMP)
  17706 027713        JMP *+5   NON-ZERO BYTE
  17707 002006        INA,SZA   FEED FRAME COUNTER
  17710 027703        JMP *-5
  17711 102077        HLT 77B   END OF TAPE
```

DISC LOADER (Cont'd)

```
 17712 027700          JMP START
 17713 077754          STB WD.CT # WORDS IN RECORD
 17714 017742          JSB READ  GET FEED FRAME
 17715 017742          JSB READ  GET ADDRESS
 17716 074000          STB 0     INITIATE CHECKSUM
 17717 077757          STB ADDR
 17720 067757  CHECK   LDB ADDR
 17721 047755          ADB MAXAD CHECK ADDR BELOW LOADER
 17722 002040          SEZ       E-1 OK
 17723 027740          JMP HLT55 ADDR>=LOADER
 17724 017742          JSB READ  GET NEXT WORD
 17725 040001          ADA 1     CONTINUE CHECKSUM
 17726 177757  M.17    STB ADDR,I ALSO USED AS CONSTANT
 17727 037757          ISZ ADDR
 17730 000040          CLE
 17731 037754          ISZ WD.CT
 17732 027720          JMP CHECK
 17733 017742          JSB READ
 17734 054000          CPB 0
 17735 027702          JMP CONT
 17736 102011          HLT 11B   CHECKSUM ERROR
 17737 027700          JMP START
 17740 102055  HLT55   HLT 55B   ADDRESS >= LOADER
 17741 027700          JMP START
 17742 000000  READ    NOP       E=0 READ WORD, =1 BYTE
 17743 006600          CLB,CME   E-REG BYTE POINTER
 17744 103713          STC RDR,C  START READER
 17745 102313          SFS RDR    ** CHECK THESE IF  **
 17746 027745          JMP *-1    ** LOADER BOMBED   **
 17747 107413          MIB RDR,C  GOT BYTE
 17750 002041          SEZ,RSS
 17751 127742          JMP READ,I
 17752 005767          BLF,CLE,BLF
 17753 027744          JMP *-7
 17754 000000  WD.CT    NOP       WORD COUNT
*17755 1X0100  MAXAD   ABS -LDR  LOADER ADDR (2'S COMP)
 17756 0200XX  DMA.C   OCT 0200XX DISC SC (DATA CHANNEL)
 17757 000000  ADDR    NOP
 17760 107700          CLC 0,C
 17761 063756          LDA DMA.C
 17762 102606          OTA DMA.6 PROG WORD
 17763 002700          CLA,CCE
 17764 102615          OTA DISC+1 DISC TRACK 0,SECTOR 0
 17765 001500          ERA
 17766 102602          OTA DMA.2  CORE ADDRESS
 17767 063777          LDA M.64
 17770 102702          STC DMA.2
 17771 102602          OTA DMA.2  WORD COUNT, BYTE
 17772 103706          STC DMA.6,C
 17773 102714          STC DISC
 17774 067776          LDB JMP.
 17775 074077          STB BP.77  FOR JUMP SELF
 17776 024077  JMP.    JMP BP.77
 17777 177700  M.64    DEC -64    TRANSFER ONE SECTOR
 00013         RDR     EQU 13B    READER SELECT CODE
 17700         LDR     EQU 17700B LOADER ADDRESS
 00014         DISC    EQU 14B    DISC SELECT CODE
 00006         DMA.6   EQU 6B     USE CHANNEL ONE
 00002         DMA.2   EQU 2B
 00077         BP.77   EQU 77B    BASE PAGE (JMP SELF)
  CHECK 17745,17746 IF LOADER IS BOMBED
                       END
```

* 8K = 160100
12K = 150100
16K = 140100
24K = 120100
32K = 100100

BMDL-7900/7901*

Address	Contents	Address	Contents			
x7700	002701	x7740	1023kk			
x7701	063722	x7741	027740			
x7702	002307	x7742	1064kk			
x7703	102077	x7743	002041			
x7704	017735	x7744	127735	y	=	0 select Boot from head 0
x7705	007307	x7745	005767	y	=	1 select Boot from head 2
x7706	027702	x7746	027737			
x7707	077733	x7747	03y000	x	=	2 for 12k, 3 for 16k,
x7710	017735	x7750	002400			4 for 20k, 5 for 24k,
x7711	017735	x7751	1026dd			6 for 28k, 7 for 32k
x7712	074000	x7752	1037dd			
x7713	077734	x7753	067747			
x7714	067734	x7754	1066cc	kk	=	tape input device
x7715	047777	x7755	1037cc			select code
x7716	002040	x7756	1066dd			
x7717	102055	x7757	063776	cc	=	low priority (higher
x7720	017735	x7760	102606			numbered) disc
x7721	040001	x7761	067732			select code
x7722	177734	x7762	106602			
x7723	037734	x7763	1037dd	dd	=	high priority (lower
x7724	000040	x7764	102702			numbered) disc
x7725	037733	x7765	106602			select code
x7726	027714	x7766	013741			
x7727	017735	x7767	1026cc	n	=	5 for 12k, 4 for 16k,
x7730	054000	x7770	1037dd			3 for 20k, 2 for 24k,
x7731	027701	x7771	103706			1 for 28k, 0 for 32k
x7732	102011	x7772	1037cc			
x7733	000000	x7773	1023cc			
x7734	000000	x7774	027773			
x7735	000000	x7775	127717			
x7736	006600	x7776	1200dd			
x7737	1037kk	x7777	1n0100			

*This is not usable with an RTE-II system that has a Grandfather disc (Halt 102074).

MTRS LOADER

```
                ASMB,A,B,L,T,C      MTRS ABSOLUTE PROTECTED LOADER
17700 063775          LDA SLORW      SELECT UNIT 0
17701 102611          OTA CMND        AND
17702 103711          STC CMND,C       REWIND TAPE.
17703 106501          LIB SSW        GET ORDINAL NUMBER OF PROGRAM.
17704 007307          CMB,CCE,INB,SZB,RSS   MAKE < 0, PRESET -E-.
17705 067767          LDB DFALT      USE DEFAULT IF SWREG = 0.
17706 077773          STB PROG#      SAVE FOR COUNTER.
17707 063774  READ    LDA RRF        OUTPUT
17710 102611          OTA CMND        READ COMMAND
17711 102511          LIA CMND          AND
17712 001323          RAR,RAR             TEST
17713 001310          RAR,SLA               FOR REJECT.
17714 027707          JMP READ       REJECTED, KEEP TRYING UNTIL O.K.
17715 103711          STC CMND,C     START TAPE.
17716 103710          STC DATA,C     INITIALIZE DATA CHANNEL.
17717 063773          LDA PROG#      GET PROG ORDNL CNTR - 0 IF LOAD.
17720 006645          CLB,SEZ,CME,INB,RSS   -B- _ DATA RECORD MASK.
17721 027725          JMP DATAR      DATA RECORD, SKIP NEXT.
```

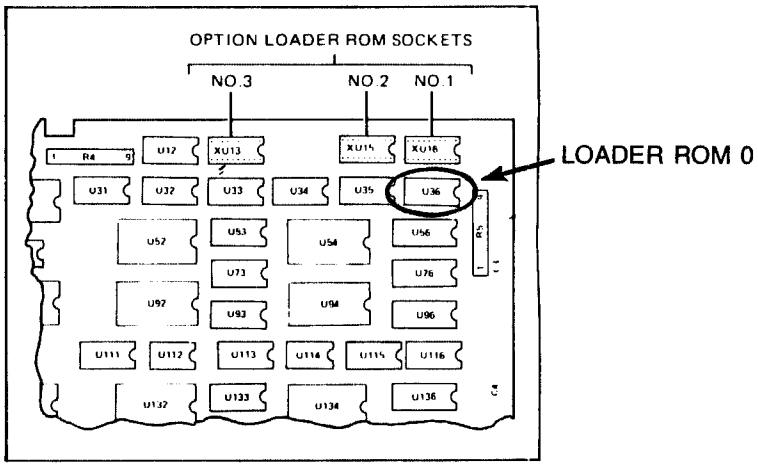
MTRS LOADER (Cont'd)

```
17722 067766          LDB ADRSA      POST RECORD,
17723 077777          STB PTR          INITIALIZE ADDRESS POINTER.
17724 067771          LDB MASK1      -B- _ POST REC MASK (S.A. ONLY).
17725 002042  DATAR   SEZ,SZA       IF DATA RECORD AND NOT LOADING,
17726 027707          JMP READ         IGNORE THE RECORD.
17727 102211          SFC CMND       POST RECORD OR (DATA RECORD AND
17730 027741          JMP DONE        LOADING), WAIT FOR DATA OR
17731 102310  LOOP    SFS DATA         FOR TAPE TO STOP.
17732 027727          JMP *-3
17733 103510          LIA DATA,C     GET WORD FROM TAPE
17734 173777          STA PTR,I        AND STORE IT.
17735 006011          SLB,RSS        IF WORD IS TO BE SAVED,
17736 037777          ISZ PTR          BUMP ADDRESS POINTER.
17737 004065          CLE,ERB        SHIFT STORE/NO STORE MASK.
17740 027731          JMP LOOP       RETURN FOR NEXT WORD.
17741 005500  DONE    ERB            FINAL SHIFT, -E- _ 1 IF WE JUST
                                       READ POST RECORD, 0 IF DATA.
17742 073777          STA PTR        SAVE DATA LOAD ADDR IF POST.
17743 067773          LDB PROG#      GET PROGRAM ORDINAL COUNTER.
17744 063776          LDA S.A.       GET PROGRAM STARTING ADDRESS.
17745 002240          SEZ,CME        IF THIS WAS DATA RECORD
17746 002003          SZA,RSS         OR CONTINUATION POST RECORD,
17747 027754          JMP ZTEST        SKIP INITIAL POST REC STEPS.
17750 033765          IOR JMP        INITIAL POST REC, INCLUDE JUMP
17751 006007          INB,SZB,RSS     TO STARTING ADDRESS.  IF THIS
17752 070002          STA 2            IS OUR PROG, STORE THE JUMP.
17753 000040          CLE            WIPE OUT -E- CAUSED BY INB,SZB.
17754 006020  ZTEST   SSB            IF WE HAVEN'T FOUND OUR PROG YET
17755 027706          JMP READ-1       UPDATE PROG#, READ NEXT REC.
17756 102511          LIA CMND       OUR PROG OR POST RECORD OF NEXT
17757 013772          AND MASK2       ONE, CHECK FOR PARITY ERROR
17760 002002          SZA              OR END-OF-FILE.
17761 102001          HLT 1          ERROR HALT.  **NOT PROTECTED**
17762 006003          SZB,RSS        1ST POST REC OF NEXT PROGRAM?
17763 027706          JMP READ-1     NO, UPDATE PROG#, CONTINUE.
17764 063770          LDA HLT70      YES, STORE FINAL HALT.
17765 024000  JMP     JMP A          GO TO IT.

   CONSTANTS AND STORAGE.

00000           A     EQU 0          -A- REGISTER ADDRESS DEFINITION.
17766 017776    ADRSA DEF CORSZ-2    POINTER TO 2-WORD BUFFER.
00011           CMND  EQU DATA+1     MAG TAPE COMMAND CHANNEL S.C.
17767 177774    DFALT ABS -DEFLT     - (PROGRAM ORDINAL DEFAULT).
17770 102070    HLT70 HLT 70B        FINAL HALT (GOOD HALT).
17771 001677    MASK1 OCT 1677       POST RECORD READ MASK.
17772 000202    MASK2 OCT 202*       MAG TAPE STATUS MASK.
17773 000000    PROG# NOP            PROGRAM ORDINAL COUNTER.
17774 000023    RRF   OCT 23         MT READ ONE RECORD COMMAND CODE.
17775 001501    SLORW OCT 1501       MT SELECT 0/REWIND COMMAND CODE.
00001           SSW   EQU 1          SWITCH REG ADDRESS DEFINITION.

   THE FOLLOWING TWO WORDS MUST BE CONTIGUOUS, AND THEIR ORDER
 MUST NOT BE CHANGED.

17776 000000    S.A.  BSS 1          PROG START ADDR (IN POST REC).
17777 000000    PTR   BSS 1          MOVING PTR/DATA REC LOAD ADDR.

                      END
```

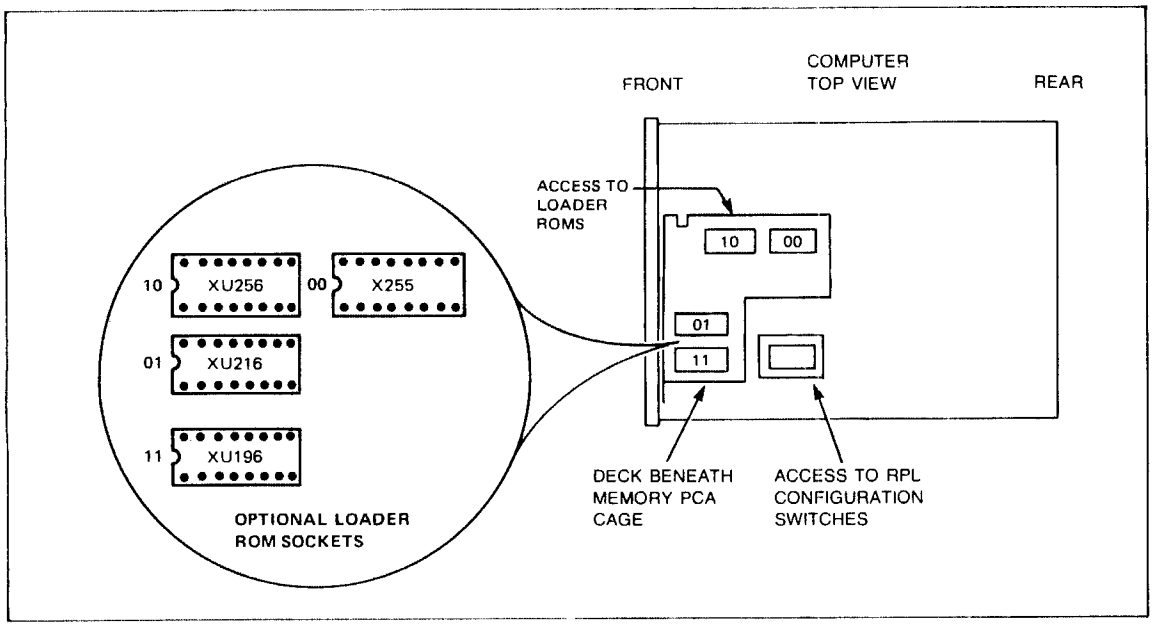
*OCT 200 TO INHIBIT PARITY CHECK

OPTIONAL LOADER ROM SOCKETS

M-Series Computer



E/F-Series Computer



7700 80

Note: ROMs are listed in the Parts section of this manual.

LOADER ROM S-REGISTER SETTINGS (EXCEPT FOR CS80 DISC MEMORIES)

Loader ROM S-Register Settings

DEVICE	S-REGISTER BIT SETTINGS																
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Cartridge Tape			0	0										0	0	0
Paper Tape			0	0										0	0	0
HP 7900A (Removable Platter) or HP 7901			0	0										0	0	1
HP 7900A (Fixed Platter)			0	0										0	0	0
HP 2883A	LOADER ROM	SELECTION	1	0	SELECT CODE OF DEVICE						* RESERVED			0	0	0
HP 7905A (Removable Platter, Upper Surface) or 7920M (Platter 1, Upper Surface)			0	1										0	0	0
HP 7905A (Removable Platter, Lower Surface) or 7920M (Platter 1, Lower Surface)			0	1										0	0	1
														0	0	1
HP 7905A (Fixed Platter) or 7920M (Platter 2, Upper Surface)			0	1										0	1	0
HP 7920M (Platter 2, Lower Surface)			0	1										0	1	1
HP 7970B/E Magnetic Tape			0	0							0	0	0	0	0	** 0/1
HP 9885 Flexible Disc			0	0							0	0	0	0	0	*** 0/1
HP 7906H (Removable Platter, Upper Surface, Head 00) or 7920H/7925H (Platter 1, Upper Surface, Head 00) or 9895 (drive 0, head 0)			0	1							R* ESERVED			0	0	
HP 7906H (Removable Platter, Lower Surface, Head 01) or 7920H/7925H (Platter 1, Lower Surface, Head 01) or 9895 (drive 0, head 1)			0	1										1	0	
HP 7906H (Fixed Platter, Head 10) or 7920H/7925H (Platter 2, Upper Surface, Head 10)			0	1										1	1	
HP 7906H (Fixed Platter, Head 11) or 7920H/7925H (Platter 2, Lower Surface, Head 11)																

* S-Register bits 5-3 are reserved and must be 0 unless called for by the operating system; i.e., diagnostics bit 3 set.

** S-Register bit 0 = 0 = Read next sequential file.
= 1 = Rewind magnetic tape and search for the file number specified in A-register; for example, file 1 = 1. The A-reg cannot be 0.

*** S-Register bit 0 = 0 = Load from track and sector address specified in B-register.
(Bits 4-0 = physical sector address.
Bits 11-5 = starting track address.)
= 1 = Load from track 0, sector 1.

LOADER ROM S-REGISTER SETTINGS (EXCEPT FOR CS80 DISC MEMORIES)

7908/7911/7912/7914/7933 CS80 Cartridge

DEVICE	S-REGISTER BIT SETTINGS			
	15 14	13 12	11 10 9 8 7 6	5 4 3 2 1 0
7908/7911/7912/ 7914/7933	LDR ROM	0 0	SELECT CODE OF LOADING DEVICE	0 0 0 Unit #

LOADER ROM HALTS

DISPLAY REGISTER	MEANING
(Octal)	
102077	Successful load
102055	Address error (record exceeds available memory).
102011	Checksum error (record data incorrect)
102000	Device error (no tape or tape read error) or wrong data format.

If an attempt is made to load a file which is not in absolute binary, a HALT 102000 may occur or the loader may hang up.

PAPER TAPE LOADER ROM

Part No. 1816-0420

```
X7700   107700  START   CLC  O,C          TURN OFF THE INTERRUPT
                                            SYSTEM
X7701   002401          CLA, RSS
X7702   063756  CONT    LDA  M.11         FEED FRAME COUNTER
X7703   006700          CLB, CCE          SET E TO READ BYTE
X7704   017742          JSB  READ         GET # OF CHAR
X7705   007306          CMB,CCE,INB,SZB   2'S COMP)
X7706   027713          JMP  *+5          NON ZERO BYTE
X7707   002006          INA, SZA          FEED FRAME COUNTER
X7710   027703          JMP  *-5
X7711   102077          HLT  77B          END OF TAPE
X7712   027700          JMP  START
X7713   077754          STB  WD.CT        WORDS IN RECORD
X7714   017742          JSB  READ         GET FEED FRAME
X7715   017742          JSB  READ         GET ADDRESS
X7716   074000          STB 0             INITIATE CHECKSUM
X7717   077755          STB ADDR
X7720   067755  CHECK   LDB  ADDR
X7721   047777          ADB  MAXAD        CHECK ADDR BELOW
                                            LOADER
X7722   002040          SEZ               E  OK
X7723   027740          JMP  HLT55        ADDR>=LOADER
X7724   017742          JSB  READ         GET NEXT WORD
X7725   040001          ADA  1            CONTINUE CHECKSUM
X7726   177755          STB  ADDR,I
X7727   037755          ISZ  ADDR
X7730   000040          CLE
X7731   037754          ISZ  WD.CT
X7732   027720          JMP  CHECK
X7733   017742          JSB  READ
X7734   054000          CPB  0
X7735   027702          JMP  CONT
X7736   102011          HLT  11B          CHECKSUM ERROR
X7737   027700          JMP  START
X7740   102055  HLT55   HLT  55B          ADDRESS>=LOADER
X7741   027700          JMP  START
X7742   000000  READ    NOP               E  READ WORD =1 BYTE
X7743   006600          CLB, CME          E REG BYTE POINTER
X7744   1037KK          STC  RDR,C        START THE READER
X7745   1023KK          SFS  RDR             CHECK THESE IF $$
X7746   027745          JMP  *-1             LOADER BOMBED $1
X7747   1064KK          MIB  RDR          GOT BYTE
X7750   002041          SEZ, RSS
X7751   127742          JMP  READ,I
X7752   005767          BLF, CLE,BLF
X7753   027744          JMP  *-7
X7754   000000  WD.CT    NOP
X7755   000000  ADDR    NOP
X7756   177765  M.11    DEC-11            FEED FRAME CONST.
X7777          MAXAD   EQU  X7777B       LOADER ADDRESS
00010          RDR     EQU  KKB          READER SELECT CODE
                       END
```

X = 1 for 8K
2 for 12K
3 for 16K
4 for 20K
5 for 24K
6 for 28K
7 for 32K

KK = Paper Tape Reader

MTRS LOADER ROM

Part No. 1816-0426

```
X7700  063774          LDA  SL0RW          SELECT UNIT 0
X7701  1026CC          OTA  CMND           AND
X7702  1037CC          STC  CMND,C         REWIND TAPE.
X7703  106501          LIB  SSW            GET ORDINAL NUMBER
                                             OF PROGRAM.
X7704  007307          CMB,CCE,INB,SZB,    MAKE < 0, PRESET -E-.
                         RSS
X7705  067767          LDB  DFALT          USE DEFAULT IF SWREG
                                             = 0.
X7706  077772          STB  PROG#          SAVE FOR COUNTER.
X7707  063773  READ    LDA  RRF            OUTPUT
X7710  1026CC          OTA  CMND           READ COMMAND
X7711  1025CC          LIA  CMND           AND
X7712  001323          RAR, RAR            TEST
X7713  001310          RAR, SLA            FOR REJECT.
X7714  027707          JMP  READ           REJECTED, KEEP TRYING
                                             UNTIL O.K.
X7715  1037CC          STC  CMND,C         START TAPE.
X7716  1037DD          STC  DATA,C         INITIALIZE DATA CHANNEL
                                             CHANNEL.
X7717  063772          LDA  PROG#          GET PROG ORDNL CNTR
                                             - 0 IF LOAD.
X7720  006644          CLB,SEZ,CME,INB     -B ← DATA RECORD MASK.
X7721  067771          LDB  MASK1          -B- ← POST REC MASK
                                             (S.A. ONLY).
X7722  002042          SEZ, SZA            IF DATA RECORD AND
                                             NOT LOADING,
X7723  027707          JMP  READ           IGNORE THE RECORD.
X7724  1022CC          SFC  CMND           POST RECORD OR (DATA
                                             RECORD AND
X7725  027741          JMP  DONE           LOADING), WAIT FOR
                                             DATA OR
X7726  1023DD  LOOP    SFS  DATA           FOR TAPE TO STOP.
X7727  027724          JMP  *-3
X7730  1035DD          LIA  DATA,C         GET WORD FROM TAPE.
X7731  004031          SLB, BRS            TEST IF WE STORE,
                                             SHIFT MASK.
X7732  027726          JMP  LOOP           NO STORE, GET NEXT
                                             WORD.
X7733  073775          STA  S.A.           WE DO, SAVE WORD IN
                                             S.A. TOO.
X7734  002041          SEZ, RSS            IF THIS IS POST RECORD,
X7735  027726          JMP  LOOP           SKIP STORE AND ADDRESS
                                             BUMP.
X7736  173776          STA  PTR,I          STORE THE WORD, THEN
X7737  037776          ISZ  PTR            BUMP ADDRESS POINTER'
X7740  027726          JMP  LOOP           RETURN FOR NEXT WORD.
X7741  073776  DONE    STA  PTR            STORE LOAD ADDR IF
                                             POST RECORD.
X7742  067772          LDB  PROG#          GET PROGRAM ORDINAL
                                             COUNTER.
X7743  063775          LDA  S.A.           GET PROGRAM STARTING
                                             ADDRESS.
X7744  006021          SSB, RSS            ARE WE LOADING?
X7745  027750          JMP  *+3            YES, SKIP S.A. TEST.
X7746  002020          SSA                 NO, IS THIS DUMMY END-
                                             OF FILE?
X7747  102001  HLT1    HLT  1              YES, OR PARITY ERROR,
                                             HALT.
                                           !!!HALT IS NOT
                                             PROTECTED!!!
X7750  002241          SEZ,CME,RSS         NO ERROR, IF WE READ
                                             DATA RECORD
```

MTRS LOADER ROM (Cont'd)

MTRS LOADERS - Continued

```
X7751  002003          SZA, RSS        OR CONTINUATION POST
                                         RECORD.
X7752  027756          JMP  ZTEST      SKIP INITIAL POST REC
                                         STEPS.
X7753  033766          IOR  JMP        INITIAL POST REC,
                                         INCLUDE JUMP
X7754  006007          INB,SZB,RSS     TO STARTING ADDRESS.
                                         IF THIS
X7755  070002          STA 2           IS OUR PROG, STORE THE
                                         JUMP.
X7756  006220  ZTEST   CME, SSB        IF WE HAVEN'T FOUND
                                         OUR PROG YET
X7757  027706          JMP  READ-1     UPDATA PROG#, READ
                                         NEXT REC.
X7760  1025CC          LIA  CMND       OUR PROG OR POST
                                         RECORD OF NEXT
X7761  001332          RAR,SLA,RAL     ONE, IF IT HAS A PARITY
                                         ERROR
X7762  027747          JMP  HLT1       GO NO FURTHER.
X7763  006003          SZB, RSS        1ST POST REC OF NEXT
                                         PROGRAM?
X7764  027706          JMP  READ-1     NO, UPDATE PROG#,
                                         CONTINUE.
X7765  063770          LDA  HLT70      YES, STORE FINAL
                                         HALT.
X7766  024000  JMP     JMP  A          GO TO IT.
00000          A       EQU  0          -A- REGISTER ADDRESS
                                         DEFINITION.
000DD          CMND    EQU  DATA+1     MAG TAPE COMMAND
                                         CHANNEL S.C.
X7767  177774  DEFAULT ABS -DEFLT       -(PROGRAM ORDINAL
                                         DEFAULT).
X7770  102070  HLT70   HLT  70B        FINAL HALT (GOOD
                                         HALT).
X7771  000677  MASK1   OCT  677        POST RECORD READ MASK.
X7772  000000  PROG#    NOP            PROGRAM ORDINAL COUN-
                                         TER.
X7773  000023  RRF     OCT  23         MT READ ONE RECORD
                                         COMMAND CODE.
X7774  001501  SL0RW   OCT  1501       MT SELECT 0/REWIND
                                         COMMAND CODE.
00001          SSW     EQU  1          SWITCH REG ADDRESS
                                         DEFINITION.
```

THE LOCATIONS OF THE FOLLOWING TWO WORDS MUST NOT BE CHANGED TO PRESERVE 2105, -08, ETC. BOOT LOADER CAPABILITY.

```
X7775  600000  S.A.    BSS  1          PROG START ADDR (IN
                                         POST REC).
X7776  000000  PTR     BSS  1          DATA RECORD LOAD
                                         ADDRESS.
                       END
```

X = 2 for 12K
3 for 16K
4 for 20K
5 for 24K
6 for 28K
7 for 32K

DD — Lower Number (Higher Priority)

CC — Higher Number (Lower Priority)

HP 12992A 7900/7901/2883 LOADER ROM

```
0001                    ASMB,A,B,L,C
0003  07700                    ORG 7700B
0004*********************************************
0005*                                           *
0006*           REV.              1-27-76       *
0007*           PART NUMBER       1816-0863     *
0008*           PRODUCT NUMBER    12992A        *
0009*                                           *
0010*********************************************
0011*
0012* SWITCH REGISTER USAGE
0013*
0014*
0015*  15-14       LOADER SELECT
0016*  13-12       00 - 7900 DISC
0017*              01 - RESERVED
0018*              10 - 2883 DISC
0019*  11-6        DISC SELECT CODE
0020*   5-3        RESERVED FOR DIAGNOSTIC GROUP
0021*   2-0        SUBCHANNEL NUMBER
0022*
0023*
0024  00010          DC     EQU 10B
0025  00011          CC     EQU DC+1
0026*
0027**** "PRESET" MUST BE PRESSED
0028*



0030  07700          START  EQU *
0031  07700 102501          LIA 1           GET CONTENTS OF S-REG
0032  07701 106501          LIB 1
0033  07702 013765          AND D7         ISOLATE SUBCHANNEL #
0034  07703 005750          BLF,CLE,SLB
0035  07704 027741          JMP READ
0036  07705 005335          RBR,SLB,ERB    PUT BIT 13 IN E - SET = 2883
0037  07706 027717          JMP ISS
0038*
0039* FALL THROUGH
0040*    A HAS LAST 3 BITS OF S REG
0041*    B HAS S REG SHIFTED
0042*    13 / 12 11 10 / 9 8 7 / 6 5 4 / 3 2 1 / 0 15 14
0043*    E IS 0
0044*
0045  07707          LOOP   EQU *
0046  07707 102611          OTA CC          DO 7900 STATUS TO
0047  07710 103711          STC CC,C        CLEAR FIRST SEEK
0048  07711 102310          SFS DC          STATUS
0049  07712 027711          JMP *-1
0050  07713 002004          INA             GET NEXT DRIVE
0051  07714 053765          CPA D7          ALL CLEARED?
0052  07715 002001          RSS              YES
0053  07716 027707          JMP LOOP
0054*
```

HP 12992A 7900/7901/2883 LOADER ROM (Cont'd)

```
0055* FALL THROUGH
0056*    A HAS A 7
0057*    B HAS S REG SHIFTED - SEE ABOVE COMMENT
0058*    E HAS CONDITION OF BIT 13 OF S REG
0059*
0060* JMP ISS
0061*    A HAS LAST 3 BITS OF S REG
0062*    B HAS S REG SHIFTED - SEE ABOVE COMMENT
0063*    E IS A 1
0064*
0065  07717          ISS   EQU *
0066  07717 067761         LDB SEEKC        GET SEEK COMND
0067  07720 106610         OTB DC           ISSUE CYCLINDER ADDR (0)
0068  07721 103710         STC DC,C         TELL CTRL. CYC. ADDR LOADED
0069  07722 106611         OTB CC
0070  07723 103711         STC CC,C         START SEEK
0071  07724 102310         SFS DC
0072  07725 027724         JMP *-1
0073  07726 006400         CLB
0074  07727 102501         LIA 1
0075  07730 002051         SEZ,SLA,RSS      SUBCHAN=1 OR ISS SKIP
0076  07731          ISSRD EQU *
0077  07731 047770         ADB BIT9
0078  07732 106610         OTB DC           SEND SECTOR ADDR
0079  07733 103710         STC DC,C
0080  07734 102311         SFS CC           WAIT FOR SEEK
0081  07735 027734         JMP *-1
0082  07736 063731         LDA ISSRD        GET ISS READ COMND
0083  07737 002341         SEZ,CCE,RSS      ISS DISC?
0084  07740 001100         ARS                NO-MAKE 7900 READ COMND
0085*
0086* FALL THROUGH
0087*    A HAS DISC READ COMND
0088*    B HAS EITHER A 0 OR BIT 9 SET
0089*    E IS A 1
0090*
0091* JMP READ
0092*    A HAS LAST 3 BITS OF THE S REG
0093*    B HAS S REG SHIFTED
0094*    E IS A 0
0095*
0096  07741          READ  EQU *
0097  07741 067776         LDB DMACW        GET DMA CONTROL WORD
0098  07742 106606         OTB 6            ISSUE DMA CONTROL WORD
0099  07743 067762         LDB ADDR1        GET MEMORY ADDR
0100  07744 077741         STB READ         MAKE BOOT NONREEXECUTABLE
0101  07745 106602         OTB 2            ISSUE MEMORY ADDR
0102  07746 102702         STC 2            SET WORD COUNT
0103  07747 067764         LDB CNT          GET WORD COUNT
0104  07750 106602         OTB 2            ISSUE WORD COUNT
0105*
0106* FALL THROUGH
0107*    A HAS EITHER THE DISC READ COMND
0108*                OR THE LAST 3 BITS OF THE S REG
0109*    B HAS DMA WORD COUNT
0110*    E IS EITHER A 1
```

HP 12992A 7900/7901/2883 LOADER ROM (Cont'd)

```
0111*              OR A 0
0112*
0113  07751 002041         SEZ,RSS
0114  07752 027766         JMP NEW
0115  07753 102611         OTA CC          ISSUE READ COMND
0116  07754 103710         STC DC,C
0117  07755 103706         STC 6,C         START DMA
0118  07756 103711         STC CC,C        START DISK READING
0119  07757 037773         ISZ SKIP
0120  07760 027773         JMP SKIP
0121*
0122*
0123* CONSTANTS
0124*
0125  07761 030000  SEEKC  OCT 30000
0126  07762 102011  ADDR1  OCT 102011
0127  07763 102055  ADDR2  OCT 102055
0128  07764 164000  CNT    DEC -6144
0129  07765 000007  D7     DEC 7
0130*
0131*
0132  07766 106710  NEW    CLC DC              SET "NEXT WRD IS COMND FLG"
0133  07767 001720         ALF,ALS       MOVE TO HEAD NUMBER LOC.
0134  07770 001000  BIT9   ALS
0135  07771 103610         OTA DC,C      OUTPUT COLD LOAD COMND
0136  07772 103706         STC 6,C
0137  07773          SKIP   EQU *
0138  07773 102310         SFS DC
0139  07774 027773         JMP *-1
0140  07775 117763  EXIT   JSB ADDR2,I
0141*
0142* EXIT
0143*    TRACK 0, SECTOR 0 OF APPROPRIATE
0144*    SUBCHANNEL NOW IN MEMORY
0145*
0146  07776 120010  DMACW  ABS 120000B+DC
0147  07777 170100         ABS -START
0148                       END
**  NO ERRORS* RTE ASMB 92001B (10/74)**
```

HP 12992B 7905 LOADER ROM (OBSOLETE VERSION)

```
0001                ASMB,A,B,L,C
0003  07700                ORG 7700B
0004*********************************************
0005*                                           *
0006*          REV.              1-28-76        *
0007*          PART NUMBER       1816-0869      *
0008*          PRODUCT NUMBER    12992B         *
0009*                                           *
0010*********************************************
0011*
0012* SWITCH REGISTER USAGE
0013*
0014*
0015*   15-14       LOADER SELECT
0016*   13-12       IGNORED
0017*   11-6        DISC SELECT CODE
0018*    5-3        RESERVED FOR DIAGNOSTIC GROUP
0019*    2-0        SUBCHANNEL NUMBER
0020*
0021*
```

HP 12992B 7905 LOADER ROM (OBSOLETE VERSION) (Cont'd)

```
0022  00010          DC     EQU 10B
0023  00011          CC     EQU DC+1
0024*
0025**** "PRESET" MUST BE PRESSED
0026*
0028  07700          START  EQU *
0029  07700 102501         LIA 1          GET CONTENTS OF S-REG
0030  07701 013716         AND D7        ISOLATE SUBCHANNEL #
0031*
0032* FALL THROUGH
0033*    A HAS LAST 3 BITS OF THE S REG
0034*    B HAS S REG SHIFTED
0035*
0036  07702 067776         LDB DMACW      GET DMA CONTROL WORD
0037  07703 106606         OTB 6          ISSUE DMA CONTROL WORD
0038  07704 067713         LDB ADDR1      GET MEMORY ADDR
0039  07705 077705         STB *          MAKE BOOT NOT REEXECUTABLE
0040  07706 106602         OTB 2          ISSUE MEMORY ADDR
0041  07707 102702         STC 2         SET WORD COUNT
0042  07710 067715         LDB CNT        GET WORD COUNT
0043  07711 106602         OTB 2          ISSUE WORD COUNT
0044*
0045* FALL THROUGH
0046*    A HAS THE LAST 3 BITS OF THE S REGISTER
0047*    B HAS DMA WORD COUNT
0048*
0049  07712 027766         JMP NEW
7050*
0051*
0052* CONSTANTS
0053*
0054  07713 102011  ADDR1  OCT 102011
0055  07714 102055  ADDR2  OCT 102055
0056  07715 164000  CNT    DEC -6144
0057  07716 000007  D7     DEC 7
0058*
0059* 39 NOP'S
0060*
0064                        LST
0065*
0066* 7905 COLD LOAD ROUTINE
0067*
0068  07766 106710  NEW    CLC DC           SET "NEXT WRD IS COMND FLG"
0069  07767 001720         ALF,ALS      MOVE TO HEAD NUMBER LOC
0070  07770 001000  BIT9   ALS
0071  07771 103610         OTA DC,C         OUTPUT COLD LOAD COMND
0072  07772 103706         STC 6,C
0073  07773          SKIP   EQU *
0074  07773 102310         SFS DC
0075  07774 027773         JMP *-1
0076  07775 117714  EXIT   JSB ADDR2,I
0077*
0078* EXIT
0079*    TRACK 0 OF THE APPROPRIATE
0080*    SUBCHANNEL NOW IN MEMORY
0081*
0082  07776 000010  DMACW  ABS DC
0083  07777 170100         ABS -START
0084                        END
**  NO ERRORS* RTE ASMB 920018 (10/74)**
```

HP 12992B 7905/7906/7920/7925 DISC LOADER ROM PROGRAM LISTING

```
                7905/06/20 DISC BOOT LOADER (12992B) - RPL COMPATIBLE

0001                    ASMB,A,B,L
0003  07700               ORG 7700B
0004*********************************************
0005*                                           *
0006*       REVISION          05 AUG 77         *
0007*       PART NUMBER        12992-80002      *
0008*       PRODUCT NUMBER     12992B           *
0009*                                           *
0010*********************************************
0011*
0012*  SWITCH REGISTER USAGE
0013*
0014*    15-14     LOADER SELECT
0015*    13        UNUSED
0016*    12        =0/1=RPL/MANUAL BOOT
0017*    11-6      DISC SELECT CODE
0018*     5-3      RESERVED
0019*     2-0      SUBCHANNEL NUMBER
0020*
0021  00010          DC     EQU 10B
0022*
0023  07700 017727  START JSB STAT       GET STATUS
0024  07701 002021        SSA,RSS        IS DRIVE READY ?
0025  07702 027742        JMP DMA          YES, SET UP DMA
0026  07703 013714        AND B20          NO, CHECK STATUS BITS
0027  07704 002002        SZA            IS DRIVE FAULTY OR HARD DOWN ?
0028  07705 102030        HLT 30B          YES, HALT 30B, "RUN" TO TRY AGAIN
0029  07706 027700        JMP START        NO, TRY AGAIN FOR DISC READY
0030*
0031*  CONSTANTS
0032*
0033  07707 102011  ADDR1 OCT 102011
0034  07710 102055  ADDR2 OCT 102055
0035  07711 164000  CNT   DEC -6144
0036  07712 000007  D7    OCT 7
0037  07713 001400  STCMD OCT 1400
0038  07714 000020  B20   OCT 20
0039  07715 017400  STMSK OCT 17400
0040*   9 NOP'S
0044                LST
0045*
0046  07727 000000  STAT  NOP            STATUS CHECK SUBROUTINE
0047  07730 107710        CLC DC,C       SET STATUS COMMAND MODE
0048  07731 063713        LDA STCMD      GET STATUS COMMAND
0049  07732 102610        OTA DC         OUTPUT STATUS COMMAND
0050  07733 102310        SFS DC         WAIT FOR STATUS#1 WORD
0051  07734 027733        JMP *-1
0052  07735 107510        LIB DC,C         B-REG = STATUS#1 WORD
0053  07736 102310        SFS DC         WAIT FOR STATUS#2 WORD
0054  07737 027736        JMP *-1
0055  07740 103510        LIA DC,C         A-REG = STATUS#2 WORD
```

HP 12992B 7905/7906/7920/7925 DISC LOADER ROM PROGRAM LISTING (Cont'd)

```
0056  07741 127727         JMP STAT,I     RETURN
0057*
0058*  SET UP DMA CHANNEL
0059*
0060  07742 067776  DMA    LDB DMACW      GET DMA CONTROL WORD
0061  07743 106606         OTB 6          OUTPUT DMA CONTROL WORD
0062  07744 067707         LDB ADDR1      GET MEMORY ADDRESS
0063  07745 106702         CLC 2          SET MEMORY ADDRESS INPUT MODE
0064  07746 106602         OTB 2          OUTPUT MEMORY ADDRESS TO DMA
0065  07747 102702         STC 2          SET WORD COUNT INPUT MODE
0066  07750 067711         LDB CNT        GET WORD COUNT
0067  07751 106602         OTB 2          OUTPUT WORD COUNT TO DMA
0068*FALL THRU
0069*  7905/20 COLD LOAD COMMAND
0070*
0071  07752 106710  CLDLD  CLC DC         SET COMMAND INPUT MODE
0072  07753 102501         LIA 1          LOAD SWITCH
0073  07754 106501         LIB 1          REGISTER SETTINGS
0074  07755 013712         AND D7         ISOLATE HEAD NUMBER
0075  07756 005750         BLF,CLE,SLB    BIT 12=0?
0076  07757 027762         JMP *+3        NO,MANUAL BOOT
0077  07760 002002         SZA            YES,RPL BOOT. HEAD#=0?
0078  07761 001000         ALS            NO,HEAD#=1, MAKE HEAD#=2
0079  07762 001720         ALF,ALS        FORM COLD LOAD
0080  07763 001000         ALS            COMMAND WORD
0081  07764 103706         STC 6,C        ACTIVATE DMA
0082  07765 103610         OTA DC,C       OUTPUT COLD LOAD COMMAND
0083  07766 102310         SFS DC         IS COLD LOAD COMPLETED ?
0084  07767 027766         JMP *-1          NO, WAIT
0085  07770 017727         JSB STAT         YES, GET STATUS
0086  07771 060001         LDA 1
0087  07772 013715         AND STMSK      A-REG = STATUS BITS OF STATUS#1 WORD
0088  07773 002002         SZA            IS TRANSFER OK ?
0089  07774 027700         JMP START        NO,TRY AGAIN
0090  07775 117710  EXIT   JSB ADDR2,I      YES, EXECUTE LOADED PROGRAM @ 2055B
0091*FALL THRU
0092*  THE NEXT 2 WORDS MUST BE THE LAST 2 WORDS
0093*    IN THE BOOTSTRAP LOADER IN THE LAST 2 MEMORY LOCATIONS
0094  07776 000010  DMACW  ABS DC
0095  07777 170100         ABS -START
0096                       END
```

HP 12992C 2644/2645/2648 LOADER ROM

```
0001                    ASMB,A,B,L     CARTRIDGE TAPE BINARY LOADER
0003  07700                    ORG 7700B
0004*********************************************
0005*                                           *
0006*                 REV.          2-18-76     *
0007*            PART NUMBER     1816-0857      *
0008*                                           *
0009*********************************************
0010  00010           SC      EQU 10B
0011  00000           A       EQU 0
0012  00001           B       EQU 1
0013*
0014*      THIS ASSUMES THE INTERFACE IS A 12966 OR 12968
0015*      THE BAUD RATE IS EXTERNAL
0016*      THE CARTRIDGE IS POSITIONED AT THE FILE TO BE READ
0017**** "RUN" CAN NOT BE PRESSED AFTER HALT 77B OR HALT 11B
0018*
0019  07700 063773  START LDA LDOTP       RESET POINTER
0020  07701 073702        STA *+1
0021  07702 063763  NCW   LDA OTP        GET A WORD FROM THE TABLE
0022  07703 037702        ISZ *-1         MOVE TO NEXT WORD IN TABLE
0023  07704 103610        OTA SC,C        OUTPUT CURRENT WORD
0024  07705 053771        CPA EOT         END OF TABLE?
0025  07706 027717        JMP NRD         YES - START INPUT
0026  07707 001727        ALF,ALF         IS THIS A CHARACTER?
0027  07710 013772        AND .377
0028  07711 002002        SZA             ?
0029  07712 027702        JMP NCW         NO - DO NEXT CONTROL WORD
0030  07713 103710        STC SC,C        PUT CARD IN DATA MODE
0031  07714 102310        SFS SC          IS CHARACTER OUT?
0032  07715 027714        JMP *-1         NO - WAIT FOR IT
0033  07716 027702        JMP NCW         YES - DO NEXT CONTROL WORD
0034  07717 017750  NRD   JSB INPUT       READ IN FIRST WORD (RECORD COUNT)
0035  07720 005727        BLF,BLF         POSITION COUNT TO LOWER BYTE
0036  07721 007007        CMB,INB,SZB,RSS  MAKE IT NEG AND IS IT EOF?
0037  07722 102077        HLT 77B         YES - END-OF-FILE
0038  07723 006021        SSB,RSS         IF COUNT WAS ALL ONES
0039  07724 102000        HLT 0           THEN TAPE ERROR
0040  07725 077776        STB WCT         SAVE COUNT
0041  07726 017750        JSB INPUT       READ STORE ADDRESS
0042  07727 077774        STB CKSUM       START CHECKSUM
0043  07730 077775        STB ADD           AND SAVE ADDRESS
0044  07731 017750  NWD   JSB INPUT       GET WORD TO BE STORED
0045  07732 063775        LDA ADD         CHECK IF ADDRESS
0046  07733 043777        ADA MXAD           IS ABOVE LOADER
0047  07734 002040        SEZ             IS IT?
0048  07735 102055        HLT 55B         YES
0049  07736 177775        STB ADD,I       NO - PUT WORD IN MEMORY
0050  07737 047774        ADB CKSUM       ADD IT TO CHECKSUM
0051  07740 077774        STB CKSUM
0052  07741 037775        ISZ ADD         MOVE ADDRESS UP ONE
0053  07742 037776        ISZ WCT         FINISHED WITH THIS RECORD?
0054  07743 027731        JMP NWD         NO - READ NEXT WORD
0056  07744 017750        JSB INPUT       YES - READ CHECKSUM
0057  07745 057774        CPB CKSUM       IS CHECKSUM OK?
0058  07746 027717        JMP NRD         YES - READ NEXT RECORD
0059  07747 102011        HLT 11B         NO
0060  07750 000000  INPUT NOP             INPUT ONE WORD FROM INTERFACE
0061  07751 006700        CLB,CCE         ZERO WORD AND START WITH UPPER HALF
0062  07752 102510        LIA SC          GET DATA
0063  07753 002021        SSA,RSS         IS IT VALID DATA?
0064  07754 027752        JMP *-2         NO
0065  07755 013772        AND .377        YES - ELIMINATE UPPER HALF
0066  07756 044000        ADB A           ADD DATA TO B REG.
0067  07757 002041        SEZ,RSS         SECOND HALF READ?
0068  07760 127750        JMP INPUT,I     YES - RETURN WITH WORD IN B REG.
0069  07761 005767        BLF,CLE,BLF     NO - MOVE BYTE TO UPPER HALF
0070  07762 027752        JMP INPUT+2     SET LOWER HALF FLAG AND READ IT
0071*
```

HP 12992C 2644/2645/2648 LOADER ROM (Cont'd)

```
0072  07763 150077  OTP   OCT 150077     MASTER RESET
0073  07764 040740        OCT 40740      INTERFACE CONTROL
0074  07765 030003        OCT 30003      CHAR FRAME CONTROL
0075  07766 000033  CHR1  OCT 33         ASCII "ESC"
0076  07767 050077        OCT 50077      RESET BUFFER STATUS
0077  07770 000145  CHR2  OCT 145        ASCII LOWER CASE "E"
0078  07771 040340  EOT   OCT 40340      INPUT COMMAND WORD
0079*
0080  07772 000377  .377  OCT 377        UPPER HALF WORD MASK
0081  07773 063763  LDOTP LDA OTP        POINTER TO OUTPUT TABLE
0082  07774 000000  CKSUM NOP            CHECKSUM STORAGE
0083  07775 000000  ADD   NOP            ADDRESS STORAGE
0084  07776 000000  WCT   NOP            INPUT WORD COUNT
0085  07777 170100  MXAD  ABS -START     START BINARY LOADER AREA
0086                END
**  NO ERRORS* RTE ASMB 92001B (10/74)**
```

HP 12992D 7970B/7970E LOADER ROM

```
0001                  ASMB,A,B,L     MAG TAPE LOADER
0003  07700                ORG 7700B
0004*********************************************
0005*                                           *
0006*              REV.        6-23-76          *
0007*          PART NUMBER   1816-0962          *
0008*                                           *
0009*********************************************
0010  00010          DC    EQU 10B
0011  00011          CC    EQU DC+1
0012*
0013**** "RUN" CAN NOT BE PRESSED AFTER ANY HALT
0014*
0015  07700 106501  START LIB 1          CHECK IF FILE FORWARD WAS REQUESTED
0016  07701 006011        SLB,RSS        ???
0017  07702 027714        JMP NRD        NO JUST READ A FILE
0018  07703 003004        CMA,INA        MAKE REQUEST NEG FOR COUNTER
0019  07704 073775        STA WCT        SAVE NUMBER AS COUNTER
0020  07705 067772        LDB SL0RW      SELECT 0 AND REWIND
0021  07706 017762  FFL   JSB CMD        OUTPUT COMMAND
0022  07707 102311        SFS CC         WAIT FOR COMPLETION
0023  07710 027707        JMP *-1
0024  07711 067774        LDB FFC        GET FILE FORWARD COMMAND
0025  07712 037775        ISZ WCT        ANY FILES LEFT?
0026  07713 027706        JMP FFL        YES
0027  07714 067773  NRD   LDB RDCMD      GET READ COMMAND
0028  07715 017762        JSB CMD        DO IT
0029  07716 103710        STC DC,C       START DATA CHANNEL
0030  07717 102211        SFC CC         CHECK FOR STATUS
0031  07720 027752        JMP STAT       YES
0032  07721 102310        SFS DC         ANY DATA
0033  07722 027717        JMP *-3        NO
0034  07723 107510        LIB DC,C       YES GET IT (RECORD COUNT)
0035  07724 005727        BLF,BLF        POSITION COUNT TO LOWER BYTE
0036  07725 007000        CMB            MAKE IT NEGATIVE
0037  07726 077775        STB WCT        SAVE INPUT COUNT
0038  07727 102211        SFC CC         CHECK FOR STATUS
0039  07730 027752        JMP STAT       YES EXIT TO STATUS
0040  07731 102310        SFS DC         WAIT TO READ NEXT WORD
0041  07732 027727        JMP *-3
0042  07733 107510        LIB DC,C       GET LOAD ADDRESS
0043  07734 074000        STB 0          START CHECKSUM
0044  07735 077762        STB CMD          AND ADDRESS POINTER
0045  07736 027742        JMP *+4
0046  07737 177762  NWD   STB CMD,I      PUT WORD IN MEMORY
0047  07740 040001        ADA 1          ADD IT TO CHECK SUM
0048  07741 037762        ISZ CMD        MOVE UP ADDRESS
0049  07742 102310        SFS DC         WAIT FOR NEXT WORD
0050  07743 027742        JMP *-1
```

HP 12992D 7970B/7970E LOADER ROM (Cont'd)

```
0051  07744 107510        LIB DC,C      GET DATA TO STORE IN MEMORY
0052  07745 037775        ISZ WCT       FINISHED WITH DATA?
0053  07746 027737        JMP NWD       NO READ NEXT WORD
0054  07747 054000        CPB 0         IS CHECKSUM OK?
0055  07750 027717        JMP NRD+3     YES - WAIT FOR COMMAND CHANNEL STATUS
0056  07751 102011        HLT 11B       NO
0058  07752 102511  STAT  LIA CC        GET STATUS
0059  07753 001727        ALF,ALF       POSITION EOF BIT
0060  07754 002020        SSA           IS IT EOF?
0061  07755 102077        HLT 77B       YES
0062  07756 001727        ALF,ALF       REPOAITION STATUS
0063  07757 001310        RAR,SLA       YES READ OK?
0064  07760 102000        HLT 0         NO TELL OPERATOR
0065  07761 027714        JMP NRD       YES READ NEXT RECORD
0066*
0067*
0068  07762 000000  CMD   NOP
0069  07763 106611        OTB CC        OUTPUT COMMAND
0070  07764 102511        LIA CC        CHECK IF REJECTED
0071  07765 001323        RAR,RAR
0072  07766 001310        RAR,SLA       ??
0073  07767 027763        JMP *-4       YES TRY AGAIN
0074  07770 103711        STC CC,C      NO START COMMAND
0075  07771 127762        JMP CMD,I     RETURN
0076*
0077*
0078  07772 001501  SLURW OCT 1501      MT SELECT 0 / REWIND
0079  07773 001423  RDCMD OCT 1423      MT READ A RECORD COMMAND
0080  07774 000203  FFC   OCT 203       MT FILE FORWARD COMMAND
0081  07775 000000  WCT   NOP           INPUT WORD COUNT
0082  07776 000000        NOP
0083  07777 000000        NOP
0084                      END
**  NO ERRORS *TOTAL **RTE ASMB 750420**
```

HP 12992E 9885 FLEXIBLE DISC LOADER ROM

```
0001                ASMB,A,B,L          761227
0003*****************************************************************
0004*                                                               *
0005*     PART NO. 1816-1051                                        *
0006*                                                               *
0007*     LOADER JUMPS TO 2 UPON SUCCESSFUL COMPLETION (NO HALT).   *
0008*     ENTER STARTING TRACK IN B-REG BITS 11-5.                  *
0009*     ENTER STARTING SECTOR IN B-REG BITS 4-0.                  *
0010*     SET S-REG BIT 0 TO SELECT TRACK 0, SECTOR 1.              *
0011*     RESTART LOADING PROCEDURE IF HALT OCCURS.                 *
0012*     LOADER USUALLY HANGS UP IF DEVICE ERROR OCCURS.           *
0013*****************************************************************
0014  07700               ORG 77008
0015  00010         CC    EQU 10B
0016  00011         DC    EQU CC+1
0017  00000         A     EQU 0
0018  00001         B     EQU 1
0019*
0020  07700 102501  START LIA 1           IF S-REG BIT 0 IS SET
0021  07701 000010        SLA
0022  07702 006404        CLB,INB           ASSUME TK 0, SEC 1
0023  07703 060001        LDA B
0024  07704 013711        AND B36         MASK OPERATOR INPUT
0025  07705 053711        CPA B36         SEC=36: FORMAT  --  SEC=37: MARK DEFECTI
0026  07706 027706        JMP *           ILLEGAL SECTOR -- LOADER CANNOT PROCEED
0027  07707 002504        CLA,CLE,INA
0028  07710 103610        OTA CC,C        PRESET CONTROLLER
0029  07711 000036  B36   SLA,ELA
0030  07712 102610        OTA CC          CLEAR PRESET BIT
0031  07713 017766        JSB OTA         CLEAR POSSIBLE ERROR FLAG
```

HP 12992E 9885 FLEXIBLE DISC LOADER ROM (Cont'd)

```
0032  07714 063774         LDA PASWD
0033  07715 017766         JSB OTA        OUTPUT PASSWORD TO CONTROLLER
0034  07716 060001         LDA B
0035  07717 033775         IOR SEEK       CONVERT OPERATOR INPUT TO SEEK COMMAND
0036  07720 017766         JSB OTA        OUTPUT SEEK TO CONTROLLER
0037  07721 063774         LDA PASWD
0038  07722 017766         JSB OTA        OUTPUT PASSWORD AGAIN
0039  07723 063734         LDA READ       READ AT LEAST 3300 SECTORS
0040  07724 017766         JSB OTA        OUTPUT READ COMMAND
0041  07725 002400         CLA            CLEAR INTERFACE
0042  07726 017766         JSB OTA
0043  07727 017760 RECLP   JSB OTLI       INPUT FMGR WORD COUNT
0044  07730 002007         INA,SZA,RSS    END OF FILE?
0045  07731 024002         JMP 2B         LOAD COMPLETE -- START PROGRAM
0046  07732 017760         JSB OTLI       INPUT ABSOLUTE COUNT
0047  07733 001727         ALF,ALF        POSITION COUNT TO LOWER BYTE
0048  07734 003304 READ    CMA,CCE,INA
0049  07735 073766         STA COUNT
0050  07736 017760         JSB OTLI       INPUT ADDRESS
0051  07737 073777         STA ADDR
0052  07740 070001         STA B          START CHECKSUM
0053  07741 102311 DATLP   SFS DC         WAIT FOR DATA CHANNEL
0054  07742 027741         JMP *-1
0055  07743 103711         STC DC,C       START NEXT TRANSFER
0056  07744 102511         LIA DC         INPUT DATA
0057  07745 173777         STA ADDR,I     STORE INTO MEMORY
0058  07746 044000         ADB A          ADD TO CHECKSUM
0059  07747 037777         ISZ ADDR       MOVE TO NEXT ADDRESS
0060  07750 037766         ISZ COUNT      DONE?
0061  07751 027741         JMP DATLP      NO, DO NEXT DATA WORD
0062  07752 017760         JSB OTLI       INPUT CHECKSUM
0063  07753 050001         CPA B          DOES CHECKSUM AGREE?
0064  07754 006401         CLB,RSS
0065  07755 102011         HLT 11B        NO, TELL OPERATOR
0066  07756 017760         JSB OTLI       DISCARD SECOND FMGR COUNT
0067  07757 027727         JMP RECLP
0068*
0069  07760 000000 OTLI    NOP            INPUT FROM DATA CHANNEL
0070  07761 102311         SFS DC         WAIT FOR DATA CHANNEL
0071  07762 027761         JMP *-1
0072  07763 103711         STC DC,C       START NEXT TRANSFER
0073  07764 102511         LIA DC         INPUT DATA
0074  07765 127760         JMP OTLI,I
0075*
0076  07766 000000 OTA     NOP            OUTPUT TO DATA CHANNEL
0077  07767 102311         SFS DC         WAIT FOR DATA CHANNEL
0078  07770 027767         JMP *-1
0079  07771 102611         OTA DC         OUTPUT DATA
0080  07772 103711         STC DC,C       START NEXT TRANSFER
0081  07773 127766         JMP OTA,I
0082*
0083*
0084  07774 127207 PASWD   OCT 127207
0085  07775 140000 SEEK    OCT 140000
0086  07776 000010 SC      ABS CC
0087  07777 000000 ADDR    NOP
0088*
0089  07766        COUNT   EQU OTA
0090*
0091*
0092                       END
**  NO ERRORS *TOTAL **RTE ASMB 76092A**
```

HP 12992F 7900/7901 DISC LOADER ROM

```
                7900 DISC BOOT LOADER (12992F) - RPL COMPATIBLE

0001                 ASMB,A,B,L
0003  07700                ORG 7700B
0004*********************************************
0005*                                           *
0006*      REVISION          05 AUG 77          *
0007*      PART NUMBER       12992-80003        *
0008*      PRODUCT NUMBER    12992F             *
0009*                                           *
0010*********************************************
0011*
0012*  SWITCH REGISTER USAGE
0013*
0014*   15-14    LOADER SELECT
0015*   13-12    UNUSED
0016*   11-6     DISC SELECT CODE
0017*    5-3     RESERVED
0018*    2-0     HEAD(SUBCHANNEL) NUMBER
0019*
0020  00010          DC    EQU 10B
0021  00011          CC    EQU DC+1
0022*
0023  07700 106710  START CLC DC         INSURE CONTROL SIGNALS ARE CLEARED
0024  07701 106711        CLC CC          ON COMMAND AND DATA CHANNELS
0025*
0026  07702 017757        JSB STAT        GET DISC STATUS
0027*
0028*  ISSUE SEEK COMMAND
0029*
0030  07703 067746  SEEK  LDB SEEKC      GET SEEK COMMAND
0031  07704 106610        OTB DC          OUTPUT CYLINDER ADDRESS
0032  07705 103710        STC DC,C          TO DATA CHANNEL
0033  07706 106611        OTB CC         OUTPUT SEEK COMMAND
0034  07707 103711        STC CC,C        TO COMMAND CHANNEL
0035  07710 102310        SFS DC         FIRST ADDRESS WORD ACCEPTED ?
0036  07711 027710        JMP *-1          NO, WAIT
0037  07712 006400        CLB              YES, SET UP HEAD/SECTOR ADDRESS
0038  07713 102501        LIA 1          INPUT SWITCH REGISTER
0039  07714 002011        SLA,RSS        IS SUBCHANNEL 0 SELECTED ?
0040  07715 047747        ADB BIT9         YES, SET BIT 9 IN HEAD ADDRESS
0041  07716 106610        OTB DC           NO, BIT 9 = 0, OUTPUT HEAD/SECTOR
0042  07717 103710        STC DC,C          ADDRESS TO DATA CHANNEL
0043  07720 102311        SFS CC         IS SEEK COMPLETE ?
0044  07721 027720        JMP *-1          NO, WAIT
0045*
0046*
0047  07722 017757        JSB STAT           YES, CHECK STATUS ON DRIVE 0
0048*
0049*  ALLOCATE DMA CHANNEL
0050*
0051  07723 067776  DMA   LDB DMACW      START DMA SET-UP
0052  07724 106606        OTB 6          OUTPUT DMA CONTROL WORD
```

HP 12992F 7900/7901 DISC LOADER ROM (Cont'd)

```
0053  07725 067750         LDB ADDR1      GET MEMORY ADDRESS
0054  07726 106602         OTB 2          OUTPUT MEMORY ADDRESS TO DMA
0055  07727 102702         STC 2          SET WORD COUNT INPUT
0056  07730 067752         LDB CNT        GET WORD COUNT
0057  07731 106602         OTB 2          OUTPUT WORD COUNT TO DMA
0058  07732 063745  READ   LDA RDCMD      GET READ COMMAND
0059  07733 102611         OTA CC         OUTPUT READ COMMAND
0060  07734 103710         STC DC,C       PREPARE DATA CHANNEL FOR READING
0061  07735 103706         STC 6,C        ACTIVATE DMA
0062  07736 103711         STC CC,C       INITIATE READ COMMAND
0063  07737 102311         SFS CC         IS READ COMPLETE ?
0064  07740 027737         JMP *-1          NO, WAIT
0065*
0066*
0067  07741 017757         JSB STAT       CHECK STATUS ON DRIVE 0
0068*
0069*
0070  07742 027775         JMP EXIT
0071*
0072*
0073*  CONSTANTS
0074*
0075*
0076  07743 037766  FSMSK  OCT 37766
0077  07744 004000  STMSK  OCT 4000
0078  07745 020000  RDCMD  OCT 20000
0079  07746 030000  SEEKC  OCT 30000
0080  07747 001000  BIT9   OCT 1000
0081  07750 102011  ADDR1  OCT 102011
0082  07751 102055  ADDR2  OCT 102055
0083  07752 164000  CNT    DEC -6144
0084*   4NOP'S
0088                       LST
0089*
0090*  REQUEST DISC STATUS
0091*
0092  07757 000000  STAT   NOP
0093  07760 002400         CLA
0094  07761 102611         OTA CC         OUTPUT STATUS REQUEST
0095  07762 103711         STC CC,C       INITIATE STATUS REQUEST
0096  07763 102310         SFS DC         IS STATUS READY?
0097  07764 027763         JMP *-1           NO,WAIT
0098  07765 102510         LIA DC            YES,INPUT STATUS WORD
0099  07766 013743         AND FSMSK      MASK BITS 14,3,0 OFF
0100  07767 002003         SZA,RSS        IS DRIVE READY?
0101  07770 127757         JMP STAT,I        YES,EXIT
0102  07771 013744         AND STMSK         NO,MASK BIT 9
0103  07772 002002         SZA            IS DRIVE FAULTY?
0104  07773 102030         HLT 30B           YES,HALT 30B,"RUN"TO TRY AGAIN
0105  07774 027700         JMP START         NO,REPEAT SEEK REQUEST
0106*
0107*
0108  07775 117751  EXIT   JSB ADDR2,I     YES, EXECUTE LOADED PROGRAM @ 2055B
0109* THE FOLLOWING 2 WORDS MUST BE THE LAST 2 LOCATIONS
0110*  IN  THE BOOT STRAP
0111  07776 120010  DMACW  ABS 120000B+DC
0112  07777 170100         ABS -START
0113                       END
```

HP 12992H 7906H/7920H/7925H/9895 DISC LOADER ROM

```
0001                ASMB,A,B,L
0002* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0003*    ICD DISC BOOT LOADER - RPL COMPATABLE                      *
0004*                                                               *
0005*  PRODUCT NUMBER - 12992H                                      *
0006*  PART NUMBER - 12992-80004                                    *
0007*                                                               *
0008* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0009*  SWITCH REGISTER OPTIONS:                                     *
0010*                                                               *
0011*  15-14  LOADER SELECT                                         *
0012*  12     0/1 = RPL/MANUAL BOOT                                 *
0013*  11-6   IBI SELECT CODE                                       *
0014*  1-0    HEAD #                                                *
0015* * * * * * * * * * * * * * * * * * * * * * * * * * * * * * * *
0016  07700                ORG 7700B
0017  00010          IBI   EQU 10B
0018*
0019  07700 102501  START LIA 1          GET SWITCH REGISTER SETTING
0020  07701 100044        LSL 4          SHIFT A LEFT 4
0021  07702 006111        CLE,SLB,RSS    SR BIT 12 SET FOR MANUAL BOOT?
0022  07703 100041        LSL 1          NO. SHIFT HEAD # FOR RPL BOOT
0023  07704 001424        ALR,ALR        SHIFT HEAD 2, CLEAR SIGN
0024*
0025*         WAIT FOR DRIVE 0 READY
0026*
0027  07705 033744        IOR HDSEC      SET EOI BIT
0028  07706 073744        STA HDSEC      PLACE IN COMMAND BUFFER
0029  07707 017756        JSB BTCTL      SEND DUMMY,U-CLR,PP
0030  07710 102510        LIA IBI        READ INPUT REGISTER
0031  07711 101027        ASR 7          SHIFT DRIVE 0 RESPONSE TO LSB
0032  07712 002011        SLA,RSS        DID DRIVE 0 RESPOND?
0033  07713 027710        JMP *-3        NO, GO LOOK AGAIN
0034  07714 107700        CLC 0,C
0035  07715 017756        JSB BTCTL      SEND TALK,CL-RD,BUS HOLDER
0036  07716 002300        CCE
0037  07717 017756        JSB BTCTL      TELL CARD TO LISTEN
0038*
0039*     NEXT PERFORM THE DMA TRANSFER
0040*
0041  07720 063776        LDA DMACW      LOAD DMA CONTROL WORD
0042  07721 102606        OTA 6          OUTPUT TO DCPC
0043  07722 106702        CLC 2          READY DCPC
0044  07723 063735        LDA ADDR1      LOAD DMA BUFFER ADDRESS
0045  07724 102602        OTA 2          OUTPUT TO DCPC
0046  07725 063740        LDA DMAWC      LOAD DMA WORD COUNT
0047  07726 102702        STC 2          READY DCPC
0048  07727 102602        OTA 2          OUTPUT TO DCPC
0049  07730 103706        STC 6,C        START DCPC
0050  07731 102206  TEST  SFC 6          SKIP IF DMA NOT DONE
0051  07732 117750        JSB ADDR2,I    SUCCESSFUL END OF TRANSFER
0052  07733 102310        SFS IBI        SKIP IF DISC ABORTED TRANSFER
0053  07734 027731        JMP TEST       RECHECK FOR TRANSFER END
0054  07735 102011  ADDR1 HLT 11B        ERROR HALT
0055*
```

HP 12992H 7906H/7920H/7925H/9895 DISC LOADER ROM (Cont'd)

```
0056*
0057*      PROGRAM CONSTANT TABLE
0058*
0059*
0060  07736 000677  UNCLR OCT 677         UNLISTEN
0061  07737 000737        OCT 737         UNTALK
0062  07740 176624  DMAWC OCT 176624      UNIVERAL CLEAR,LBO
0063  07741 000440  LIST  OCT 440         LISTEN BUS ADDRESS 0
0064  07742 000550  CMSEC OCT 550         SECONDARY GET COMMAND
0065  07743 000000  BOOT  OCT 0           COLD LOAD READ COMMAND
0066  07744 001000  HDSEC OCT 1000        HEAD,SECTOR PLUS EOI
0067  07745 000677  UNLST OCT 677         ATN,PRIMARY UNLISTEN,PARITY
0068  07746 000500  TALK  OCT 500         SEND READ DATA
0069  07747 100740  RDSEC OCT 100740      SECONDARY READ DATA
0070  07750 102055  ADDR2 OCT 102055      BOOT EXTENSION STARTING ADDRESS
0071  07751 004003  CTLP  OCT 4003        INT=LBO,T,CIC
0072  07752 000047        OCT 47          PPE,L,T,CIC
0073  07753 004003        OCT 4003        INT=LBO,T,CIC
0074  07754 000413        OCT 413         ATN,P,L,CIC
0075  07755 001015        OCT 1015        INT=EOI,P,L,CIC
0076*
0077*
0078*
0079  07756 000000  BTCTL NOP
0080  07757 107710        CLC IBI,C       RESET IBI
0081  07760 063751  BM    LDA CTLP        LOAD CONTROL WORD
0082  07761 102610        OTA IBI         OUTPUT TO CONTROL REGISTER
0083  07762 102710        STC IBI         RETURN IBI TO DATA MODE
0084  07763 037760        ISZ BM          INCREMENT CONTROL WORD POINTER
0085  07764 002240        SEZ,CME
0086  07765 127756        JMP BTCTL,I     RETURN
0087  07766 063736  LABL  LDA UNCLR       LOAD DATA WORD
0088  07767 037766        ISZ LABL        INCREMENT WORD POINTER
0089  07770 102610        OTA IBI         OUTPUT TO HPIB
0090  07771 002021        SSA,RSS         SKIP IF LAST WORD
0091  07772 027766        JMP LABL        GO BACK FOR NEXT WORD
0092  07773 102310        SFS IBI         SKIP IF LAST WORD SENT TO BUS
0093  07774 027773        JMP *-1         RECHECK ACCEPTANCE
0094  07775 027757        JMP BTCTL+1
0095  07776 000010  DMACW ABS IBI
0096  07777 170100        ABS -START
0097                      END
**  NO ERRORS *TOTAL **RTE ASMB 92067-16011**
```

HP 12992J 7908/7911/7912/7914/7933 CS80 DISC LOADER ROM

```
00001                ASMB,A,L
00002*****************************************************************
00003*   CS80 BOOT LOADER      RPL COMPATIBLE      810915               *
00004*                                                                  *
00005*                                                                  *
00006*     PRODUCT NUMBER  12292J                                       *
00007*     PART NUMBER     12992-80005                                  *
00008*                                                                  *
00009*                                                                  *
00010*     S REG                                                        *
00011*       15 - 14  BOOT ROM                                          *
00012*       11 - 6   IBI SELECT CODE                                   *
00013*        2 - 0   UNIT                                              *
00014*****************************************************************
00015*
00016  07700                ORG 7700B
00017        000010  IBI    EQU 10B
00018  07700 102501  START  LIA 1        GET SWITCH REGISTER
00019  07701 013751         AND XXX      AND OUT UNIT
00020  07702 033742         IOR UNIT     PUT IN UNIT COMMAND
00021  07703 073742         STA UNIT     SAVE FOR BUS
00022  07704 000040         CLE
00023*
00024*  WAIT FOR DRIVE 0 READY
00025*
00026  07705 017756         JSB BTCTL    SEND UDC,PPOL
00027  07706 102510         LIA IBI      READ INPUT REGISTER
00028  07707 101027         ASR 7        SHIFT DRIVE 0 RESPONSE TO LSB
00029  07710 002011         SLA,RSS      DID DRIVE 0 RESPOND
00030  07711 027706         JMP *-3      NO GO WAIT
00031*
00032  07712 107700         CLC 0,C      SHUT DOWN EVERYONE ELSE
00033  07713 017756         JSB BTCTL    SEND TALK,READ,BUS HOLDER
00034  07714 002300         CCE
00035  07715 017756         JSB BTCTL    TELL CARD TO LISTEN
00036*
00037*     PERFORM DMA TRANSFER
00038*
00039  07716 063776         LDA DMACW    LOAD DMA CONTROL WORD
00040  07717 102606         OTA 6        OUTPUT TO DCPC
00041  07720 106702         CLC 2        READY DCPC
00042  07721 063733         LDA ADDR1    LOAD DMA BUFFER ADDRESS
00043  07722 102602         OTA 2        OUTPUT TO DCPC
00044  07723 063736         LDA DMAWC    LOAD DMA WORD COUNT
00045  07724 102702         STC 2        READY DCPC
00046  07725 102602         OTA 2        OUTPUT TO DCPC
00047  07726 103706         STC 6,C      START DCPC
00048  07727 102206  TEST   SFC 6        SKIP IF DMA NOT DONE
00049  07730 117747         JSB ADDR2,I  SUCCESSFUL END OF TRANSFER
```

HP 12992J 7908/7911/7912/7914/7933 CS80 DISC LOADER ROM (Cont'd)

```
00050  07731 102310         SFS IBI       SKIP IF DISC ABORTED TRANSFER
00051  07732 027727         JMP TEST      WAIT...WAIT...WAIT
00052  07733 102011  ADDR1  HLT 11B       ERROR HALT
00054*
00055*      PROGRAM CONSTANT TABLE
00056*
00057  07734 000677  UNCLR  OCT 677       UNLISTEN
00058  07735 000737         OCT 737       UNTALK
00059  07736 176624  DMAWC  OCT 176624    UNIVERSAL CLEAR,LBO/DMA WORD COUNT
00060  07737 000624         OCT 624       SECOND UNIVERSAL CLEAR
00061  07740 000440  LIST   OCT 440       LISTEN BUS ADDRESS 0
00062  07741 000745  CMSEC  OCT 745       COMMAND MESSAGE
00063  07742 000040  UNIT   OCT 40        UNIT
00064  07743 001000  READ   OCT 1000      READ
00065  07744 000677  UNLST  OCT 677       UNLISTEN
00066  07745 000500  TALK   OCT 500       DEVICE TALK
00067  07746 100556  EXEC   OCT 100556    EXECUTION MESSAGE
00068  07747 102055  ADDR2  OCT 102055    BOOT EXTENSION STARTING ADDRESS
00069  07750 004003  CTLP   OCT 4003      INT=LBO,T,CIC
00070  07751 000047  XXX    OCT 47        PPE,L,T,CIC
00071  07752 004003         OCT 4003      INT=LBO,T,CIC
00072  07753 000413         OCT 413       ATN,P,L,CIC
00073  07754 001015         OCT 1015      INT=EOI,P,L,CIC
00074  07755 000000         NOP
00075*
00076*
00077*
00078  07756 000000  BTCTL  NOP
00079  07757 107710         CLC IBI,C     RESET IBI
00080  07760 063750  BM     LDA CTLP      LOAD CONTROL WORD
00081  07761 102610         OTA IBI       OUTPUT TO IBI
00082  07762 102710         STC IBI       RETURN IBI TO DATA MODE
00083  07763 037760         ISZ BM        INCREMENT CONTROL WORD POINTER
00084  07764 002240         SEZ,CME
00085  07765 127756         JMP BTCTL,I   RETURN
00086  07766 063734  LABL   LDA UNCLR     LOAD DATA WORD
00087  07767 037766         ISZ LABL      INCREMENT WORD POINTER
00088  07770 102610         OTA IBI       OUTPUT TO HPIB
00089  07771 002021         SSA,RSS       SKIP IF LAST WORD
00090  07772 027766         JMP LABL      GO BACK FOR NEXT WORD
00091  07773 102310         SFS IBI       SKIP IF LAST WORD SENT TO BUS
00092  07774 027773         JMP *-1       WAIT FOR ACCEPTANCE
00093  07775 027757         JMP BTCTL+1
00094  07776 000010  DMACW  ABS IBI
00095  07777 170100         ABS -START
00096                       END
MACRO:  No  errors  total
```

HP 12992K PAPER TAPE LOADER ROM

```
X7700   107700  START   CLC  O,C          TURN OFF THE INTERRUPT
                                            SYSTEM
X7701   002401          CLA, RSS
X7702   063756  CONT    LDA  M.11         FEED FRAME COUNTER
X7703   006700          CLB, CCE          SET E TO READ BYTE
X7704   017742          JSB  READ         GET # OF CHAR
X7705   007306          CMB,CCE,INB,SZB   2'S COMP)
X7706   027713          JMP  *+5          NON ZERO BYTE
X7707   002006          INA, SZA          FEED FRAME COUNTER
X7710   027703          JMP  *-5
X7711   102077          HLT  77B          END OF TAPE
X7712   027700          JMP  START
X7713   077754          STB  WD.CT        WORDS IN RECORD
X7714   017742          JSB  READ         GET FEED FRAME
X7715   017742          JSB  READ         GET ADDRESS
X7716   074000          STB 0             INITIATE CHECKSUM
X7717   077755          STB ADDR
X7720   067755  CHECK   LDB  ADDR
X7721   047777          ADB  MAXAD        CHECK ADDR BELOW
                                            LOADER
X7722   002040          SEZ               E  OK
X7723   027740          JMP  HLT55        ADDR>=LOADER
X7724   017742          JSB  READ         GET NEXT WORD
X7725   040001          ADA  1            CONTINUE CHECKSUM
X7726   177755          STB  ADDR,I
X7727   037755          ISZ  ADDR
X7730   000040          CLE
X7731   037754          ISZ  WD.CT
X7732   027720          JMP  CHECK
X7733   017742          JSB  READ
X7734   054000          CPB  0
X7735   027702          JMP  CONT
X7736   102011          HLT  11B          CHECKSUM ERROR
X7737   027700          JMP  START
X7740   102055  HLT55   HLT  55B          ADDRESS>=LOADER
X7741   027700          JMP  START
X7742   000000  READ    NOP               E  READ WORD =1 BYTE
X7743   006600          CLB, CME          E REG BYTE POINTER
X7744   1037KK          STC  RDR,C        START THE READER
X7745   1023KK          SFS  RDR             CHECK THESE IF $$
X7746   027745          JMP  *-1             LOADER BOMBED $1
X7747   1064KK          MIB  RDR          GOT BYTE
X7750   002041          SEZ, RSS
X7751   127742          JMP  READ,I
X7752   005767          BLF, CLE,BLF
X7753   027744          JMP  *-7
X7754   000000  WD.CT    NOP
X7755   000000  ADDR    NOP
X7756   177765  M.11    DEC-11            FEED FRAME CONST.
X7777           MAXAD   EQU  X7777B       LOADER ADDRESS
00010           RDR     EQU  KKB          READER SELECT CODE
                        END
```

X = 1 for 8K
2 for 12K
3 for 16K
4 for 20K
5 for 24K
6 for 28K
7 for 32K

KK = Paper Tape Reader

LOADER ROM IDENTIFICATION

HP PRODUCT NUMBER	HP PART NUMBER	ASSOCIATED DEVICE			FORMAT
		PERIPHERAL PRODUCT	INTERFACE	SUBSYSTEM NUMBER	
12992A	12992-80008	7900 Cartridge Disc	13210A Disc Interface	12960A	Disc Boot
		7901 Cartridge Disc	13210A Disc Interface	12961A	Disc Boot
		2883 Disc Drive	12565A Disc Interface	12965A	Disc Boot
12992B	12992-80002	7905 Cartridge Disc	13175A/B Disc Interface	12962C/D	Disc Boot
		7906 Cartridge Disc	13175A/B Disc Interface	N/A	Disc Boot
		7920 Cartridge Disc	13175A/B Disc Interface	N/A	Disc Boot
		7925 Cartridge Disc	13175A/B Disc Interface	N/A	Disc Boot
12992C	12992-80009	CRT Terminal 2644/ 2645/4648	12966A Buffered Async Interface or 12968A Async Interface	N/A	Absolute Binary
12992D	1816-0962	7970B Mag Tape	13181A Mag Tape Interface	12970A	Absolute Binary
		7970E Mag Tape	13183A Mag Tape Interface	12972A	Absolute Binary
12992E	12992-80007	9885 Flexible Disc	Included in Subsystem	12732A	Absolute Binary
12992F	12992-80003	7900 Cartridge Disc	13210A Disc Interface	12960A	Disc Boot
		7901 Cartridge Disc	13210A Disc Interface	12961A	Disc Boot
12992H	12992-80004	7906H Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
		7920H Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
		7925H Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
		9895 Flexible Disc	12821A Disc Interface	N/A	Disc Boot
12992J	12992-80005	7908 Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
		7911 Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
		7912 Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
		7914 Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
		7933 Cartridge Disc	12821A Disc Interface	N/A	Disc Boot
12992K	12992-80010	Paper Tape	12597A Interface	N/A	Absolute Binary

M/E/F-SERIES COMPATIBILITY MATRIX

The following tables show the compatibility of the various combinations of products available for the M/E/F-Series of Computers. They are arranged by category of component vs. the computer model number and operating system. These tables are also contained in the Hardware History Library, part no. 92851-90002 Section III; the HP 1000 System Designer's Guide, part no. 92007-90001, and in the HP 1000 Systems Ordering and Compatibility Information, part no. 5953-8745.

The HP 1000 A/L-Series and M/E/F-Series Compatibility Matrices in the remaining pages of this section summarize the functional compatibility of HP 1000 Computer Systems, plug-in accessories, peripheral devices, and software. Compliance of HP 1000 Systems, computers, and peripheral devices with FCC and FTZ Electro-Magnetic (Radio Frequency) Interference (EMI) regulations is also summarized.

Functional Compatibility

Functional compatibility is basically coded as follows:

C = Compatible (Compatible systems and peripheral devices also comply with applicable safety standards)

N = Not compatible

Nt = Not Tested

Products designated as Nt may in fact be functionally compatible, but at the time of publication of the compatibility matrix, Hewlett-Packard takes no responsibility for their degree of compatibilty. Relatively new Nt items may later be tested and designated as compatible, but until such testing has been completed and a C designation given to an item, establishing and maintaining its compatibility is the responsibility of the customer who wishes to use the Nt item.

Qualifications required for compatibility and/or further compatibility information is provided in numbered C and N footnotes and additional footnotes.

Electro-Magnetic (Radio Frequency) Interference Compliance of Products

EMI compliance is specified in the compatibility matrices by additional lower-case letters appended to the C designation of functionally-compatible items. The complete codes are:

Cz = A functionally-compatible item whose compliance with EMI regulations in Germany is attested by its having received an FTZ license. Items that do not have an FTZ license may require a special license and/or site certification for use in Europe, a costly, time-consuming procedure that seriously limits European sales of non-licensed data processing equipment.

Cc = A functionally compatible item which has demonstrated compliance with FCC Class A EMI regulations in tests at the HP factory. All systems and peripherals must comply with FCC EMI regulation to be deliverable to U.S. unless they are to be used in exempt applications.

Ccz = A functionally compatible item which meets both the Cc and Cz EMI qualifications.

Cep = A functionally compatible item whose EMI compliance is pending, either waiting for successful completion of EMI tests or the issuance of an FTZ license. This category generally indicates HP's intention to make the respective product comply with EMI regulations.

Cn = Non-compliance with FCC and FTZ EMI regulations of a functionally-compatible product. As noted above, products designated Cn can be delivered to U.S. customers only for applications that exempt from FCC EMI regulations.

FCC EMI Qualification Exempt Applications

In the United States, certain applications are exempt from FCC EMI regulations. Customers who wish to buy non-complying products for use in exempt applications must fill out a prepared form that is available through the order processing coordinator at the local HP sales office.

EMI Testing

HP 1000 Computer Systems are tested for compliance in a configuration pursuant to FCC/VDE rules and regulations. The system is also tested to confirm its compliance with FCC Class A/VDE Level A EMI standards with any of the peripherals in the table below.

HP 1000 System Models	SPU Product Numbers	Disc Product Numbers	Printer Product Numbers	Console Product Numbers
6+	2186C 2186D	7908P 7911P 7912P 7914P 7914TD 7933H 7935H	2563A+214 2608S+214 2631B+214 2671A/G 2673A 2932A 2932A+046 82905B 82906A	2621B 2622A 2623A 2624B 2627A 2635B
Micro 26	2486A	248xA Opt 110 7908P/R 7911P/R 7912P/R 7914P/R 7914TD 7933H 7935H	2563A+214 2608S+214 2631B+214 2671A/G 2673A 2932A 2932A+046 82905B 82906A	2621B 2622A 2623A 2624B 2627A 2635B
Micro 27	2487A			
Micro 29	2489A			
26	2196C 2196D	7908R 7911R 7912R 7914R 7914TD 7933H 7935H	2563A+214 2608S+214 2631B+214 2671A/G 2673A 2932A 2932A+046 82905B 82906A	2621B 2622A 2623A 2624B 2627A 2635B
27	2197C 2197D			
29	2199C 2199D			
40	2176E	7906M 7906MR 7920M 7925M	2608A+210 2932A	2621B 2622A 2623A 2624B 2627A 2635B 2645A+ 007 2647A 2648A+ 007
45	2177F			
60	2178C	7906M 7906MR 7920M 7925M 7908R 7911R 7912R 7914R 7914TD+ 236 7933H 7935H	2563A+210 2608A+210 2608S+210 2932A	
65	2179C			

LEGEND:
Cc = Compatible and qualified under FCC Class A EMI stds
Cz = Compatible and FTZ licensed
Ccz = Compatible, qualified under FCC Class A EMI stds and FTZ licensed
Cep = Compatible, EMI qualification pending
Cn = Compatible, but not EMI qualified
C = Compatible or supported without reference to EMI qualification
N = Not compatible
Nt = Not tested
I = Currently included hardware

PRODUCT AND OPTION NUMBERS	DESCRIPTION	COMPATIBILITY													
		COMPUTERS AND SYSTEMS											OP SYSTEM		
		2108M/2112M	2109E/2113E	2111F/2117F	2176C	2176E	2177C	2177F	2178A	2178C	2179A	2179C	RTE-6/VM	RTE-IVB	RTE-IVE
1. HP 1000 M/E/F-SERIES COMPUTERS															
2108M	Computer with 64kb memory, up to 2Mb avail.	Cn	N	N	N	N	N	N	N	N	N	N	C1	C	C
2108MK	Board Computer with 64kb memory	I	N	N	N	N	N	N	N	N	N	N	C1	C	C
2109E	Computer with 64kb memory, up to 2Mb avail.	N	Cn	N	N	N	N	N	N	N	N	N	C	C	C
2109EK	Board Computer with 64kb memory	N	I	N	N	N	N	N	N	N	N	N	C	C	C
2111F	Computer with 64kb memory, up to 2Mb avail.	N	N	Cn	N	N	N	N	N	N	N	N	C	C	C
2112M	Computer with 128kb memory, up to 2Mb av.	Cn	N	N	N	N	N	N	N	N	N	N	C1	C	C
2113E	Computer with 128kb memory, up to 2Mb av.	N	Cn	N	I	I	N	N	I	I	N	N	C	C	C
2117F	Computer with 128kb memory, up to 2Mb av.	N	N	Cn	N	N	I	I	N	N	I	I	C	C	C
2. HP 1000 E/F-SERIES SYSTEM PROCESSOR UNITS (SPUs)															
2176C	Model 40 SPU with 128kb memory	N	N	N	Cn	N	N	N	N	N	N	N	N	I	N
2176E	EMI-qualified Model 40 SPU w/256kb memory	N	N	N	N	Ccz	N	N	N	N	N	N	N	I	N
2177C	Model 45 SPU with 128kb memory	N	N	N	N	N	Cn	N	N	N	N	N	N	I	N
2177F	EMI-qualified Model 45 SPU w/256kb memory	N	N	N	N	N	N	Ccz	N	N	N	N	N	I	N
2178A	Model 60 SPU with 256kb memory	N	N	N	N	N	N	N	Cn	N	N	N	I	N	N
2178C	EMI-qualified Model 60 SPU w/256kb memory	N	N	N	N	N	N	N		Ccz	N	N	I	N	N
2179A	Model 65 SPU with 256kb memory	N	N	N	N	N	N	N	N	N	Cn	N	I	N	N
2179C	EMI-qualified Model 65 SPU w/256kb memory	N	N	N	N	N	N	N	N	N	N	Ccz	I	N	N
3. M/E/F-SERIES MEMORY PRODUCTS (see pages 2.4-5 through 2.4-8)															
2102B	Std Perf Mem Ctrlr (Incl. in 12784/6A-D)	C2	C	N	C	C	N	N	C	C	N	N	C2	C2	C2
2102C	Std Perf Fault Control Memory Controller (Included in 12785/7A-D)	C3	C3	N	C	C	N	N	C	C	N	N	C3	C3	C3

2102E	High Perf Mem Ctrlr (Incl. in 12788A-H)	N	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3
2102H	High Perf Fault Control Memory Controller (Included in 12789A-M)	N	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3	C3
12666H	1Mb High Perf Fault Control Check Bit Bd*	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C	C	C
12699H	256kb High Perf Memory Module*	C5	C5	C	C5	C5	C	C	C5	C5	C	C	C	C	C
12746A	64kb Std Perf Memory Module*	C	C	N	C	C	N	N	C	C	N	N	C	C	C
12746H	64kb High Perf Memory Module*	C5	C5	C	C5	C5	C	C	C5	C5	C	C	C	C	C
12747A	128kb Std Perf Memory Module*	C	C	N	C	C	N	N	C	C	N	N	C	C	C
12747H	128kb High Perf Memory Module*	C6	C6	C6	C6	C6	C6	C6	C6	C6	C6	C6	C	C	C
12749H	512kb High Perf Memory Module*	C6	C6	C6	C6	C6	C6	C6	C6	C6	C6	C6	C	C	C
12779A	256kb Std Perf Fault Control Check Bit Bd*	C7	C7	N	C7	C7	N	N	C7	C7	N	N	C	C	C
12779H	256kb High Perf Fault Ctrl Check Bit Bd*	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C	C	C
12780A	512kb Std Perf Fault Control Check Bit Bd*	C7	C7	N	C7	N	C7	C7	C7	N	N	N	C7	C7	C7
12780H	512kb High Perf Fault Ctrl Check Bit Bd*	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C4	C	C	C
12784A	128kb Std Perf Memory Package	I1	N	N	C	N	N	N	N	N	N	N	C	C	C
12784B-D	256kb-1024kb Std Perf Memory Packages	C8	N	N	C	N	N	N	N	N	N	N	C	C	C
12785A-D	128kb-1024kb Std Perf FC Memory Packages	C8	N	N	C	N	N	N	N	N	N	N	C	C	C
12786A	128kb Std Perf Memory Package	N	I1	N	I	N	N	N	N	N	N	N	C	C	C
12786B	256kb Std Perf Memory Package	N	C8	N	C	N	N	N	I	I	N	N	C	C	C
12786C-D	512kb-1024kb Std Perf Memory Packages	N	C8	N	C	C	N	N	C	C	N	N	C	C	C
12787A-D	128kb-1024kb Std Perf FC Memory Packages	N	C8	N	C	C	N	N	C	C	N	N	C	C	C
12788A	128kb High Perf Memory Package	N	C5	C5	C5	C5	I	C5	N	N	N	N	C	C	C
12788B	256kb High Perf Memory Package	N	C5	C5	C5	C5	C5	C5	C5	C5	C5	C5	C	C	C
12788BB	256kb High Perf Memory Package	N	C5	C5	C5	I	C5	I	C5	C5	I	I	C	C	C
12788C-H	512kb-2048kb High Perf Memory Packages	N	C8	C8	C	C	C	C	C	C	C	C	C	C	C
12789A-H	128kb-2048kb High Perf FC Memory Packages	N	C8	C8	C	C	C	C	C	C	C	C	C	C	C
12789J-M	512kb-2048kb Std Perf FC Memory Packages	N	C8	C8	C	C	C	C	C	C	C	C	C	C	C

FOOTNOTES:

C1 = 2108M and 2112M Computers are compatible with RTE-6/VM only for purposes of program transportability. Because of insufficient control store capacity, these computers cannot use the RTE-6/VM firmware and must use much slower equivalent software routines.

C2 = Memory controller w/date code 1728 or later is compatible.

C3 = Memory controller w/date code 1720 or later is compatible when used in computer with date code 1720 or later.

C4 = Requires 2102C or 2102H Fault Control Memory Controller in Computer or SPU, but high performance memory cycle time is achieved only with 2102H Memory Controller in 2109E, 2111F, 2113E, or 2117F Computer or 2176C/E, 2177C/F, 2178A/C, or 2179A/C System Processor Unit.

C5 = High performance memory can be used with any 2102x Memory Controller, but high performance cycle time is achieved only with 2102E/H Memory Controller in 2109E, 2111F, 2113E, or 2117F Computer or 2176C/E, 2177C/F, 2178A/C, or 2179A/C System Processor Unit.

C6 = Requires Memory controller with date code 1801 or later; note C5 also applies to the 12747H and 12749H Memory Modules.

C7 = Requires 2102C Fault Control Memory Controller in Computer or SPU.

C8 = 1278xD (1024kb) Memory Package will require 12990B Memory Extender when used with 2108M, 2109E, or 2111F Computer.

I1 = 12784A/12786A (128kb) Standard Performance Memory Package is included in 2112M/2113E Computer and 2176C SPU.

* = 12666H, 12699H, 12747H, 12749H, 12779A and 12780A Memory Modules and Check Bit Boards are included in various 1278x Memory packages.

LEGEND:
Cc = Compatible and qualified under FCC Class A EMI stds
Cz = Compatible and FTZ licensed
Ccz = Compatible, qualified under FCC Class A EMI stds and FTZ licensed
Cep = Compatible, EMI qualification pending
Cn = Compatible, but not EMI qualified
C = Compatible or supported without reference to EMI qualification
N = Not compatible
Nt = Not tested
I = Currently included hardware

PRODUCT AND OPTION NUMBERS	DESCRIPTION	COMPATIBILITY													
		COMPUTERS AND SYSTEMS											OP SYSTEM		
		2108M/2112M	2109E/2113E	2111F/2117F	2176C	2176E	2177C	2177F	2178A	2178C	2179A	2179C	RTE-6/VM	RTE-IVB	RTE-IVE
3. M/E/F-SERIES MEMORY PRODUCTS, continued (see pages 2.4-5 thru 2.4-8)															
12892B	Memory Protect Module (incl. in 12784x throught 12789x Memory Packages)	C	C	C	C	C	C	C	C	C	C	C	C9	C9	C9
12897B	Dual-Channel Port Controller	C	C	C	C	C	C	C	C	C	C	C	C10	C10	C10
12898A	Dual-Channel Port Controller for I/O Ext.	C	C	C	C	C	C	C	C	C	C	C	C11	C11	C11
12976B	M-Series Dynamic Mapping System	C	N	N	N	N	N	N	N	N	N	N	C	C	C
+003	Adds Fast FORTRAN Processor to 12976B	C	N	N	N	N	N	N	N	N	N	N	C	C	C
12978B	M-Series Dynamic Mapping Instructions	C	N	N	N	N	N	N	N	N	N	N	C	C	C
13305A*	E/F-Series Dyn Mapping Sys for 13304A FAB	N	C12	N	N	N	N	N	N	N	N	N	C13	C13	C13
13307A*	E/F-Series Dynamic Mapping Instruction ROMs (part of 13305A)	N	C12	N	N	N	N	N	N	N	N	N	C13	C13	C13
13307B	E/F-Series Dynamic Mapping Instruction ROMs for use on 12791A or 13304A	N	I1	I1	I	I	I	I	I	I	I	I	C13	C13	C13
12731A	Memory Exp Module (incl. in 12784x-9x)	I2	I2	I2	I	I	I	I	I	I	I	I	C14	C14	C14
4. M/E/F-SERIES COMPUTER AND SYSTEM ACCESSORIES AND UPGRADES															
12539C	Time Base Generator	C	C	C	I	I	I	I	I	I	I	I	C	C	C
12620A	I/O Breadboard - RTE Priv Interrupt Fence	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12777A	Priority Jumper Card	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12791A	Firmware Expansion Module (FEM)	C	I	I	C	I	I	I	I	I	I	I	C	C	C
12823F	F-Series Firmware Upgrade Kit for computer with serial prefix 1920 or earlier	N	N	C	na	na	na	na	na	na	na	na	C	C	C
12824A	Vector Instruction Set for use in RTE-IVB	C15	C15	C	C15	C15	I	I	N	N	N	N	N	C	N
12829A	Vector Instruction Set for use in RTE-6/VM	C15	C15	C	N	N	N	N	C15	C15	I	I	C	C	C
12944B	Power Fail Recovery Sys for 2108M or 2109E	C	C	C	C	N	N	N	N	N	N	N	C	C	C
12945A	M-Series User Control Store	C	N	N	N	N	N	N	N	N	N	N	C	C	C
12977B	M-Series Fast FORTRAN Processor	C16	N	N	N	N	N	N	N	N	N	N	C	C	C

12991B	Power Fail Recovery Sys for 2111F, 2112M, 2113E, and 2117F Computers and 12990B	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12992B	RPL-compatible 7905A/79xxM Disc Loader ROM	N	C	C	C	C	C	C	C	C	C	C	C	na	na	na
12992C	264x Terminal Minicartridges Loader ROM	C	I	I	I	I	I	I	C	I	I	C	C	na	na	na
12992D	7970B/E+226/236 or equiv 7971A Mag Tape Loader ROM	C	I	I	C	C	C	C	C	C	C	C	C	na	na	na
12992E	12732A (9885M) Flexible Disc Loader ROM	C	C	C	C	C	C	C	C	C	C	C	C	na	na	na
12992F	RPL-compatible 7900 Disc Loader ROM	N	C	C	C	C	C	C	C	C	C	C	C	na	na	na
12992J	CS/80 Disc Loader ROM	C	C	C	C	C	C	C	C	C	C	C	C	na	na	na
12992K	Paper Tape Loader ROM	C	C	C	C	C	C	C	C	C	C	C	C	na	na	na
13197A	1k Writable Control Store (WCS) board	C	C	C	C	C	C	C	C	C	C	C	C	C17	C17	C17
13304A	Firmware Accessory Board (FAB)	N	C	C	I	C	C	C	C	C	C	C	C	C	C	C
13306A	E/F-Series Fast FORTRAN Proc for FAB mtg	N	C	N	C	N	C	C	C	N	N	N	N	C	C	C
13306B	E/F-Series Fast FORTRAN Proc for FEM mtg	N	C	C	C	I	C	C	C	I	I	I	C	C	C	C

5. M/E/F-SERIES EXTENDERS

12781A	Dual CPU Kit for 12979B	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12979B	Dual-Port I/O Extender	C	C	C	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C
12979B+001	12979B Modified for EMI compliance	C	C	C	C	Ccz	C	Ccz	C	Ccz	C	Ccz	C	C	C	C
12990B*	Memory Extender	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C

FOOTNOTES:

C9 = Memory Protect module with date code 1704 or later is compatible.
C10 = 12897B Dual-Channel Port Controller with date code 1649 or later is compatible.
C11 = 12898A Dual-Channel Port Controller with date code 1647 or later is compatible.
C12 = Requires 13304A Firmware Accessory Board, which is provided as 2109E/2113E Computer option 003.
C13 = Compatible when 13305A and/or 13307A/B includes Dynamic Mapping Instruction ROMS with part numbers 13307-80021 through 80026 or higher.
C14 = Memory Expansion Module with date code 1652 or later is compatible.
C15 = Compatibility is with software equivelents included in the 12824A/12829A Vector Instruction Set.
C16 = Compatible in 2108M/2112M Computer with "B" revision of base instruction set.
C17 = Requires 92061A RTE Microprogramming Package.
I1 = 12788A (128kb) High Performance Memory Package and 13307B Dynamic Mapping Instr. are included in 2117F Computer.
I2 = 12731A is included in 2112M, 2113E, and 2117F Computers.
na = Not Applicable
* = Obsolete product listed here for reference only.

LEGEND:
Cc = Compatible and qualified under FCC Class A EMI stds
Cz = Compatible and FTZ licensed
Ccz = Compatible, qualified under FCC Class A EMI stds and FTZ licensed
Cep = Compatible, EMI qualification pending
Cn = Compatible, but not EMI qualified
C = Compatible or supported without reference to EMI qualification
N = Not compatible
Nt = Not tested
I = Currently included hardware

PRODUCT AND OPTION NUMBERS	DESCRIPTION	COMPATIBILITY: COMPUTERS AND SYSTEMS: 2108M/2112M	2109E/2113E	2111F/2117F	2176C	2176E	2177C	2177F	2178A	2178C	2179A	2179C	OP SYSTEM: RTE-6/VM	RTE-IVB	RTE-IVE
6. RECOMMENDED M/E/F-SERIES TERMINAL INTERFACES															
12790A	Multipoint/Data Link Interface	C18	C18	C18	C18	C18	C18	C18	C18	C18	C18	C18	C19	C19	C19
12792A*/B	Eight-Channel Asynchronous Multiplexer	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12920B	16-Channel Asynchronous Multiplexer	C	C	C	C	C	C	C	Nt	Nt	Nt	Nt	Nt	C20	C20
12966A	Buffered Async (1 ch pt-pt) Comm I/F	C21	C21	C21	C21	C21	C21	C21	C21	C21	C21	C21	C22	C22	C22
7. OTHER M/E/F-SERIES TERMINAL INTERFACES															
12531C	Teleprinter Current Loop Interface	C	C	C	C	C	C	C	Nt	Nt	Nt	Nt	Nt	C	C
12531D	Terminal Current Loop Interface	C	C	C	C	C	C	C	Nt	Nt	Nt	Nt	Nt	C	C
12880A*	Console Terminal Interface	C	C	C	C	C	C	C	Nt	Nt	Nt	Nt	Nt	C	C
8. M/E/F-SERIES OPERATOR COMMUNICATION TERMINALS (For configuration information, see pages 4.1-1 thru 14)															
2382A	Office Display Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23
2621A*	Interactive Terminal	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C23	C23	C23
2621P*	Interactive Terminal with printer	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C23	C23	C23
2621B	Interactive Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23
2622A	Display Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23
2623A	Graphics Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23
2624A*	Display Station	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C23	C23	C23
2624B	Display Station	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Ccz	Cc	C23	C23	C23
2626A	Display Station	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Gn	Ccz	Cn	Ccz	C23	C23	C23
2627A	Color Graphics Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23
2635A*/B+051	Printing Terminal	Cn	Cn	Cn	Cn	Nt	Cn	Nt	Cn	Nt	Cn	Nt	C23	C23	C23
2635B	Printing Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23

2645A	Display Station	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23
+007	Adds Mini cartridge tape I/O	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C
2647A*	Intelligent Graphics Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C
2647F	Intelligent Graphics Terminal	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt
2648A	Graphics Terminal	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C23	C23	C23
+007	Adds Mini cartridge tape I/O	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C
2675A*+070	Thermal Printing Terminal with Mini cartridges deleted	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C
27201A	Speech Output Module conn via a compatible terminal (requires 27203A)	Cn	Cn	Cn	N	N	N	N	Cn	Cep	Cn	Cep	C	N	N
27203A	Speech Output Module Speech Library	Cn	Cn	Cn	N	N	N	N	C	C	C	C	C	N	N

9. M/E/F-SERIES DATA CAPTURE TERMINALS (See pages 4.2-1 and 2 for connections)

3075A	Desktop Data Capture Terminal	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C24	C24	N
3076A	Wall-mounting Data Capture Terminal	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C24	C24	N
3077A	Time Reporting Terminal	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C24	C24	N
3078A	Data Coupler	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt

10. M/E/F-SERIES DISC INTERFACES AND DISC MEMORIES (for connections, see pages 5.1-4 through 6)

12732A	Flexible Disc Memory Subsystem	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C
12821A	Interface to as many as four 7908/11/12/ 33/35 CS/80 Discs or as many as two 9898A and/or 7906H/20H/25H Discs	C	C	C	C	C	C	C	C	C	C	C	C	C	C
13175B*/D	Interface to 79xxM MAC Master Disc and up to seven 79xxS MAC Slave Discs	C	C	C	C	C	C	C	C	C	C	C	C	C	N
13178C*/D	Multi-CPU Interface (2nd thru 7th additional conn to 79xxM MAC Master Disc and associated 79xxS MAC Slave Discs)	C	C	C	C	C	C	C	C	C	C	C	C	C	N
7906H	19.6Mb Cartridge ICD Memory via 12821A I/F	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	N
7906HR+020	19.6Mb Cartridge ICD Memory via 12821A I/F	Cn	Cn	Cn	Cn	Cn	Cn	N	Cn	Cn	N	Cn	C	C	N

FOOTNOTES:
C18 = Compatible when used with 2645A Display Stations with serial number 1747A06465 or later, 2648A Graphics Terminals with serial number 1747A00846 or later, 264x OEM versions of these terminals, the 2624B Display Terminal, 2626A Display Station, and 2629x OEM versions of these terminals when equipped with the appropriate multipoint terminal option or accessory.
C19 = Requires 91730A Multipoint Subsystem Software.
C20 = Requires 91731A Multiplexer Subsystem Software.
C21 = 12966A interface card with date code 1629 or later is compatible with 2109E, 2111F, 2113E, and 2117F Computers and 2176C/E, 2177C/F, 2178A/C, and 2179A/C System Processor Units.
C22 = 12966A is software-supported in RTE only for use with 238x, 262x, 2635A*/B, and 264x Terminals.
C23 = This terminal is usable as a system console if a 264x Terminal with Mini cartridge I/O and 12966A+107 interface or another system load device is available at the system site for loading of diagnostics and updates.
C24 = Requires 91730A Multipoint Subsystem Software and 92080A DATACAP/1000 software.
* = Obsolete product listed here for reference only.

LEGEND:
Cc = Compatible and qualified under FCC Class A EMI stds
Cz = Compatible and FTZ licensed
Ccz = Compatible, qualified under FCC Class A EMI stds and FTZ licensed
Cep = Compatible, EMI qualification pending
Cn = Compatible, but not EMI qualified
C = Compatible or supported without reference to EMI qualification
N = Not compatible
Nt = Not tested
I = Currently included hardware

PRODUCT AND OPTION NUMBERS	DESCRIPTION	COMPATIBILITY													
		COMPUTERS AND SYSTEMS											OP SYSTEM		
		2108M/2112M	2109E/2113E	2111F/2117F	2176C	2176E	2177C	2177F	2178A	2178C	2179A	2179C	RTE-6/VM	RTE-IVB	RTE-IVE
10 M/E/F-SERIES DISC INTERFACES AND DISC MEMORIES, continued															
7906M/S	19.6Mb MAC Master/Slave Cartridge Disc Memory via 13175D/13178D interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	N
7906MR+020	19.6Mb MAC Master Cartridge Disc Memory via 13175D/13178D interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	N
7908P	16.5Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C	N	N
7908R	16.5Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	N	Ccz	N	Ccz	C	N	N
7911P	28.1Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C	N	N
7911R	28.1Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	N	Ccz	N	Ccz	C	N	N
7912P	65.6Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C	N	N
7912R	65.6Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	N	Ccz	N	Ccz	C	N	N
7914P	132.1Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C	N	N
7914R	132.1Mb Fixed Disc** via 12821A interface	Cn	Cn	Cn	N	N	N	N	N	Ccz	N	Ccz	C	N	N
7914TD+236	132.1Mb Fixed Disc and 7970E+236 Mag Tape in 63-in cabinet w/13183A two-card I/F	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C	N	N
7920H/7925H	50Mb/120Mb ICD Memory via 12821A interface	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	N
7920M and S	50Mb MAC Master and Slave Disc Memories via 13175D/13178D interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	N
7925M and S	120Mb MAC Master and Slave Disc Memories via 13175D/13178D interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	N
7933H	404Mb Fixed Disc via 12821A interface	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C25	N	N
7935H	404Mb Removable Media Disc via 12821A I/F	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C25	N	N
9121D/S	512kb/286kb Microfloppy disc via 12821A interface	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt
9133A/B	4.6Mb/9.2Mb Fixed disc and single 286kb Microfloppy disc via 12821A interface	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt
9134A/B	4.6Mb/9.2Mb Fixed disc via 12821A I/F	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt
9135A	4.6Mb Fixed disc and single Minifloppy disc via 12821A interface	N	N	N	N	N	N	N	N	N	N	N	N	N	N

9138A*	4.6Mb Fixed disc and Flexible discs via 12821A interface	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
9895A	2.35Mb Master Dual Flexible Disc Drive via 12821A interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C	

11. M/E/F-SERIES MAGNETIC TAPE SUBSYSTEMS (all include 13181B or 13183B interface; for connections, see page 5.5-3)

7970B+226/236	800 bpi, 9-tr NRZI Mag Tape Subsystem	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C	
7970E+226/236	1600 bpi, 9-tr, PE Mag Tape Subsystem	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C	
7971A+2xx	One or two 7970B/E Mag Tape Subsystems in tall cabinet	Cn	Cn	Cn	C	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C	

12. M/E/F-SERIES PRINTER INTERFACES AND PRINTERS (for connections, see page 5.2-4)

12792A*/B	8-Ch Async Mpxer to 2601A or 2932A Printer multiplexer panel	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
12845B	Interface to 2611A/13A*/17A*/19A/31A*+050/31B+050 Printer	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
26099A	Interface to 2608A Line Printer	C	C	C	C	C	C	C	C	C	C	C	C	C	C	
2563A	300 lpm Line Printer	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C	N	N	
2601A	40 cps Daisywheel Printer via 12792A*/B interface and multiplexer panel	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C	
2608A+210	400 LPM Line Printer (incl. 26099A I/F)	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C	
2608S+210	400 LPM Line Printer (incl. 12821A+001 I/F)	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C	N	N	
2611A*+100	600 LPM Line Printer (incl. 12845B I/F)	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C	
2613A*+100	300 LPM Line Printer (incl. 12845B I/F)	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C	
2617A*+100	600 LPM Line Printer (incl. 12845B I/F)	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C	
2619A*+100	1000 LPM Line Printer (incl. 12845B I/F)	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C	
2631A*/B+210	180 cps (impact) Printer (incl. 12845B I/F)	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C	
2671A	120 cps (thermal) Printer	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	
2671G	120 cps (thermal) Graphics Printer	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	
2673A	120 cps Intelligent Graphics Printer	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	
2687A	Desktop Laser Page Printer	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	
2932A	General Purpose Printer	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C	C	C	
82905A/B	80 cps Impact Printer	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	
82906A	160 cps Dot-Matrix Printer	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	
9876A	Thermal Graphics Printer	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C	

FOOTNOTES:

C25 = Requires Magnetic Tape Subsystem for bootup of system for which 7933H or 7935H is the system disc.
* = Obsolete product listed here for reference only.
** = 7908P/R, 7911P/R, 7912P/R, and 7914P/R Fixed Discs include built-in cartridge tape drive for backup and software loading.

LEGEND:
Cc = Compatible and qualified under FCC Class A EMI stds
Cz = Compatible and FTZ licensed
Ccz = Compatible, qualified under FCC Class A EMI stds and FTZ licensed
Cep = Compatible, EMI qualification pending
Cn = Compatible, but not EMI qualified
C = Compatible or supported without reference to EMI qualification
N = Not compatible
Nt = Not tested
I = Currently included hardware

PRODUCT AND OPTION NUMBERS	DESCRIPTION	COMPATIBILITY													
		COMPUTERS AND SYSTEMS											OP SYSTEM		
		2108M/2112M	2109E/2113E	2111F/2117F	2176C	2176E	2177C	2177F	2178A	2178C	2179A	2179C	RTE-6/VM	RTE-IVB	RTE-IVE
13. M/E/F-SERIES GRAPHICS INTERFACES AND GRAPHICS/1000-II SUPPORTED GRAPHICS DEVICES (for connections, see pages 5.3-3 and 4)															
12966A+107	Buffered Async Interface to 264x Graphics Terminal	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12966A+004	Buffered Async Interface to 722xC/T RS-232 Plotter and required 2635A*/B+051 or 262x Terminal	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12966A+105	Buffered Async Interface to 262x Graphics Terminal	C	C	C	C	C	C	C	C	C	C	C	C	C	C
59310B	HP-IB Interface to 1350S*/1351S, 7225A* w/17601, 7245A*, 7470A, 7580A+002*/7580B, 7585A+002*/7585B, 9111A, 9872A*/B*/C/S*/T, or 9874A*	C	C	C	C	C	C	C	C	C	C	C	C	C	C
1350S*/1351S	Graphics Display System via 1/14 of 59310B Interface	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C26	C26	C26
2608A+210	Line Printer (includes 26099A interface)	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	N
2608S+210	Line Printer (includes 12821A+001 I/F)	Cn	Cn	Cn	N	N	N	N	Cn	Ccz	Cn	Ccz	C26	N	N
2623A	Graphics Terminal via 12966A+105 I/F	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
2627A	Color Graphics Terminal via 12966A+105 I/F	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C27	C27	C27
2647A*	Intelligent Graphics Terminal via 12966A+107 interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
2647F	Intelligent Graphics Terminal	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt	Nt
2648A	Graphics Terminal via 12966A+107 interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
7220C/T	RS-232 Graphics Plotter w/8 pens & HP/GL programming via 12966A+004 I/F and 2635A*/B+051 or 264x Terminal	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C26	C26	C26
7221C/T or	RS-232 Graphics Plotter w/8 pens & compacted binary programming via 12966A+004	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C26	C26	C26

	I/F and 2635A*/B+051 or 264x Terminal														
7225B*+17601A*	Graphics Plotter (one pen) via 1/14 of 59310B interface	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C26	C26	C26
7245B*	Plotter/Printer via 1/14 of 59310B I/F	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C28	C28	C28
7470A+002	Graphics Plotter (two pens) via 1/14 of 59310B interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
7580B or 7580A*+002	Drafting Plotter (eight pens) via 1/14 of 59310B interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
7585B or 7585A*+002	Drafting Plotter (eight pens) via 1/14 of 59310B interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
9111A	Graphics Tablet via 1/14 of 59310B I/F	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
9872C/T	Graphics Plotter (eight pens) via 1/14 of 59310B interface	Cn	Cn	Cn	Cn	Ccz	Cn	Ccz	Cn	Ccz	Cn	Ccz	C26	C26	C26
9872A*/B*/S*	Graphics Plotter (four pens) via 1/14 of 59310B interface	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C26	C26	C26
9874A*	Digitizer via 1/14 of 59310B interface	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C26	C26	C26

14. OTHER PERIPHERAL DEVICES (for more information, see pages 5.6-1 and 5.6-2)

12925A*	Punched Tape Reader Subsystem	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C
12926A	Tape Punch Subsystem	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C
12985A*	Card Reader Subsystem	Cn	Cn	Cn	Cn	Cn	Nt	Nt	Nt	Nt	Nt	Nt	Nt	C	C

15. HP 1000 DSN INTERFACES AND PROGRAMMABLE SERIAL INTERFACE (for more information, see pages 4.3-1 thru 12)

12250A	DSN/X.25 Network (modem) I/F to Packet Switched Networks	C	C	C	C	C	C	C	C	C	C	C	C29	C29	C29
12260A	DSN/MRJE 1000 Interface	C	C	C	C	C	C	C	C	C	C	C	C30	N	N
12771A	Computer Serial Interface to HP 1000	C	C	C	C	C	C	C	C	C	C	C	C31	C31	C31
12773A	Computer Modem Interface to HP 1000	C	C	C	C	C	C	C	C	C	C	C	C31	C31	C31
12790A+001	Data Link Master Interface to HP 1000	C	C	C	C	C	C	C	C	C	C	C	C32	C32	C32

FOOTNOTES:

C26 = Requires 92841A Graphics/1000-II Device-Independent Graphics Library.
C27 = Requires 92841A Graphics/1000-II Device-Independent Graphics Library having date code 2301 or higher.
C28 = Requires 92840A Graphics/1000 Graphics Plotting (mature) Software.
C29 = Requires 91751A DSN/X.25 Communications Software.
C30 = Requires 91782A DSN/MRJE 1000 Multileaving Remote Job Entry Software.
C31 = Requires 91750A DS/1000-IV Network Software and 91740P/R DS/1000 firmware; 12773A will also require 12620A interface used as privileged fence.
C32 = Requires 91730A Multipoint Subsystem Software and 91750A DS/1000-IV Network Software.
* = Obsolete product listed here for reference only.

LEGEND:
Cc = Compatible and qualified under FCC Class A EMI stds
Cz = Compatible and FTZ licensed
Ccz = Compatible, qualified under FCC Class A EMI stds and FTZ licensed
Cep = Compatible, EMI qualification pending
Cn = Compatible, but not EMI qualified
C = Compatible or supported without reference to EMI qualification
N = Not compatible
Nt = Not tested
I = Currently included hardware

PRODUCT AND OPTION NUMBERS	DESCRIPTION	COMPATIBILITY													
		COMPUTERS AND SYSTEMS											OP SYSTEM		
		2108M/2112M	2109E/2113E	2111F/2117F	2176C	2176E	2177C	2177F	2178A	2178C	2179A	2179C	RTE-6/VM	RTE-IVB	RTE-IVE
15. HP 1000 DSN INTERFACES AND PROGRAMMABLE SERIAL INTERFACE, continued															
12793A*/B	DS/1000-IV Bisync (modem) I/F to HP 3000	C	C	C	C	C	C	C	C	C	C	C	C33	C33	C33
12794A*/B	DS/1000-IV HDLC (modem) I/F to HP 1000	C	C	C	C	C	C	C	C	C	C	C	C33	C33	C33
12825A	DS/1000-IV HDLC Dir Conn I/F to HP 1000	C	C	C	C	C	C	C	C	C	C	C	C33	C33	C33
12826A/B	Programmable Serial (modem) Interface	C	C	C	C	C	C	C	C	C	C	C	N1	N1	N1
12830A	DS/1000-IV Data Link Slave I/F to HP 1000	C	C	C	C	C	C	C	C	C	C	C	C33	C33	C33
12834A	DS/1000-IV Bisync Dir Conn I/F to HP 3000	C	C	C	C	C	C	C	C	C	C	C	C33	C33	C33
12889A	Hardwired Serial I/F to HP 3000 Ser II/III	C	C	C	C	C	C	C	C	C	C	C	C33	C33	C33
16. OTHER M/E/F-SERIES DATA COMMUNICATIONS INTERFACES															
12261A	Multi-Use Prog Mpxer for PCL/1000-AB	C	C	C	C	C	C	C	C	C	C	C	C34	N1	N1
12587B	Asynchronous Communications Interface	C	N	N	N	N	N	N	N	N	N	N	Nt	N1	N1
12589B	Automatic Calling Unit Interface	C	N	N	N	N	N	N	N	N	N	N	Nt	N1	N1
12618A	Sync Data Set I/F w/send & receive cards	C	C	C	C	C	C	C	C	C	C	C	C35	C35	N
12967A	Synchronous Communications Interface	C	C	C	C	C	C	C	C	C	C	C	N1	N1	N1
12968A	Asynchronous Communications Interface	C	C	C	C	C	C	C	C	C	C	C	N1	N1	N1
39301A	Fiber Optic Multiplexer (pair of 39301As and 39200B cabling are used with 12792B)	C	C	C	C	C	C	C	C	C	C	C	C	C	C
17. M/E/F-SERIES MEASUREMENT AND CONTROL INTERFACES AND PERIPHERALS (for connections, see pages 5.4-3 and 5.4-4)															
59310B	HP-IB I/F for 2240/2250 & other HP-IB Inst	C	C	C	C	C	C	C	C	C	C	C	C	C	C
91000A	Plug-in A-to-D Interface Subsystem	C	C	C	C	C	C	C	C	C	C	C	Nt	C36	C36
2240A*	Measurement & Control Processor & Access.	C	C	C	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C
2250M/N/R	Measurement & Control Processor & Access.	C	C	C	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	C	C	C
2313B*	Analog I/O Subsystem (includes interface)	C	C	C	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Cn	Nt	C36	C36

18. M/E/F-SERIES GENERAL-PURPOSE INTERFACES

12551B	16-Bit Relay Output Register	C	C	C	C	C	C	C	C	C	C	C	N1	N1	N1
12554A	16-Bit Duplex Register	C	C	C	C	C	C	C	C	C	C	C	N1	N1	N1
12556B	40-Bit Output Register	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12560A*	Incremental Digital Plotter Interface	C	C	C	C	C	C	C	C	C	C	C	Nt	Nt	Nt
12566B*/C	Microcircuit Duplex Register	C	C	C	C	C	C	C	C	C	C	C	C	C	C
12604B	Data Source Interface	C	N	N	N	N	N	N	N	N	N	N	C	C	C
12620A	Breadboard Interface/RTE Priv Inter Fence	C	C	C	C	C	C	C	C	C	C	C	C37	C37	C37
91200B	TV Interface	C	C	C	C	C	C	C	C	C	C	C	C	C	C

19. M/E/F-SERIES SOFTWARE (See pages 2.4-1 through 2.4-4 for application requirements)

91730A	Multipoint Interface Subsystem Software (used with 12790A interface)	C	C	C	C	C	C	C	C	C	C	C	C	C	C
91731A	Asynchronous Multiplexer Software (used with 12920B interface)	C	C	C	C	C	C	C	Nt	Nt	Nt	Nt	Nt	C	C
91740A**	DS/1000 Network software-firmware	C	N	N	N	N	N	N	N	N	N	N	N	C	C
91740P	DS/1000 Network firmware and right to copy 91740A software to one system	C	N	N	N	N	N	N	N	N	N	N	N	C	C
91740B**	DS/1000 Network software-firmware	N	C	C	C	C	C	C	C	C	C	C	N	C	C
91740R	DS/1000 Network firmware and right to copy 91740B software to one system	N	C	C	C	C	C	C	C	C	C	C	N	C	C
91741A**	DS/1000 S/W Enhancement for HP 3000 comm.	C	C	C	C	C	C	C	C	C	C	C	N	C	C
91745A	Datasafe/1000 on-line disc cartridge duplication software	C38	C38	C	N	N	N	N	C	C	C	C	N	C	N
91747A	Datashare/1000 multi-CPU file sharing s/w	C39	C39	C39	N	N	N	N	C39	C39	C39	C39	N	C	N
91750A	DS/1000-IV Network Software	C	C	C	C	C	C	C	C	C	C	C	C	C	C

FOOTNOTES:

C33 = Requires 91750A DS/1000-IV Network software.
C34 = Requires 92140A PCL/1000-AB Programmable Controller Link software.
C35 = Requires 91780A RJE/1000 (which includes the 12618A interface).
C36 = Requires 92066A RTE Measurement and Control Software.
C37 = Compatible as RTE Privileged Interrupt Fence; support as user-developed interface requires user-developed software.
C38 = Compatible in 2108/2112 Computer with Serial Prefix 1810 or later, 2109/2113 Computer with Serial Prefix 1812 or later, and all 2108/2109/2112/2113 Computers that have been upgraded for use with RTE-IV/IVB or RTE-6/VM.
C39 = Compatible only in system with 79xxM MAC Discs and computer that meets the criteria of C38, above.
N1 = Support of this interface requires user-developed software.
* = Obsolete product listed here for reference only.
** = Inactive software product listed here for reference only.

LEGEND:
Cc = Compatible and qualified under FCC Class A EMI stds
Cz = Compatible and FTZ licensed
Ccz = Compatible, qualified under FCC Class A EMI stds and FTZ licensed
Cep = Compatible, EMI qualification pending
Cn = Compatible, but not EMI qualified
C = Compatible or supported without reference to EMI qualification
N = Not compatible
Nt = Not tested
I = Currently included hardware

PRODUCT AND OPTION NUMBERS	DESCRIPTION	COMPATIBILITY													
		COMPUTERS AND SYSTEMS											OP SYSTEM		
		2108M/2112M	2109E/2113E	2111F/2117F	2176C	2176E	2177C	2177F	2178A	2178C	2179A	2179C	RTE-6/VM	RTE-IVB	RTE-IVE
19. M/E/F-SERIES SOFTWARE, continued															
91751A	DSN/X.25 Communications software	C	C	C	C	C	C	C	C	C	C	C	C	N	N
91780A	RJE/1000 Remote Job Entry Package	C	C	C	C	C	C	C	C	C	C	C	C	C	N
91782A	DSN/MJRE 1000 Multileaving Remote Job Entry Package	C	C	C	N	N	N	N	C	C	C	C	C	N	N
92001B**	RTE-II Operating System	C	C	N	N	N	N	N	N	N	N	N	N	N	N
92060A**	RTE-III Operating System	C	C	N	N	N	N	N	N	N	N	N	N	N	N
92061A	RTE Microprogramming Package	C40	C40	C40	C40	C40	C40	C40	C40	C40	C40	C40	C	C	C41
92063A**	Image/1000 with Query	C	C	C	C	C	N	N	N	N	N	N	N	C	N
92064A**	RTE-M Operating System	C	C	C	N	N	N	N	N	N	N	N	N	N	N
92065A**	BASIC/1000M	C	C	C	N	N	N	N	N	N	N	N	N	N	N
92066A	RTE Meas and Control Software Package	C	C	C	C	C	C	C	C	C	C	C	C	C	C
92067A**	RTE-IV Operating System	C42	C42	C	N	N	N	N	N	N	N	N	N	N	N
92068A	RTE-IVB Operating System	C42	C42	C	I	I	I	I	N	N	N	N	N	C	N
92068E	RTE-IVE Operating System	C42	C42	C	C	C	N	N	N	N	N	N	N	N	C
92069A	Image/1000 with Query	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92073A**	Image/1000 without Query	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92080A	DATACAP/1000-II	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92081A	Image/1000-II with Query	C	C	C	N	N	N	N	C	C	C	C	C	N	N
92082A**	ACCEL/1000 software	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92083A	RTE Profile Monitor	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92084A	RTE-6/VM Operating System	C42	C42	C	N	N	N	N	I	I	I	I	C	N	N
92091A	HPSPICE Circuit Simulation Program	N	N	C	N	N	N	N	C	C	C	C	C	N	N

92101A	BASIC/1000D	C	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92120A	HP Process Monitoring and Control/1000 S/W	N	C	C	N	N	N	N	N	N	C	C	C	N	N	N
92130A	HP Quality Decision Management/1000 S/W	N	N	C	N	N	N	N	N	N	C	C	C	N	N	N
92140A	PCL/1000-AB Prog Controller Link S/W	N	C	C	N	N	N	N	C	C	C	C	C	N	N	N
92400A	Sensor-based DAS Utility Package	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
92832A	Pascal/1000	C	C	C	C	C	C	C	N	N	N	N	N	C	N	N
92833A	Pascal/1000	C	C	C	N	N	N	N	C	C	C	C	C	N	N	N
92834A	FORTRAN 4X	C	C	C	C	C	C	C	N	N	N	N	N	C	N	N
92835A	Signal/1000 Digital Signal Processing Pkg	N	N	C	N	N	C	C	N	N	C	C	C	C	N	N
92836A	FORTRAN 77	C	C	C	N	N	N	N	C	C	C	C	C	C	N	N
92840A	Graphics/1000 Graphics Plotting Software	C	C	C	C	C	C	C	Nt	Nt	Nt	Nt	Nt	C	N	N
92841A	Graphics/1000-II Device-Independent Graphics Library	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
92842A	Graphics/1000-II Advanced Graphics Package	C	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92843X	Graphics/1000-II Skeleton Device Handler Source Product	C	C	C	C	C	C	C	C	C	C	C	C	C	C	N
92857A	BASIC/1000C	C	C	C	N	N	N	N	C	C	C	C	C	N	N	N
92860A	Symbolic Debug/1000	C	C	C	N	N	N	N	C	C	C	C	C	N	N	N

FOOTNOTES:

C40 = Requires 13197A 1k Writable Control Store board.
C41 = Only WCS Driver and WCS Load Utility are supported in RTE-IVE.
C42 = Compatible in 2108/2112 Computer with Serial Prefix 1810 or later, 2109/2113 Computer with Serial Prefix 1812 or later, and 2108/2109/2112/2113 Computers having earlier serial prefixes that have been upgraded for use with RTE-IV/IVB/IVE or RTE-6/VM.
** = Inactive software product listed here for reference only.

INDEX — SERVICE NOTE MICROFICHE

ISSUE DATE - AUGUST, 1983

* = ISSUES NOT ON PREVIOUSLY ISSUED MICROFICHE

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

ISSUE NO.		TITLE	LOC/COUNT
2108B-11	*	FRONT PANEL SILK SCREEN ERROR	1-J25 2
2108B-12	*	1255A DIGITAL-TO-ANALOG CONVERTER	1-K 3 1
2108B-13	*	NEW VERSION OF LOW COST POWER SUPPLY	1-K 4 3
2109A-01A		INPUT FILTER CAPACITOR DEFECT	1-K 7 1
2109A-02		ERATIC INDICATIONS DURING POWER UP/ NORMAL OPERATION OF COMPUTER	1-K 8 1
2109A-03		FRONT PANEL 'RUN' LIGHT TURNS ON WITHOUT PRESSING 'RUN' SWITCH	1-K 9 3
2109A-04A		NEW MEMORY BACKPLANE FOR 2109A	1-K12 1
2109A/B-04		E-SERIES BASE SET AND EIG/FLOATING POINT ROMS COMBINED INTO THREE 8K ROMS	1-K13 3
2109A/B-05		E-SERIES BASE SET MICROCODE CHANGE	1-K16 2
2109A-06		NEW EXCHANGE ASSEMBLY CONFIGURATION FOR THE 2108A/2109A/12979A 'A' POWER SUPPLY	1-K18 2
2109B-06		REV 'B' MOTHER BOARD INTRODUCTION	1-K20 4
2109B-07		B POWER SUPLY UPDATE REV B MOTHER	1-K24 4
2109B-08		B POWER SUPPLY	1-L 4 4
2109B-09		B POWER SUPPLY JUMPER BOARD (5061-1351)	1-L 8 1
2109B-10		CHANGE IN M/E/F-SERIES COMPUTER FANS (P/N 3160-0301, 3160-0224, 3160-0302)	1-L 9 1
2109B-11		B POWER SUPPLY THERMAL SHUTDOWN OPERATION	1-L10 2
2109B-11a		REQUIRED CONFIGURATION FOR RETURN TO CSD	1-L12 2
2109B-12		REDEFINITION OF RPL FEATURE	1-L14 6
2109B-13		REDESIGNED "B" TYPE POWER SUPPLY	1-L20 1
2109B-14	*	SELF-TEST FAILURE WITH POWER FAIL OPT.	1-L21 1
2109B-15	*	NEW VERSION OF LOW COST POWER SUPPLY	1-L22 3
2109E-01		HP 1000 E/F-SERIES COMPUTER'S RUN LIGHT REMAINS ON WHEN COMPUTER IS HALTED	2-A 2 2
2109E-02	*	MINI-CARTRIDGE TAPE LOADER ROM REPLACES PAPER TAPE LOADER ROM	2-A 4 1
2111F-01		2111F, 2117F FPP ARITHMETIC ASSY.	2-A 5 1
2111F-02		2111F/2117F BASE SET, FAST FORTRAN PROCESSOR, AND SCIENTIFIC INSTRUCTION SET FIRMWARE ENHANCEMENTS	2-A 6 2
2111F-03		REV 'B' MOTHER BOARD INTRODUCTION	2-A 8 4
2111F-04		B POWER SUPPLY UPDATE REV B MOTHER BOARD INTRODUCTION	2-A12 4
2111F-05		B POWER SUPPLY	2-A16 4
2111F-06		B POWER SUPPLY JUMPER BOARD (5061-1351)	2-A20 1
2111F-07		F-SERIES (2111F, 2117F) SCIENTIFIC INSTRUCTION SET FIRMWARE ERROR	2-A21 2
2111F-08		CHANGE IN M/E/F-SERIES COMPUTER FANS (P/N 3160-0301, 3160-0224, 3160-0302)	2-A23 1
2111F-09		B POWER SUPPLY THERMAL SHUTDOWN OPERATION	2-A24 2
2111F-10		HP 1000 E/F-SERIES COMPUTER'S RUN LIGHT REMAINS ON WHEN COMPUTER IS HALTED	2-B 2 2
2111F-11		F-SERIES BASE SET AND EIG/FLOATING POINT ROMS COMBINED INTO THREE 8K ROMS	2-B 4 2

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

ISSUE NO.		TITLE	LOC/COUNT
12746A/H-01		12741A, 12746A/H, 12747A/H, 12779A/H, 12780A/H, 12998A AND 13187B DELAY LINE CHANGE	3-H16 1
12746H-02		RANDOM PARITY ERRORS AND MEMORY PROTECT VIOLATIONS	3-H17 1
12747A-01		RANDOM MEMORY PROBLEMS	3-H18 1
12747A/H-02		12741A, 12746A/H, 12747A/H, 12779A/H, 12780A, 12998A AND 13187B DELAY LINE CHANGE	3-H19 1
12747H-03	*	RANDOM PARITY ERRORS AND MEMORY PROTECT VIOLATIONS	3-H20 1
12750B-01		CAPACITOR C21 VALUE CHANGE	3-H21 1
12771A-01		DS CARD DATA OVERRUN ERRORS	3-H22 1
12773A-01		DATA OVERRUN ERRORS	3-H23 1
12773A-02		ERRONEOUS DATA TRANSMISSION	3-H24 1
12773A-03		EXTRA ZEROS INPUT BETWEEN CORRECT WORDS	3-H25 1
12779A/H-01		12779A AND 12779H CHECK BIT ARRAYS	3-I 2 2
12779A/H-02		12741A, 12746A/H, 12747A/H, 12779A/H, 12780A/H, 12998A AND 13187B DELAY LINE CHANGE	3-I 4 1
12779H-03	*	RANDOM PARITY ERRORS AND MEMORY PROTECT VIOLATIONS	3-I 5 1
12780A/H-01		12741A, 12746A/H, 12747A/H, 12779A/H, 12780A/H, 12998A AND 13187B DELAY LINE CHANGE	3-I 6 1
12780H-02	*	RANDOM PARITY ERRORS AND MEMORY PROTECT VIOLATIONS	3-I 7 1
12790A-01		12790A MULTIPOINT TERMINAL INTERFACE	3-I 8 1
12790A-02		HP 12790A MULTIPOINT FIRMWARE CHANGES	3-I 9 3
12845A-01		MISMARKED I.C.	3-I12 1
12845B-01		PREVENTING STROBE WHEN PRINTER OFF-LINE	3-I13 3
12880A-01		IMPROVED RELIABILITY OF DATA TRANS-MISSION	3-I16 1
12880A-02		INCOMPATIBILITY WITH DMA/DCPC	3-I17 1
12880A-03		COMPUTER TERMINAL INTERFACE REQUIRES CONNECTION OF POWERED-ON TERMINAL	3-I18 2
12889A-01A		CONNECTOR KIT FOR CUSTOMER FURNISHED CABLE	3-I20 1
12889A-02		NOISY INTERFACE CABLE	3-I21 1
12889A-03		INTERMITTENT DATA ERRORS	3-I22 1
12889A-04		INTERFACE CABLE CONNECTORS FOR 12889-60004 DO NOT MATE WITH 12889-60003	3-I23 3
12892A-01A		DATA ERRORS USING DCPC/RTE-II/III UPDATE	3-J 2 2
12892A-02		MEMORY PROTECT FUNCTION CAUSING ERRONEOUS I/O CONTROL PROBLEMS	3-J 4 2

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

INDEX — SERVICE NOTE MICROFICHE (Cont'd)

MISCELLANEOUS

TESTS AND DIAGNOSTICS

COMPUTER SPECIFICATIONS

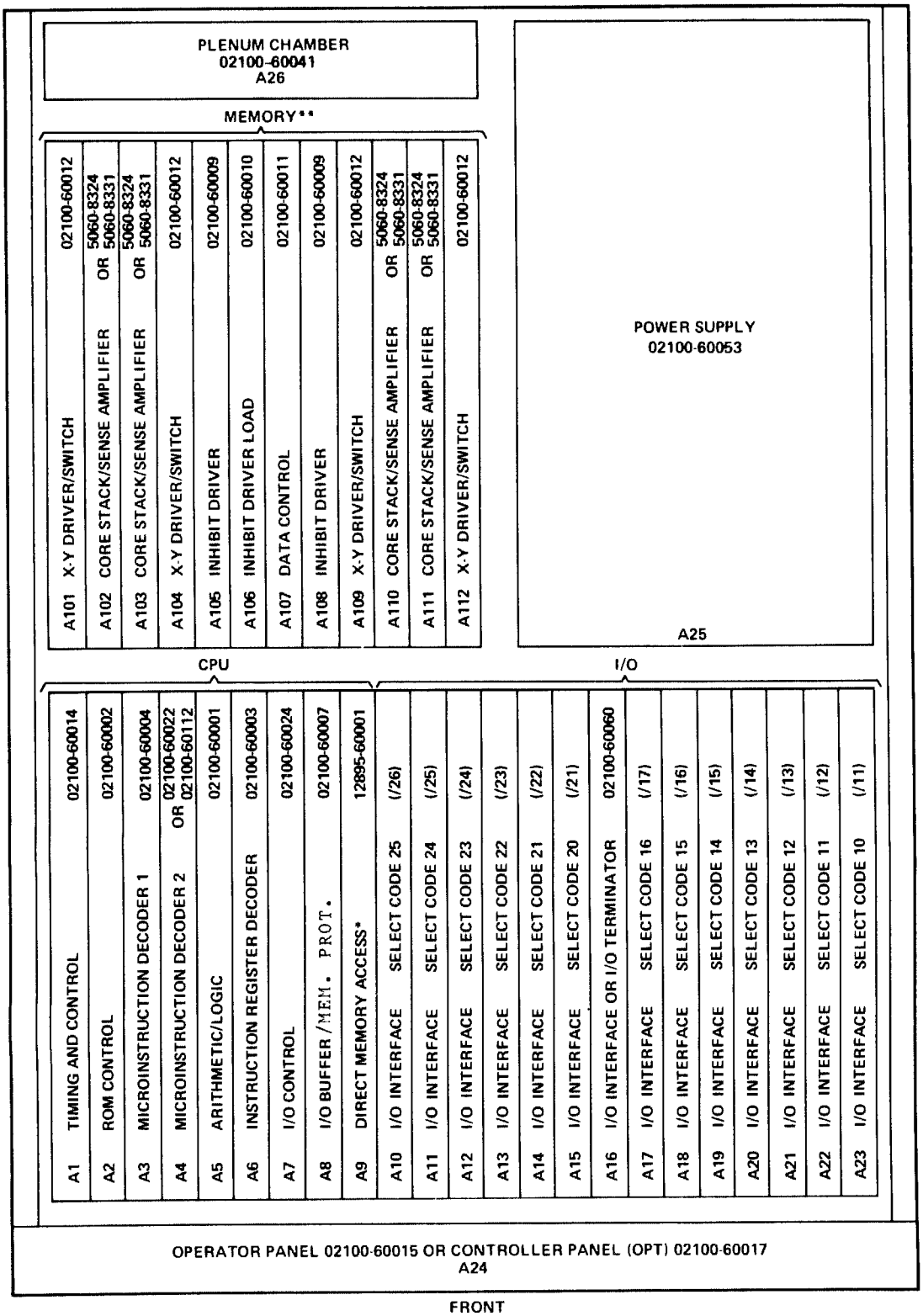
Memory Cycle Time:	980nS
Microinstruction Execution Time:	196nS
I/O Slots in Mainframe:	14
Memory Size:	4K to 32K
Ambient Operating Temp:	0-55°C (32-131°F)
Weight:	91 pounds (41 kg) minimum 121 pounds (55 kg) maximum
Dimensions:	12" x 16.75" x 26" 30.1 cm x 42.6 cm x 66 cm

HARDWARE MANUALS

SHORT TITLE	P/N	MICROFICHE
HP 2100A I&M*	02100-90002	02100-90132
HP 2100A Diagrams	02100-90003	02100-90134
HP 2100A IPB**	02100-90004	02100-90067
HP 2100A Reference	02100-90001	
HP 2100S I&M*	02100-90162	02100-90163
HP 2100S Diagrams	02100-90164	02100-90165
HP 2100S IPB**	02100-90166	02100-90167
HP 2100S Reference	02100-90160	02100-90161

*Installation and Maintenance
**Illustrated Parts Breakdown

PRINTED-CIRCUIT CARD LOCATIONS

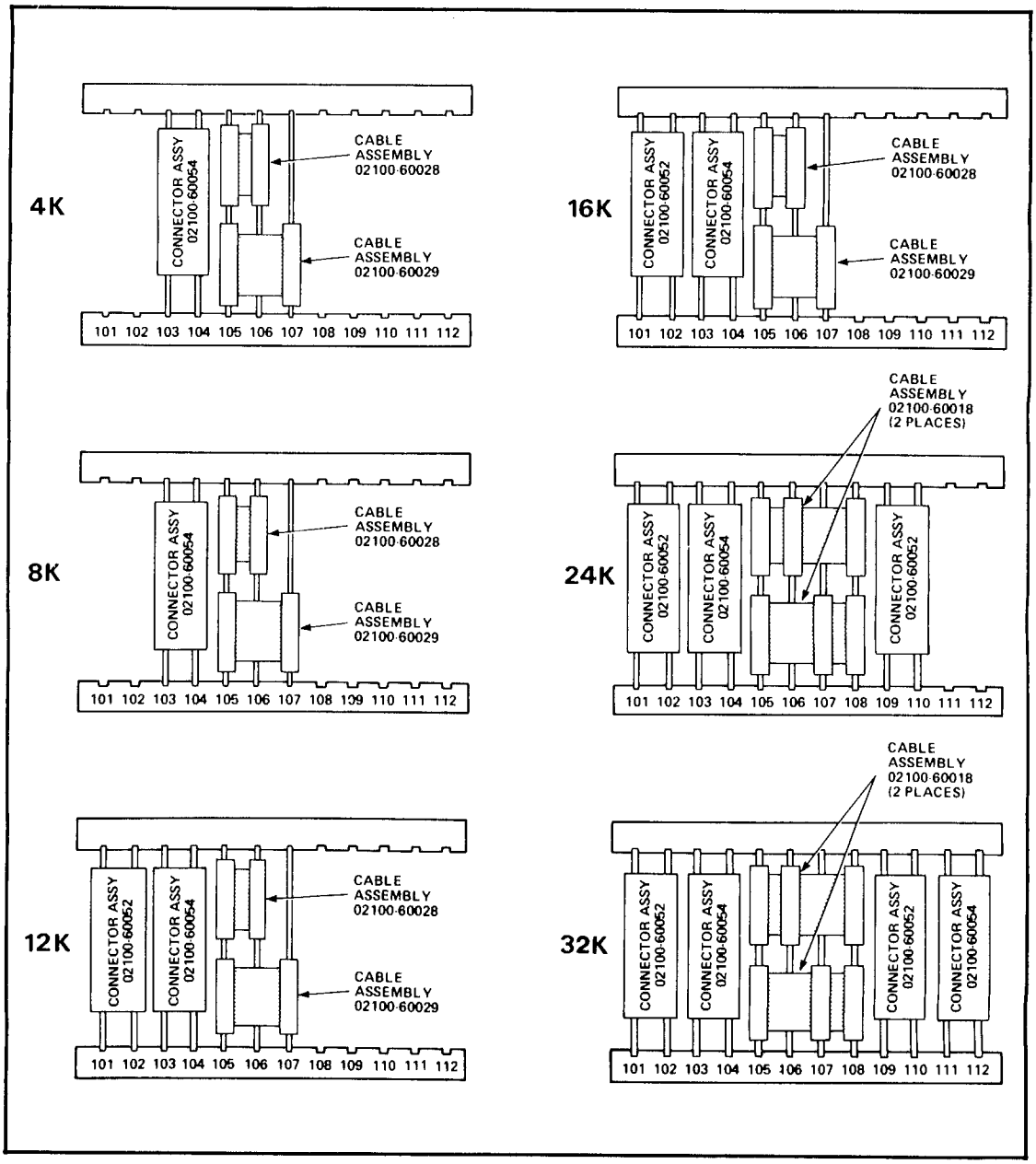


NOTES: *DIRECT MEMORY ACCESS CARD IS AN ACCESSORY TO THE COMPUTER AND IS NOT PART OF THE BASIC CONFIGURATION.

**MEMORY SECTION LOADING SHOWN IS FOR 32K MEMORY. REFER TO FIGURE 4-2 FOR OTHER MEMORY SIZE LOADING.

2133-3C

MEMORY CARD CAGE LOADING



2100 MEMORY DATA TRANSFER

This program is useful in transferring a loader to another memory module in a 2100 computer. It is used when you want to replace the module in which the loader resides without losing the loader contents.

B-Reg = Ending address of data to be transferred.
HLT77 indicates end of transfer.

ADDR	CONTENTS	MNEMONIC	
100	034110	ISZ 110	
101	034111	ISZ 111	
102	160111	LDA 111,I	STARTING ADDRESS
103	170110	STA 110,I	
104	060111	LDA 111	
105	054000	CPB A	
106	102077	HLT 77	
107	024100	JMP 100	
110	XXXXXX	STARTING ADDR FOR DUMP AREA (TO)	
111	XXXXXX	STARTING ADDR OF DATA TO BE TRANSFERRED (FROM)	

DMA TEST

To check operation of the DMA word count register:

Address	Mnemonic	Octal
100B	LIA 1	102501
101	STC XX	1037XX
102	OTA XX	1026XX
103	LIB XX	1065XX
104	JMP *-4	024100

XX = DMA channel programming select code 2 or 3 sends data from switches as programmed word count. Reads actual word count from DMA word count register up to 2^{13}.

LOADER ADDRESS FOR MEMORY DATA TRANSFER

Size	Address
4K	07700
8K	17700
12K	27700
24K	57700
32K	77700

MEMORY PARITY ERROR TEST (2100 COMPUTERS)

SET P=2

ADDRESS	MNEMONIC	CONTENTS
2	LDB 16	064016
3	CME	002200
4	ELA	001600
5	STA1,I	170001
6	CPA,I	150001
7	RSS	002001
10	HLT 0	102000
11	OTA,1	102601
12	LDB,4	006004
13	CPB 17	054017
14	JMP 2	024002
15	JMP 4	024004
16	20 TEST	
17	BBL RANGE	

Halts 102000 on Errors

"A" = Proper Data
"B" = Failing Address

LONG DIAGNOSTIC (FIELD SERVICE VERSION)

1. Load 1st segment using ABL
2. S.A. 10_8
3. RUN; Halt 107000_8
4. SW Reg. =0-5 Photoreader or buffered TTY select code
   6-11 TTY Select Code
   14 Delete central interrupt test
   15 Serial TTY
5. RUN; Halt 107001_8
6. SW Reg. =0 Test 2 channels if DMA present
   1-14 Delete test # that corresponds to switch #
   15 Short version (one pass per test)
7. RUN; Halt 107002_8
8. SW Reg. = Upper memory limit (normally ABL-1)
9. RUN; Halt 107003_8
10. SW Reg. =0
11. RUN
12. Normal halt 102077_8

DIAGNOSTICS INCLUDED IN TAPE

#1 Hi Memory Address – Error Halt 102001_8
A Reg. = Address Expected
B Reg. = Address Read

#2 Hi Memory Crusher – Error Halt 102001_8
A Reg. = Data Read
B Reg. = Data Expected
RUN; Halt 102002_8
A Reg. = Data Read
B Reg. = Address of failure

#3 MRG Test 24209 Rev A
#4 ASG Test 24208 Rev A
#5 SRG Test 24210 Rev A
#6 EAU Test 24214 Rev A
#7 Memory Protect 24222 Rev A
#8 Reserved for Floating Point
#9 Basic I/O W/Interrupt 24215 Rev A
#10 Super Duper DMA
Error Halts
102011 Ch. #1 102021 #2 –CLF failure
102012 Ch. #1 102022 Ch. #2 –STF failure
102013 Ch. #1 102023 Ch. #2 –Wd.-Cntr bit failure
102014 Ch. #1 102024 Ch. #2 –Data Output Failure
102015 Ch. #1 102025 Ch. #2 –Data Input Failure
102016 Ch. #1 102026 Ch. #2 –Interrupt failure
102017 Ch. #1 102027 Ch. #2 –Wd.-Cntr Counting

#11 Lo Memory Address – Same as #1
#12 Lo Memory Crusher – Same as #2
#77 End-of-Tapes

LONG DIAGNOSTIC (FIELD SERVICE VERSION) (Cont'd)

CONTROL PROGRAM HALTS

107000 – Set SW Reg. for I/O devices
107001 – Set SW Reg. for program options
107002 – Set SW Reg. for Upper Memory Limit
107003 – Set SW Reg. for diagnostic parameters
102051 – No reader select code specified (restart)
102055 – Checksum on control program (Restart)
102065 – Reader time out (RUN to continue)

RESTART (TO READ NEXT TEST)

In Hi Control $=7070_8$
In Lo Control $=145_8$ (Last two tests)

MEMORY ADDRESS TEST

MEM ADDR	CONTENTS	LABEL	INSTRUCTION
00002	006204		INB, CME
00003	060023		LDA FRST
00004	150000	CMPAR	CPA Ø, I
00005	002001		RSS
00006	102000		HLT
00007	052022		CPA LAST
00010	024014		JMP START
00011	002004		INA
00012	024004		JMP CMPAR
00013	000000		NOP
00014	060023	START	LDA FRST
00015	170000	STORE	STA Ø, I
00016	050022		CPA LAST
00017	024002		JMP CMPAR-2
00020	002004		INA
00021	024015		JMP STORE
00022*	007777	LAST	OCT 7777
00023	000024	FRST	OCT 00024

*For 8K machines (22) 017777
Use 007677 or 017677 if you do not desire to test protected area.
Starting address 14.
Depress PRESET and RUN. The computer shall run. If it halts, there is an address error.
Extend bit shall blink on and off, B-reg increments each pass.
Locations 00022 and 00023 may be changed to test any core area.
(requires ≈ 1 sec)

COMPUTER CHECK PROGRAM

If the computer runs, halt it manually. Get the contents of the "M" Register (on 2100A, Press "M"). If 77<M<122 then O.K. - Press RUN and let it run (especially if looking for intermittent).

```
                ASMB,A,B,L

    THIS PROGRAM MAY BE USED TO CHECK CERTAIN
    INSTRUCTIONS USED BY THE BBL.  IT ASSUMES
    THAT THE LOADER IS INTACT (I.E. CHECKED
    AGAINST LISTING OR BOOTED). THIS PROGRAM
    DOES NOT CHECK THOSE INSTRUCTIONS USED
    BY THE BOOT WHICH ARE:
     STC,C  SFS  JMP  LIA  MIA  STA B,I

    THIS PROGRAM CHECKS THE FOLLOWING:
     A REGISTER - SET AND CLEAR ALL BITS
     B REGISTER - SET AND CLEAR ALL BITS
     E REGISTER - SET BY CARRY AND CLEAR BY
                  INSTRUCTION
     ARITHMETIC - ALL ADDERS & CARRIER &
                  COMPARE
     MEM REFERENCE - A CRUDE TEST OF LOAD,
                     STORE & JSB.

    IT IS EQUALLY USEFUL IN THE FIELD OR
     CAN BE TOGGLED BY A CUSTOMER OVER
     THE TELEPHONE.

   00100                ORG 100B
   00100 003500  START  CCA,CLE       DONT'T START HERE AGAIN
   00101 007400         CCB
   00102 054000         CPB 0         A=B=177777?
   00103 002040         SEZ           E=0 AFTER CLE?
   00104 102001         HLT 1B
   00105 002004         INA           BUMP "A"
   00106 002040         SEZ           DID "E" SET?
   00107 002002         SZA           DID "A" ROLL OVER
   00110 102003         HLT 2B
   00111 006004         INB           BUMP "B"
   00112 006002         SZB           DID "B" ROLL OVER
   00113 102003         HLT 3B
   00114 060122         LDA B377      GET 8 LOW BITS
   00115 070001         STA 1B        ALSO IN "B"
   00116 001727         ALF,ALF       NOW HIGH 8 BITS
   00117 030001         IOR 1B        A=177777
   00120 000040         CLE
   00121 014100         JSB START     THAT'S RIGHT, JSB!
   00122 000377  B377   OCT 377
                        END

 NO ERRORS*
```

REPETITIVE CPU-MEMORY TEST PROGRAM

This program stores a bit pattern in memory, reads it back, and compares it. A constant is added and the sum is stored in the same memory location repetitively. When an overflow is reached the next sequential memory location is loaded with the same variable bit patterns. When the specified ending address is reached the program will repeat the test. If an error occurs, a HLT 33 will be displayed. Run time is a function of memory size, the value in location 40, and the computer.

```
Mem Loc 35 = Failing address; A-Reg = Good data; B-Reg = Faulty data.
Mem Loc 36 and 37 = Starting and ending locations to be tested.
Mem Loc 40 = Value to increment data by.

10 103101 CLO                      Starting address
11 064036 LDB 36                   Establish starting addr to be tested
12 074035 STB 35
13 106601 OTB 1                    Put addr in S-reg
14 003534 CCA,CLA,SSA,SLA,INA
15 000135 SLA,ERA A=100000;E=0
16 102011 HLT 11                   Halt 11
17 170035 STA I,35                 Store data in memory
20 164035 LDB I,35                 Get data from memory
21 054000 CPB A                    Retrieved data = stored data
22 024024 JMP*+ 2                  = Yes
23 102033 HLT 33                   # A=good B=bad
24 040040 ADA 40                   Increment A-reg by loc 40
25 103301 SOS,C                    A-reg=077777+1,clo
26 024017 JMP 17                   No overflow, continue
27 064035 LDB 35                   Current addr=last
30 054037 CPB 37                     addr to be tested?
31 024011 JMP 11                   Yes: restart
32 034035 ISZ 35                   No: increment addr by 1
33 106601 OTB 1                    Output new addr to S-reg
34 024014 JMP 14
35 ●●●●●●                         Addr under test by prog
36 000041                          Addr to start test on*
37 XXXXXX                          Addr to end test on*
40 000001                          Increment data by this value*
     *CHANGE FOR DESIRED TEST CONDITIONS
```

SHORT CPU-MEMORY TEST PROGRAM

This test program is useful if absolute programs cannot be loaded with the ABL due to hardware failures. It first tests a selection of ASG and SRG instructions followed by some MRG instructions. With the help of this program a certain bit pattern is stored in the first available memory location, read back and compared. A constant is added and the sum is stored in the same memory location repetitively. When a positive overflow is reached the next sequential memory location is loaded with the same variable bit patterns. Whenever the ABL is reached or one memory location does not compare a HLT 33 occurs with memory location 20 displaying the failing address or starting address of the ABL, the A-Reg. displaying the proper and the B-Reg. the faulty data pattern. Run time is a function of memory size and computer.

ADDR	CONTENTS		
2	103101	CLO	
3	003534	CCA,CLE,SSA,SLA,INA	A-Reg:000000,E=1
4	000135	SLA,ERA	A-Reg:100000,E=0
5	102011	HLT 11	
6	170020	STA I,20	
7	164020	LDB I,20	
10	054000	CPB A	Go to HLT 33 if not equal
11	002003	SZA,RSS	JMP to 13
12	102033	HLT 33	
13	040004	ADA 4	ADD 135_8 to A-Reg
14	103301	SOS,C	0VFF set if A-Reg 07777,CLO
15	024006	JMP 6	
16	034020	ISZ 20	Go to next mem. loc.
17	024003	JMP 3	
20	000021	DEF 21	Starting Address

NOTE: If location 20 contains the address of the ABL at HLT 33, the test ran correctly. To restart, location 000020 must be changed to 000021.

SUPER JUMP SELF MEMORY TEST

```
          ASMB,A,B,L,T
OPERATING PROCEDURE
STARTING ADDRESS 10Ø
SWITCH REGISTER (BITS Ø-5) SELECT CODE OF OUTPUT DEVICE
SET BIT 15 TO A 1 TO LOOP
OUTPUT DEVICE-BUF'D TTY CARD(MOST EFFECTIVE)OR GND TRUE I/O
TTY CARD MUST HAVE HOOD REMOVED,GRD TRUE I/O MUST HAVE
SPECIAL HOOD CONNECTOR (SAME AS DMA TEST)
"RUN"
HALT ØB
SET SWITCH REGISTER FOR LAST AVAILABLE WORD OF MEMORY
"RUN"
THIS PROGRAM MUST BE RELOADED TO RESTART.
                    ORG 4B
       1Ø2ØØ4       HLT 4B
       1Ø2ØØ5       HLT 5B
                    ORG 1ØØB
       Ø64137       LDB WRD1        GET "JMP GO" INSTRUCTION.
       1Ø25Ø1       LIA 1           GET DEVICE SELECT CODE.
       ØØ1Ø21       ELA,ARS         PUT LOOPING FLAG IN E REG.
       174ØØØ       STB Ø,I         PUT "JMP GO" IN TRAP CELL.
       Ø3Ø121       IOR S1          CONFIGURE
       Ø7Ø121       STA S1           I/O
       Ø3Ø126       IOR S2            INSTRUCTIONS.
       Ø7Ø126       STA S2
       ØØ244Ø       CLA,SEZ         LOOPING FLAG SET?
       Ø7Ø116       STA END         YES.
       1Ø2ØØØ       HLT Ø
       1Ø25Ø1       LIA 1           GET MAXIMUM MEMORY
       Ø7Ø143       STA MAXAD        ADDRESS AND SAVE IT.
       ØØ2ØØ1       RSS
       1Ø2Ø77 END   HLT 77B         DONE. "RUN" TO RESTART.
       1Ø21ØØ       STF Ø           ENABLE INTERRUPTS.
       Ø6Ø14Ø       LDA OUT         CONFIGURE INTERFACE
       1Ø26ØØ S1    OTA Ø            FOR OUTPUT.
       Ø6Ø141       LDA BEGIN       STARTING ADDRESS FOR
       Ø64142 R1    LDB INSTR        JUMP SELF INSTRUCTION.
       174ØØØ R2    STB Ø,I
       1Ø26Ø1       OTA 1
       ØØ11ØØ S2    OCT 1100        THIS BECOMES A STC CHAN,C.
       124ØØØ       JMP Ø,I         EXECUTE JUMP SELF.
       Ø5Ø143 GO    CPA MAXAD       END OF MEMORY?
       Ø24116       JMP END         YES.
       ØØ2ØØ4       INA             BUMP MEMORY ADDRESS OF
       ØØ6ØØ4       INB              JUMP SELF INSTRUCTION.
       Ø54144       CPB PAGE        END OF MEMORY PAGE?
       Ø24123       JMP R1          YES.
       Ø24124       JMP R2          NO.
       Ø2413Ø WRD1  JMP GO
       11ØØØØ OUT   OCT 110000
       ØØ2ØØØ BEGIN OCT 2000
       Ø26ØØØ INSTR OCT 26000
       ØØØ4ØØ MAXAD BSS 1
       Ø3ØØØØ PAGE  OCT 30000
                    END
```

CLEARING CORE

Address	Mnemonic	Octal
2	STA 1, I	170001
3	INB	006004
4	JMP *-2	024002

Initialize: P-Reg = 2
B-Reg = 5_8 Will destroy loader if left enabled
A-Reg contains bit pattern stored in core (0)

MEMORY ADDRESS TEST

Address	Mnemonic	Contents
2 Start	LDA First	060012
3	STA , I	170000
4	CPA , I	150000
5	INA, RSS	002005
6	HLT	102005
7	CPA Last	050013
10	JMP Start	024002
11	JMP Start + 1	024003
12 First	OCT 14	000014
13 Last	OCT *	

*Set to last location to be tested @ 1 location 12 may also be changed to test a different starting location.

Start at address 2. Stores memory address in the address. If an error occurs, the program halts with failing address in the A register.

MEMORY CHECKERBOARD TEST (CORE MEMORY)

Address	Mnemonic	Contents
2 Start	LDB First	064022
3	INB	006004
4	LDA CT	060021
5	STA CTR	070020
6	CLA	002400
7 Loop	STA B, I	170001
10	CPA B,I	150001
11	CMA, RSS	003001
12	HLT	102001
13	ISZ CTR	034020
14	JMP Loop	024007
15	CPB Last	054023
16	JMP Start	024002
17	JMP Start + 1	024003
20 CTR	BSS 1	
21 CT	OCT *	
22 First	OCT **	
23 Last	OCT **	

Start at address two. Alternately stores all ones and zeros in a given location. Will continue this on that location for a number of times determined by contents of memory location.

*Number of times for test — 21 in this case.

**Starting and ending locations to be tested are determined by the contents of locations 22 and 23. Error halts with correct pattern in A Register and falling location in B Register.

CPU BIT AND MEMORY CHECKER

ADDRESS	MNEMONIC	CONTENTS
02	OCT	177777
03	OCT	017677
04	OCT	000026
05	OCT	000026
06	NOP	000000
07	LDA 4	060004
10	INA	002004
11	STA 4	070004
12	CPA 3	050003
13	JMP 25	026025
14	LIA 1	102501
15	STA 4,I	170004
16	LDB 4,I	164004
17	CPB 2	054002
20	JMP 22	026022
21	HLT 22	102022
22	CLA	002400
23	STA 4,I	170004
24	JMP 6	026006
25	LDA 5	060005
26	JMP 10	026010

02 (Changed for bit pattern)
03 (Stop address)
04 (Start address and error)
05 (Auto restart address)
06 (Program starting address)
07 (SW reg = address 02)

2100 CORE MEMORY SCHM00 TEST

The following procedure is used to determine a midpoint for the ±20V at which the memory section will properly operate. The ±20V will be adjusted to locate the highest and lowest voltages where parity errors may occur while running a memory diagnostic.

NOTE

It is not necessary to decrease the ±20V supply below 17.5 volts or higher than 23 volts.

1. Turn power OFF; remove computer bottom cover; turn power ON.

2. If using Low Memory Pattern Test (24193-60001) perform steps 1 through 7 as outlined on page X-Y in the section.

   If some other memory diagnostic is used, load and prepare it to execute the standard tests. Do not execute at this time.

3. Decrement the ±20V supply by a .5V by adjusting R40 on the power supply board A2 and execute one pass of the memory diagnostic. If a parity error occurs, note the ±20V supply value and proceed to step 4. Otherwise, repeat this step.

4. Set the ±20V supply to its original value.

5. Increment the ±20V supply by .5V and execute one pass of the diagnostic. If a parity error occurs, note the ±20V supply value and proceed to step 6. Otherwise, repeat this step.

6. Using the voltages noted in steps 3 and 5, determine the midpoint voltage and set the ±20V supply to that value.

7. Execute the memory diagnostic to ensure there are no parity errors.

NOTE

This procedure may be used on the 2114/15/16 computers. It should be noted that the minimum and maximum values for the ±20V supply and components specified in this procedure may not apply to the 2114/15/16.

DIAGRAMS

TESTS

FIRMWARE

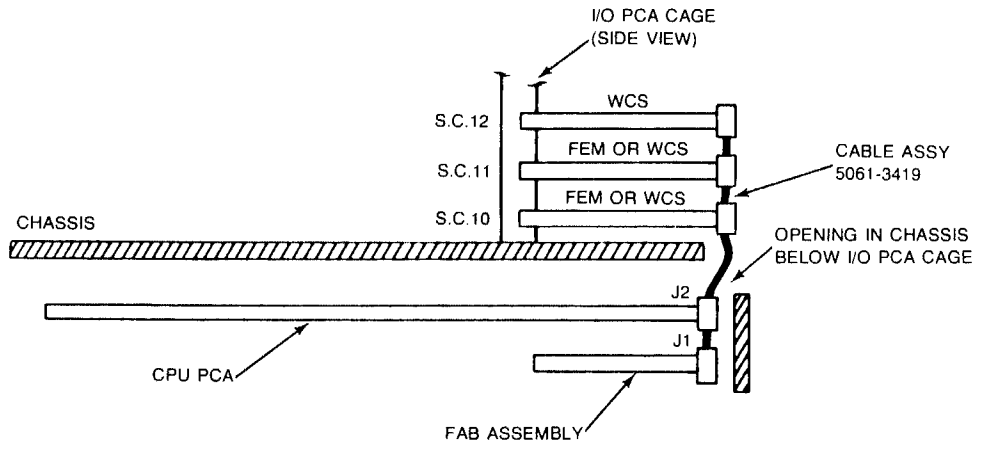
DIAGNOSTICS

21MX-M SPECIAL REGISTER DISPLAY MODE POINTERS

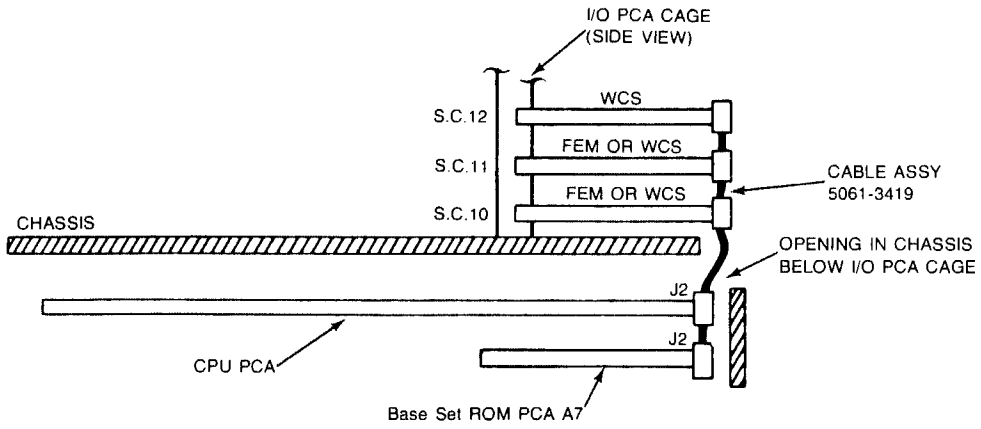
REGISTER DESIRED	POINTER (15 14 ... 3 0)
X	1 0 0000
Y	1 0 0001
COUNTER	1 0 0010
S3	1 0 0011
S4	1 0 0100
S5	1 0 0101
S6	1 0 0110
S7	1 0 0111
S8	1 0 1000
S9	1 0 1001
S10	1 0 1010
S11	1 0 1011
S12	1 0 1100
CIR	1 0 1101
OVERFLOW	1 0 1110
EXTEND	1 0 1111

DMS MAPS	POINTER (15 14 ... 6 5 4 3 2 1 0; MAP REG. NO.)
SYSTEM	1 1 ... 0 0 ...
USER	1 1 ... 0 1 ...
PORT A	1 1 ... 1 0 ...
PORT B	1 1 ... 1 1 ...

WCS AND FEM BOARD INSTALLATION DETAILS



a. Installation Details (HP 1000 E/F-Series Computer)



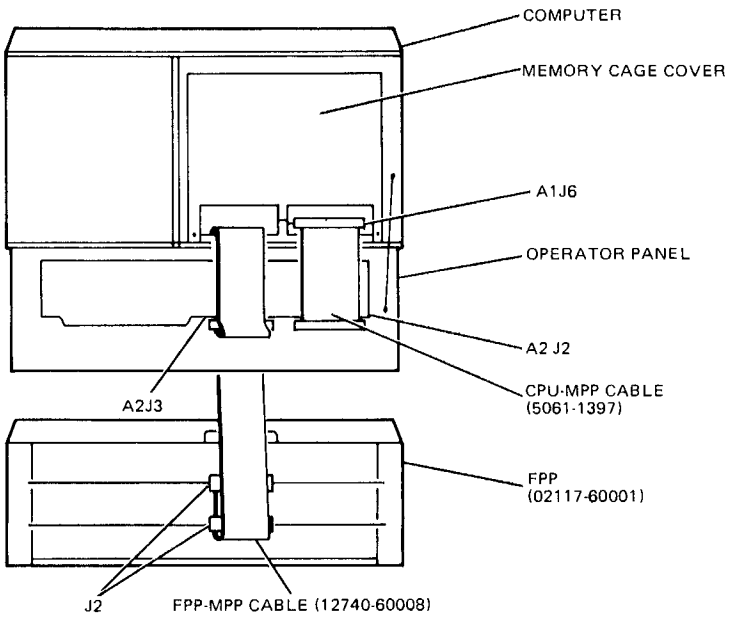
NOTES:

FEM → 12791A FIRMWARE EXPANSION MODULE
FAB → 13304A FIRMWARE ACCESSORY BOARD
WCS → 13197A WRITABLE CONTROL STORE

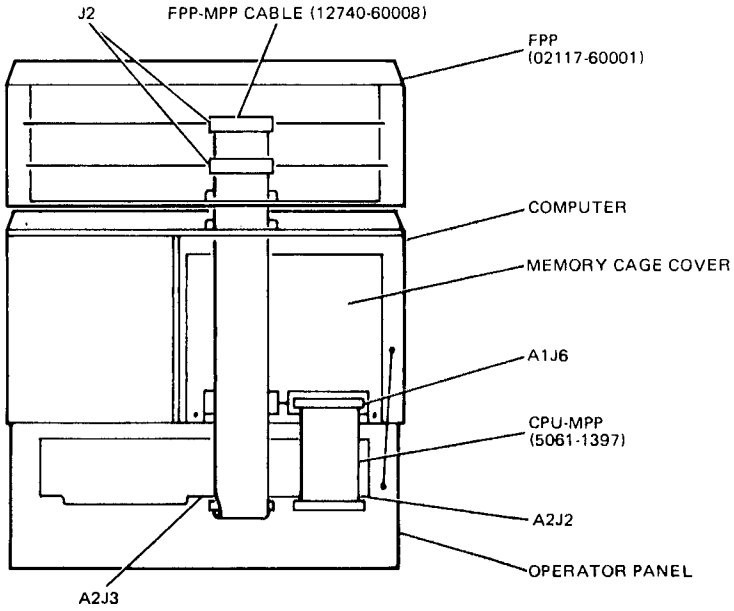
b. Installation Details (HP 1000 M-Series Computer)

F-SERIES FPP-MPP AND CPU-MPU CABLE CONNECTIONS

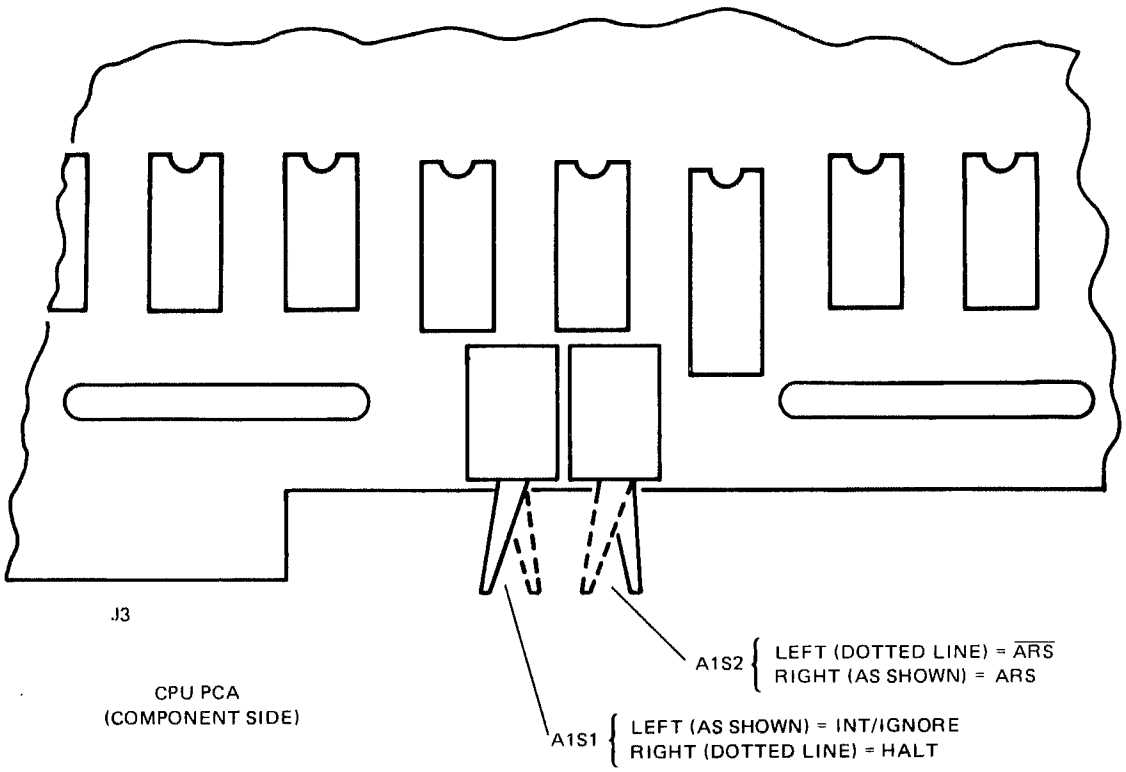
RECOMMENDED CONFIGURATION
FPP MOUNTED BELOW COMPUTER



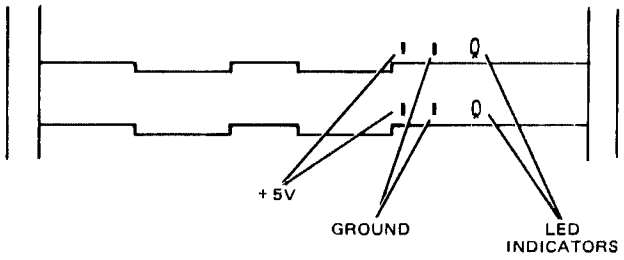
FPP MOUNTED ABOVE COMPUTER



F-SERIES INTERNAL SWITCH CONFIGURATION



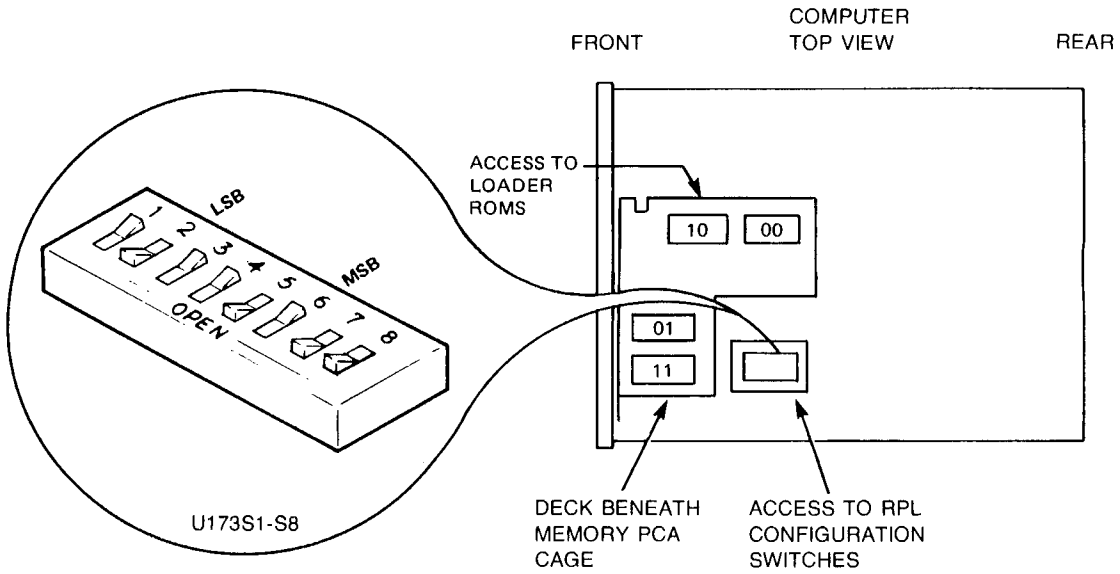
F-SERIES FLOATING POINT PCA VOLTAGE TEST POINTS



7700-178

NOTES: 1. Both LEDs lit verify that the DVM indicates +4.75 to +5.25 volts. If either LED is not lit the voltage is not within tolerance.
2. The Arithmetic and FPP controller PCA can be in either position.

21MX-E/F RPL CONFIGURATION SWITCHES



TYPICAL CONFIGURATION

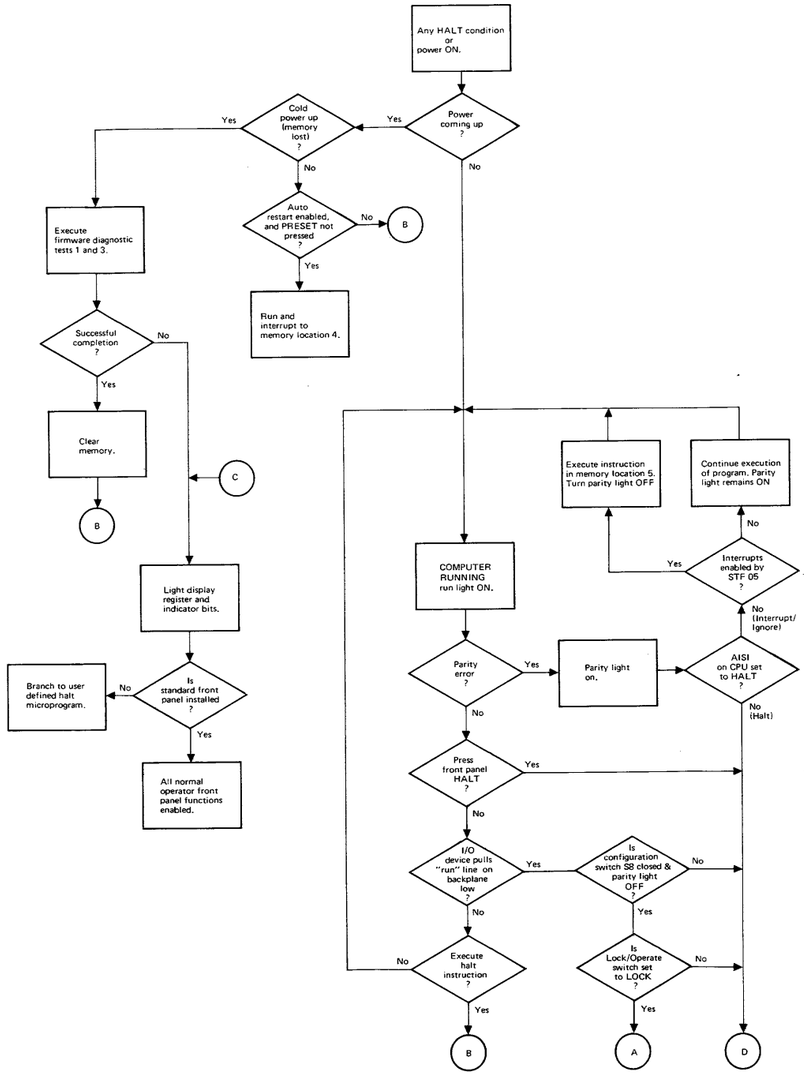
SWITCH	FUNCTION
U173S1	CHANNEL SELECT, 0 OR 1.
U173S2 (LSB) U173S3 U173S4 U173S5 U173S6 (MSB)	DECODES THE FIVE BIT OCTAL SELECT CODE OF THE INPUT DEVICE (S.C. 10-37). SWITCHES SHOWN SET TO SELECT CODE 11_8 (01001_2).
U173S7 U173S8	SELECTS ONE OF TWO LOADER ROMS, IF SWITCH S8 IS CLOSED. CLOSED POSITION (AS SHOWN) ENABLES REMOTE PROGRAM LOAD (RPL); OPEN POSITION SELECTS STANDARD FRONT PANEL (SFP).*

SWITCHES		RPL SELECTIONS
U173S8	U173S7	
0	0	RPL NOT ENABLED, SFP* CAPABILITY
0	1	RPL NOT ENABLED, SFP* CAPABILITY
1	0	RPL WITH STANDARD DISC LOADER, ROM 10
1	1	RPL WITH OPTIONAL LOADER, ROM 11

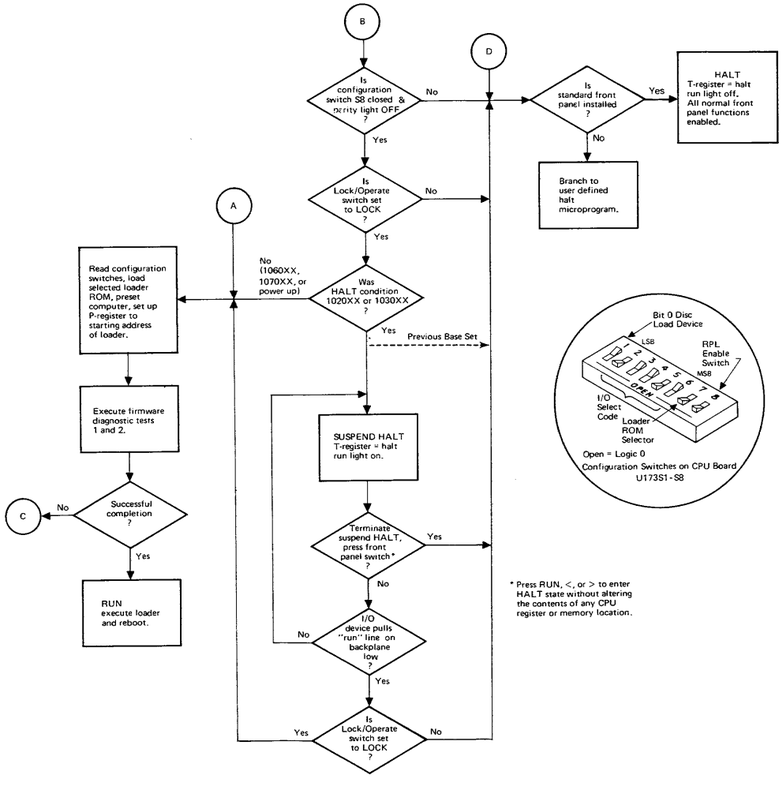
NOTE: OPEN POSITION = LOGIC 0
CLOSED POSITION = LOGIC 1

*STANDARD FRONT PANEL = SFP

7700-86A



7700-577



Remote Program Load Flowchart

PARITY ERROR TEST PFIND

```
                    Macro/1000 Version 2226

                        ASMB,A,B,L



  THE PROGRAM 'PFIND' IS USED TO FIND THE PHYSICAL PAGE
  NUMBER OF A PARITY ERROR AFTER A SYSTEM OR DIAGNOSTIC
  PARITY HALT.


UPON SYSTEM OR DIAGNOTIC PARITY ERROR HALT:

 1. TEST 1ST 32K WITH THIS PROGRAM:

    2  LDA  1,I  160001
    3  INB       006004
    4  JMP  *-2  024002
    5  HLT  5    102005

    P=2, B=0, PRESET, RUN
    IF PARITY ERROR OR HALT 5, B CONTAINS FAILING ADDRESS
    IF NO ERROR, CONTINUE

 2. LOAD PFIND WITH ABSOLUTE LOADER

 3. P=100, PRESET, RUN, PROGRAM TESTS 1ST 32K AGAIN
     HALT 77 OR PARITY ERROR:
        -IF PARITY ERROR OR HALT 5, S REG CONTAINS
           PHYSICAL PAGE NUMBER IN OCTAL
        -IF HALT 77, PRESS RUN TO TEST NEXT 32K
           DON'T HIT PRESET!


00005                   ORG  5B
00005 102005            HLT  5      PUT HALT IN PARITY TRAP CELL

00100                   ORG  100B

00100 006400  START     CLB         MAKE PROGRAM REUSABLE, INITIALIZE STOR TO 0
00101 074000            STB  STOR
00102 014135            JSB  IMAP   INITIALIZE SYSTEM MAP
00103 060153            LDA  ADDR   A REG CONTAINS ADDRESS OF BUFFER
00104 101710            SYA         LOAD SYSTEM MAP
00105 105734            SJP  *+2    ENABLE SYSTEM MAP
00106 000107

00107 105745            LDX  K      X REG IS 1K LOOP COUNTER
00110 000151
00111 002400            CLA
00112 102601            OTA  1B     CLEAR S REG, S CONTAINS PAGE NUMBER



00113 060153  LOOP1     LDA  ADDR   A REG CONTAINS ADDRESS OF BUFFER
00114 101711            USA         LOAD USER MAP
00115 006400            CLB
00116 101724  LOOP2     XLA  1,I    CROSS LOAD A PER B INDIRECT
00117 100001

00120 105761            DSX         FINISHED THIS PAGE?
00121 024127            JMP  INC      NO, KEEP GOING
00122 102501            LIA  1B       YES, INCREMENT PAGE NUMBER
00123 002004            INA
00124 102601            OTA  1B
00125 105745            LDX  K      RE-INITIALIZE 1K LOOP COUNT
00126 000151
```

PARITY ERROR TEST PFIND (Cont'd)

```
 00127 006004  INC     INB         INCREMENT MEMORY ADDRESS
 00130 006021          SSB,RSS     FINISHED 32K SEGMENT?
 00131 024116          JMP  LOOP2      NO,CONTINUE
 00132 102077          HLT  77B        YES, GOOD HALT

PRESS RUN TO CHECK NEXT 32K SEGMENT, DON'T HIT PRESET

 00133 014135          JSB  IMAP   LOAD USER MAP AGAIN
 00134 024113          JMP  LOOP1  CHECK NEXT 32K

INIALIZE MAP SUBROUTINE

 00135 000000  IMAP    NOP
 00136 105755          LDY  U40    Y=COUNTER FOR THIS LOOP
 00137 000152
 00140 064153          LDB  ADDR   B REG CONTAINS ADDRESS OF BUFFER
 00141 060000          LDA  STOR   GET BEGINING PAGE NO. FOR NEXT 32K
 00142 170001  COPY    STA  1,I    STORE IN BUFFER
 00143 002004          INA         INCREMENT PAGE NUMBER
 00144 006004          INB         INCREMENT MAP NUMBER
 00145 105771          DSY         DECREMENT LOOP COUNTER, SKIP IF 0
 00146 024142          JMP  COPY   NOT FINISHED
 00147 070000          STA  STOR   SAVE LAST PAGE NUMBER AND RETURN
 00150 124135          JMP  IMAP,I

 00151 002000  K       DEC  1024
       000000  STOR    EQU  0
 00152 000040  U40     OCT  40
 00153 000154  ADDR    DEF  BFFR
 00154         BFFR    BSS  37B
                       END
```

NOTE: Due to a CPU timing problem, the E- and F-Series Fault Control Memory Controller may incorrectly indicate an error at power up. To verify correct operation of the Fault Control Memory Controller, the following CPU power on self-test must be executed from the front panel:

1. Set P=0
2. Set A=00000 (octal)
3. Press PRESET
4. Press INSTR/STEP

After the test is completed, all six LEDs on the Fault Control Memory Controller should be on (normal condition).

SEMICONDUCTOR MEMORY TEST

Manual: 24395-90001

Required Hardware:

a. Minimum of 4K memory with a 21MX-M/E/F Computer.

b. An absolute binary loading device.

NOTE

Messages are reported via various halt codes; therefore a terminal is not required.

Required Software:

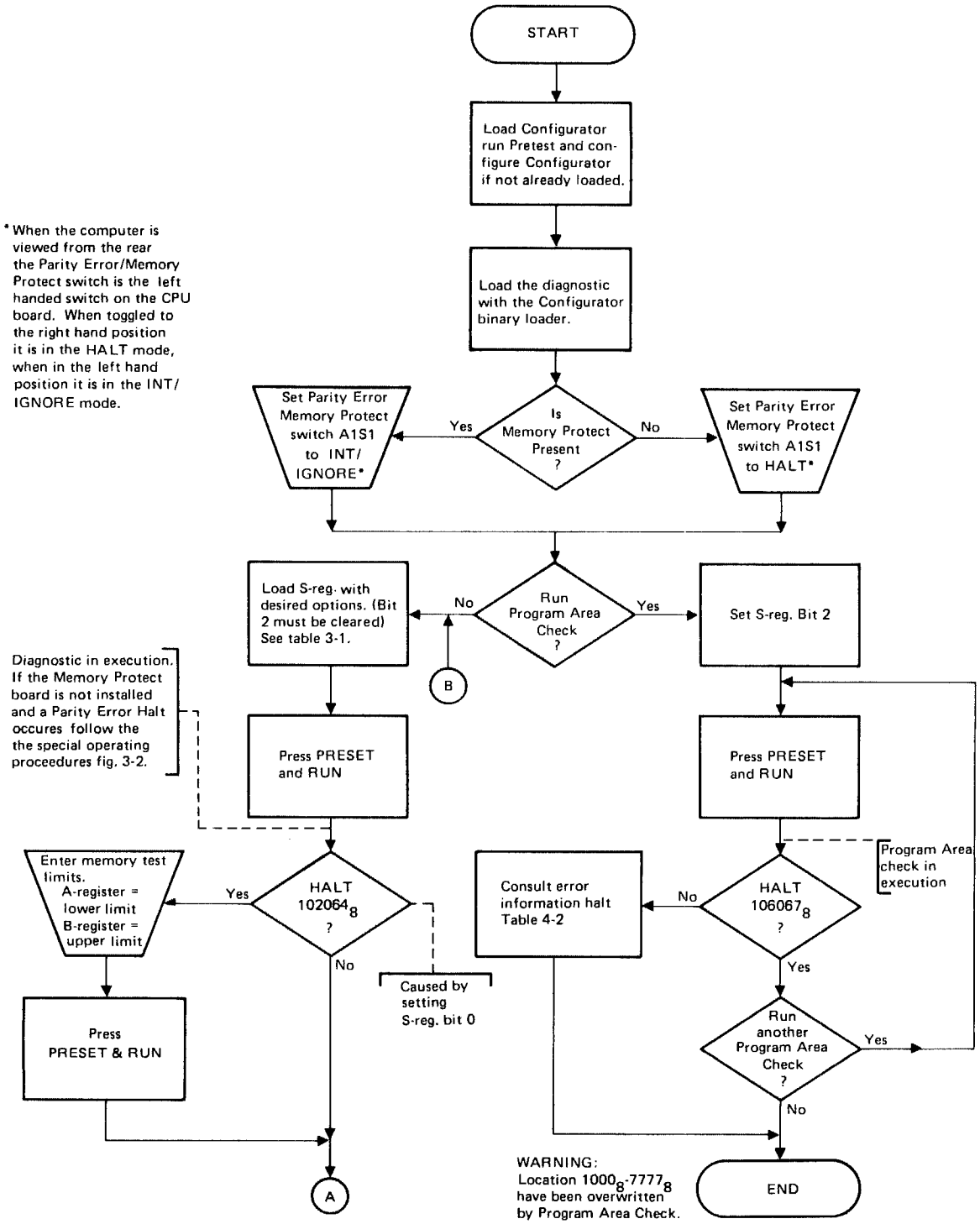
a. Diagnostic Configurator p/n 24296-60001.

b. Diagnostic for Semiconductor Memory

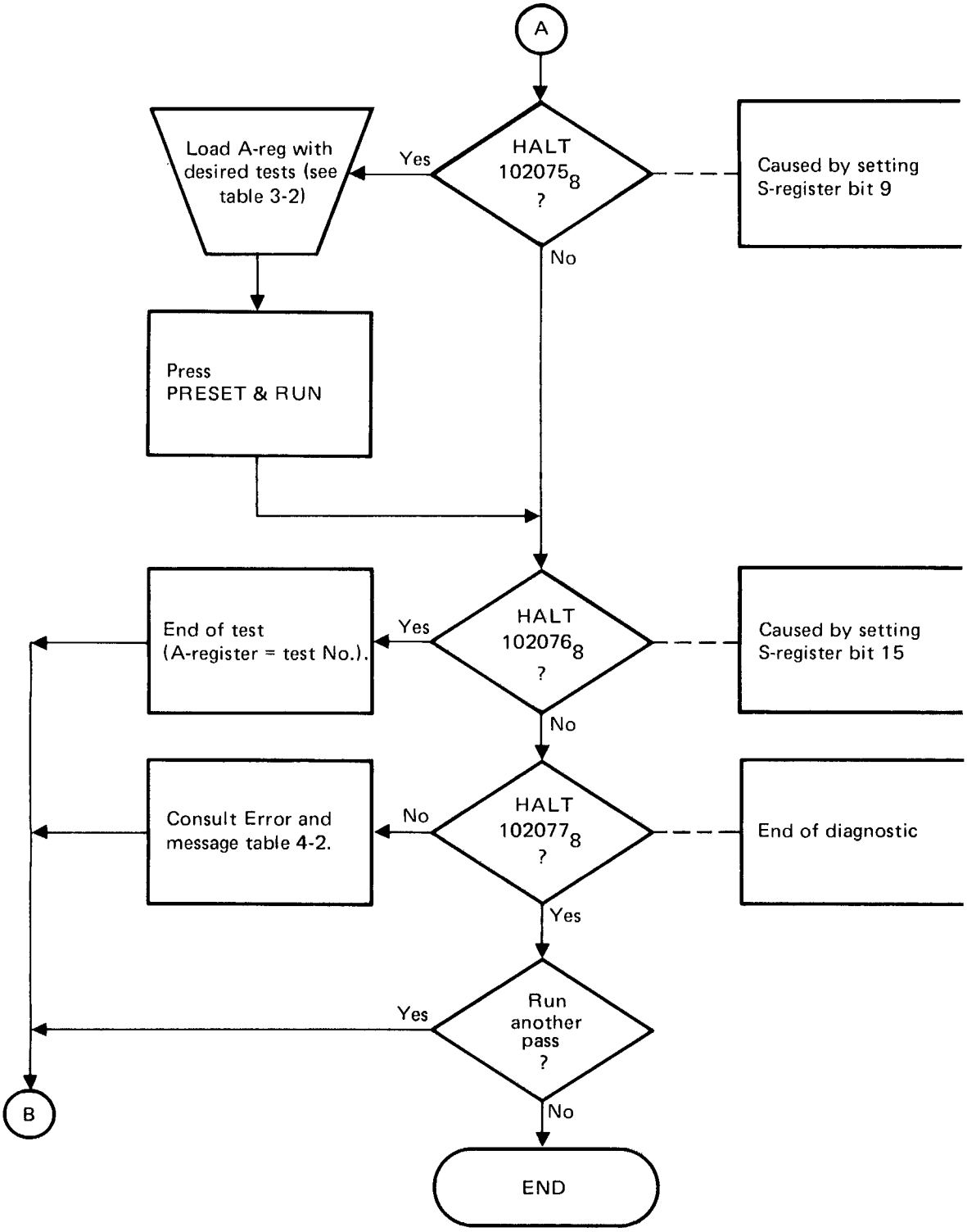
24395-16001	Single file paper tape
24396-12001	(1644 or later) multiple file paper tape
24396-13301	(1901 or later) cartridge tape
24396-14001	Mag tape

To execute, refer to flowchart.

SEMICONDUCTOR MEMORY TEST FLOWCHART (1 of 2)

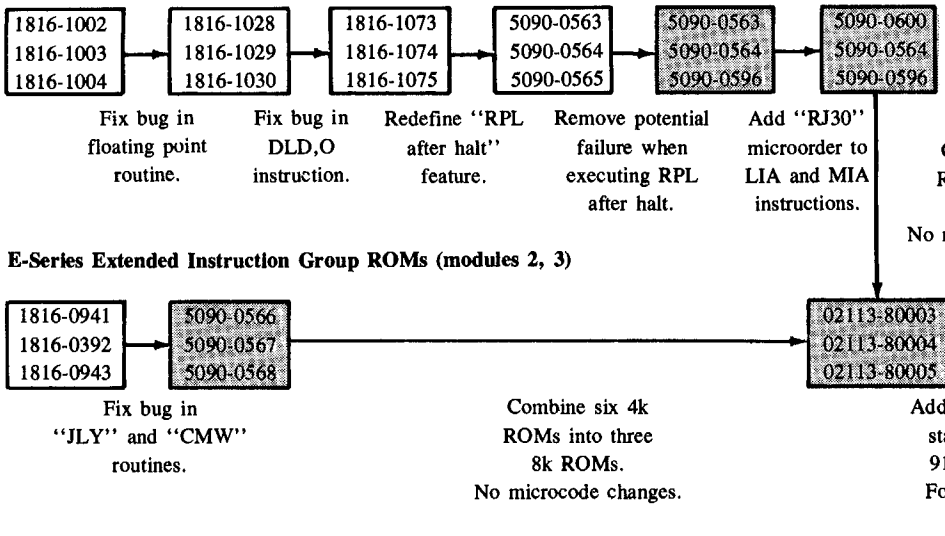


SEMICONDUCTOR MEMORY TEST FLOWCHART (2 of 2)

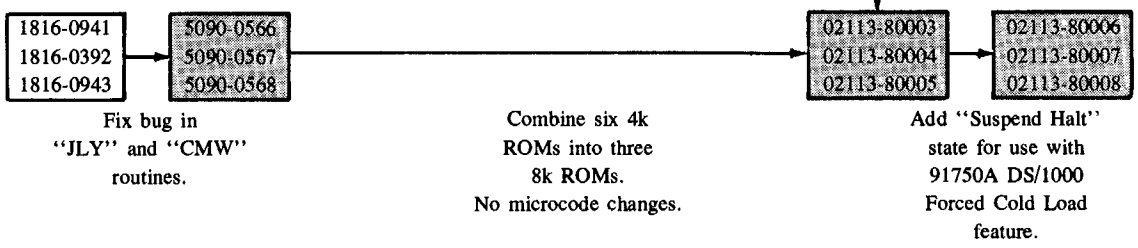


ROM PART NUMBER HISTORY (1 of 4)

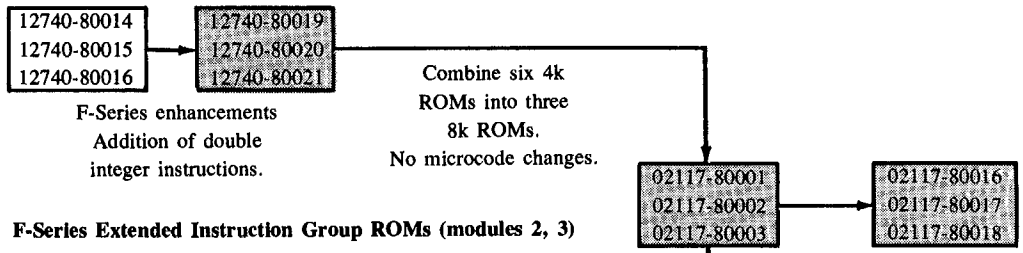
E-Series Base Set ROMs (modules 0, 1)



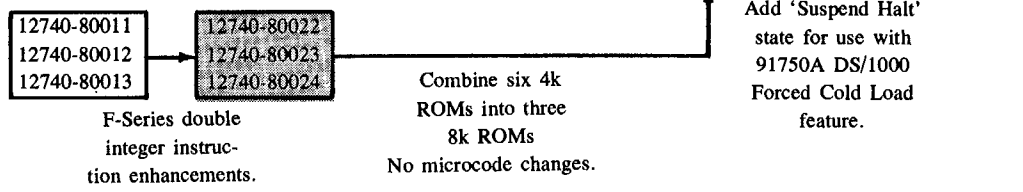
E-Series Extended Instruction Group ROMs (modules 2, 3)



F-Series Base Set ROMs (modules 0, 1)



F-Series Extended Instruction Group ROMs (modules 2, 3)



ROM PART NUMBER HISTORY (2 of 4)

E/F-Series RTE-6/VM Extended Memory Area/Virtual Memory Area ROMs (modules 36, 37)

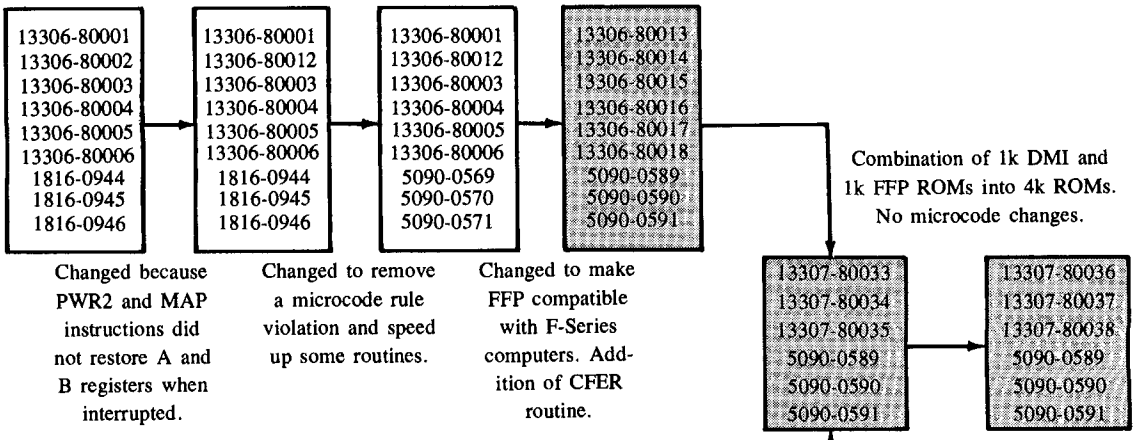
Original Release
92084-80004
92084-80005
92084-80006

E/F-Series RTE-6/VM Operating System ROMs (E-Series modules 44, 45; F-Series modules 16, 17)

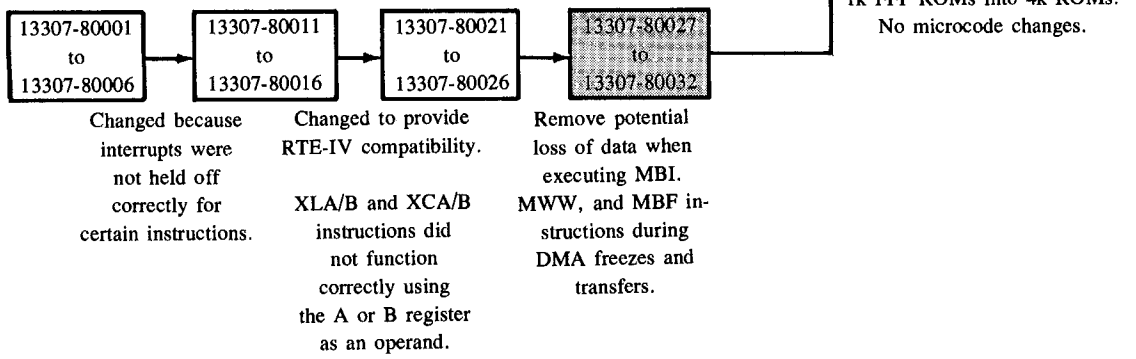
Original Release		
92084-80001	92084-80001	92084-80001
92084-80002	92084-80102	92084-80102
92084-80003	92084-80103	92084-80103

ROM PART NUMBER HISTORY (3 of 4)

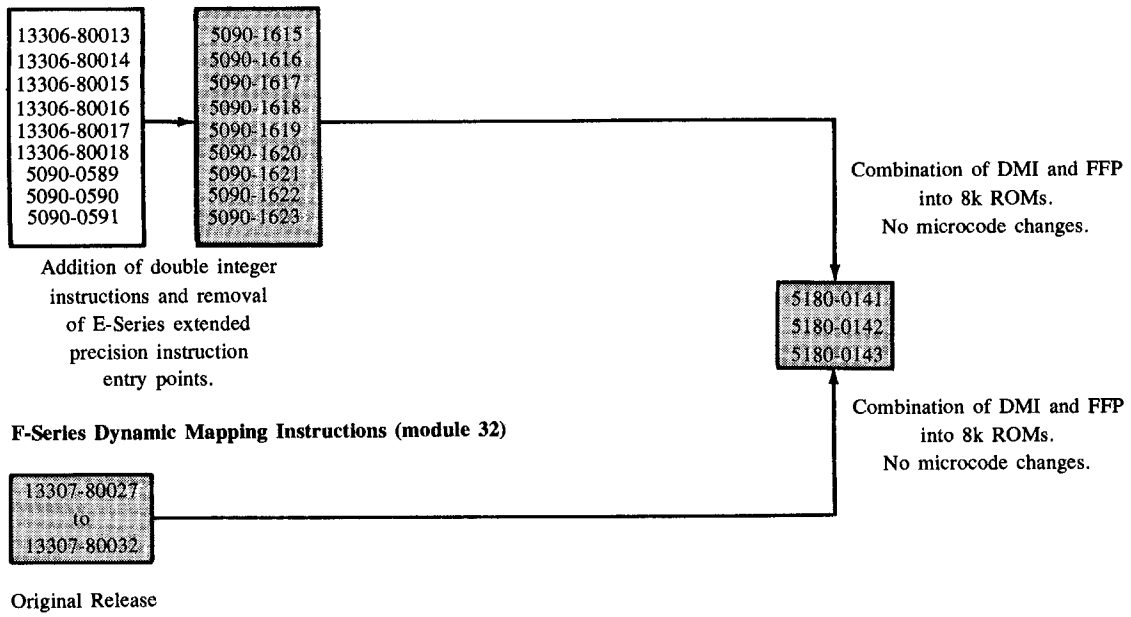
E-Series Fast FORTRAN Processor ROMs (modules 33, 34, 35)



E-Series Dynamic Mapping Instructions (module 32)



F-Series Fast FORTRAN Processor ROMs (modules 33, 34, 35)



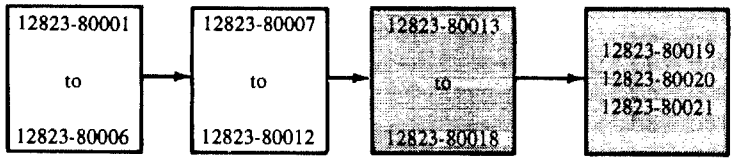
F-Series Dynamic Mapping Instructions (module 32)

13307-80027 to 13307-80032

Original Release

ROM PART NUMBER HISTORY (4 of 4)

F-Series Scientific Instruction Set ROMs (modules 40, 41, 42, 43)

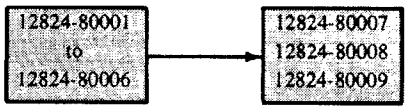


Addition of DPOLY, IATLG, FPWR, and TPWR routines as well as double precision capability.

Fix a bug in the /CMRT routine.

Combination of six 4k ROMs into three 8k ROMs. No microcode changes.

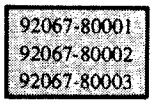
F-Series Vector Instruction Set ROMs (modules 12, 13, 14, 15)



Original release.

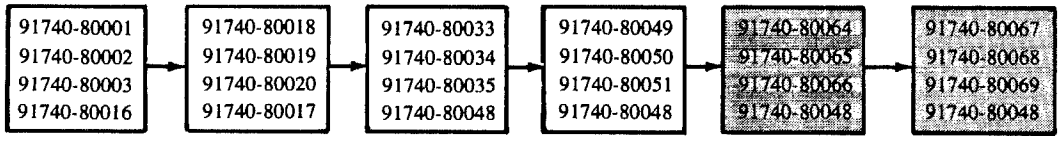
Combination of six 4k ROMs into three 8k ROMs. No microcode changes.

E/F-Series RTE-IVA/B Extended Memory Area ROMs (modules 36, 37)



Original release.

E/F-Series DS/1000 ROMs (modules 38, 39)



Date code 1740

Changed located of microcode addressing from modules 44/45 to 38/39.

Date code 1813

Enhance download capability.

Date code 1826

Enhance communication line noise immunity.

Date code 1913

Removal of potential download problems.

Date code 2003

Change ROM vendor for problems when installed on a FAB computer with in a 2 UCS boards.

Date code 2003

13304A FAB ROM LOCATIONS

Table 1. ROM Location for Block A

4-BIT SET	ROM PACKAGE LOCATION	
	LEAST SIGNIFICANT MODULE (LSM)	MOST SIGNIFICANT MODULE (MSM)
23-20 MSB	A6 (XU608)	A12 (XU808)
19-16	A5 (XU607)	A11 (XU807)
15-12	A4 (XU606)	A10 (XU806)
11-8	A3 (XU604)	A9 (XU804)
7-4	A2 (XU603)	A8 (XU803)
3-0 LSB	A1 (XU602)	A7 (XU802)

Notes:
1. Locations A1-A6 are selected first (the lower 1:4K configuration).
2. Locations A7-A12 are selected last (the upper 1:4K configuration).
3. See figure for ROM locations.

Table 2. ROM Location for Blocks B, C, and D

8-BIT SET	ROM PACKAGE LOCATION	
	LEAST SIGNIFICANT MODULE PAIR (LSMP)	MOST SIGNIFICANT MODULE PAIR (MSMP)
23-16 MSB	B3 (XU404) C3 (XU204) D3 (XU104)	B6 (XU409) C6 (XU209) D6 (XU109)
15-8	B2 (XU402) C2 (XU202) D2 (XU102)	B5 (XU408) C5 (XU208) D5 (XU108)
7-0 LSB	B1 (XU401) C1 (XU201) D1 (XU101)	B4 (XU406) C4 (XU206) D4 (XU106)

Notes:
1. Locations suffixed 1, 2, and 3 are selected first (the lower 1:2K configuration).
2. Locations suffixed 4, 5, and 6 are selected last (the upper 1/2K configuration).
3. See figure for ROM locations.

13304A FAB ROM LOCATIONS (Cont'd)

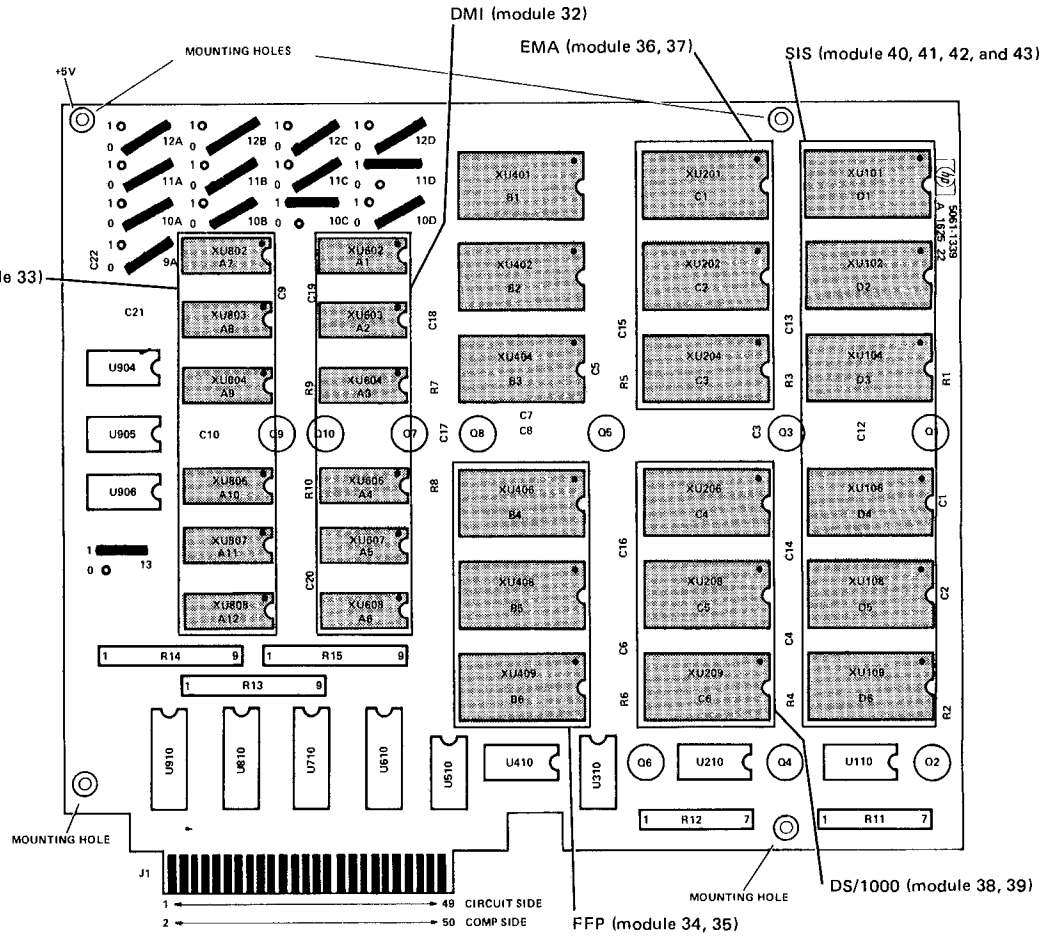
FAB Jumper Configurations

MODULE NO.	ADDRESSES		JUMPER PREFIX				UPPER/ LOWER 8K JUMPER
	DECIMAL	OCTAL	NOTE 1 9	10	11	12	NOTE 2 13
0	0-00255	00000-00377	0	0	0	0	0
1	00256-00511	00400-00777					
2	00512-00767	01000-01377	1				
3	00768-01023	01400-01777					
4	01024-01279	02000-02377	0	1	0	0	0
5	01280-01535	02400-02777					
6	01536-01761	03000-03377	1				
7	01762-02047	03400-03777					
8	02048-02303	04000-04377	0	0	1	0	0
9	02304-02559	04400-04777					
10	02560-02815	05000-05377	1				
11	02816-03071	05400-05777					
12	03072-03327	06000-06377	0	1	1	0	0
13	03328-03583	06400-06777					
14	03584-03849	07000-07377	1				
15	03850-04095	07400-07777					
16	04096-04351	10000-10377	0	0	0	1	0
17	04352-04607	10400-10777					
18	04608-04863	11000-11377	1				
19	04864-05119	11400-11777					
20	05120-05375	12000-12377	0	1	0	1	0
21	05376-05631	12400-12777					
22	05632-05887	13000-13377	1				
23	05888-06143	13400-13777					
24	06144-06399	14000-14377	0	0	1	1	0
25	06400-06655	14400-14777					
26	06656-06911	15000-15377	1				
27	06912-07167	15400-15777					
28	07168-07423	16000-16377	0	1	1	1	0
29	07424-07679	16400-16777					
30	07680-07935	17000-17377	1				
31	07936-08191	17400-17777					
32	08192-08447	20000-20377	0	0	0	0	1
33	08448-08703	20400-20777					
34	08704-08959	21000-21377	1				
35	08960-09215	21400-21777					
36	09216-09571	22000-22377	0	1	0	0	1
37	09572-09727	22400-22777					
38	09728-09983	23000-23377	1				
39	09984-10239	23400-23777					
40	10240-10495	24000-24377	0	0	1	0	1
41	10496-10751	24400-24777					
42	10752-10917	25000-25377	1				
43	10918-11263	25400-25777					
44	11264-11519	26000-26377	0	1	1	0	1
45	11520-11775	26400-26777					
46	11776-12031	27000-27377	1				
47	12032-12287	27400-27777					
48	12288-12543	30000-30377	0	0	0	1	1
49	12544-12799	30400-30777					
50	12800-13055	31000-31377	1				
51	13056-13311	31400-31777					
52	13312-13557	32000-32377	0	1	0	1	1
53	13558-13823	32400-32777					
54	13824-14079	33000-33377	1				
55	14080-14335	33400-33777					
56	14336-14591	34000-34377	0	0	1	1	1
57	14592-14847	34400-34777					
58	14848-15103	35000-35377	1				
59	15104-15359	35400-35777					
60	15360-15615	36000-36377	0	1	1	1	1
61	15616-15871	36400-36777					
62	15872-16127	37000-37377	1				
63	16128-16383	37400-37777					

1. Jumper 9 applies to block A only.
2. Jumper 13 selects upper or lower 8K of control store.
3. See figure for jumper locations.

13304A FAB ROM LOCATIONS (Cont'd)

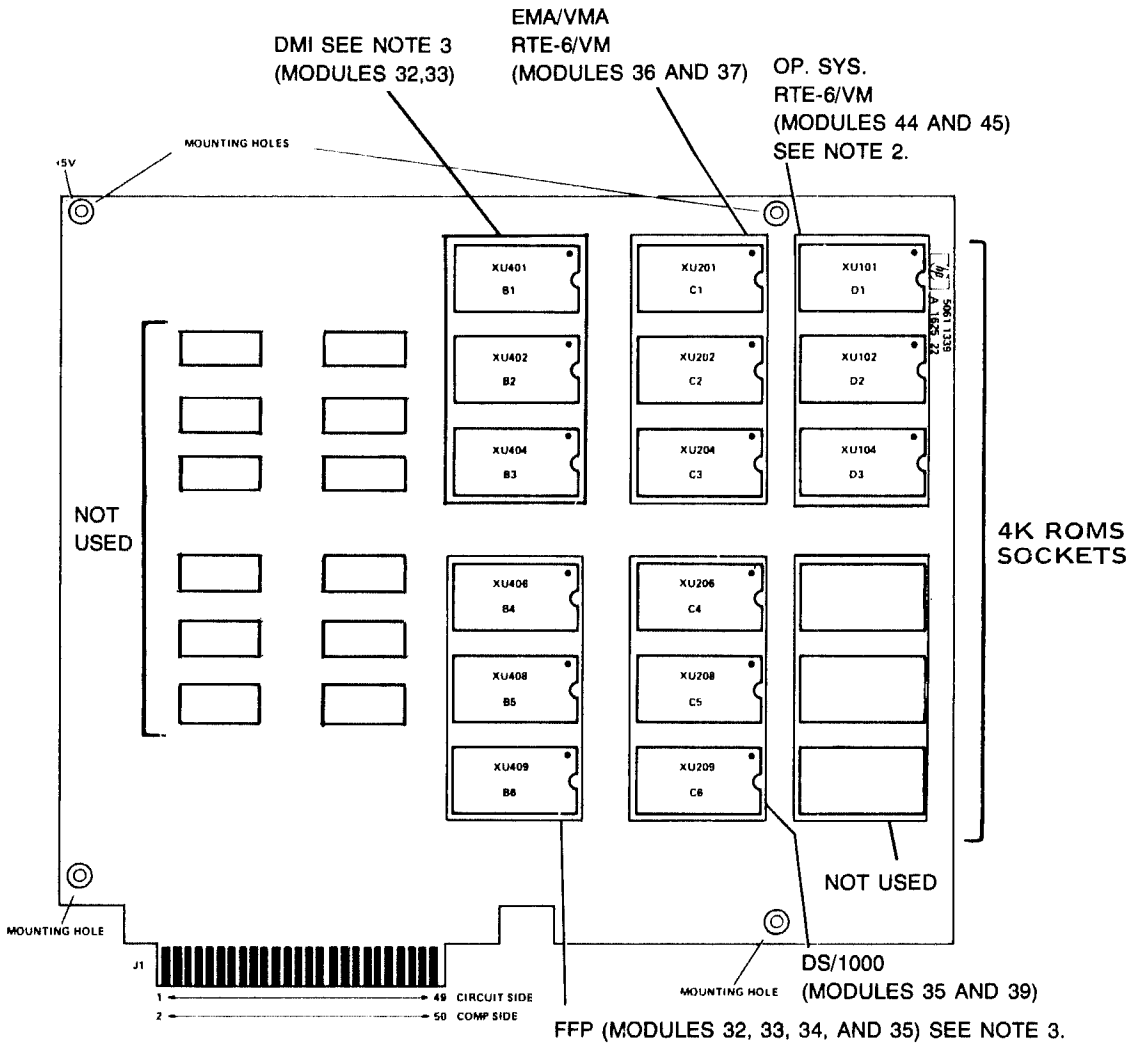
FAB RTE-IVB ROM Location Diagram



NOTES:
1. SHADED AREA SHOWS ROM IC SOCKET LOCATIONS.
2. SEE TABLES 1 AND 2 FOR DESIGNATED ROM LOCATIONS.
3. JUMPERS 9A, 10A, 11A, 12A, AND 13 SHOWN CONFIGURED FOR BLOCK A MODULES 32 AND 33. JUMPERS 10B, 11B, 12B, AND 13 SHOWN CONFIGURED FOR BLOCK B MODULES 32, 33, 34, AND 35 (DMI AND FFP).
4. JUMPERS 10C, 11C, 12C, AND 13 SHOWN CONFIGURED FOR BLOCK C MODULES 36, 37, 38, AND 39 (EMA AND DS/1000). JUMPERS 10D, 11D, 12D, AND 13 SHOWN CONFIGURED FOR BLOCK D MODULES 40, 41, 42, AND 43 (SIS).

13304A FAB ROM LOCATIONS (Cont'd)

FAB RTE-6/VM ROM Location Diagram



NOTES:

1. For RTE-IVB EMA and RTE-6/VM EMA/VMA in the same CPU, install these ROMs on the FEM.
2. E-Series ROMs are shown. F-Series ROMs use modules 16, 17, 36, 37.
3. Also modules 33 if there are no FFP ROMs.

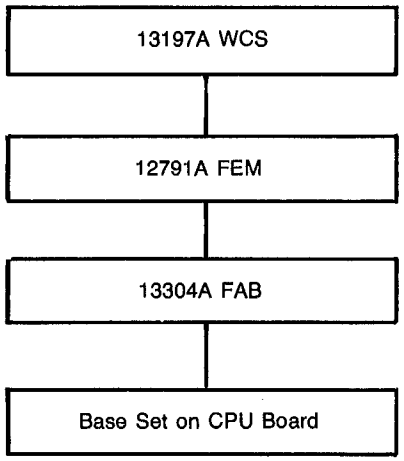
12791A FIRMWARE EXPANSION MODULE (FEM)

SPECIFICATIONS

Equipment:	12791-60001	Firmware Expansion Module Assy.
	5061-3419	Ribbon Cable Assy.

Power Requirements: Worst case (fully loaded)
5.0V 5.4A

In an E/F-Series Computer the priority is as follows:

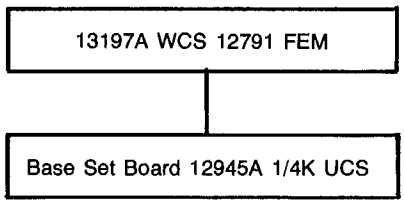


Highest Priority

When a module of Control memory is addressed on a particular control memory board all equivalent modules on lower priority boards are disabled.

Lowest Priority

In a M-Series Computer the priority is as follows:



Highest Priority

Lowest Priority

NOTE: A red LED mounted on the FEM will be lit whenever the control memory located on the FEM is addressed.

12791A FIRMWARE EXPANSION MODULE (FEM) (Cont'd)

FEM ADDRESS SWITCH SETTINGS

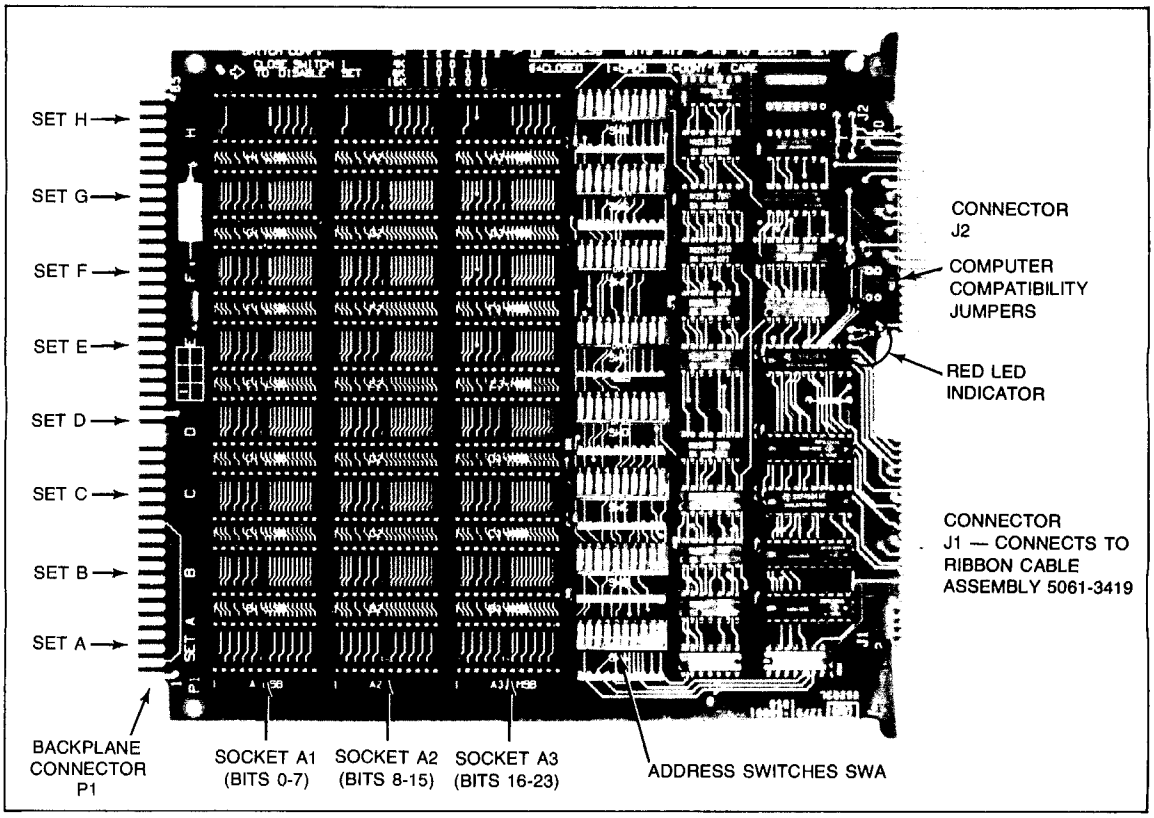
MODULE NO.	ADDRESSES		4K ROMS										8K ROMS									
			SWITCHES										SWITCHES									
	DECIMAL	OCTAL	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10
0	0-00255	00000-00377	1	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	0	0	0	X
1	00256-00511	00400-00777																				
2	00512-00767	01000-01377	1	0	0	1	1	0	0	0	0	1										
3	00768-01023	01400-01777																				
4	01024-01279	02000-02377	1	0	0	1	1	0	0	0	1	0	1	0	1	0	1	0	0	0	1	X
5	01280-01535	02400-02777																				
6	01536-01761	03000-03377	1	0	0	1	1	0	0	0	1	1										
7	01762-02047	03400-03777																				
8	02048-02303	04000-04377	1	0	0	1	1	0	0	1	0	0	1	0	1	0	1	0	0	1	0	X
9	02304-02559	04400-04777																				
10	02560-02815	05000-05377	1	0	0	1	1	0	0	1	0	1										
11	02816-03071	05400-05777																				
12	03072-03327	06000-06377	1	0	0	1	1	0	0	1	1	0	1	0	1	0	1	0	0	1	1	X
13	03328-03583	06400-06777																				
14	03584-03849	07000-07377	1	0	0	1	1	0	0	1	1	1										
15	03850-04095	07400-07777																				
16	04096-04351	10000-10377	1	0	0	1	1	0	1	0	0	0	1	0	1	0	1	0	1	0	0	X
17	04352-04607	10400-10777																				
18	04608-04863	11000-11377	1	0	0	1	1	0	1	0	0	1										
19	04864-05119	11400-11777																				
20	05120-05375	12000-12377	1	0	0	1	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	X
21	05376-05631	12400-12777																				
22	05632-05887	13000-13377	1	0	0	1	1	0	1	0	1	1										
23	05888-06143	13400-13777																				
24	06144-06399	14000-14377	1	0	0	1	1	0	1	1	0	0	1	0	1	0	1	0	1	1	0	X
25	06400-06655	14400-14777																				
26	06656-06911	15000-15377	1	0	0	1	1	0	1	1	0	1										
27	06912-07167	15400-15777																				
28	07168-07423	16000-16377	1	0	0	1	1	0	1	1	1	0	1	0	1	0	1	0	1	1	1	X
29	07424-07679	16400-16777																				
30	07680-07935	17000-17377	1	0	0	1	1	0	1	1	1	1										
31	07936-08191	17400-17777																				
32	08192-08447	20000-20377	1	0	0	1	1	1	0	0	0	0	1	0	1	0	1	1	0	0	0	X
33	08448-08703	20400-20777																				
34	08704-08959	21000-21377	1	0	0	1	1	1	0	0	0	1										
35	08960-09215	21400-21777																				
36	09216-09571	22000-22377	1	0	0	1	1	1	0	0	1	0	1	0	1	0	1	1	0	0	1	X
37	09572-09727	22400-22777																				
38	09728-09983	23000-23377	1	0	0	1	1	1	0	0	1	1										
39	09984-10239	23400-23777																				
40	10240-10495	24000-24377	1	0	0	1	1	1	0	1	0	0	1	0	1	0	1	1	0	1	0	X
41	10496-10751	24400-24777																				
42	10752-10917	25000-25377	1	0	0	1	1	1	0	1	0	1										
43	10918-11263	25400-25777																				
44	11264-11519	26000-26377	1	0	0	1	1	1	0	1	1	0	1	0	1	0	1	1	0	1	1	X
45	11520-11775	26400-26777																				
46	11776-12031	27000-27377	1	0	0	1	1	1	0	1	1	1										
47	12032-12287	27400-27777																				
48	12288-12543	30000-30377	1	0	0	1	1	1	1	0	0	0	1	0	1	0	1	1	1	0	0	X
49	12544-12799	30400-30777																				
50	12800-13055	31000-31377	1	0	0	1	1	1	1	0	0	1										
51	13056-13311	31400-31777																				
52	13312-13567	32000-32377	1	0	0	1	1	1	1	0	1	0	1	0	1	0	1	1	1	0	1	X
53	13568-13823	32400-32777																				
54	13824-14079	33000-33377	1	0	0	1	1	1	1	0	1	1										
55	14080-14335	33400-33777																				
56	14336-14591	34000-34377	1	0	0	1	1	1	1	1	0	0	1	0	1	0	1	1	1	1	0	X
57	14592-14847	34400-34777																				
58	14848-15103	35000-35377	1	0	0	1	1	1	1	1	0	1										
59	15104-15359	35400-35777																				
60	15360-15615	36000-36377	1	0	0	1	1	1	1	1	1	0	1	0	1	0	1	1	1	1	1	X
61	15616-15871	36400-36777																				
62	15872-16127	37000-37377	1	0	0	1	1	1	1	1	1	1										
63	16128-16383	37400-37777																				

1 0 = CLOSED 1 = OPEN X = DON'T CARE
"CLOSED" AND OPEN REFER TO THE SETTINGS ON THE DIP ROCKER SWITCHES

2 ALL UNUSED SETS MUST BE DISABLED BY SETTING S1 CLOSED

12791A FIRMWARE EXPANSION MODULE (FEM) (Cont'd)

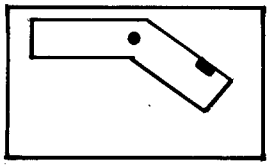
FEM SWITCH AND JUMPER LOCATIONS



NOTE: Install the FEM in slot 10 if no WCS is present, otherwise install the FEM in slot 11.

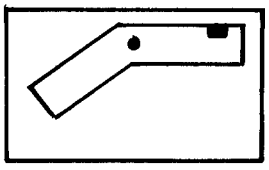
SWITCH SENSE

OPEN



CLOSED "0"

OPEN



OPEN "1"

13047A USER CONTROL STORE (UCS)

SPECIFICATIONS

Equipment:	13047-60001	User Control Strore Board
	5061-3419	Ribon Cable Assy
No.of IC Socket:	48 IC sockets to accommodate 8 modules of control store	
Power Requirement:	+5V	1.15A + 0.78A (for each additional module of control store)
Jumper Configuration:	W1	always in
	W2	out HP 1000 M-Series
		in HP 1000 E-Series

Note

If no WCS PCA is present, install UCS board in slot 10. If one WCS PCA is present, install UCS in slot 11. If two WCS PCA's are present, install UCS board in slot 12.

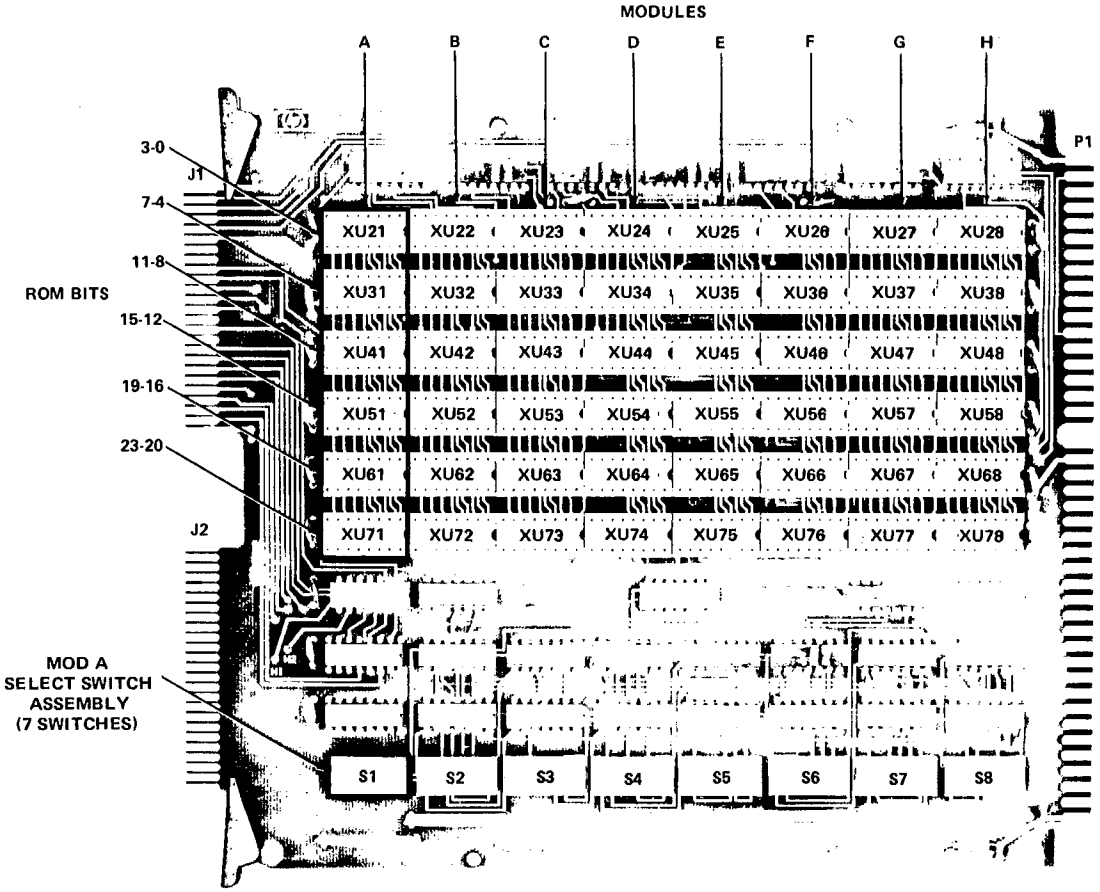
13047A USER CONTROL STORE (UCS) (Cont'd)

UCS MODULE SELECT SWITCH SETTINGS

7	6	5	4	3	2	1	MODULE NO.
2^6	2^5	2^4	2^3	2^2	2^1	2^0	
0	0	0	0	0	0	0	0
0	0	0	0	0	0	1	1
0	0	0	0	0	1	0	2
0	0	0	0	0	1	1	3
0	0	0	0	1	0	0	4
0	0	0	0	1	0	1	5
0	0	0	0	1	1	0	6
0	0	0	0	1	1	1	7
0	0	0	1	0	0	0	8
0	0	0	1	0	0	1	9
0	0	0	1	0	1	0	10
0	0	0	1	0	1	1	11
0	0	0	1	1	0	0	12
0	0	0	1	1	0	1	13
0	0	0	1	1	1	0	14
0	0	0	1	1	1	1	15
•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•
•	•	•	•	•	•	•	•
1	1	1	1	1	1	1	63

Open switch = logic 0
CLOSED switch = logic 1

UCS ROM & SWITCH LOCATIONS



E/F-SERIES DYNAMIC MAPPING INSTRUCTIONS

EQUIPMENT

13304A Firmware Accessory Board
or
13047A User Control Store Board
13307-80027
thru 1K ROM IC (bits 0-23)
13307-80032

Note: Later versions are combined with FFP firmware.

FAB ROM Locations — Old Version

LOCATION	ROM IC	BITS	MODULE NO.
A1 (XU602)	13307-80027	3-0	32
A2 (XU603)	13307-80028	7-4	
A3 (XU604)	13307-80029	11-8	
A4 (XU606)	13307-80030	15-12	
A5 (XU607)	13307-80031	19-16	
A6 (XU608)	13307-80032	23-20	

JUMPER	SETTING
9A	0
10A	0
11A	0
12A	0
13	1

FAB ROM Locations — New Version

LOCATION	ROM IC	BITS	MODULE NO.
B1	13307-80033	7-0	32, 33
B2	13307-80034	15-8	
B3	13307-80035	23-16	

JUMPER	SETTING
10B	0
11B	0
12B	0
13	1

Note: If an UCS Board is used install the 6 ROMs into any vacant set of sockets and configure the switches for module 32.

DMI TEST AND VERIFICATION

The DMI chips can be 'quick tested' by executing a 101701 or 105701 opcode. If the chips are in place, P will increment and the A-register (101701) will complement into 076076, and the B-register contents will likewise be complemented for the 105701 opcode. Note that this is not a test of DMI capability, only their presence and strapping is correct.

Verify the DMI by running the following diagnostics:

DIAGNOSTIC	MANUAL	ABSOLUTE BINARY NO.
Memory Protect-Parity Error Test	12892-90005	12892-16001
Memory Expansion Module Test	12929-90003	12929-16001

E-SERIES BASE INSTRUCTION SET AND EIG/FPP

EQUIPMENT

5090-0600
5090-0564 4K ROMs Base Set/FP
5090-0596

5090-0566
5090-0567 4K ROMs Extended Instruction Group
5090-0568

or

02113-80006
02113-80007 8K ROMs BS/EIG/FP
02113-80008

E-Series CPU 2109A or 2113A

or

12791A FEM

F-SERIES BASE INSTRUCTION SET AND EIG/FPP

EQUIPMENT

12740-80019
12740-80020 4K ROMs Base Set/FP
12740-80021

12740-80022
12740-80023 4K ROMs Extended Instruction Group
12740-80024

or

02117-80016
02117-80017 8K ROMs BS/EIG/FP
02117-80018

F-Series CPU 2111F or 2113F

or

12791A FEM

BASE SET/EIG FL. PT. INSTALLATION ON CPU BOARD

4K ROMs			8K ROMs		
ROM P/N		MODULES	ROM P/N		MODULES
E-SERIES					
5090-0600	(U21)	0,1	02113-80006	(U23)	0,1,2,3
5090-0564	(U41)	0,1	02113-80007	(U43)	0,1,2,3
5090-0596	(U81)	0,1	02113-80008	(U83)	0,1,2,3
5090-0566	(U23)	2,3	VACANT	(U21)	
5090-0567	(U43)	2,3	VACANT	(U41)	
5090-0568	(U83)	2,3	VACANT	(U81)	
F-SERIES					
12740-80019	(U21)	0,1,2,3	02117-80001	(U23)	0,1,2,3
12740-80020	(U41)	0,1,2,3	02117-80002	(U43)	0,1,2,3
12740-80021	(U81)	0,1,2,3	02117-80003	(U83)	0,1,2,3
12740-80022	(U23)	0,1,2,3	VACANT	(U21)	
12740-80023	(U43)	0,1,2,3	VACANT	(U41)	
12740-80024	(U83)	0,1,2,3	VACANT	(U81)	

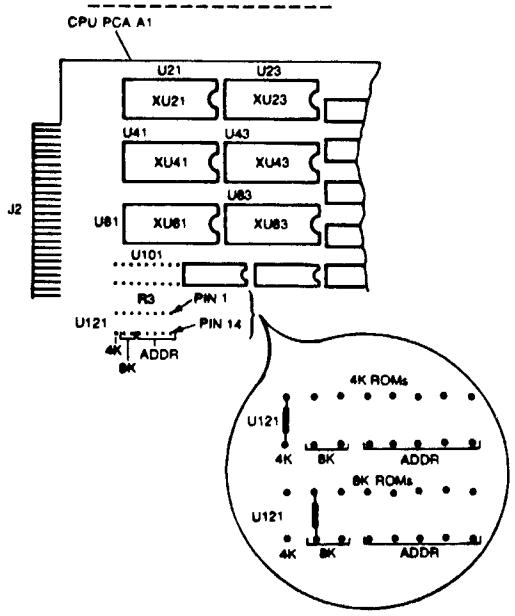
CPU BOARD JUMPERING

The CPU board must be jumpered for 4K or 8K ROMs. The silk screen indicating the 8K ROM jumpers is in error. Only the one shown below must be installed. DO NOT INSTALL THE 2ND 8K JUMPER.

COMPATIBILITY

	4K	8K
REV A/B	YES	NO
REV C/D	YES	YES

JUMPER LOCATIONS



E-SERIES CONTROL MEMORY MAP

CONTROL MEMORY MODULE ALLOCATION	MODULE NO.	ADDRESS		SOFTWARE ENTRY POINT	
		DECIMAL	OCTAL		
HP BASE SET	0	0-00255I	00000-00377	YES	1K
	1	00256-00511	00400-00777	YES	
	2	00512-00767	01000-01377	YES	
	3	00768-01023	01400-01777	YES	
AVAILABLE FOR USER MICROPROGRAMMING	4	01024-01279	02000-02377	NO	2K
	5	01280-01535	02400-02777	NO	
	6	01536-01761	03000-03377	NO	
	7	01762-02047	03400-03777	NO	
	8	02048-02303	04000-04377	NO	3K
	9	02304-02559	04400-04777	NO	
	10	02560-02815	05000-05377	NO	
	11	02816-03071	05400-05777	NO	
	12	03072-03327	06000-06377	NO	4K
	13	03328-03583	06400-06777	NO	
	14	03584-03849	07000-07377	NO	
	15	03850-04095	07400-07777	NO	
	16	04096-04351	10000-10377	NO	5K
	17	04352-04607	10400-10777	NO	
	18	04608-04863	11000-11377	NO	
	19	04864-05119	11400-11777	NO	
	20	05120-05375	12000-12377	NO	6K
	21	05376-05631	12400-12777	NO	
	22	05632-05887	13000-13377	NO	
	23	05888-06143	13400-13777	NO	
	24	06144-06399	14000-14377	NO	7K
	25	06400-06655	14400-14777	NO	
	26	06656-06911	15000-15377	NO	
	27	06912-07167	15400-15777	NO	
	28	07168-07423	16000-16377	NO	8K
	29	07424-07679	16400-16777	NO	
	30	07680-07935	17000-17377	NO	
HP DYNAMIC MAPPING SYSTEM →	31	07936-08191	17400-17777	NO	
	32	08192-08447	20000-20377	YES	9K
HP FAST FORTRAN PROCESSOR	33	08448-08703	20400-20777	NO	
	34	08704-08959	21000-21377	YES	
	35	08960-09215	21400-21777	YES	
RTE-IV EMA OR RTE-6/VM EMA/VMA DS/1000	36	09216-09571	22000-22377	YES	10K
	37	09572-09727	22400-22777	YES	
	38	09728-09983	23000-23377	YES	
	39	09984-10239	23400-23777	YES	
HP RESERVED	40	10240-10495	24000-24377	YES	11K
	41	10496-10751	24400-24777	NO	
	42	10752-10917	25000-25377	NO	
	43	10918-11263	25400-25777	NO	
RTE-6/VM OPERATING SYSTEM	44	11264-11519	26000-26377	YES	12K
	45	11520-11775	26400-26777	YES	
	46	11776-12031	27000-27377	YES	
	47	12032-12287	27400-27777	YES	
RECOMMENDED FOR USER MICROPROGRAMMING	48	12288-12543	30000-30377	YES	13K
	49	12544-12799	30400-30777	YES	
	50	12800-13055	31000-31377	YES	
	51	13056-13311	31400-31777	NO	
	52	13312-13557	32000-32377	NO	14K
	53	13558-13823	32400-32777	NO	
	54	13824-14079	33000-33377	NO	
	55	14080-14335	33400-33777	NO	
	56	14336-14591	34000-34377	YES	15K
	57	14592-14847	34400-34777	YES	
	58	14848-15103	35000-35377	YES	
	59	15104-15359	35400-35777	YES	
	60	15360-15615	36000-36377	YES	16K
	61	15616-15871	36400-36777	NO	
	62	15872-16127	37000-37377	YES	
	63	16128-16383	37400-37777	NO	

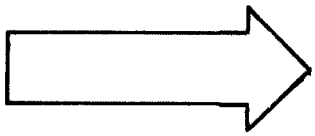
F-SERIES CONTROL MEMORY MAP

CONTROL MEMORY MODULE ALLOCATION	MODULE NO.	ADDRESS		SOFTWARE ENTRY POINT	
		DECIMAL	OCTAL		
HP BASE SET	0	0-00255	00000-00377	YES	1K
	1	00256-00511	00400-00777	YES	
	2	00512-00767	01000-01377	YES	
	3	00768-01023	01400-01777	YES	
HP RESERVED	4	01024-01279	02000-02377	YES	2K
	5	01280-01535	02400-02777	NO	
	6	01536-01761	03000-03377	NO	
	7	01762-02047	03400-03777	NO	
	8	02048-02303	04000-04377	YES	3K
	9	02304-02559	04400-04777	NO	
	10	02560-02815	05000-05377	NO	
	11	02816-03071	05400-05777	NO	
VECTOR INSTRUCTION SET	12	03072-03327	06000-06377	YES	4K
	13	03328-03583	06400-06777	NO	
	14	03584-03849	07000-07377	NO	
	15	03850-04095	07400-07777	NO	
RTE-6/VM OPERATING SYSTEM	16	04096-04351	10000-10377	YES	5K
	17	04352-04607	10400-10777	NO	
	18	04608-04863	11000-11377	YES	
	19	04864-05119	11400-11777	NO	
HP RESERVED	20	05120-05375	12000-12377	YES	6K
	21	05376-05631	12400-12777	NO	
	22	05632-05887	13000-13377	NO	
	23	05888-06143	13400-13777	NO	
	24	06144-06399	14000-14377	NO	7K
	25	06400-06655	14400-14777	NO	
	26	06656-06911	15000-15377	NO	
	27	06912-07167	15400-15777	NO	
AVAILABLE FOR USER MICROPROGRAMMING	28	07168-07423	16000-16377	NO	8K
	29	07424-07679	16400-16777	NO	
	30	07680-07935	17000-17377	NO	
	31	07936-08191	17400-17777	NO	
HP DYNAMIC MAPPING SYSTEM → HP FAST FORTRAN PROCESSOR	32	08192-08447	20000-20377	YES	9K
	33	08448-08703	20400-20777	NO	
	34	08704-08959	21000-21377	YES	
	35	08960-09215	21400-21777	YES	
RTE-IV EMA OR RTE-6/VM EMA/VMA DS/1000	36	09216-09571	22000-22377	YES	10K
	37	09572-09727	22400-22777	NO	
	38	09728-09983	23000-23377	YES	
	39	09984-10239	23400-23777	NO	
SCIENTIFIC INSTRUCTION SET	40	10240-10495	24000-24377	YES	11K
	41	10496-10751	24400-24777	NO	
	42	10752-10917	25000-25377	NO	
	43	10918-11263	25400-25777	NO	
HP RESERVED	44	11264-11519	26000-26377	NO	12K
	45	11520-11775	26400-26777	NO	
	46	11776-12031	27000-27377	YES	
	47	12032-12287	27400-27777	YES	
RECOMMENDED FOR USER MICROPROGRAMMING	48	12288-12543	30000-30377	YES	13K
	49	12544-12799	30400-30777	YES	
	50	12800-13055	31000-31377	YES	
	51	13056-13311	31400-31777	NO	
	52	13312-13557	32000-32377	NO	14K
	53	13558-13823	32400-32777	NO	
	54	13824-14079	33000-33377	NO	
	55	14080-14335	33400-33777	NO	
	56	14336-14591	34000-34377	YES	15K
	57	14592-14847	34400-34777	YES	
	58	14848-15103	35000-35377	YES	
	59	15104-15359	35400-35777	YES	
	60	15360-15615	36000-36377	YES	16K
	61	15616-15871	36400-36777	NO	
	62	15872-16127	37000-37377	YES	
	63	16128-16383	37400-37777	NO	

MEMORY CHIP MALFUNCTION ISOLATION

S-REGISTER* BITS 2:0	MEMORY MODULE NUMBERS**
000	0, 1, 2, 3
001	4, 5, 6, 7
010	8, 9, 10, 11
011	12, 13, 14, 15
100	16, 17, 18, 19
101	20, 21, 22, 23
110	24, 25, 26, 27
111	28, 29, 30, 31

*S-register will be zero if DMS is not installed in computer.
**Each module number represents 16K bytes of memory.



In the example shown in the shaded areas, the computer halts on a cold power-up with the register "dots" lighted and 000003 (octal) in the S-register. This signifies that a memory failure has occurred somewhere in the fourth contiguous 64k byte block of memory in memory module number 12, 13, 14, or 15.

The M-register is selected and displays a value between 34000 and 35777 (octal). Examing the memory module column shows that the module number 13 matches one of the module numbers identified by the S-register. If module number 13 is a 16k byte memory board, the failing address is in the second 8k byte segment of that board; if module number 13 is a 32k byte memory board, the failing address is in the fourth 8k byte segment of the board; and if module number 13 is a 128k byte memory board, then the failing address is in the third 32k byte segment of that board.

The A-register is selected and its contents noted as shown below. (The A-register will always contain the expected or good data.)

A bit-by-bit comparison is made and indicates that bit 9 in the B-register is a logical "1" instead or a logical "0". After module number 13 is identified by the jumper configurations shown in the E/F-Series Memory Maps, the failing chip associated with bit 9 on that memory module or the memory module may be replaced.

If more than 128k bytes of memory are used, this cycle must be repeated for each 128k byte section.

A-REGISTER (EXPECTED DATA)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	1	1	0	0	0	1	1	0	1	1	1	0	0	1

B-REGISTER (ACTUAL DATA)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1

MEMORY CHIP MALFUNCTION ISOLATION (Cont'd)

M-REGISTER ADDRESS (OCTAL)	MEMORY MODULE NUMBERS	16k BYTES MM (8k BYTES)	32k BYTES MM (8k BYTES)	128k BYTES MM (32k BYTES)
00000 to 07777	0, 8, 16, 24	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 1 (1st 32k bytes)
10000 to 17777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
20000 to 27777	1, 9, 17, 25	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
30000 to 37777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	
40000 to 47777	2, 10, 18, 26	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 2 (2nd 32k bytes)
50000 to 57777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
60000 to 67777	3, 11, 19, 27	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
70000 to 77777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	
00000 to 10000	4, 12, 20, 28	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 3 (3rd 32k bytes)
10000 to 17777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
20000 to 27777	5, 13, 21, 29	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
30000 to 37777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	
40000 to 47777	6, 14, 22, 30	Row 1 (1st 8k bytes)	Row 1 (1st 8k bytes)	Row 4 (4th 32k bytes)
50000 to 57777		Row 2 (2nd 8k bytes)	Row 2 (2nd 8k bytes)	
60000 to 67777	7, 15, 23, 31	Row 1 (1st 8k bytes)	Row 3 (3rd 8k bytes)	
70000 to 77777		Row 2 (2nd 8k bytes)	Row 4 (4th 8k bytes)	

E/F-SERIES SELF-TEST SUMMARIES

CPU AND MEMORY — E/F-SERIES

1. A-Reg. = 100000 (octal)
2. B-Reg. = 0
3. S-Reg. = Bit pattern to be stored in memory.
4. PRESET and INSTR STEP

SCIENTIFIC INSTRUCTION SET — F-SERIES (SIS)

1. A-Reg. = 105337
2. P = S = X = 0
3. PRESET and INSTR STEP
   S-Reg. = 102077;
   x-Reg. = Set # (revision)

FLOATING POINT PROCESSOR — F-SERIES (FPP)

1. A-Reg. = 105004
2. P = S = X = 0
3. PRESET and INSTR STEP
   S-Reg. = 102077'
   x-Reg. = Set # (revision)

VECTOR INSTRUCTION SET — F-SERIES (VIS)

1. A-Reg. = 105477
2. P = S = X = 0
3. PRESET and INSTR STEP
   S-Reg. = 102077;
   x-Reg. = Set # (revision)

FAST FORTRAN PROCESSOR — F-SERIES (FFP)

1. A-Reg. = 105200
2. P = S = X = 0
3. PRESET and INSTR STEP
   S-Reg. = 102077;
   x-Reg. = Set # (revision)

EXTENDED MEMORY AREA — E/F-SERIES (EMA)

1. A-Reg. = 105242
2. P = S = 0
3. PRESET and INSTR STEP
4. x-Register will show the firmware revision number.

DS/1000 FIRMWARE — M/E/F-SERIES (DS) (CBL NOT TESTED)

1. A-Reg. = 105304 for E/F-Series
   105524 for M-Series
2. P = S = 0
3. PRESET and INSTR STEP
   S-Reg. = date code in BCD

RTE-6/VM OS SELF-TEST — E-SERIES

1. A-Reg. = 105355
2. P = 0
3. PRESET and INSTR STEP

BASE SET FIRMWARE DIAGNOSTIC

Test 1 — Tests most of the computer registers and functions. An error condition will set all display register indicator bits (A, B, M, T, P, S) and the overflow register.

Test 2 — Checks the presently enabled memory space (up to 32K words). The M-register will contain the logical memory location of a failure, the A-register will contain the expected (good) data, and the B-register will contain the actual (bad) data.

Test 3 — Checks all memory installed in the computer. Error reporting is the same as in Test 2 except the S-register will contain the number of the 32K word space where the memory failure occurred.

CPU AND MEMORY SELF-TEST

On a cold power-up, Tests 1 and 3 will each be executed once.

Pressing the IBL-TEST switch on the operator panel will perform the loader function, it will also cause the execution of Tests 1 and 2.

Tests 1 and 3 may also be executed via the operator panel as follows:

a. Set P = 0.

b. Set A = 100000 (octal).

c. At the end of the diagnostic (when executed once), memory will be filled with the value in the S-register. Set the S-register if desired.

d. Press PRESET.

e. To loop the diagnostic, set the LOCK/OPERATE switch to LOCK.

f. Press INSTR STEP, the diagnostic will now be executed.

g. While the diagnostic is being executed, if S-register bit 5 is set, the S-register will display the number of executions (bit 5 = LSB) if MEM installed.

F-SERIES SCIENTIFIC INSTRUCTION SET (SIS(

EQUIPMENT

12823-80007
thru 4K ROMs
12823-80012
or
12823-80019
thru 8K ROMs
18823-80021

13304A Firmware Accessory Board
or
12791A Firmware Expansion Module

FAB 4K ROM LOCATIONS

LOCATION	ROM IC	BITS	MODULE NO.
D1 (XU101)	12823-80007	7-0	
D2 (XU102)	12823-80008	15-8	40,41
D3 (XU104)	12823-80009	23-16	
D4 (XU106)	12823-80010	7-0	
D5 (XU108)	12823-80011	15-8	42,43
D6 (XU109)	12823-80012	23-16	

FEM 8K ROM LOCATIONS

LOCATION	ROM IC	BITS	MODULE NO.
A-H 1	12823-80019	7-0	40, 41, 42, 43
A-H 2	12823-80020	15-8	
A-H 3	12823-80021	23-16	

FAB JUMPERS

JUMPER	SETTING
10D	0
11D	1
12D	0
13	1

Note: If a FEM is used, install the ROMs in any available set of sockets.

SIS VERIFICATION

F-Series SIS Self-Test:

To execute proceed as follows:

a. Store 105337 in the A-register.

b. Store 0 in the P-register.

c. Store 0 in the X-register.

d. Press PRESET; INSTR STEP

One of the three results of the test should be returned in the S-register.

1. S=102077 indicates successful completion.

2. S=102001 floating point PCAs not cabled or not powered.

3. S=102002 a numerical error in the diagnostic calculation; defective floating point PCAs or ROMs.

NOTE:

12823-80001 thru 12823-80006	Return 0 in the X-register
12823-80007 thru 12823-80012	Return 3 in the X-register
12823-80013 thru 12823-80018	Return 4 in the X-register
12823-80019 thru 12823-80021	Return 4 in the X-register

F-SERIES FLOATING-POINT VERIFICATION

To execute the firmware self-test, proceed as follows:

a. Store 105004 (octal) in the A-register.

b. Store 0 in the P-register and press PRESET. If the OVFL light remains on, check that the FPP-MPP cable is installed correctly (not twisted). Otherwise, a defective CPU, floating point PCA, or FPP is indicated. Use software diagnostics for further troubleshooting.

c. Press INSTR STEP.

d. A 102077 (octal) in the display register (S) indicates successful completion. If 10200X (octal) is returned in the display register, the firmware test failed and the halt code is interpreted as shown in the table. If the firmware test returns an error halt code, use software diagnostics for further troubleshooting.

FLOATING POINT SELF-TEST ERROR HALTS

HALT	PROBABLE PROBLEM
102001	a. Power not supplied to floating-point PCA's. b. FPP-MPP cable not properly connected. Refer to Installation and Reference Manual. c. Floating point CONTROL PCA not installed or not connected properly. d. If A-register not 177777 (octal) and B-register not 0, then floating point ROMs defective.
102002	a. If A- and B-registers equal 0 and OVFL lit, then FPP-MPP cable twisted. b. If A- and B-registers equal 177777 (octal), then floating point ARITH PCA not connected properly or CPU-MPP cable not connected.
102003	a. Floating point PCA, ALU PCA, or cables defective.
102004	a. Floating point PCA, ALU PCA, or cables defective.
XXXXXX	a. If display register does not indicate any of the above halts, either the floating point ROMs are not present, ROMs are defective, or computer is defective.

F-SERIES VECTOR INSTRUCTION SET (VIS)

EQUIPMENT

12824-80001
thru
12824-80006
or
12824-80007
12824-80008
12824-80009

six 4K ROMs (F-Series only)

three 8K ROMs (F-Series only)

12791A Firmware Expansion Module

FEM 4K ROM LOCATIONS

LOCATION	ROM IC	BITS	MODULE NO.
A1	12824-80001	7-0	
A2	12824-80002	15-8	12,13
A3	12824-80003	23-16	
B1	12824-80004	7-0	
B2	12824-80005	15-8	14,15
B3	12824-80006	23-16	

SWITCH SETTINGS

SWA		SWB	
SWITCH	SETTING	SWITCH	SETTING
S1	1	S1	1
S2	0	S2	0
S3	0	S3	0
S4	1	S4	1
S5	1	S5	1
S6	0	S6	0
S7	0	S7	0
S8	1	S8	1
S9	1	S9	1
S10	0	S10	1

F-SERIES VECTOR INSTRUCTION SET (VIS) (Cont'd)

FEM 8K ROM LOCATIONS

LOCATION	ROM IC	BITS	MODULE NO.
A-H 1	12824-80007	7-0	12, 13, 14, 15
A-H 2	12824-80008	15-8	
A-H 3	12824-80009	23-16	

SWITCH SETTINGS

SW A-H	
SWITCH	SETTING
S1	1
S2	0
S3	1
S4	0
S5	1
S6	0
S7	0
S8	1
S9	1
S10	X (Don't care)

VIS VERIFICATION

To execute proceed as follows:

a. Store 105477B in the A-register.

b. Store 0 in the P-register.

c. Store 0 in the X-register.

d. Press PRESET; then INSTR STEP.

A 102077 in the display register indicates successful completion.

NOTE: The VIS ROMs 12824-80001/6 will return a 3 in the X-register.

E-SERIES FAST FORTRAN PROCESSOR (FFP)

EQUIPMENT

FFP ROMS

5090-0589
thru 4K ROM IC (bits 0-23)
5090-0591 (FAB or FEM)

Add to combine FFP/DMI/DMS in E-Series of Serial Prefixes >21XX

13307-80033
thru 4K ROM includes DMI/DMS
13307-80035

13304A Firmware Accessory Board
or
12791A Firmware Expansion Module

OBSOLETE DMI

13306-80013
thru 1K ROM IC (bits 0-23)
13306-80018 (FAB only)

FAB Locations

LOCATION	ROM IC	BITS	MODULE NO.
B1 (XU401)	13307-80033	7-0	32, 33
B2 (XU402)	13307-80034	15-8	
B3 (XU404)	13307-80035	23-16	
B4 (XU406)	5090-0589	7-0	34, 35
B5 (XU408)	5090-0590	15-8	
B6 (XU409)	5090-0591	23-16	

Note: If the FEM board is used, the six ROMs can be installed in any available socket sets; e.g., Set A and Set B.

Obsolete ROM FAB Locations

LOCATION	ROM IC	BITS	MODULE NO.
A7 (XU802)	13306-80013	3-0	33
A8 (XU803)	13306-80014	7-4	
A9 (XU804)	13306-80015	11-8	
A10 (XU806)	13306-80016	15-12	
A11 (XU807)	13306-80017	19-16	
A12 (XU808)	13306-80018	23-20	
B4 (XU406)	5090-0589	7-0	34, 35
B5 (XU408)	5090-0590	15-8	
B6 (XU409)	5090-0591	24-16	

F-SERIES FFP AND DMI

EQUIPMENT

FFP Only

5090-1615 thru 5090-1620 } 1K ROMs (bits 0-23) (FAB only)

5090-1621 thru 5090-1623 } 4K ROMs (bits 0-23) (FAB or FEM)

13304A Firmware Accessory Board
or
12791A Firmware Expansion Module

FFP and DMI

5180-0141 thru 5180-0143 } 8K ROMs

Note: F-Series FFP ROMs, part nos. 5090-1615 thru 5090-1623, require compatible F-Series Base Instruction Set ROMs, part nos. 12740-80019 thru 12740-80024 and vice versa for correct operation.

FFP ROM FAB Locations

LOCATION	ROM IC	BITS	MODULE NO.	JUMPER	SETTING
A7 (XU802)	5090-1615	3-0	33	9A	0
A8 (XU803)	5090-1616	7-4		10A	0
A9 (XU804)	5090-1617	11-8		11A	0
A10 (XU806)	5090-1618	15-12		12A	0
A11 (XU807)	5090-1619	19-16		10B	0
A12 (XU808)	5090-1620	23-20		11B	0
B4 (XU406)	5090-1621	7-0	34, 35	12B	0
B5 (XU408)	5090-1622	15-8		13	1
B6 (XU409)	5090-1623	23-16			

Note: If a FEM is used install the 4K ROMs in any vacant set of sockets, and configure the switches for module 34 and 35.

FFP/DMI ROMs FEM Locations

LOCATIONS	ROM IC	BITS	MODULE NO.
A-H 1	5180-0141	7-0	32, 33, 34, 35
A-H 2	5180-0142	15-8	
A-H 3	5180-0143	23-16	

F-SERIES FFP/DMI VERIFICATION

FFP Self Test:

To execute proceed as follows:

a. Store 105200B in the A-register.

b. Store 0 in the P-register.

c. Store 0 in the X-register.

d. Press PRESET; INSTR STEP

One of three results should be displayed in the S-register.

1. S=102077 indicates successful completion.

2. S=102001 module 33 defective or missing.

3. S=102002 module 35 defective or missing.

NOTE: FFP firmware (P/N 13306-80016/18 and 5090-0589/91) will return a 4 in the x-register when self test is run. FFP firmware (P/N 5090-1615 thru 1623) does not have a self test, and a zero will be in the x-register.

RTE-IVA/B EXTENDED MEMORY AREA FIRMWARE (EMA)

EQUIPMENT

No. of ROMs: 3 4K ROMs

Equipment: 13304A Firmware Accessory Board
or
12791A Firmware Expansion Module
92067-80001 thru 92067-80003 } 4K ROM IC (bits 0-23)

ROM Locations on the FAB

LOCATION	ROM IC	BITS	MODULE NO.	JUMPER	SETTING
B1 (XU401) C1 (XU201) D1 (XU101)	92067-80001 (EMA ROM)	7-0		10C 11C 12C 13	1 0 0 1
B2 (XU402) C2 (XU202) D2 (XU102)	92067-80002 (EMA ROM)	15-8	36, 37		
B3 (XU404) C3 (XU202) D3 (XU104)	92067-80003 (EMA ROM)	23-16			
B4 (XU406) C4 (XU206) D4 (XU106)	91740-80049 (DS 1000 ROM)	7-0			
B5 (XU408) C5 (XU208) D5 (XU108)	91740-80050 (DS 1000 ROM)	15-8	38, 39		
B6 (XU409) C6 (XU209) D6 (XU109)	91740-80051 (DS 1000 ROM)	23-16			

Notes: 1. Sockets C1 through C3 are recommended for the EMA firmware location on the FAB.

2. If a FEM with an unused block of sockets is available, it may be desirable to install the ROMs on the FEM to facilitate future access to the ROMs. The three ROM ICs may be installed in any available set of sockets on the FEM, and the switches configured for modules 36 and 37.

RTE-IVA/B EXTENDED MEMORY AREA FIRMWARE (EMA) (Cont'd)

EMA VERIFICATION

EMA Self Test:

To execute proceed as follows:

a. Store 105242 in the A-register.

b. Store 0 in the P-register.

c. Store 0 in the X-register.

d. Press PRESET.

e. Press INSTR STEP.

A 102077 in the S-register indicates that the firmware is operational. If the test is not successful then check for the following conditions:

a. Incorrect IC orientation on the FAB or FEM.

b. Incorrect jumper positioning on the FAB board, or switch settings on the FEM.

c. IC pin(s) are bent under or broken off.

NOTE: ROMs 92067-80001 thru 80003 return a 0 in the X-register.

91740B DISTRIBUTED SYSTEM FIRMWARE

EQUIPMENT

13304A Firmware Accessory Board
or
12791A Firmware Expansion Module

91740-80067 thru 91740-80069 } 4K ROMs (bits 0-23) Driver Microcode

Note: 91740-80048 1K Communications Bootstrap Loader ROM is required on the CPU board.

FAB ROM Locations

LOCATION	ROM IC	BITS	MODULE NO.	JUMPER	SETTING
C4 (XU106)	91740-80067	7-0	38,39	10C	1
C5 (XU108)	91740-80068	15-8		11C	0
C6 (XU109)	91740-80069	23-16		12C	0
				13	1

Note: If a FEM is used install the 4K ROMs in any available set of sockets.

91740B DISTRIBUTED SYSTEM FIRMWARE (Cont'd)

DS/1000 VERIFICATION

To execute proceed as follows:

a. Select the S-register.

b. Press CLEAR DISPLAY. If the CBL ROM was installed in loader socket binary 11_2 (XU196), press switches 14 and 15. If the CBL ROM was installed in loader socket binary 10_2 (XU256), press switch 15.

c. Set bits 6 through 11 of the Display Register to the select code of the DS/1000 communications interface. If a system contains multiple DS/1000 communications PCA's, choose the select code of the primary downloading PCA.

d. Press STORE.

e. Press PRESET and then IBL/TEST. Do NOT press RUN!

f. Select the P-register. Do NOT clear the display. Press switches 3, 4, and 5. Press STORE.

g. Press RUN.

If the DS/1000 CBL ROM and Driver Microcode ROM's are installed properly, the RUN light should remain lit and the Display Register should indicate the date code of the installed firmware. If the Display Register is partitioned into four equal sections, (see the table below) with each section representing a BCD digit (bits 15-12 representing the most significant digit), the number displayed corresponds to the approximate release time of the firmware.

If the Display Register indicates 102055_8, the RUN light is off, and the T-register select light is on, then the CBL ROM is installed properly; but, a problem concerning the DS/1000 Driver Microcode ROM's has been detected. The FAB assembly should be removed and inspected for the following:

a. Incorrect ROM IC orientation.

b. Incorrect jumper positioning.

c. Bent or broken ROM IC pin(s).

d. Incorrect 4K ROM IC part numbers.

e. Damaged parts.

If the Display Register contains any other value, the CBL ROM should be inspected for the following:

a. Incorrect orientation.

b. Bent or broken pin(s).

c. Incorrect part number. Also, other Display Register values may result from a CPU failure.

Note: A defective DS/1000 interface can also cause a halt 102055.

Display Register with Self-Test Passed

BCD	1				9				1				3			
LAMPS ON BITS				★	★			★				★			★	★
	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
OCTAL	0	1			4			4			2		3			

NOTE: The Display Register returns the data code of the firmware as a BCD number.

91740B DISTRIBUTED SYSTEM FIRMWARE (Cont'd)

DS/1000 VERIFICATION (Cont'd)

DS/1000 Firmware Self Test (CBL not tested): Proceed as follows:

a. Select the A-register and set it as follows:

E/F-Series: 105304 (octal)
M-Series: 105524

b. Set the P and S-registers to 0.

c. If the firmware passes the self-test, the S-register will display the date code in BCD as described on the previous page.

E-SERIES RTE-6/VM OPERATING SYSTEM/EMA/VMA

The HP RTE-6/VM OS/VMA/EMA firmware consists of six 4K ROMs that are installed on the FEM or FAB. The six ROMs are divided into two groups, a set of three 4K ROMs for the RTE-6/VM Operating System firmware allocated to control memory modules 44 and 45, and a set of three 4K ROMs for the RTE-6/VM EMA/VMA firmware allocated to control memory modules 36 and 37.

FAB ROM Locations

LOCATION	ROM IC	BITS	MODULE NO.	JUMPER	SETTING
D1 (XU101)	92084-80001	7-0	44, 45	10C	1
D2 (XU102)	92084-80102	15-8	44, 45	11C	0
D3 (XU103)	92084-80003	23-16	44, 45	12C	0
				13C	1
C1 (XU201)	92084-80004	7-0	36, 37	10D	1
C2 (XU202)	92084-80005	15-8	36, 37	11D	1
C3 (XU203)	92084-80006	23-16	36, 37	12D	0
				13D	1

Note: If DS/1000 ROMs 91740-80064, 91740-80065, and 91740-80066 are located on the FAB board, they must be located in sockets C4, C5, and C6 respectively.

VERIFICATION

To execute the RTE-6/VM OS Firmware Self-Test proceed as follows:

a. Store 105355B in the A-register.

b. Store 0 in the P-register.

c. Press PRESET.

d. Press INSTR STEP.

If the Self-Test passes, a 102077B will appear in the S-register. The contents of the x-register will indicate the revision of the installed firmware. Any other value displayed in the S-register indicates the RTE-6/VM OS Firmware Self-Test failed.

E-SERIES RTE-6/VM OPERATING SYSTEM/EMA/VMA (Cont'd)

VERIFICATION (Cont'd)

To execute the RTE-6/VM EMA/VMA Firmware Self-Test proceed as follows:

a. Store 105242B in the A-register.

b. Store 0 in the P-register.

c. Press PRESET.

d. Press INSTR STEP.

If the Self-Test passes, a 102077B will appear in the S-register. The contents of the x-register indicate the revision of the installed firmware. Any other value displayed in the S-register indicates the RTE-6/VM VMA/EMA Firmware Self-Test failed.

SIGNAL/1000 FIRMWARE

The Signal Processing Instruction microcode used by SIGNAL/1000 is contained in three ROMs part nos.: 92835-80001, 92835-80002 and 92835-80003.

This microcode resides in modules 56 through 59 of the F-Series processor control store, corresponding to the address space 34000B-35777B. Macro entry points 105600B through 105617B are used to link to these instructions.

These ROMs must be installed on the 12791A Firmware Expansion Module (FEM) of the F-Series processor.

Switch S1 = 1
Switch S2 = 0
Switch S3 = 1
Switch S4 = 0
Switch S5 = 1
Switch S6 = 1
Switch S7 = 1
Switch S8 = 1
Switch S9 = 0
Switch S10 = 0

SIGNAL/1000 VERIFICATION

The internal self-test opcode can be executed from the CPU front panel by the following sequence:

Set P = 0
Set A = 105617B
PRESET
INSTR STEP

The S-register on the front panel should now show the content "102077B". Any other display content indicates improper firmware installation. Following a successful self-test execution, the firmware revision number will be contained in the x-register. Additional firmware verification can be accomplished with the on-line firmware diagnostic program.

Software module %FFTRP, contained in relocatable library $HPFFT, will link a program to the appropriate entry point for the Signal Processing Instructios.

21MX-E/F FFP DIAGNOSTIC

Required Hardware:

a. Minimum 4K memory
b. 12977 FFP, or 13306 FFP
c. Standard I/O interface board

To execute proceed as follows:

1. Load Diagnostic Configurator.

2. Configure configurator and load diagnostic.

3. Configure diagnostic: P-Reg = 100 (octal), S-Reg (5-0) = SC of standard I/O device used by interruptible tests.

4. Press PRESET,RUN,HALT 102074.

5. Set S-Reg = Switch options.

6. Press PRESET,RUN.

7. Restart: P-Reg = 2000 (octal), S-Reg = Switch options, press PRESET,RUN.

Switch Options

BIT	MEANING IF SET
8-0	Reserved.
9	Abort current diagnostic execution and halt (102075); user may specify a new group of tests in the A-register clear bit 9, and then press RUN.
10	Suppress non-error messages.
11	Suppress error messages.
12	Repeat all selected tests after diagnostic run is complete without halting. Message "PASS XXXXXX" will be output before looping unless bit 10 is set or console is not present. Also those tests requiring operator intervention will be suppressed.
13	Repeat last test executed (loop on test).
14	Suppress error halts.
15	Halt (102076) at the end of each test; the A-register will contain the test number in octal.

F-SERIES FPP/SIS/FFP DIAGNOSTIC

Manual: 12740-90004

Required Hardware:

a. Minimum 32K memory.
b. Absolute binary loading device.
c. Console device for message reporting.
d. I/O card other than the system console interface.

Required Software:

a. Diagnostic Configurator (1627 or later) Absolute Binary Program 24296-60001.

b. FPP/SIS/FFP Diagnostic Absolute Binary Program 12740-16001.

To execute proceed as follows:

1. Load Diagnostic Configurator.

2. Configure configurator and load diagnostic.

3. Configure diagnostic: P-Reg = 100 (octal), S-Reg (5-0) = SC of standard I/O device used by the interruptible tests.

4. Press PRESET,RUN. HALT 102074.

5. Set S-Reg = Switch options.

6. Press PRESET,RUN.

7. Restart: P-Reg = 2000 (octal), S-Reg = Switch options.

Switch Options:

S-REGISTER BITS	MEANING IF SET
15	Halt at the end of each test (HALT 102076 octal). A-register contains the octal number of the test just run.
14	Suppress error halts.
13	Repeat last test (loop on one test).
12	Repeat all tests without halting (loop on entire disgnostic).
11	Suppress error messages.
10	Suppress non-error messages.
9	Abort current test (HALT 102075 octal). New tests may be specified in the A-register.
8	Execute in the short pass mode.
7-0	Reserved (all zero).

VIS ON-LINE DIAGNOSTIC

The RTE Operating System should be up and running. The proper entry points for VIS firmware should be specified during generation or declared to the loader with a separate RPL file.

The diagnostic program is supplied as a relocatable file which is loaded using the RTE loader. The main program to be loaded and library to search are:

	RTE-6/VM	**RTE-A**	**RTE-IVB**
Main	%VISO6	%VISOA	%VISOD
Library	$VLB6A	$VLBA1	$VLIB1

Once the diagnostic has been loaded, it can be executed as follows:

:RU,VISOD[,LU] [,#PASSES] [,PRIV]

LU = output logical unit number. Specifies where message are to be output.
If 0 or not specified, defaults to user terminal.

#PASSES = number of passes to be run.
If 0 or not specified, 1 pass is run.

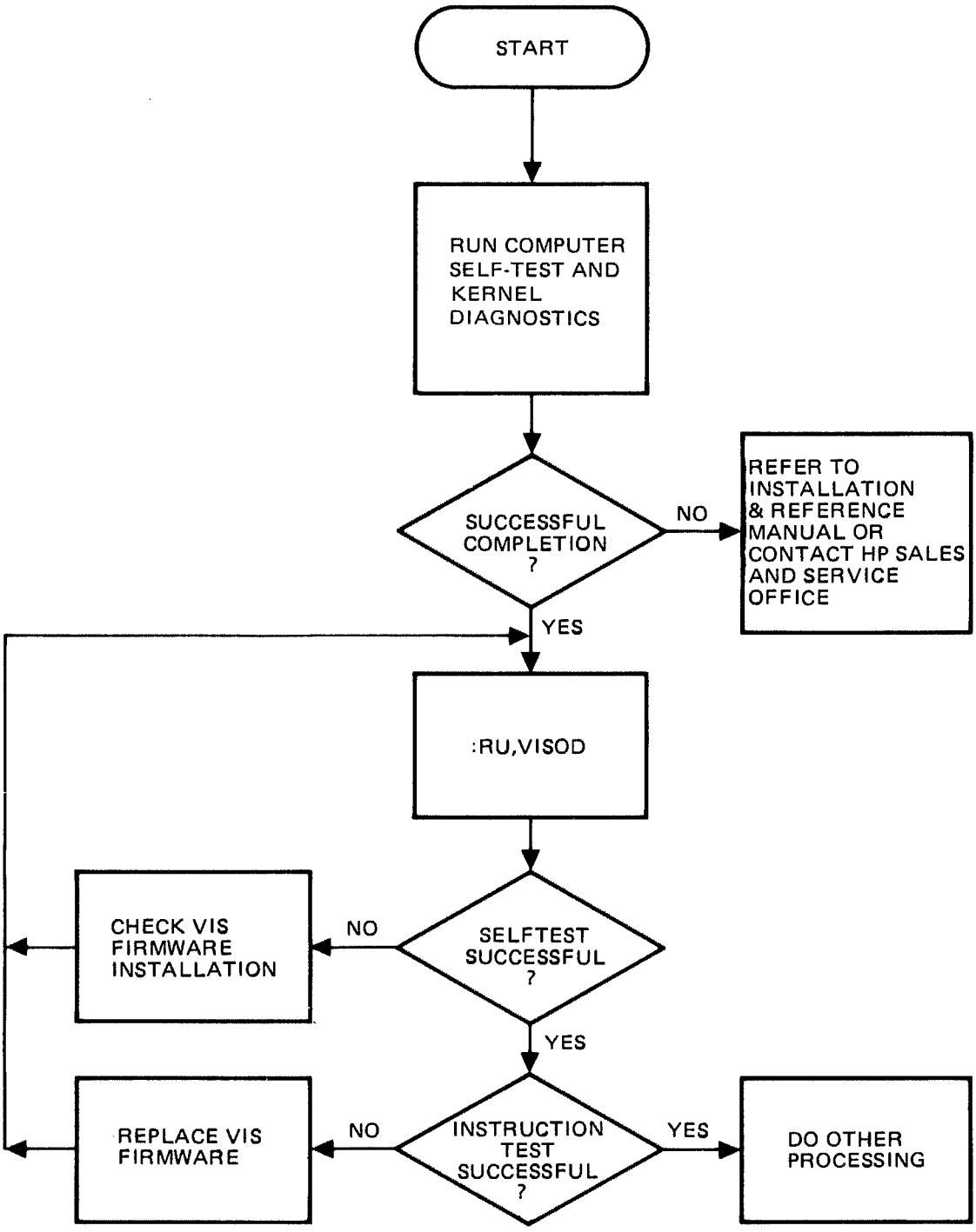
PRIV = privileged section flag.
If 0 or not specified, do not run privileged section test.
If 1, run privileged section test.

CAUTION

When executing the privileged section, malfunctions in VIS firmware could cause overwriting of the operating system. It is recommended that other critical tasks not be executing concurrently.

VIS ON-LINE DIAGNOSTIC (Cont'd)

VIS ON-LINE TROUBLESHOOTING FLOWCHART



91711B DIAGNOSTIC/VERIFICATION PACKAGE

MEDIA PART NUMBERS

Mini-cartridges: Part numbers 91711-13319 thru 91711-13328 and 91711-13334

Mag tape (800 bpi) Part number 91711-13503

Mag tape (1600 bpi) Part number 91711-13504

PRODUCT DESCRIPTION

The 91711B provides three types of troubleshooting tools as follows:

1. On-line Verification Programs:

   These programs which run under the operating system concurrently with other system activity, provide basic functional pass-fail testing of various processor sections and peripherals. These are not extensive and exhaustive tests, and successful completion of the verification program assures a basic level of integrity.

2. On-line Diagnostic Programs:

   These programs which run under the operating system concurrently with other system activity, provide in-depth testing of various processor sections and peripherals, attempting to isolate the failure to a particular module. Where applicable, the diagnostic will indicate the order of probability in which individual sub-assemblies should be replaced.

3. Stand Alone Diagnostics:

   Stand alone diagnostics do not run under the operating system. Stand alone diagnostics are loaded into the computer as absolute programs. A stand alone diagnostic is loaded through an absolute binary loading device (2645/48 mini-cartridge, 800 bpi mag tape, 1600 bpi mag tape) using the appropriate loader ROM. The diagnostic interacts with the operator via the system console for program operation and error reporting.

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

91711B Library Structure (Minicartridges)

FILE NAME	DATE CODE	DESIGNATION	MINICARTRIDGE
DIR #1	2201	Minicartridge #1 Directory	Minicart #1 91711-13319
%TXPM0	2201	Main Processor Verification	
%RODFK	2201	- Subroutine	
#TXPM0	2201	- Loader Command File	
%TXPM1	2226	Memory Verification Father	
%NPART	2226	- Subroutine	
#TXPM1	2201	- Loader Command File	
%TXPM2	2201	Memory Verification Son #1	
#TXPM2	2201	- Loader Command File	
%TXPM3	2201	Memory Verification Son #2	
#TXPM3	2201	- Loader Command File	
%TXPF0	2201	Supported Firmware Verification	
%RPTBL	2201	- Table of Entry Points	
%MORFE	2201	- Subroutine	
%FFPVF	2201	- Subroutine	
%HFPVF	2201	- Subroutine	
%SISVF	2201	- Subroutine	
%VMAVF	2201	- Subroutine	
%DISVF	2201	- Subroutine	
%VISVF	2201	- Subroutine	
#TXPF0	2201	- Loader Command File	
%TXMV0	2226	7900/06/20/25 Disc Verification	
#TXMV0	2201	- Loader Command File	
%TXDS0	2201	DS/1000 Verification	
#TXDS0	2201	- Loader Command File	
%TXIB0	2201	HP-IB Interface Verification	
#TXIB0	2201	- Loader Command File	
%TXMT0	2201	7970 Mag Tape Verification	
#TXMT0	2201	- Loader Command File	
%TXTD0	2201	3070 Data Terminal Verification	
#TXTD0	2201	- Loader Command File	
DIR #2	2201	Minicartridge #2 Directory	Minicart #2 91711-13320
%TXTD1	2201	3075A/76A/77A Verification	
%TXTD2	2201	- Segment 1	
%TXTD3	2201	- Segment 2	
%CFTML	2201	- Segment 3	
%IWRZZ	2201	- Segment 4	
%IMPTM	2201	- Segment 5	
$XXTD1	2201	- Library	
#TXTD1	2201	-Loader Command File	

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

91711B Library Structure (Minicartridges) (Cont'd)

FILE NAME	DATE CODE	DESIGNATION	MINICARTRIDGE
DIR #3	2201	Minicartridge #3 directory	Minicart #3 91711-13321
%TXTTO	2201	2645/48 Terminal Verification	
#TXTTO	2201	- Loader Command File	
%TXTT1	2201	2645/48 Multipoint Verification	
#TXTT1	2201	- Loader Command File	
%TXTRO	2201	RS-232 Terminal Verification	
#TXTRO	2201	- Loader Command File	
%TXPF1	2201	F-Series HFP Processor Diagnostic	
%RODSK	2201	- Subroutine	
#TXPF1	2201	- Loader Command File	
%TXPF2	2201	F-Series SIS Diagnostic	
%RODTK	2201	- Subroutine	
#TXPF2	2201	- Loader Command File	
%TXPF3	2201	RTE IV EMA Diagnostic	
#TXPF3	2201	- Loader Command File	
%TXPF4	2201	F-Series VIS Diagnostic	
#TXPF4	2201	- Loader Command File	
%VMACK	2201	RTE-6/VM VMA Diagnostic	
#VMACK	2201	- Loader Command File	
DIR #4	2201	Minicartridge #4 directory	Minicart #4 91711-13323
!ICD01	2201	RTE-IVE Off-Line Host	
DIR#5	2201	Minicartridge #5 Directory	Minicart #5 91711-13324
FORM	2201	H-Disc RTE-IVE Format Utility	
DIAG	2201	H-DISC RTE-IVE Diagnostic	
DIR#6	2201	Minicartridge #6 Directory	Minicart #6 91711-13325
ERT	2201	H-Disc RTE-IVE Error Rate Test	
DISCZ	2201	H-Disc RTE-IVE Disc Analyzer	
DIR#7	2201	Minicartridge #7 Directory	Minicart #7 91711-13322
%TXWLO	2201	Line Printer Verification	
#TXWLO	2201	-loader command file	
%TXMV1	2201	7900/06/20/25 Disc Verification	
#TXMV1	2201	-loader command file	
%VISO6	2201	RTE-6/VM VIS Diagnostic	
#VISO6	2201	-loader command file	
DIR#8	2226	Minicartridge #8 Directory	Minicart #8 91711-13326
!CS801	2226	RTE-IVE CS80 Off-line Host	
DIR#9	2226	Minicartridge #9 Directory	Minicart #9 91711-13327
EXR1	2226	CS80 Disc Exerciser	
TAPE	2301	CS80 Cartridge Tape Exerciser	Minicart #10 91711-13328
OPER	2226	CS80 OP-Design	
DIR#11	2301	Minicartridge #11 Directory	Minicart #11 91711-13334
!MUXST	2301	Offline MUX Diagnostic	
%MUXST	2301	Online MUX Diagnostic	
%TESTM	2301	37214A Systems Modem Verification	
%JENTS	2301	Subroutine for TESTM	
#TESTM	2301	Loader Command File for TESTM	

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

91711B Library Structure (800/1600 BPI Mag Tape)

FILE NAME	DATE CODE	DESIGNATION	FILE NO. DECIMAL	OCTAL
DIR.MT	2201	Mag Tape Directory	1	1
!ICD01	2201	RTE-IVE H Series Host	2-14	2-16
FORM	2201	H-Disc RTE-IVE Format Utility	15	17
DIAG	2201	H-Disc RTE-IVE Diagnostic	16	20
ERT	2201	H-Disc RTE-IVE Error Rate Test	17	21
DISCZ	2201	H-Disc RTE-IVE Disc Analyzer	18	22
!CS801	2226	RTE-IVE CS80 Off-line Host	19-32	23-40
EXR1	2226	CS80 Disc Exerciser	33	41
TAPE	2301	CS80 Cartridge Tape Exerciser	34	42
OPER	2226	CS80 OP-Design	35	43
!MUXST	2301	Offline MUX Diagnostic	36	44
%TXPM0	2201	Main Processor Verification	37	45
%RODFK	2201	- Subroutine	38	46
#TXPM0	2201	- Loader Command File	39	47
%TXPM1	2226	Memory Verification Father	40	50
%NPART	2226	- Subroutine	41	51
#TXPM1	2201	- Loader Command File	42	52
%TXPM2	2201	Memory Verification Son	43	53
#TXPM2	2201	- Loader Command File	44	54
%TXPM3	2201	Memory Verification Son	45	55
#TXPM3	2201	- Loader Command File	46	56
%TXPF0	2201	Supported Firmware Verification	47	57
%RPTBL	2201	- Table of Entry Points	48	60
%MORFE	2201	- Subroutine	49	61
%FFPVF	2201	- Subroutine	50	62
%HFPVF	2201	- Subroutine	51	63
%SISVF	2201	- Subroutine	52	64
%VMAVF	2201	- Subroutine	53	65
%DISVF	2201	- Subroutine	54	66
%VISVF	2201	- Subroutine	55	67
#TXPF0	2201	- Loader Command File	56	70
%TXMV0	2226	7900/06/20/25 Disc Verification	57	71
#TXMV0	2201	- Loader Command File	58	72
%TXDS0	2201	DS/1000-IV Verification	59	73
#TXDS0	2201	- Loader Command File	60	74
%TXIB0	2201	HP-IB Interface Verification	61	75
#TXIB0	2201	- Loader Command File	62	76
%TXMT0	2201	7970 Mag Tape Verification	63	77
#TXMT0	2201	- Loader Command File	64	100
%TXWL0	2201	Line Printer Verification	65	101
#TXWL0	2201	- Loader Command File	66	102
%TXTT0	2201	2645/48 Terminal Verification	67	103
#TXTT0	2201	- Loader Command File	68	104
%TXTT1	2201	2645/48 Multipoint Verification	69	105
#TXTT1	2201	- Loader Command File	70	106

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

91711B Library Structure (800/1600 BPI Mag Tape) (Cont'd)

FILE NAME	DATE CODE	DESIGNATION	FILE NO. DECIMAL	OCTAL
%TXTRO	2201	RS232 Terminal Verification	71	107
#TXTRO	2201	- Loader Command File	72	110
%TXTDO	2201	3070 Data Terminal Verification	73	111
#TXTDO	2201	- Loader Command File	74	111
%TXTD1	2201	3075A/76A/77A Verification	75	113
%TXTD2	2201	- Segment 1	76	114
%TXTD3	2201	- Segment 2	77	115
%CFTML	2201	- Segment 3	78	116
%IWRZZ	2201	- Segment 4	79	117
%IMPTM	2201	- Segment 5	80	120
$XXTD1	2201	- Library	81	121
#TXTD1	2201	- Loader Command File	82	122
%TXMV1	2201	7906H/20H/25H ICD Disc and 1303 Controller Disc Verification	83	123
#TXMV1	2201	- Loader Command File	84	124
%TXPF1	2201	F-Series HFP Processor Diagnostic	85	125
%RODSK	2201	- Subroutine	86	126
#TXPF1	2201	- Loader Command File	87	127
%TXPF2	2201	F-Series SIS Diagnostic	88	130
%RODTK	2201	- Subroutine	89	131
#TXPF2	2201	- Loader Command File	90	132
%TXPF3	2201	RTE IVB EMA Diagnostic	91	133
#TXPF3	2201	- Loader Command File	92	134
%TXPF4	2201	F-Series VIS Diagnostic	93	135
#TXPF4	2201	- Loader Command File	94	136
%VMACK	2201	RTE-6/VM VMA Diagnostic	95	137
#VMACK	2201	- Loader Command File	96	140
%VISO6	2201	RTE-6/VM VIS Diagnostic	97	141
#VISO6	2201	- Loader Command File	98	142
%MUXST	2301	Online MUX Diagnostic	99	143
%TESTM	2301	32714A Systems Modem Verification	100	144
%JENTS	2301	Subroutine for TESTM	101	145
#TESTM	2301	Loader Command File for TESTM	102	146

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

LOADING STAND-ALONE DIAGNOSTICS

From mag tape:

1. Mount the mag tape containing the 91711A product.

2. Refer to the tables at the front of this section to determine the file number of the desired stand-alone diagnostic.

3. Execute the loader ROM as follow:
   a. A-Reg. = file number (in octal).
   b. Set S-Reg. bits: 15-14 = loader ROM select
      13-12 = 0
      11-6 = mag tape select code
      5-1 = 0
      0 = 1
   c. Press PRESET, IBL, RUN.
   d. The file specified in the A-Reg. will load and the CPU will stop with a HALT 77B (102077).

From mini-cartridges:

1. Refer to the tables at the front of this section to determine the file number of the desired stand-alone diagnostic.

2. Insert the correct mini-cartridge in the left CTU of a 2645/28.

3. To display the directory on file 1, press "GOLD-f1-f7-GREEN-f2" and the file will be displayed on the screen.

4. Press "GREEN-f8-n-f5" to advance the tape to file n where n is the file number of the desired stand-alone diagnostic.

5. Once the tape is loaded and positioned, execute the loader ROM as follows:
   a. Set S-Reg. bits: 15-14 = loader ROM select
      13-12 = 0
      11-6 = console select code
      5-0 = 0
   b. Press PRESET, IBL, RUN.
   c. The file selected on the tape will be read and the CPU will stop with a HALT 77B (102077).
   d. In some situations, the code for the diagnostic is contained in two files on two different cartridges. Consult the directory files and repeat the procedure above until all pertinent files for the desired diagnostic have been loaded in the proper sequence.

STARTING THE STAND-ALONE DIAGNOSTIC AFTER LOADING

1. Set S-Reg. bits: 15-12 = 0 11-6 = select code of the device under test
   5-0 = console select code Press STORE.

2. Set P-Reg. = 2. Press STORE.

3. Press PRESET, RUN.

4. An appropriate opening message will be output to the console, and the diagnostic will begin execution. The diagnostic will interact with the operator via the console.

   If the program completes, it can be restarted by entering:
   *RU,DIAG
   where the asterisk (*) is the system prompt (the stand-alone alone diagnostics run under an RTE-M system).

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

Disc Files

Each program has a corresponding Loader Command File (same name as the program with a "#" as the first character instead of "%") which will relocate all the necessary main and subroutine sections required for diagnostic operation and search the necessary system libraries.

To load the program on-line:

```
:RU,LOADER,<loader cmnd file>,,<list output device>
```

Mag Tape and Minicartridge Files

The individual files may be stored onto the disc individually from the mag tape or CTU by using the FMGR "ST" command as follows:

1. Mount the mag tape or position minicartridge at the start of the required file.

2. :ST,<LU #>,<disc file namr>,BR(binary relocatable) or AS(ASCII)

To load the program, run the RTE loader.

```
:RU,LOADR,<loader cmnd file>,,<list output lu>
```

The program UPDATE will store all programs into the system disc area once all required files are available to the system.

DIAGNOSTIC/VERIFICATION PROGRAM SUMMARY

HP 1000 M/E/F-Series Processors

```
:RU,TXPM0,loglu,#passes
```

HP 1000 M/E/F-Series Memory System

```
:RU,TXPM1[,loglu,#passes]
```

NOTE

Execution time is about one second per 32K partition. It may be excessively long if another program is currently executing in the partition to be tested and is not in a swappable state or has a higher priority than TXPM2 or TXPM3.

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

Supported Firmware Identification

```
:RU,TXPF0,loglu [,option]

option   specify 'CH' to change system entry point table ($SYENT)
```

Notes:

1. TXPF0 should be run stand-alone because in certain cases it will crash the system.

2. The question "DO YOU WANT ALL TESTS PERFORMED? YE OR NO" is asked. If YE, then TXPF0 will test for the presence of all possible firmware without further questioning. If NO, then TXPF0 will ask what firmware you want tested (HPF, FFP, SIS, VIS, VMA, DS)?

3. The optional 'CH' should not be performed unless you are certain that you want a permanent modification of the system. If you elect to proceed with this change option, first back up the system, e.g., LSAVE LU02 and LU03.

MUX Interface 12966A On-Line - %MUXST

Load on-line diagnostic from disc:

```
:RU,LOADR,,%MUXST
or
:RU,LOADR
  /LOADR;   RE,%MUXST
```

Execute:

```
:RU,DIAG
```

MUX Interface 12966 Stand-Alone - !MUXST

Requires at least 32k memory, memory protect and DCPC, 12966A interface, and a 12992A minicartridge loader ROM.

Follow procedure for loading and running stand-alone diagnostics for file name !MUXST

7900/06/20/25 and 7908/11/12 CS80 Disc Drives

```
:RU,TXMV0,loglu,disclu
```

7970B/E Mag Tape

```
:RU,TXMT0,ilu,maglu,#passes
```

2608/17/19/31 Line Printer

```
:RU,TXWL0,ilu,[op],prntlu,[prntc],[vfct]

op        is the program mode selection:
            1.  1 for the verification mode.
            2.  2 for the diagnostic mode.
```

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

prntc is the line printer specification.
1. 1 for the 2608A
2. 2 for the 2619A
3. 3 for the standard line printer under DVA12.

vfct is the VFC tape code. (Applicable to the 2619 only).
1. 0 defaults to 0 and signifies that a 12 channel VFC tape is installed on the 2619 printer under test.
2. 1 if an 8 channel VFC tape is installed on printer under test.

NOTE: prntc and op can be omitted and the program will request them as a default.

2645/48 or 2621 (keyboard only) Terminals

:RU,TXTT0,loglu,k,l or M,r

loglu is the LU for logging information and error messages.

k is the keyboard/display LU (always required).

l is the left cartridge tape unit LU (0 if N/A).

M specifies the menu mode (default is automatic mode).

r is the right cartridge tape unit LU (not required if M is specified as previous parameter, 0 if N/A).

Notes:

1. The program requires operator interaction at the terminal to be tested.
2. This test runs in one (of two) modes specified in the run command.
3. Insert scratch CTU in appropriate tape drive and slide RECORD tab to record and then protect as prompted by the test.

2645/48 Multipoint Terminal with DVR07

:RU,TXTT1,loglu,tstlu

Notes:

1. The test runs in about 5 seconds per terminal.
2. The test can be run in a system environment with other programs scheduled and running.
3. The multipoint line must be enabled and the multipoint terminal straps must match the initialization parameters.
4. Since use of CTUs as system LUs is not supported by Multipoint, CTUs are not tested by this test.

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

3070A/B Data Terminal with 40280A

```
:RU,TXTD0,loglu,tstlu
```

Note: The test runs in approximately two minutes.

3075A/76A/77A Data Terminal in a 12790A Subsystem

```
:RU,TXTD1,loglu,ilu,iop,lilu,telu
```

loglu is the LU for logging information and error messages (default to operator console).

ilu is the operator console LU (must not be part of the multipoint system under test).

iop is the operation code (OP CODE, see details below) (default is SV).

lilu is the LU number of the multipoint line for test.

telu is the LU number of the terminal to be tested.

iop codes (OP CODES):

```
??  Display list of operation codes.
VL  Verify multipoint line then end.
VT  Verify terminal.
OF  Off-line terminals survey
SV  Multipoint LU survey message.
IL  Initialize a line.
RL  Remove a line.
IT  Initialize a terminal.
RT  Remove a terminal.
CF  Configure a terminal.
GP  Who are you on all groups
TG  Who are you on specified group?
LN  Multipoint line assignment.
EN  End.
/E  End.
EX  End.
space space End.
```

If the following message appears on the operator's console:

```
TXTD1 - INPUT AN OP CODE_
```

enter an operation code from the above list.

If CF is chosen the following message will appear after entry of basic information:

```
TXTD1 - ENTER OP CODE (??  FOR CFTML OP CODE LIST):_
```

If ?? is entered, a terminal operation codes list will be printed that is valid while in the configure terminal mode.

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

RS232 Terminal with DVR00

```
:RU,TXTR0,loglu,tstlu
```

This program requires operator interaction. The program can be run in a system environment with other programs scheduled and running.

HPIB Bus with 59310B Interface

```
:RU,TXIB0,loglu,tstlu
```

Note: This program requires no operator interaction, and it can be run in a system environment with other programs scheduled and running.

H-Series or 13037 Controlled Disc Drives and 7906H/20H/25H/9895A ICD or 7906/20/25 with 13037

```
:RU,TXMV1,loglu,disclu,ST,MT or MM,xxx
```

loglu is the LU for logging information and error messages.

disclu is the legal disc LU for testing.

ST if "ST" is specified, the optional self-test for H-Series discs will be run. Default is no self-test.

MT if "MT" is specified the optional media test will be executed (test file = rest of cartridge).

MM same as MT, but information messages are returned indicating the % completion as the test executes.

xxx is the optional number of passes (default = 1)

Note: The test requires no operator interaction. and it can be run in a system environment with other programs scheduled and running.

DS/1000 Interface with M-Series Computer

```
:RU,TXDS0,loglu,tstlu,node#
```

node# is the remote node number to which the test is run if = 0, the program requests the operator to input the node#.

The operator should consult the DS/1000 Programmer's Manual, DS/1000 Network Manager's Manual, and Guide for New Users of DS/1000 for information regarding initialization of remote and local nodes for testing.

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

37214 Systems Modem

Initialize a Port as a modem LU. For example, initialize Port 2 to a modem, LU=36, BRG=1, 1200 baud, 8-bits/char, 1 stop bit, and enable ENQ/ACK:

```
:CN,36,30B,172272B
```

There are two options: 0 for local analog loop test and 1 for same test plus the remote digital loop test.

Program Execution:

```
:RU,TESTM,loglu,locsc,loccp,#test,iopt,remno,locno
```

loglu is the log device (default=terminal).
logsc is the local modem select code (B for octal required).
loccp is the local modem card cage port (default=0).
#test is the number of tests (default=1).
iopt is the run option (default=0).
remno is the remote telephone number (prefix P=pulse or dialed, or T=touchtone).
locno is the local telephone number (prefix P=pulse or dialed, or T=touchtone).

Hdw Floating-Point Diagnostic TXPF1, F-Series Computer

Floating-Point Instructions Executed:

Single Precision		Extended Precision	
FAD	FIX	.XADD	.XFXS
FSB	FLT	.XSUB	.XFXD
FMP	.FIXD	.XMPY	.XFTS
FDV	.FLTD	.XDIV	.XFTD

Program Execution:

```
:RU,TXPF1,loglu,#passes
```

The program requires no operator interaction. The program can be run in a system environment with other programs scheduled and running.

SIS Diagnostic TXPF2, F-Series Computer

The following instructions are tested:

SIN	COS	TAN	EXP	TANH
ALOG	ATAN	ALOGT	SQRT	

The following instructions are not tested:

DPOLY	/ATLG	.FPWR	.TPWR

Program Execution:

```
:RU,TXPF2,loglu,#passes
```

The program requires no operator interaction. The program can be run in a system environment with other programs scheduled and running.

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

RTE-IVB EMA Diagnostic TXPF3, E/F-Series Computer

Program Execution:

```
:RU,TXPF3,loglu,#passes
```

The program requires no operator intervention. The program can be run in a system environment while other programs are scheduled and running.

RTE-IVB, VIS TXPF4, F-Series

The VIS instructions for TXPF4 are:

VADD	VSSB	VSUM	VMIN	.ESEG
VSUB	VSMY	VNRM	VMIB	.VSET
VMPY	VSDV	VDOT	VMOV	WSUM
VDIV	VPIV	VMAX	VSWP	
VSAD	VABS	VMAB	.ERES	

A 12 page partition is required for operation.

The diagnostic contains self-test, non-privileged and privileged sections. In the self-test section, the VIS self-test op-code (105477B) is executed and checked for proper results. If the self-test fails, a message is issued and the program executes a STOP 11.

The non-privileged section contains all the tests that can be performed in a non-privileged user environment. These include all the non-EMA VIS instructions as well as the .ERES, the EMA call-by-reference address resolver. Any error will cause a message to be issued and a STOP 11 executed.

NOTE

The privileged section tests the VIS instructions .ESEG and .VSET by temporarily entering a privileged user environment. In addition, the program must lock itself into memory for this portion of the tests. It is recommended that this section be executed only on a quiescent system.

Program Execution:

```
:RU,TXPF4,loglu,#passes,priv
```

priv is the privileged section flag (default is 0)

(0 = privileged section not executed)
(1 = privileged section is executed)

The program requires no operator intervention. The program can be run in a system environment with other programs scheduled and running.

91711B DIAGNOSTIC/VERIFICATION PACKAGE (Cont'd)

RTE-6/VM VMA TXPF5/VMACK, E/F-Series Computer

Program Execution:

```
:RU,VMACK,loglu,#passes
```

Note: VMACK can be run while other programs are being run

RTE-6/VM, VIS VISO6, F-Series Computer

The program is divided into three main sections:

1. Self-Test: The VIS self-test opcode (105477B) is executed and checked. The self-test should return the octal value 102077B.

2. Non-privileged: The non-privileged user environment includes all of the non-EMA VIS instructions and .ERES which resolves EMA call by reference addressing.

3. Privileged: Tests the VIS instructions .ESEG and .VSET by temporarily entering a privileged environment. Since malfunctions in VIS firmware could cause catastrophic system failure, it is recommended that this section be executed only on a quiescent system.

CAUTION

When executing the privileged section, malfunctions in VIS firmware could cause overwriting of the operating system. It is not recommended that other critical tasks execute concurrently with diagnostics in a privileged section.

The last test in the privileged section executes the VIS EMA sum routine, WSUM, to assure that individually tested instructions correctly perform together.

Program Execution:

```
:RU,VISOD[,LU][,#PASSES][,PRIV]
```

PRIV privileged section flag. If zero or not specified, do not run privileged section test. If one, run privileged section test.

POWER SUPPLIES/EXTENDERS

OBSOLETED POWER SUPPLIES

HP 1000 "B" POWER SUPPLY

POWER-FAIL RECOVERY SYSTEMS

EXTENDERS

2100 POWER SUPPLY

POWER REQUIREMENTS

LINE VOLTAGE:	115V ac ± 10%, single phase, 12A, or 230V ac ± 10%, single phase, 6A
LINE FREQUENCY:	47.5 to 66 Hz
POWER CONSUMPTION:	1400 volt-amperes, maximum

POWER CABLE (CONNECTED TO COMPUTER OR EXTENDER)

LENGTH:	10 feet (304, 8 centimeters)
CONNECTOR:	NEMA Type 5-15P (for 115V ac operation), or NEMA Type 6-15P (for 230V ac operation)

DC SUPPLY VOLTAGES AND CURRENTS

+30V, 0.1A
+12V, 5A for 2155A Extender; +12V, 3A for 2100 Computer
+4.85V, 50A
-2V, 23A
-12V, 5A for 2155A Extender; +12V, 3A for 2100 Computer
+20V, 6A
-20V, 0.5A } For 2100 Computer only

ENVIRONMENTAL LIMITS

AMBIENT TEMPERATURE RANGE:

Operating:	0° to 55°C (32° to 131°F)
Non-operating:	-40° to 75°C (-40° to 167°F)

RELATIVE HUMIDITY: 50 to 95% at 25° to 40°C (77° to 104°F) without condensation

ALTITUDE:

Operating:	15,000 feet (4572 meters)
Non-operating:	25,000 feet (7620 meters)

VENTILATION

AIR FLOW:	200 cubic feet (5,6634 cubic meters) per minute
HEAT DISSIPATION:	2300 BTUs (579,6 kilocalories) per hour, maximum

WEIGHT AND DIMENSIONS

WEIGHT:	36 pounds (16,344 kilograms)
HEIGHT:	10 inches (254 millimeters)
WIDTH:	7.75 inches (196,85 millimeters)
DEPTH:	12 inches (304,8 millimeters)

2100 POWER SUPPLY (CONT)

CONFIGURATION

POWER SUPPLY DATE CODE	CARD REVISION CODE					REMARKS
	A1	A2	A3	A4	A5	
1126	1133	1126	1132	1126	1125	
1140	1139	1126	1132	1126	1125	
1141	1140	1140	1132	1126	1139	
1146	1140	1140	1132	1126	1139	
1148	1140	1140	1132	1144	1139	(Note 1)
1149	1140	1140	1147	1144	1139	
1150	1140	1140	1147	1144	1150	
1215	1148	1140	1215	1144	1150	
1220	1148	1140	1215	1144	1150	(Note 2)
1229	1148	1140	1215	1144	1150	(Note 3)
1240	1224	1140	1243	1224	1150	(Note 4)
1243	1224	1140	1243	1224	1150	(Note 5)
1249	1249	1249	1243	1224	1150	
1250	1249	1249	1250	1224	1150	
1314	1249	1249	1250	1224	1150	(Note 6)
1320	1249	1249	1320	1224	1150	
1322	1249	1249	1322	1224	1150	
1330	1249	1330	1322	1224	1330	
1345	1249	1345	1322	1224	1330	

NOTES:
1. Cards A1 through A5 did not change. Part number of A6Q1 and A6Q2 changed to 1884-0219.
2. Cards A1 through A5 did not change. Change made to power supply to bring up to UL, CSA, and IEC standards.
3. Cards A1 through A5 did not change. Change made to A11 ±20 volts Regulator.
4. Part no. of cards A1, A3, and A4 changed to 02100-60108, 02100-60109, and 02100-60110, respectively.
5. Date code 1243 is identical to date code 1240.
6. Cards A1 through A5 did not change. Assembly A7 changed mechanically.

REGULATOR BOARDS

These boards cannot be indiscriminately changed from "old" to "new." The A1 and A4 boards must be changed as a pair when changing to the "new" A4 board. The A1 and A3 boards, however, can be changed separately.

ASSY	PART NO.	ASSY	PART NO.
A1 (old)	02100-60046	A4 (old)	02100-60061
A1 (new)	02100-60108	A4 (new)	02100-60110
A3 (old)	02100-60047	A2	02100-60058
A3 (new)	02100-60109		

2100 POWER SUPPLY (CONT)

DC SUPPLY VOLTAGES

TEST JACK	READING		RIPPLE AND NOISE VOLT. TOL. P-P
	MIN.	MAX.	
+30	+29.0	+31.5	<20%
+20*	+19.8	+20.2	±1%
+12	+12.0	+13.1	<2%
+4.85	+4.80	+4.90	<2%
-2	-1.85	-2.5	<2%
-12	-12.0	-13.1	<2%
-20*	-19.8	-20.2	±1%

*@25°C (room temperature)

CURRENT AVAILABLE FOR I/O CARDS

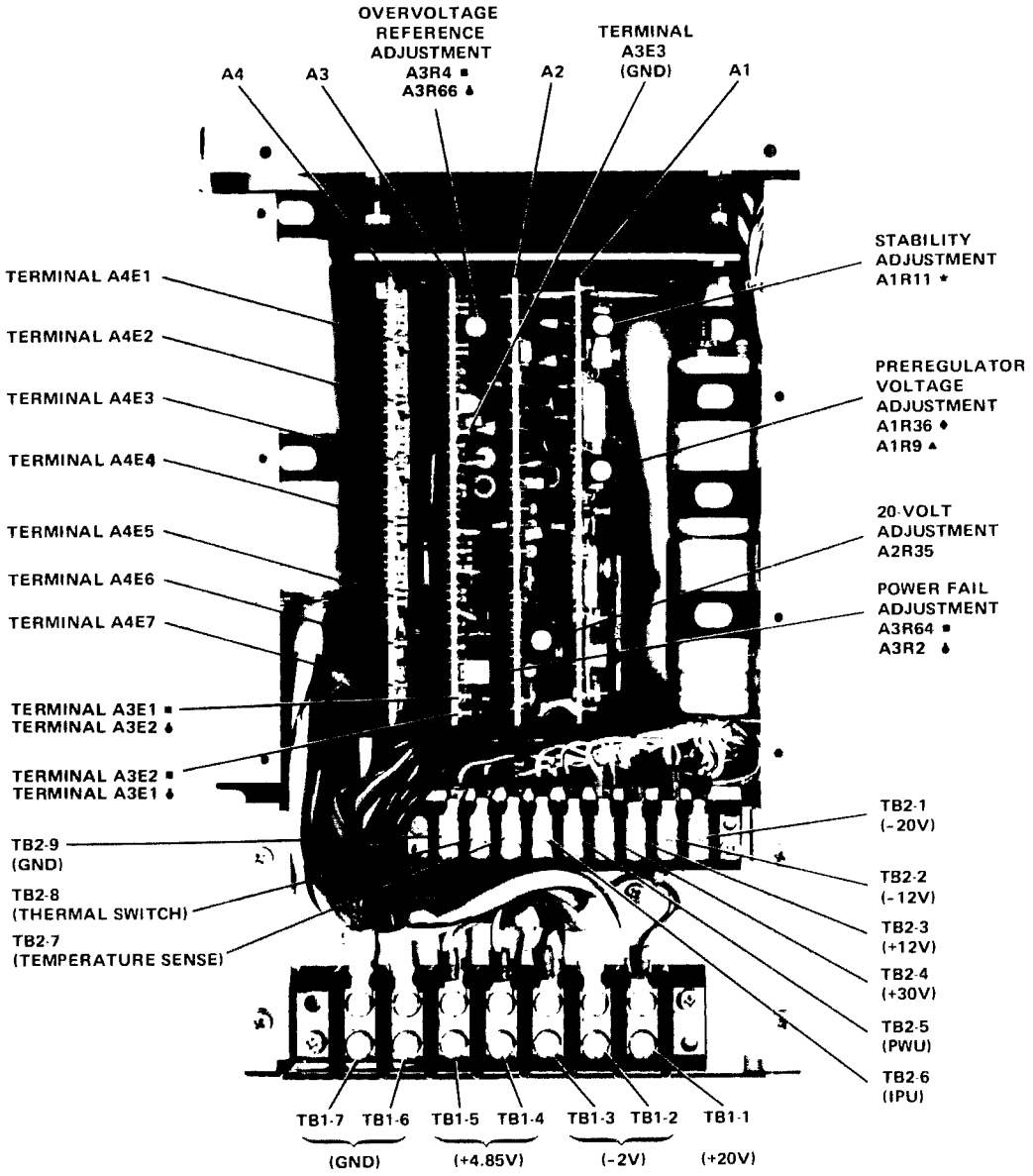
SUPPLY VOLTAGE	CURRENT AVAILABLE DEPENDING ON MEMORY SIZE (AMPERES)					
	4K	8K	12K	16K	24K	32K
+30	0.1	0.1	0.1	0.1	0.1	0.1
+12	3.0	3.0	3.0	3.0	3.0	3.0
+4.85	23.6	23.6	22.7	22.7	21.6	20.8
-2	10.9	10.9	10.1	10.1	9.3	8.5
-12	3.0	3.0	3.0	3.0	3.0	3.0

NOTE: The currents specified are available with the DMA accessory kit installed.

VOLTAGE RANGE FOR OVERVOLTAGE (CROWBAR TRIGGER CONDITION)

OUTPUT VOLTAGE	OUTPUT TERM.	OVERVOLTAGE (VDC) RANGE
-2	TB1-2,3	-2.8 to -3.1
+4.85	TB1-4,5	+5.3 to +5.75
-12	TB2-2	-14.0 to -15.5
+12	TB2-3	+14.0 to +15.5
-20	TB2-1	-23.5 to -27.0
+20	TB1-1	+23.5 to +25.5

2100 POWER SUPPLY (CONT)



NOTES: FOR COMPLETE REFERENCE DESIGNATIONS WHEN POWER SUPPLY IS INSTALLED IN A COMPUTER OR EXTENDER, PREFIX ALL REFERENCE DESIGNATIONS WITH A25.

■ APPLIES TO A3, PART NO. 02100-60047.

♦ APPLIES TO A3, PART NO. 02100-60109.

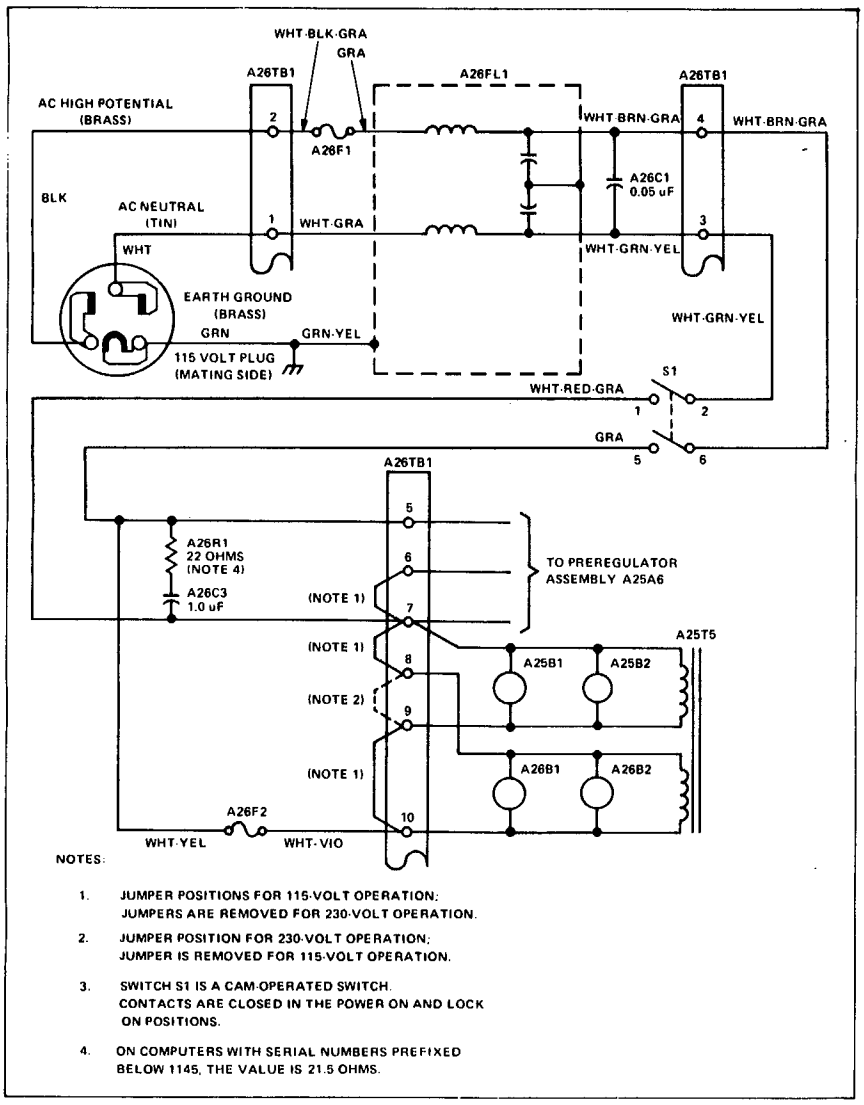
* APPLIES TO A1, PART NO. 02100-60046 ONLY.

♦ APPLIES TO A1, PART NO. 02100-60046.

▲ APPLIES TO A1, PART NO. 02100-60108.

2100 POWER SUPPLY (CONT)

AC POWER CONNECTIONS



When converting to 230V from 115V, or vice versa, change fuse current ratings as listed below. Also change power cord plug as described in 2100 Installation and Maintenance Manual.

VOLTAGE	A26F1	A26F2
115	12A	2A
230	6A	1A

2105A/2108A/2109A AND 12979A POWER SUPPLY

EQUIPMENT

2105A Power Supply	02105-60012
2108A/2109A and 12979A Power Supply	02108-60023

POWER REQUIREMENTS

Line Voltage: 110V ac ± 20%, single-phase
220V ac ± 20%, single-phase

Line Frequency: 47.5 to 66 Hz

Power Consumption: HP 2105A — 400 watts, maximum
HP 2108A/2109A and 12979A — 525 watts, maximum

DC SUPPLY VOLTAGES AND CURRENTS

MAXIMUM CURRENT AVAILABLE FOR MEMORY, ACCESSORIES, AND I/O CARDS

SUPPLY VOLTAGE	2105A	2108A	2109A	12979A[1]
+5V	12.8A	24.8A	24.6A	33.0A
−2V	1.5A	4.5A	4.5A	7.6A
+12V	1.0A	1.5A	1.5A	3.5A[2]
−12V	1.0A	1.5A	1.5A	3.5A[2]
+28V	.25A	.25A	.25A	0.1A

[1] Current available to I/O assumes DCPC is installed.
[2] 1.75A is available to both front and rear I/O backplanes.

ENVIRONMENTAL LIMITS

Ambient Temperature

Operating: 0° to 55°C (32° to 131°F)
Nonoperating: −40° to 75°C (−40° to 167°F)

Altitude

Operating: 15,000 feet (4,573 meters)
Nonoperating: 40,000 feet (12,199 meters)

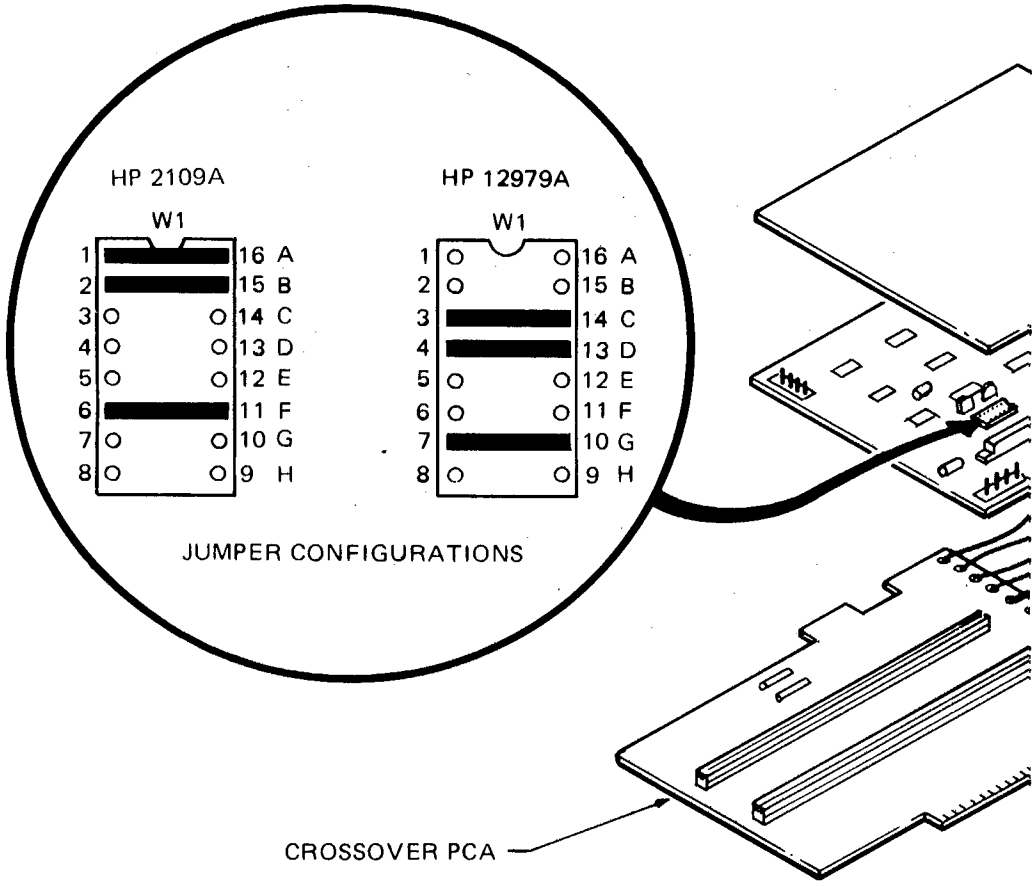
Relative Humidity

20 to 95° at 25° to 40°C (77° to 104°F) without condensation.

2105A/2108A/2109A AND 12979A POWER SUPPLY (CONT)

INSTALLATION NOTES

Power Supply Jumper Configurations



IN-1 Refer to 2112A/2113A Power supply section for crossover PCA power connections and for +28V DC jumper location.

SERVICE INFORMATION

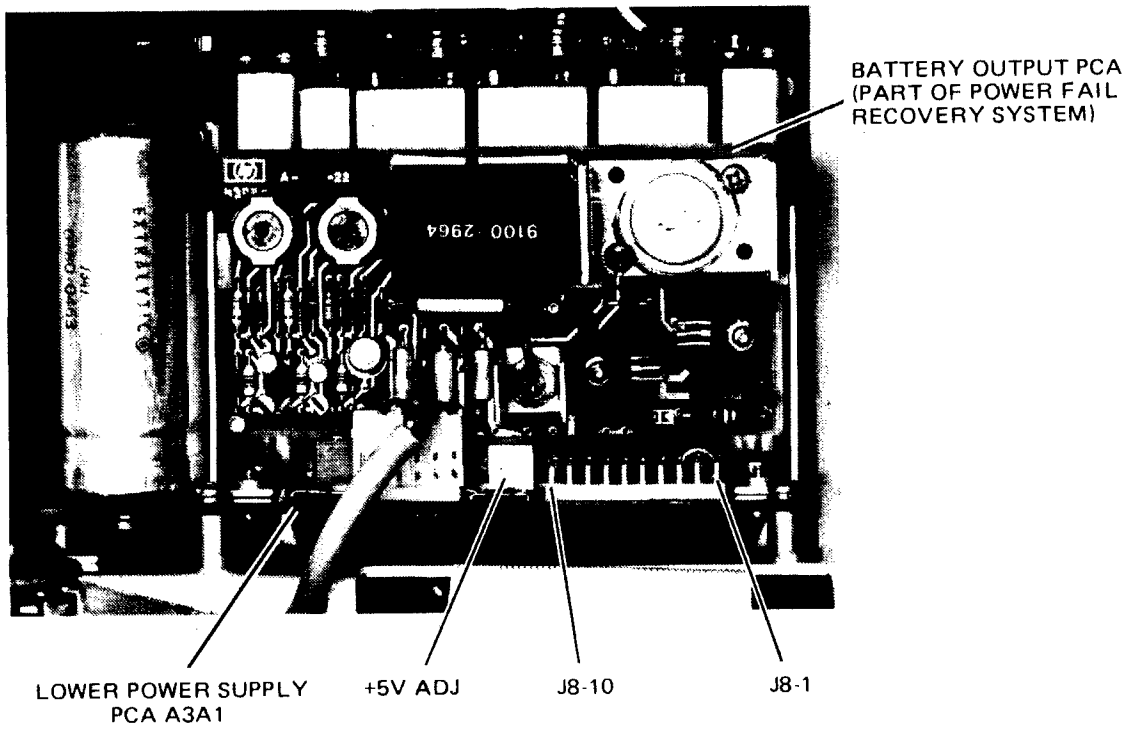
HP 2105A/2108A/2109A and 12979A Power Supply Tolerances

SUPPLY	TEST POINT*	TOLERANCE
−12V	J8-1	±0.6V
Common	J8-2	—
+12V	J8-3	±0.6V
−2.3V	J8-4	±0.2V
+5V	J8-5	±0.25V
+5VM**	J8-6	±0.25V
V+(BAT)**	J8-7	—
$\overline{\text{PUUP}}$	J8-8	—
+12VM**	J8-9	±0.6V
−12VM**	J8-10	±0.6V

*J8 is mounted on lower power supply PCA.
**Not applicable for 12979A.

2105A/2108A/2109A AND 12979A POWER SUPPLY (CONT)

HP 2105A/2108A/2109A and 12979A Power Supply Field Adjustment and Test Points



2112A/2113A POWER SUPPLY

EQUIPMENT

Power Supply 02112-60006

POWER REQUIREMENTS

Line Voltage: 110V ac ± 20%, single-phase
220V ac ± 20%, single-phase

Line Frequency: 47.5 to 66 Hz

Power Consumption: 800 watts, maximum

DC SUPPLY VOLTAGES AND CURRENTS

CURRENT AVAILABLE FOR MEMORY ACCESSORIES, AND I/O CARDS

SUPPLY VOLTAGE	2112A	2113A
+5V	38.2A	38.0A
−2V	9.5A	9.5A
+12V	3.0A	3.0A
−12V	3.0A	3.0A
+28V	.25A	.25A

ENVIRONMENTAL LIMITS

Ambient Temperature

Operating: 0° to 55°C (32° to 131°F)
Nonoperating: −40° to 75°C (−40° to 167°F)

Altitude

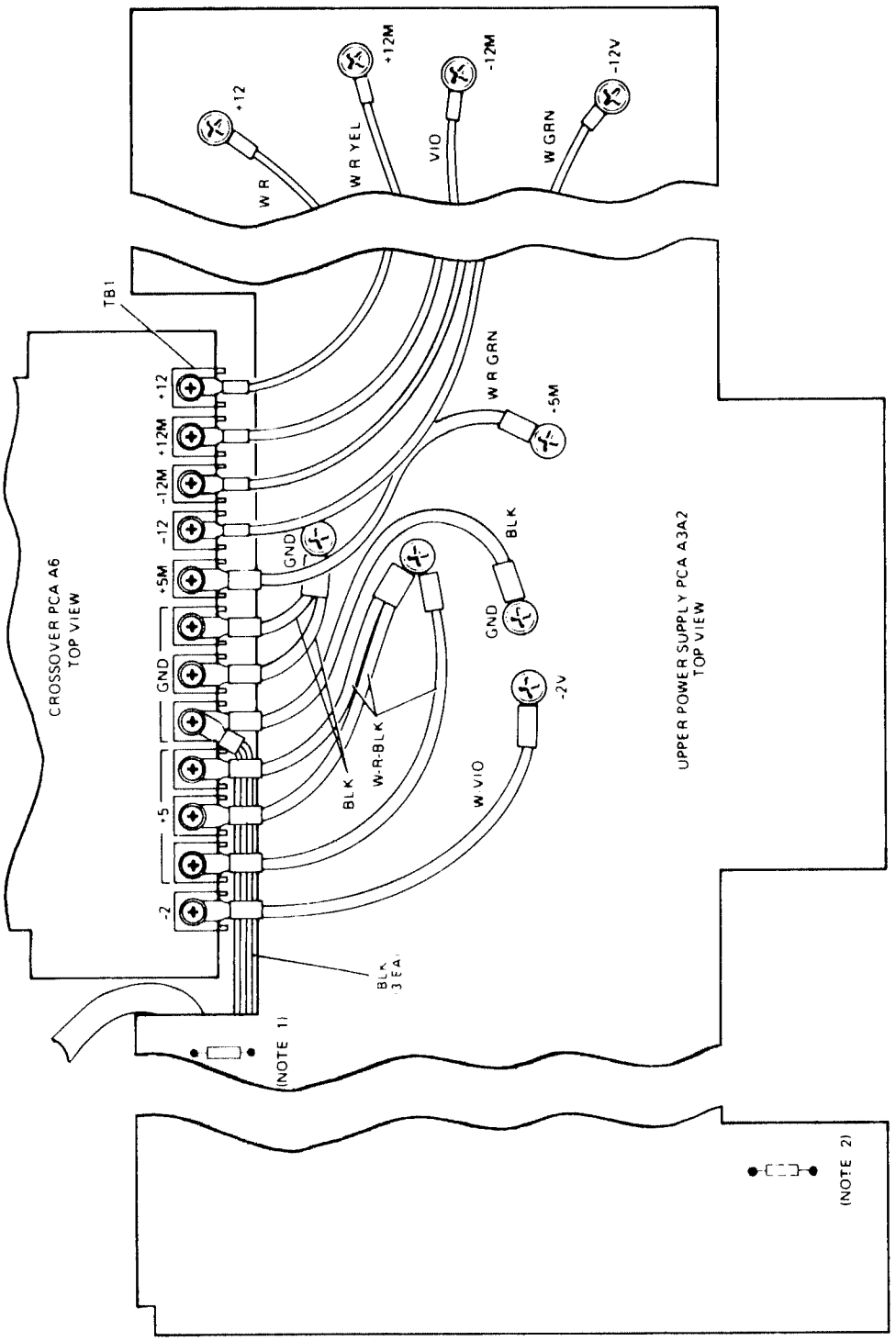
Operating: 15,000 feet (4,573 meters)
Nonoperating: 40,000 feet (12,199 meters)

Relative Humidity

20 to 95% at 25° to 40°C (77° to 104°F) without condensation.

2112A/2113A POWER SUPPLY (CONT)

INSTALLATION NOTES



NOTES:
1. ☐ Denotes applicable to HP 2108A/2109A and 12979A. For HP 2108A/2109A and 12979A, Jumper W2 must be installed if +28V DC is required at the I/O backplane.
2. ⊏⊐ Denotes applicable to HP 2112A/2113A for HP 2112A/2113A, Jumper W2 must be installed if +28V DC is required at the I/O backplane.

REAR VIEW OF CPU

P3

1	2	3
4	5	6
7	8	9

1- BROWN	$\overline{\text{RESET}}$
2- RED	$\overline{\text{STANDBY}}$
3- ORN	$\overline{\text{OPERATE}}$
4- YEL	GROUND
5- GRN	PWU —
6- BLU	$\overline{\text{MLOST}}$

2112A/2113A POWER SUPPLY (CONT)

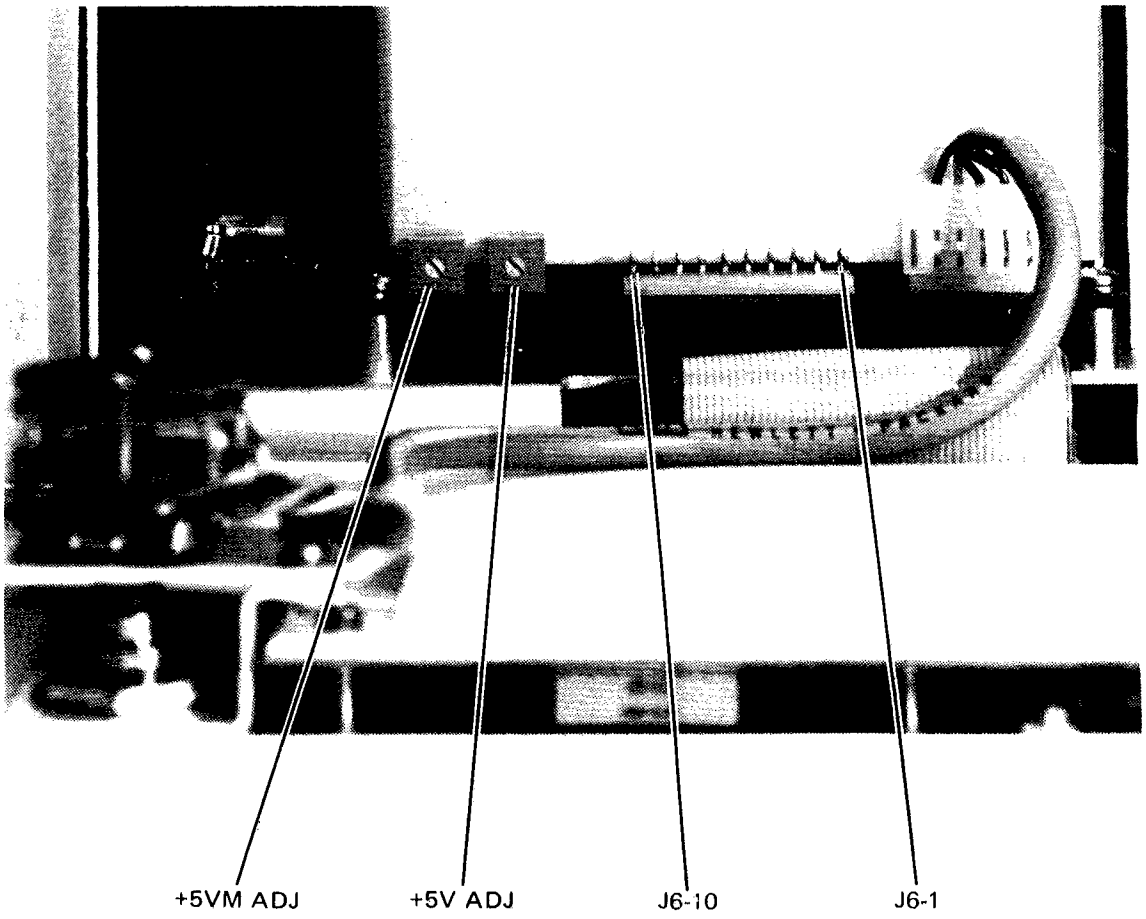
SERVICE NOTES

HP 2112A/2113A Computer Power Supply Voltage Tolerances

SUPPLY	TEST POINT*	TOLERANCE
$\overline{\text{PUUP}}$	J6-1	—
Common	J6-2	—
+28V**	J6-3	±2.8V
−2.3V	J6-4	±0.2V
+5V	J6-5	±0.25V
+5VM	J6-6	±0.25V
+12VI/O	J6-7	±0.6V
−12VI/O	J6-8	±0.6V
+12VM	J6-9	±0.6V
−12VM	J6-10	±0.6V

*J6 is mounted on lower power supply PCA.
**+28V is present if jumper is installed on upper power supply PCA.

HP 2112A/2113A Computer Power Supply Field Adjustments and Test Points



21MX-SERIES "B" TYPE POWER SUPPLIES

INTRODUCTION

Two versions of the "B" type power supply currently exist in the field. The older 5061-1356 and 5061-3476 supplies are basically the same but the current 5061-6615 is quite different. These supplies are equivalent functionally but the adjustment procedures differ slightly. The following pages contain information that is unique to the different versions as well as information common to them.

The new version supplies are covered by computer type in Service Notes issued 02/83-22 titled "New Version of Low Cost Power Supply".

PART NO. CROSS REFERENCE

	MOLEX CONNECTOR VERSIONS		TERMINAL BLOCK VERSION
Computer Prefix	2108 & Earlier	2108 - 2204	2305 & Later
Complete New PS	5061-1356	5061-3476	5061-6615
Complete Exch. PS	5061-3401	5061-3477	5061-6616
Control Board	5061-1345	5061-3455	5061-3455
Inverter Board	5061-1344	5061-3454	5061-3454
Pre-reg Board	5061-1347	5061-3457	5061-3457
Jumper	5061-1351 (unchanged)		5061-1351
Battery Backup	5061-1349 (unchanged)		5061-1349
Battery Charger	5061-1348 (unchanged)		5061-1348
High Current Cable	--	--	5061-6613
Low Current Cable	--	--	5061-6614
Cross-Over CPU Cable	5061-1363	5061-1363	5061-6612
Cross-Over I/O Ext Cbl	12979-60020	12979-60020	12979-60033
Cross-Over Mem Ext Cbl	12990-60016	12990-60016	12990-60019
Terminal Block Cover	None	None	5040-6309

INSTALLATION DIFFERENCES

Installation for the supplies are identical except as follows: For the 5061-3476 and 5061-6615 supplies the upper fan cables are part of the exchange power supply and should be returned with the defective supply to CSD. For the 5061-6615, the high and low current cables are now fastened to a terminal block where previously they were connected by a Molex connector.

ADJUSTMENT PROCEDURE

For the +5V CPU voltage and LPU are not adjustable. There are no potentiometers on the control board. Adjustments are as follows:

1. Check +5V CPU on the crossover test point. If not within specification, refer to the troubleshooting procedure.

2. For NO BATTERY BACKUP, check +12VM and adjust R12 as necessary on the jumper board. Check all other voltages. They cannot be adjusted, but should be within specification.

3. For BATTERY BACKUP, check +5VM and +12VM and adjust R1 and R2 respectively as necessary on the battery backup board. Check all other voltages. They cannot be adjusted, but should be within specification.

All battery charger circuit adjustments are unchanged. Refer to the subsequent section.

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

TROUBLESHOOTING

The control board and the pre-reg board contain LEDs which give some indication of the fault condition of the power supply. The following parts location indicates the LED locations.

The control LED is visible through a hole in the control board cover. Below are the various LED combinations and their fault status meaning:

Control OFF	& Pre-reg OFF	Normal Operating state.
Control OFF	& Pre-reg ON	Not normal fault condition (will not occur).
Control ON	& Pre-reg OFF	Over current on +12I/O, -12I/O, -2I/O or an overtemperature shutdown.
Control ON	& Pre-reg ON	Not normal fault condition (will not occur).
Control FLASHING	& Pre-reg OFF	Power supply unable to turn on. Possible low line voltage or primary switching circuit failure.*
Control FLASHING	& Pre-reg ON	Primary circuit unable to turn on. Due to primary circuit over-current.**

* For example, this will occur if an attempt is made to turn on the power supply with the inverter board removed, or shorted inverter/pre-regulator transistor.

** This situation will occur following an inverter transistor failure for example. However, if the supply is turned off and then on, the failing condition will switch to -1-, since the supply now cannot turn on due to the short in the primary circuit.

LED Information:

The Pre-reg LED is mainly intended for use in manufacturing. All required fault status information is available from the control LED.

Control Off - Power supply OK

Control ON - +12, -12, or -2 overcurrent or overtemperature. Allow cool-down time for power supply. Check fans. Remove all I/O and memory cards to remove possible short. If the power supply now powers up with the control LED OFF, failure is due to overtemperature of external short.

Control FLASHING - Main switching circuit cannot turn on. Failure or short in the +5V CPU circuit. Remove DC output connector to remove possible short. If the LED remains at power up, replace the power supply.

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

POWER SUPPLY CONFIGURATIONS

1. Power Supply WITHOUT the Power-Fail Option

   The supply will contain the following vertical plug-in boards:

   Control Board
   Inverter Board
   Pre-regulator Board
   Jumper Board

   and a Battery Load Simulator Plug (BISP), HP P/N 12991-60002, must be connected to the BATT IN connector at the rear of the supply.

2. Power Supply WITH the Power-Fail Option

   The supply will contain the following vertical plug-in boards:

   Control Board
   Inverter Board
   Pre-regulator Board
   Battery Backup Board
   Battery Charger Board

   and a battery pack must be connected to the BATT IN connector at the rear of the supply.

POWER SUPPLY REMOVAL AND INSTALLATION

REMOVAL. Proceed as follows:

a. Disconnect the output voltage connector and the status connector from the front of the supply. For later supplies, disconnect cable from the terminal board.

b. Unfasten the two clips at the front of the supply, and remove the two screws located at the bottom rear panel of the supply.

c. If the power recovery system is installed, set the BATTERY switch to OFF and disconnect the battery cable from the BATT INPUT connector at the rear of the supply.

d. If the computer is a 2112B, 2113B, 2111F, or 2117F the cables for the top two fans must be disconnected. Slide the power supply rearward (toward the rear of the computer) about 50mm (2 in.) and stop. Reach in and disconnect the fan cables by squeezing the latching sides of the connector.

e. Continue sliding the power supply out and remove it from the computer.

INSTALLATION. Install the power supply in the reverse order of removal procedure.

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

VOLTAGE AND SIGNAL TEST POINTS

VOLTAGE/SIGNAL	TEST POINT	ADJUSTMENT LOCATION
+5V CPU	CROSSOVER BOARD	R1 ON CONTROL BD. *
+12V I/O	CROSSOVER BOARD	NOT ADJUSTABLE
-12V I/O	CROSSOVER BOARD	NOT ADJUSTABLE
-2V I/O	CROSSOVER BOARD	NOT ADJUSTABLE
+30V I/O	CROSSOVER BOARD	NOT ADJUSTABLE
+5V MEMORY	CROSSOVER BOARD	R1 ON BATT. BOARD (ONLY IF PFRS IS IS INSTALLED)
+12V MEMORY	CROSSOVER BOARD	R12 ON JUMPER BD (PFRS NOT INSTALLED) -OR- R2 ON BATTERY BACKUP BOARD (PFRS INSTALLED)
-12V MEMORY	CROSSOVER BOARD	NOT ADJUSTABLE
PON	CROSSOVER/STATUS CONNECTOR	NOT ADJUSTABLE
PWU	CROSSOVER/STATUS CONNECTOR	NOT ADJUSTABLE
$\overline{\text{MLOST}}$	CROSSOVER/STATUS CONNECTOR	NOT ADJUSTABLE
PSU	POWER CONTROL IN/OUT CONN.	NOT ADJUSTABLE
LPU	POWER CONTROL IN/OUT CONN.	R2 ON CONTROL BD. *
$\overline{\text{MLO}}$	POWER CONTROL IN/OUT CONN.	NOT ADJUSTABLE
BATTERY CHARGER CURRENT ADJUST	TEST POINT LABELED "REP" ON THE BATTERY CHARGER BOARD	R2 ON BATTERY CHARGER BOARD
BATTERY CUTOFF LIMIT ADJUST	TEST POINT LABELED "CUT OFF" ON THE BATTERY CHARGER BOARD	R1 ON BATTERY CHARGER BOARD
16.25+/- 0.25V BATTERY CHARGER RAIL	YELLOW WIRE CONNECTED TO ANODE OF DIODE IN THE CENTER OF THE BATTERY CHARGER BOARD -OR- "EXT" TERMINALS ON BATTERY PACK WITH SWITCH SET TO EXT	R3 ON A BATTERY CHARGER BOARD

* 5561-1356 only.

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

VOLTAGES AND TOLERANCES (5061-1356)

SUPPLY VOLTAGE	MAXIMUM CURRENT	SUPPLY UPPER LIMIT	VOLTAGE LOWER LIMIT	TEST POINT
+5V I/O	50 A	+5.25 vdc	+5.00 vdc	A6 Crossover* Assy +5V
		set to +5.15		
+5V M	5.5 A	+5.25 vdc	+5.00 vdc	A6 Crossover Assy +5M
		set to +5.15		
+12V I/O	2.5 A	+12.6 vdc	+11.4 vdc	A6 Crossover Assy +12V
		set to +12.5		
+12V M	2.0 A	+12.6 vdc	+11.4 vdc	A6 Crossover Assy +12M
-2V I/O	6.0 A	-2.2 vdc	-1.8 vdc	A6 Crossover Assy -2V
-12V I/O *	2.0 A	-12.6 vdc	-11.4 vdc	A6 Crossover Assy -12V
-12V M	250 ma	-16 vdc	-9 vdc	A6 Crossover Assy -12M
		(unregulated)		
+30V I/O **	250 ma	+42 vdc	+22 vdc	A6 Crossover Assy J2 in Pin 4
		(unregulated)		

* Maybe -13V if unloaded in I/O Extender (some I/O PCAs do not use -12V).
** ONLY if 1 amp fuse installed on power supply mother board (A6F2)

VOLTAGES AND TOLERANCES (5061-6615/5061-3476)

SUPPLY VOLTAGE	MAXIMUM CURRENT	SUPPLY UPPER LIMIT	NOMINAL SETTING	VOLTAGE LOWER LIMIT	TEST POINT
+5V I/O	50A	+5.25Vdc	+5.15Vdc	+5.00Vdc	A6 Crossover Assy +5V
+5V M	4.5A	+5.25Vdc	+5.15Vdc	+5.00Vdc	A6 Crossover Assy +5M
+12V I/O	2.5A	+12.6Vdc	*	+11.4Vdc	A6 Crossover Assy +12V
+12V M	2.0A	+12.6Vdc	+12.5Vdc	+11.4Vdc	A6 Crossover Assy +12M
-2V I/O	4.0A	-2.2Vdc	*	-1.8Vdc	A6 Crossover Assy -2V
-12V I/O	2.0A	-12.6Vdc	*	-11.4V	
-12V M	250mA	-16Vdc	*	-9Vdc	A6 Crossover Assy -12M
			Unregulated		
+30V I/O	250mA	+42Vdc		+22Vdc	A6 Crossover Assy J2 Pin 4
			Unregulated		

* Not adjustable

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

VOLTAGE ADJUSTMENTS WITHOUT THE POWER-FAIL OPTION

a. Some power supplies will have a slot in the top cover. If a variable resistor can be seen through the slot, it will not be necessary to remove the computer top cover. If necessary, remove the supply and remove the top cover of the supply. Install the supply in the computer and reconnect all cables.

b. 5061-1356 Only: Connect a DVM between the +5V CPU(+5VOUT) and GND test points on the crossover board.

c. 5061-1356 Only: Set the LOCK/OPERATE SWITCH to OPERATE, and the POWER switch to the ON position.

d. 5061-1356 Only: Adjust the +5V control (R1 on the control board, access through the cutout at the front of the supply) until the DVM indicates +5.15.

e. Connect the DVM between the +12VM (+12M) and GND test points on the crossover board.

f. Adjust the +12VM control (R12 on the jumper board) until the DVM indicates +12.5 volts.

g. The other voltages are not adjustable, and should fall within the specified range.

VOLTAGE ADJUSTMENTS WITH THE POWER-FAIL OPTION

a. Remove the supply from the computer and remove the top cover. Install the supply in the computer and reconnect all cables.

b. Remove the top cover of the computer.

c. Set the BATTERY switch to the OFF position.

d. 5061-1356 Only: Connect a DVM between the +5V CPU (+5V) and GND test points on the crossover board.

e. 5061-1356 Only: Set the LOCK/OPERATE switch to OPERATE and the POWER circuit breaker to the ON position.

f. 5061-1356 Only: Adjust the +5V control (R1 on the control board, access through the cutout at the front of the supply) until the DVM indicates +5.15 volts.

g. Connect the DVM to the +5Vdc (+5M) test point on the Crossover Assy (A6).

h. Adjust R1 on the Battery Backup Board (A4) until the DVM indicates +5.15V (+.1V, -.15V).

i. Connect the DVM between +12VM (+12M) and GND test points on the crossover board.

j. Adjust the +12VM control (R2 on the Battery Backup Board) until the DVM indicates +12.5 volts.

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

BATTERY CHARGING CIRCUIT ADJUSTMENTS WITH THE POWER-FAIL OPTION

BATTERY CUTOFF ADJUST - This adjustment is set at the factory, and should only be adjusted if it is known to be out of specification.

a. Set the POWER circuit breaker to the OFF position.

b. Connect the DVM to the test point labeled "CUT OFF" on the Battery Charger Board.

c. Set the BATTERY switch to the EXT position. Connect a +12.5V dc source to the external terminals of the battery pack.

d. The DVM should indicate approximately 0.0 volts.

e. Adjust the cutoff control (R1 on the Battery Charger Board) until the voltage indicated by the DVM jumps to approximately 2.0 volts. R1 should be adjusted so that the voltage seen at "CUT OFF" is at the crossover point.

f. Connect the DVM to test point labeled "REF" on the Battery Charger Board.

g. Adjust R2 on the Battery Charger Board for a DVM reading of +5.0 +/- 0.25 Vdc.

h. Connect the DVM to the anode of CR4 which is the yellow wire on the Battery Charger Board.

i. Adjust R3 on the Battery Charger Board for a DVM reading of +16.25 +/- 0.25 Vdc.

POWER UP THRESHOLD ADJUSTMENT (5061-1356)

The computer is shipped with the power-up threshold set at the lower limit of the line configuration (88 volts for 110 volt operation and 176 volts for 220 volt operation).

a. Remove the protective cover on the front of the supply to expose the top of the control board.

b. Connect the power cord of the computer to an autotransformer, and connect an AC voltmeter across the output of the autotransformer. Set the transformer output to 115 Vac (standard) or 220 Vac (option 15).

c. Set the POWER switch to ON, the LOCK/OPERATE switch to OPERATE, and the ARS switch (on the rear of the CPU PCA) to the ARS position.

NOTE

The RUN indicator must be lighted in order to perform the power-fail adjustments.

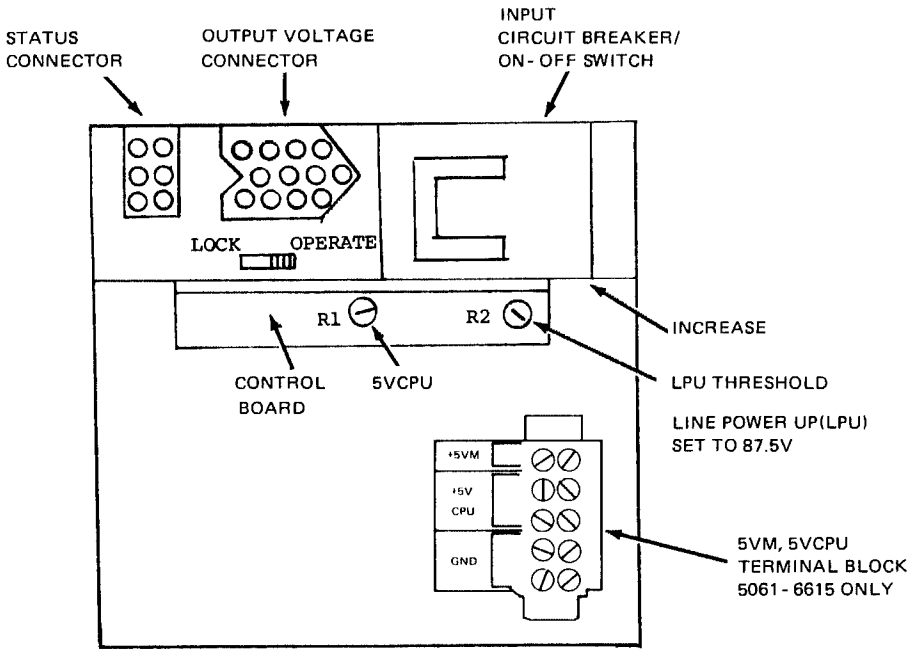
d. Lower the voltage of the autotransformer to 87.5 Vac rms (standard) or 174 Vac rms (option 15).

e. Adjust the power-fail control (R2 on the control board) until the RUN indicator extinguishes.

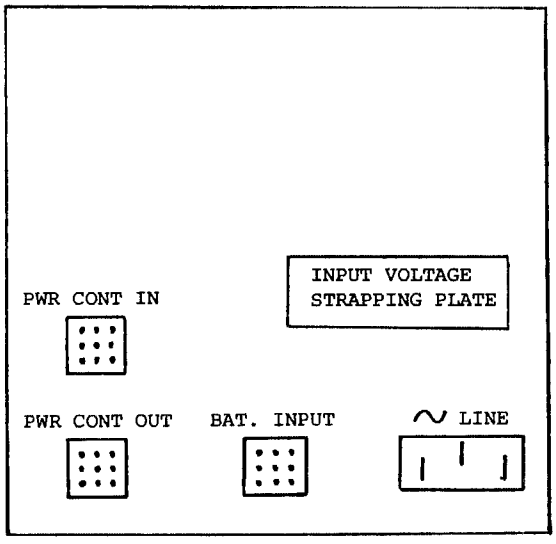
f. Lower the output voltage of the autotransformer to approximately 60 Vac rms (standard) or 150 Vac rms (option 15). Slowly increase the voltage, noting that at approximately 87.5 Vac rms (standard) or 174 Vac rms (option 15) the POWER-FAIL indicator will light and the T-Register will be displayed.

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

FRONT AND REAR PANEL ASSEMBLIES



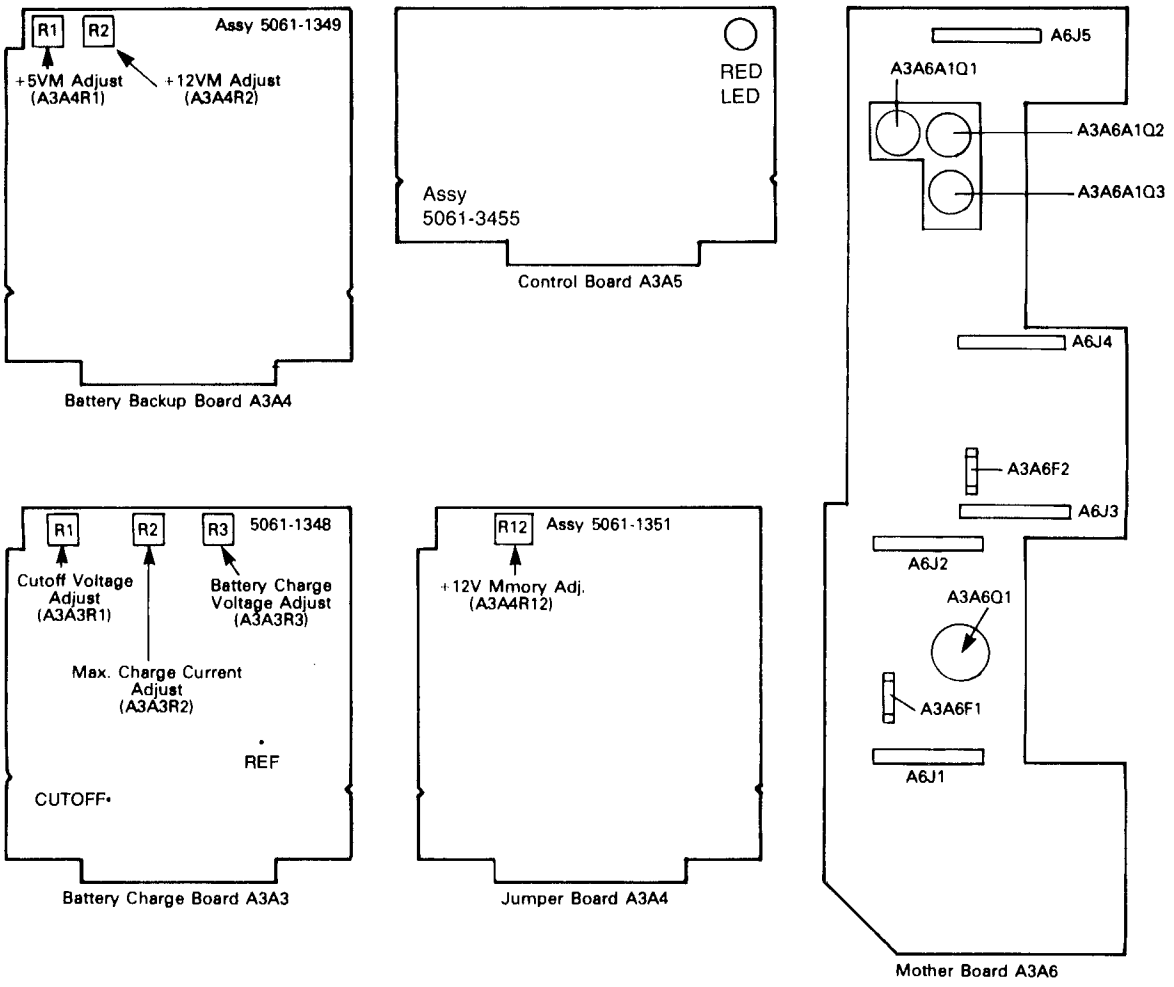
Front of Power Supply

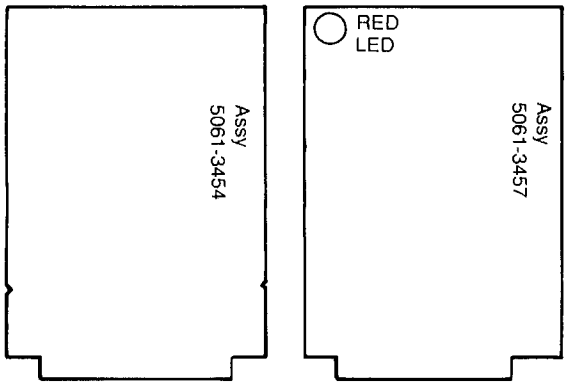


Rear of Power Supply

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

BOARDS AND PARTS IDENTIFICATION FOR THE 5061-6615 AND 5061-3476

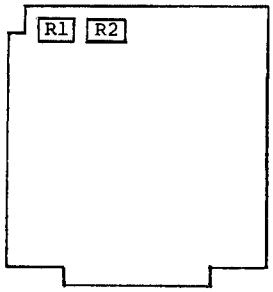




Description	New Part #	
Preregulator BD, A3A1	5061-3457	Power Supply A3, 5061-3476 & 5061-6615
Inverter Bd, A3A2	5061-3454	
Jumper Bd, A3A4	5061-1351	
Control Bd, A3A5	5061-3455	
Mother Bd, A3A6	5061-1371	
Output Regulator Bd, A3A6A1 (Mother Bd subassembly	5061-3403	
A3A6A1Q3 -2V I/O Transistor	1854-0063	
A3A6A1Q1-12V I/O Transistor	1854-0611	
A3A6A1Q2 +12V Regulator	1813-0093	
Battery Charge Bd, A3A3	5061-1348	Power Fail 12991B
Battery Backup Bd, A3A4	5061-1349	

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

BOARDS AND PARTS IDENTIFICATION FOR THE 5061-1356

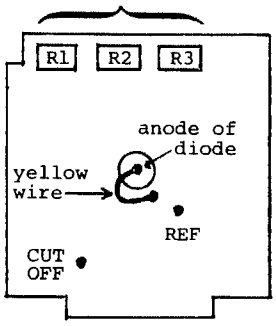


BATTERY BACKUP BOARD

New part no. 5061-1349
Exch part no. 5061-1379

R1 -- +5V Memory Adjustment
R2 -- +12V Memory Adjustment

Do not adjust unless
out of specifications

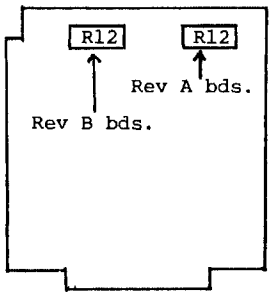


BATTERY CHARGER BOARD

New part no. 5061-1348
Exch part no. 5061-1378

R1 -- Battery Cutoff Adjust
(adjusted so that memory voltage generation ceases when battery voltage drops below +12V).
R2 -- Max Charge Current Adjust
(adjusted so that max battery charging current is 2.0 amps).
R3 -- Battery Charge Voltage Adjust
(adjusted so that the battery charger voltage is +16.45V).

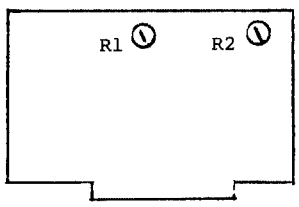
"CUT OFF" -- Test point for adjusting R1.
"REF" -- Test point for adjusting R2.
yellow wire -- Test point for adjusting R3.



JUMPER BOARD

New part no. 5061-1351
Exch part no. none

R12 -- +12V Memory Adjust.



CONTROL BOARD

New part no. 5061-1345
Exch part no. 5061-1370

R1 -- +5V CPU Adjust
R2 -- LPU Adjust

INVERTED BOARD

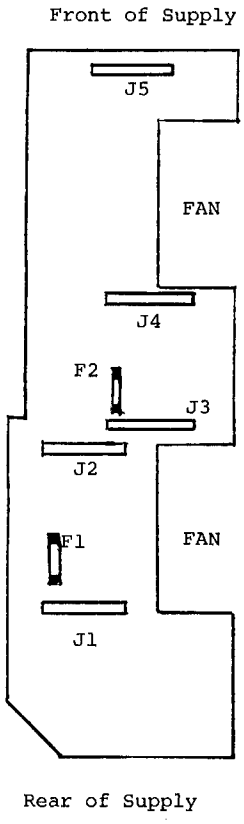
New part no. 5061-1344
Exch part no. 5061-1375

PRE-REGULATOR BOARD

New part no. 5061-1347
Exch part no. 5061-1377

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

BOARDS AND PARTS IDENTIFICATION FOR THE 5061-1356 (Cont'd)



MOTHER BOARD

New part no. 5061-1371
Exch part no. none

J1 -- Pre-regulator Board (component side facing FRONT of the supply).

J2 -- Inverter Board (component side facing REAR of the supply).

J3 -- Battery Charger Board (component side facing FRONT of the supply).

J4 -- Jumper Board (component side facing FRONT of the supply)
-or-
Battery Backup Board (component side facing FRONT of the supply).

J5 -- Control Board (component side facing FRONT of the supply).

F1 -- 1A fuse for pre-reg circuit (required).

F2 -- 1A fuse for +30V I/O (optional).

Supply without Power Fail Option Installed will have the following boards installed:

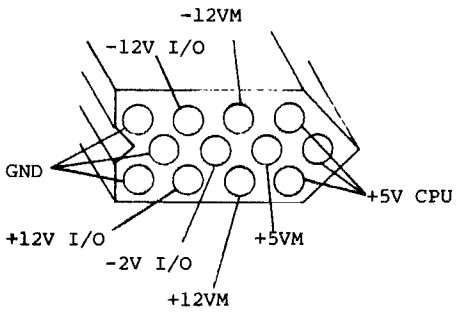
J1 -- Pre-regulator Board
J2 -- Inverter Board
J4 -- Jumper Board
J5 -- Control Baord

Supply with the Power Fail Option Installed will have the following boards installed:

J1 -- Pre-regulator Board
J2 -- Inverter Board
J3 -- Battery Charger Board
J4 -- Battery Backup Board
J5 -- Control Board

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

TEST POINTS AND SIGNAL LOCATIONS

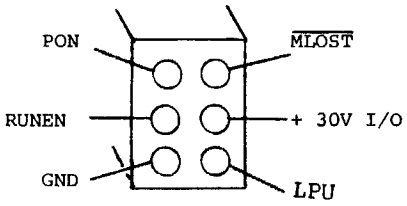


OUTPUT VOLTAGE CONNECTOR

- located on the front of the supply.
- connects to crossover load.

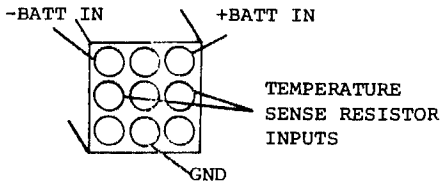
+5V CPU* +5VM*

* Not used on the 5061-6615 supply



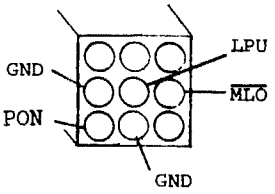
STATUS CONNECTOR

- located on the front of the supply.
- connects to the crossover board.



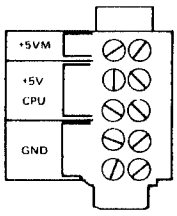
BATTERY INPUT CONNECTOR

- located on the rest of the supply



POWER CONTROL IN/OUT CONNECTOR

- located on the rest of the supply.



TERMINAL BLOCK CONNECT (5061-6615 Supply).

- located on front panel.
- connects to crossover board.

21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

TEST POINTS AND SIGNAL LOCATIONS (Cont'd)

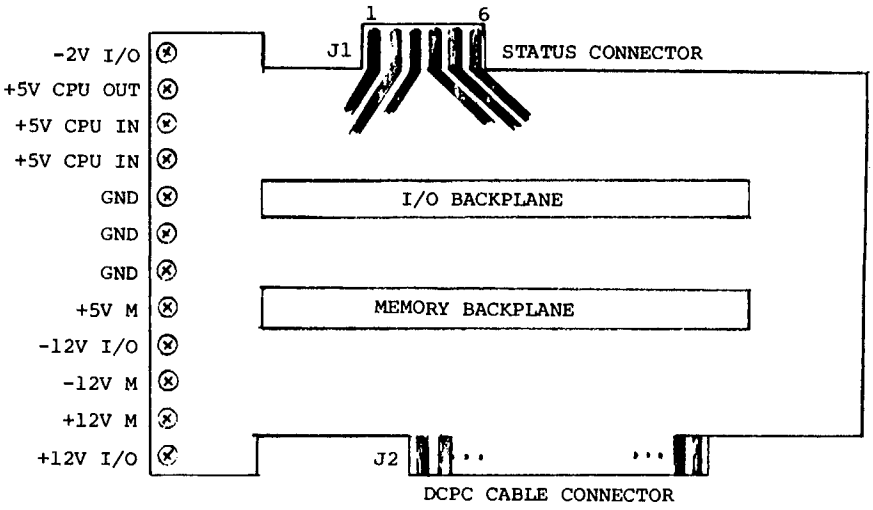
Computer Crossover Board

J1

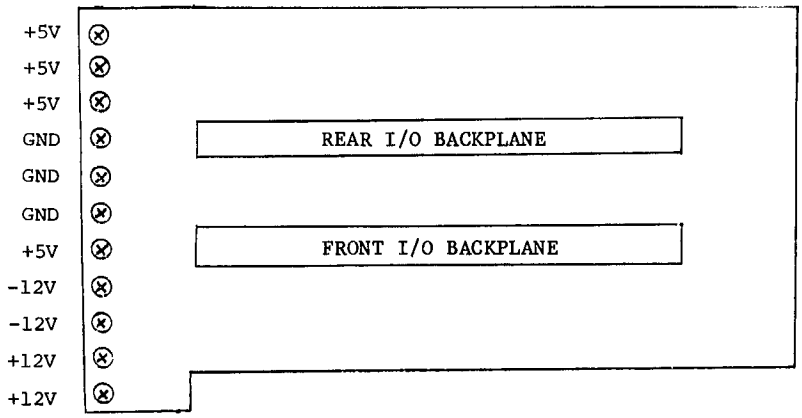
Pin 1 -- PWU
Pin 2 -- PON*
Pin 3 -- PON*
Pin 4 -- +30V I/O
Pin 5 -- RUNDN
Pin 6 -- MLOST

Crossover Board Status Edge Connector Pin Assignments

* Pins 2 and 3 tied on CPU crossover PCA.



I/O Extender Crossover Board

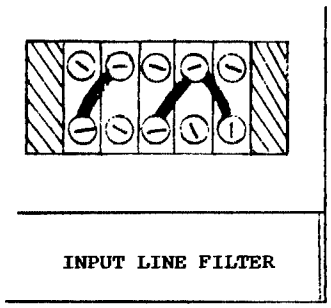


21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

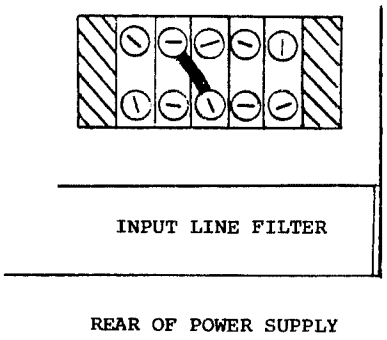
INPUT VOLTAGE CONFIGURATION

To access the input configuration block, remove the supply from the computer and remove the top cover. Remove the protective cover, and configure for the appropriate configuration.

Input configuration block jumpering for 110 volt operation.

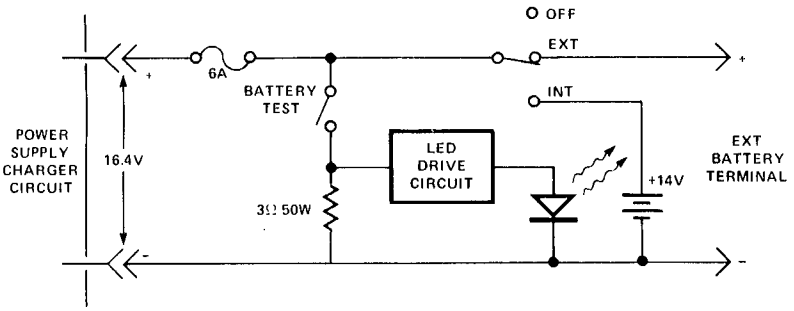


Input configuration block jumpering for 220 volt operation.



21MX-SERIES "B" TYPE POWER SUPPLIES (Cont'd)

TESTING PROCEDURE FOR BATTERY CHARGER



CHARGER VOLTAGE TEST

1. Set the ~POWER circuit breaker to the ON position.

2. Put the switch on the battery pack in the EXT position.

3. Check the voltage across the EXT BATT terminals. It should read 16.25V +/- 0.25V. If the voltage is out of spec, adjust R3 on the Battery Charger Board.

   -NOTE-

   If the power supply top cover is removed and the internal boards are accessible, the voltage on the yellow wire (the anode of the large diode in the center of the Battery Charger Board) can be monitored instead of the voltage on the EXT BATT terminals.

CHARGER CURRENT LIMIT TEST

1. Set the ~POWER circuit breaker to the ON position.

2. Put the switch on the battery pack in the EXT position.

3. The voltage at the EXT BATT terminals should be 16.25V +/- 0.25V. Depress the BATT TEST switch and the voltage should drop to 6.0V +/- 0.50V indicating that the charger circuit is outputting 2 amps. If not within spec, adjust R2 on the battery charger board.

   -NOTE-

   If the power supply top cover is removed, and the internal boards are accessible, the test point labeled "REF" on the Battery Charger Board can be monitored. The voltage at this point should be set to 5.0V +/- 0.25V.

12991B POWER-FAIL RECOVERY SYTEM

The 12991B Power Fail Recovery System (PFRS) is an accessory for HP 2112B, 2113B, 2111F, and 2117F computers and for the HP 12990B Memory Extender.

Product Contents

a. Battery Charger Board (P/N 5061-1348)
b. Battery Backup Board (P/N 5061-1349)
c. Battery Load Simulator Plug (P/N 12991-60002)
d. Battery Box Assembly (P/N 12991-60001), which contains:
   1. Battery Status PCA (P/N 5061-1352)
   2. Two Battery Packs (P/N 0950-1596)
e. Battery Cable (12944-60002)

Sustaining Battery

14 volt, 10 amp-hour sealed lead acid

Memory Sustaining Time

No. of Memory Modules	1	2	3	4	5	6	7	8	9	10
No. of Hours	4.4	3.8	3.4	3.0	2.6	2.3	2.2	2.1	2.0	1.8

Operation

A terminal block and two switches are mounted on the battery box. The BATTERY SELECT switch has three positions.

a. INT connects the internal battery pack voltage to the power supply.
b. EXT connects an external battery voltage (if used) to the power supply. The battery must be connected to the terminal block.
c. OFF disconnects battery voltage from the power supply. This position allows the line power to be turned off without the battery discharging through memory.

The BAT. TEST switch allows a fast check of the battery. When the switch is moved to the TEST position (BATTERY SELECT at INT), the indicator lights if the battery power source has sufficient energy to sustain memory for at least five minutes.

NOTE

If the BAT.TEST switch is moved to the TEST position when the BATTERY SELECT switch is not in the INT position (or EXT with an external battery connected), and the computer is running, the memory voltages will be pulled down, and parity errors will result.

12991B POWER-FAIL RECOVERY SYTEM (Cont'd)

If an external battery is used, it must have an output voltage above 14 volts and below 18 volts, and must be capable of accepting a maximum charge current of 2 amperes.

Installation

a. Remove the power supply as described in the power supply removal section.

b. Remove the Jumper Board from connector J4

c. Install the Battery Charger Board in connector J3 (component side facing the front of the supply).

d. Install the Battery Backup Board in connector J4 (component side facing the front of the supply).

e. Install the power supply in the computer, and check +5V memory, and +12V memory and adjust if necessary.

f. Secure the battery pack to the back of the computer.

g. Connect battery cable between BAT.INPUT connector on the computer/extender and the matching connector on the battery box.

NOTE

The BLSP connector (12991-60002) must be connected if the computer is to be operated with the battery box disconnected. This connector must be plugged into the BAT. INPUT connector.

g. Verify that a 6A fast-blow fuse is installed in the battery box fuse holder.

Internal Switch Settings

Automatic restart switch A1S2 which is mounted on the CPU PCA will alternatively enable or disable the automatic restart capability of the computer. The action that the computer will take upon restoration of primary power following a power failure is determined bu the following switch settings:

a. ARS. The automatic restart feature is enabled

b. ARS. The automatic restart feature is disabled. The computer is halted immediately regardless of wether the computer was running when the power failure occurred.

Checkout

a. Set the BATTERY SELECT switch to INT and move the BAT. TEST switch to TEST. The battery status indicator should light.

b. Perform the diagnostic test as described in the POWER FAIL/ AUTO RESTART DIAGNOSTIC REFERENCE MANUAL, part no. 02100-90216.

12944B POWER-FAIL RECOVERY SYSTEM

The 12944B Power Fail Recovery System (PFRS) is an accessory for the HP 2108B and 2109B computers.

Product Contents

a. Battery Charger Board (P/N 5061-1348)
b. Battery Backup Board (P/N 5061-1349)
c. Battery Cable (P/N 12994-60002)
d. Battery Load Simulator Plug (P/N 12991-60002)
e. Battery Box Assembly (P/N 12944-60001). which contains:
   (1) Battery Status PCA (P/N 5061-1352)
   (2) One Battery Pack (P/N 0950-1596

The Operation, Installation, Internal Settings, and Checkout for the 12944B are the same as those for the 12991B.

Sustaining Battery

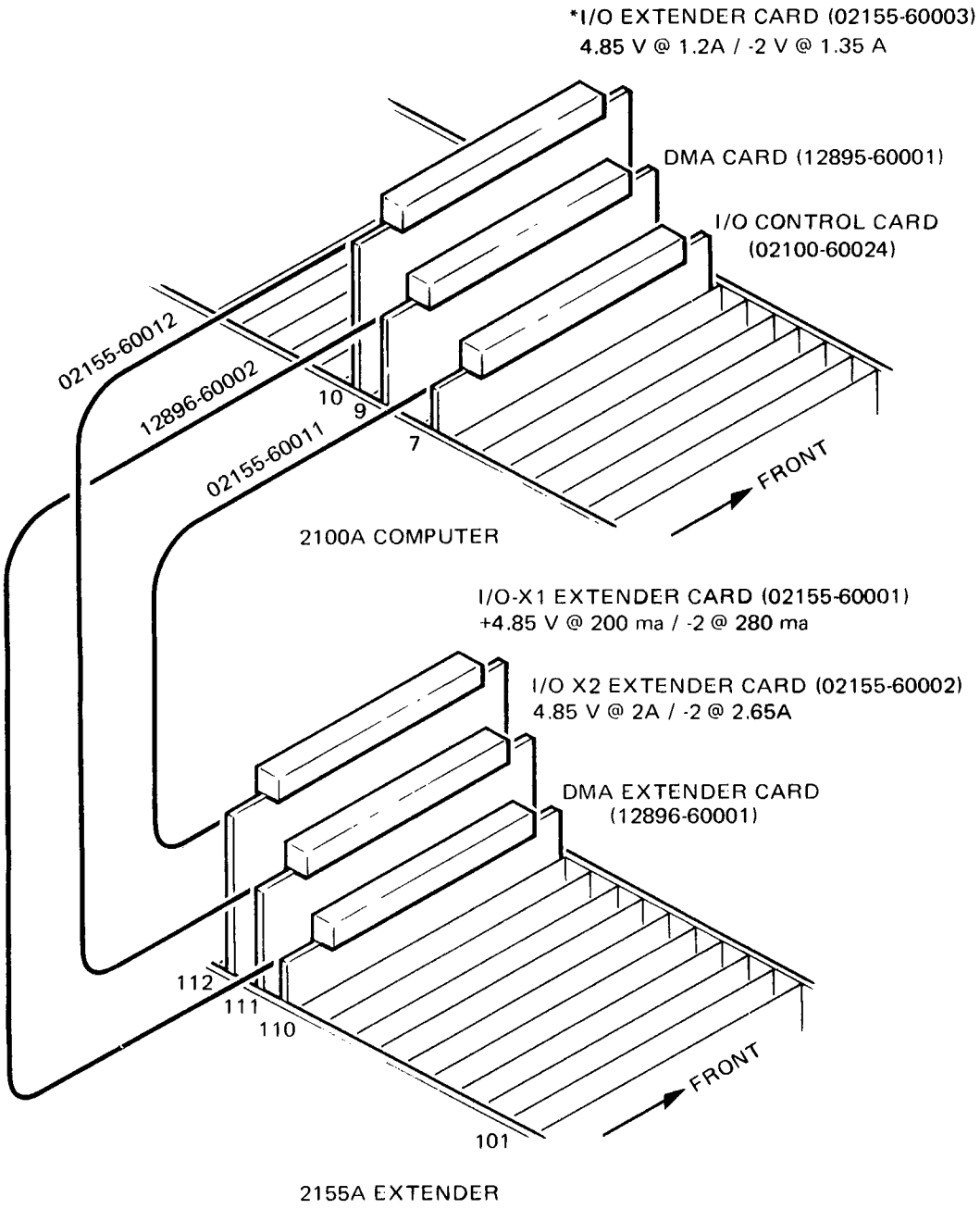
14 volt, 5 amp-hour sealed lead acid

Memory Sustaining Time

No. of Memory Modules	1	2	3	4	5
No. of Hours	4.1	3.3	2.5	1.9	1.6

2155A I/O EXTENDER

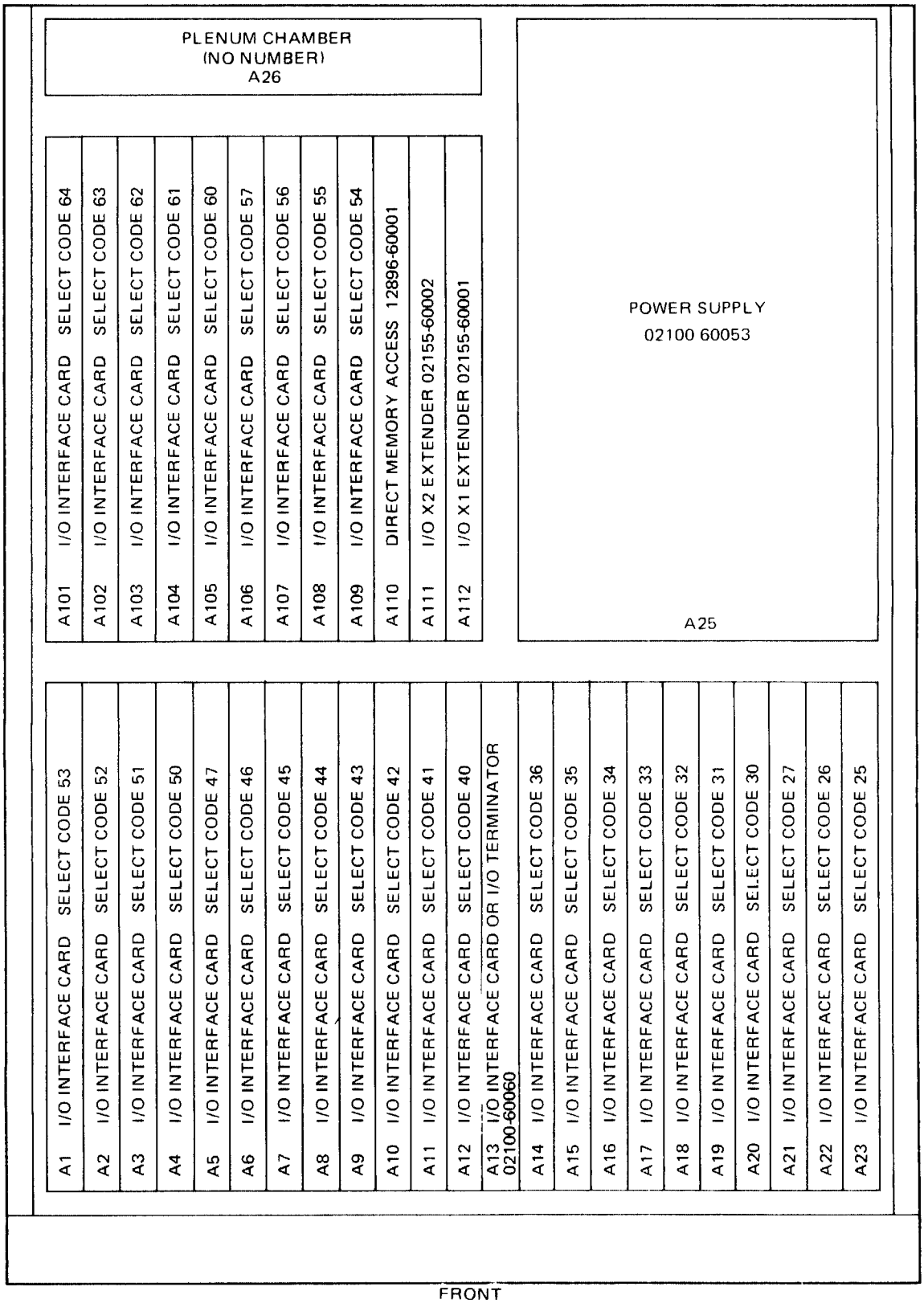
I/O EXTENDER WITH 12896A DMA KIT INTERFACE TO COMPUTER



*FURNISHED WITH EXTENDER

2155A I/O EXTENDER (Cont'd)

LOCATION OF ASSEMBLIES IN 2155 I/O EXTENDER



NOTE: *DIRECT MEMORY ACCESS CARD IS AN ACCESSORY TO THE EXTENDER AND IS NOT PART OF THE BASIC CONFIGURATION.

12979B INPUT/OUTPUT EXTENDER

EQUIPMENT

12979B	Extender & Power Supply
12979-60022	Extender Buffer PCA
12979-60008	Flat I/O Extension Cable
12979-60024	I/O Extension Cable
12979-60025	Power Control Cable
12979-69029	I/O Buffer
12979-60028	I/O Buffer Cable
02100-60060	Terminator PCA

DOCUMENTATION

HP 12979B Input/Output Extender Installation and Service Manual
HP P/N 12979-90016

HP 12979B Input/Output Extender Operating and Reference Manual
HP P/N 12979-90014

POWER REQUIREMENTS

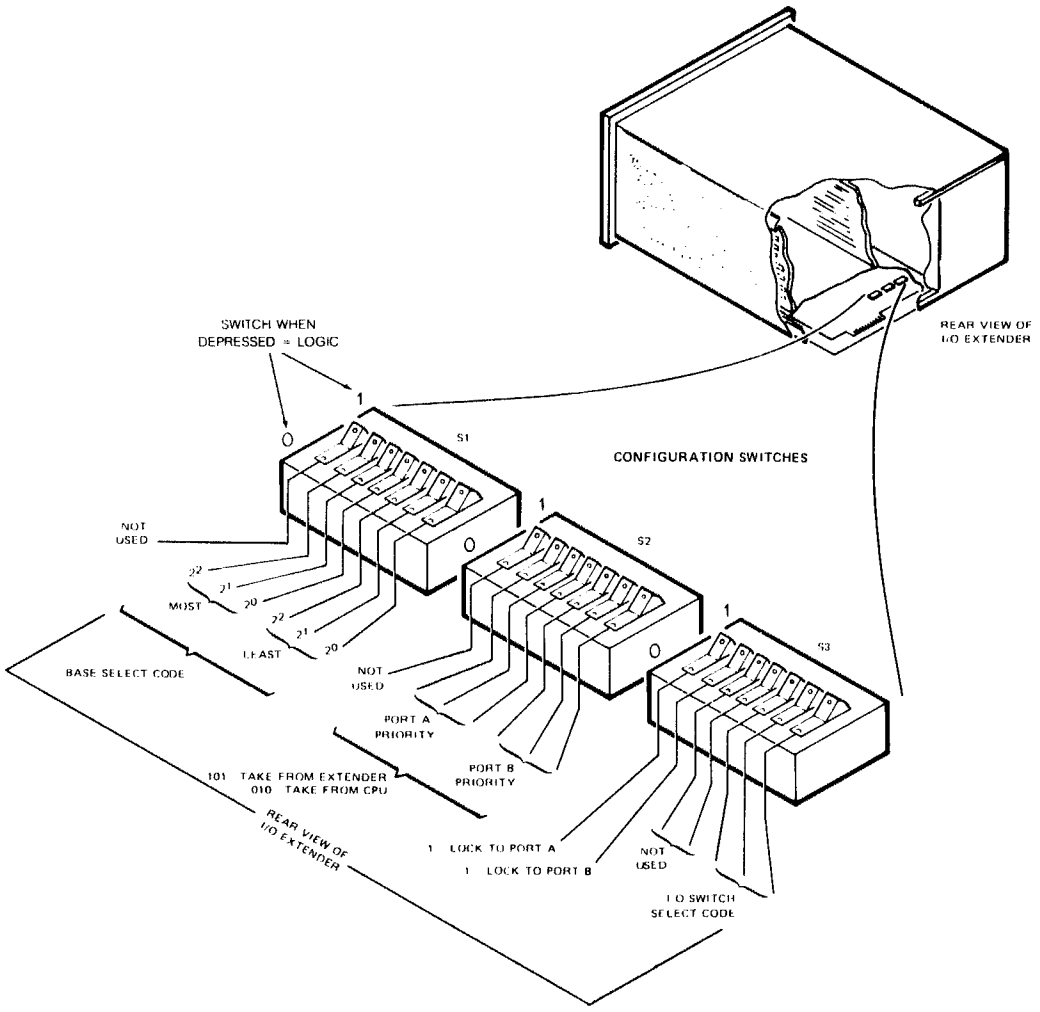
770 Watts Max Power Consumption at:

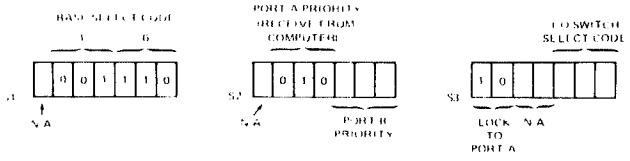
110 + 20% VAC or 220 + 20% VAC

12979B INPUT/OUTPUT EXTENDER (Cont'd)

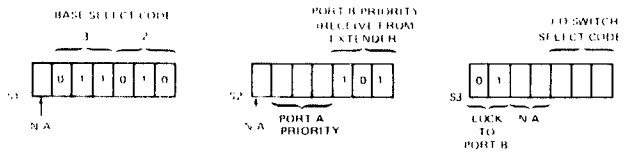
CONFIGURATION

Extender Control PCA Rocker Switch Settings





a. EXTENDER NO. 1 WITH BSC 16_8



b. EXTENDER NO. 2 WITH BSC 32_8

NOTES

1 ALL ROCKER SWITCHES ARE SHOWN IN A LOGIC "0" POSITION

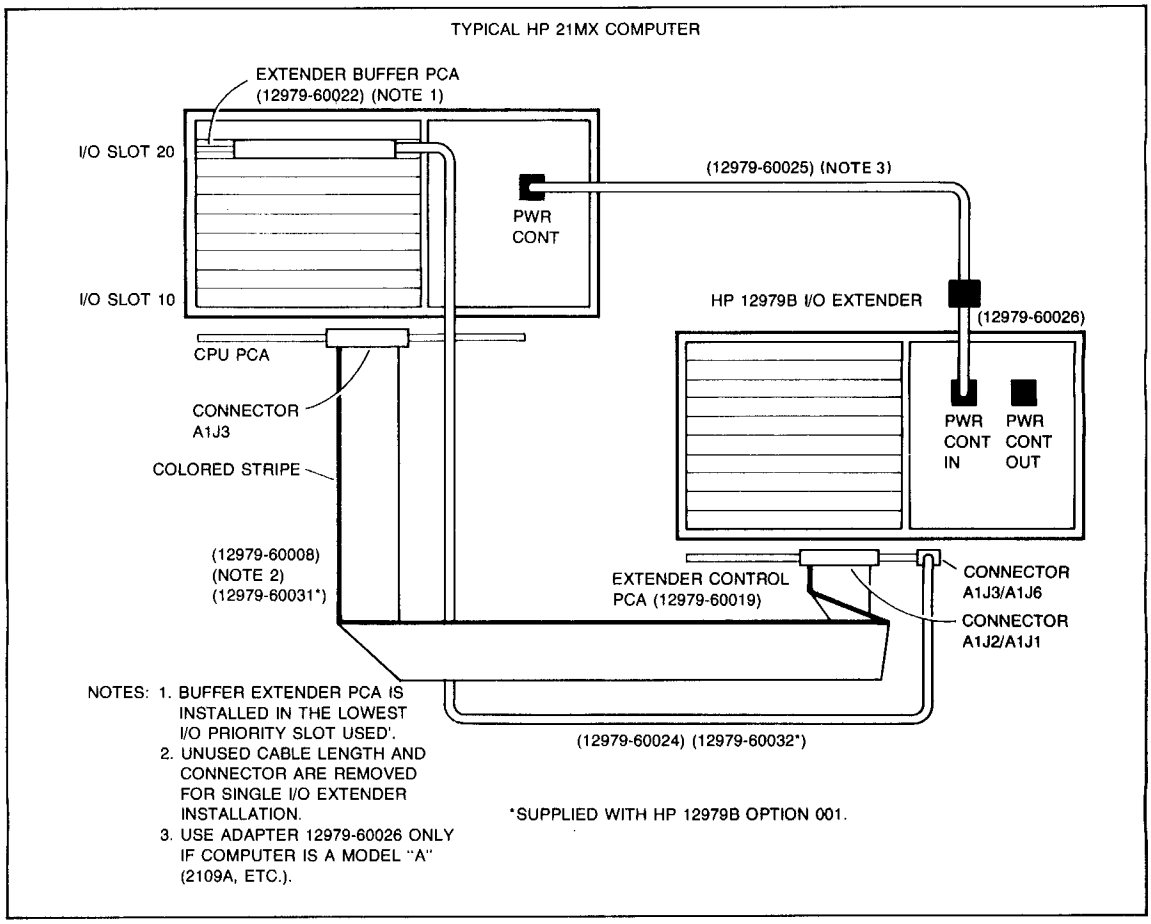
2 1 = LOGIC "1" POSITION
0 = LOGIC "0" POSITION

3 ROCKER SETTING ASSUMES THAT EXTENDERS ARE USED ONLY FOR ADDITIONAL I/O SWITCH S3 LOCKS THE EXTENDER TO PORT A OR B AND OVERRIDES ANY I/O SWITCH SELECT CODE

4 ONLY ONE EXTENDER AT A TIME CAN BE ENABLED TO RECEIVE PRIORITY FROM THE SAME CPU

12979B INPUT/OUTPUT EXTENDER (Cont'd)

Single I/O Extender, Interface to Computer (Rear View)



PROCEDURE:

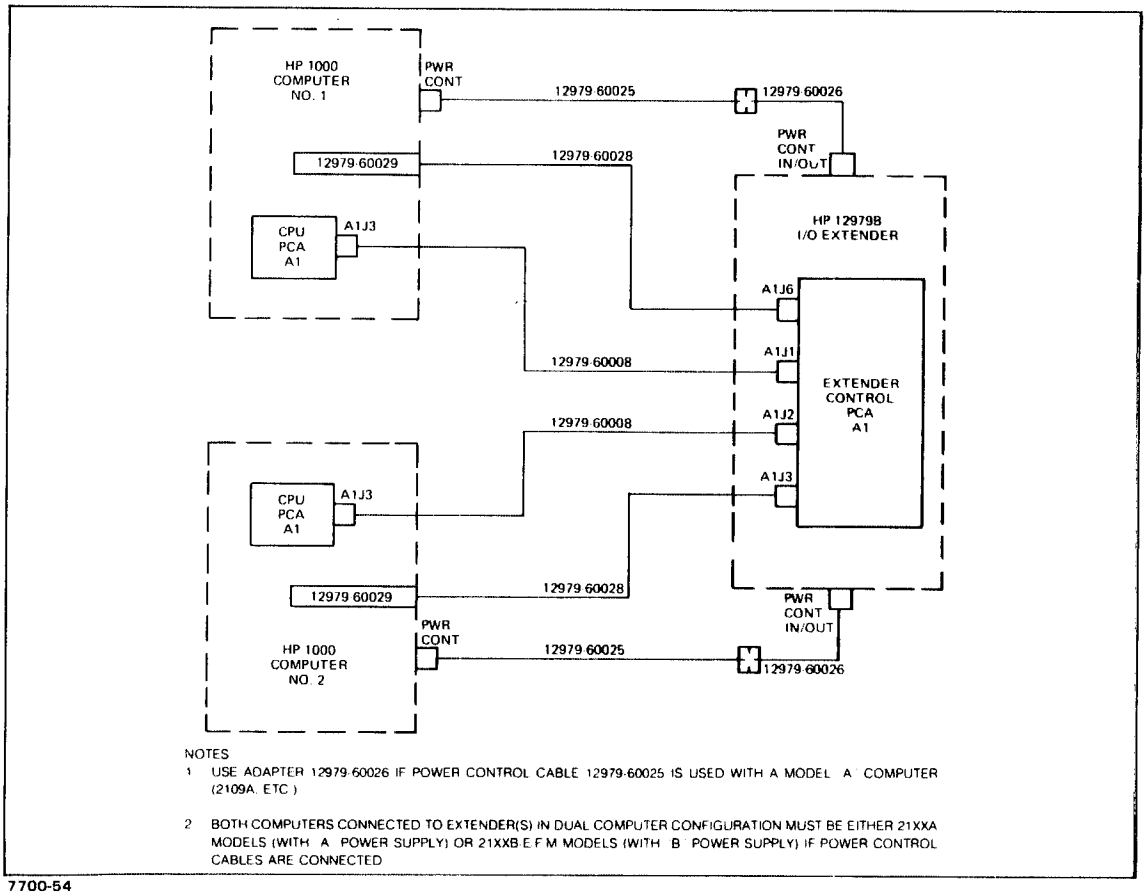
1. Set the rocker switches A1S1 to the desired base select code (octal). Note that the least significant bit is on the right and that a "1" is set by depressing the top of a rocker.

2. Set rocker switches A1S2 to receive priority from the computer at either Port A or B, as appropriate for the cabling setup.

3. Set rocker switch A1S3 only to lock the computer to Port A or B, as appropriate.

12979B INPUT/OUTPUT EXTENDER (Cont'd)

One Extender, Two Computers



NOTES

1. USE ADAPTER 12979-60026 IF POWER CONTROL CABLE 12979-60025 IS USED WITH A MODEL A COMPUTER (2109A, ETC.)
2. BOTH COMPUTERS CONNECTED TO EXTENDER(S) IN DUAL COMPUTER CONFIGURATION MUST BE EITHER 21XXA MODELS (WITH A POWER SUPPLY) OR 21XXB,E,F,M MODELS (WITH B POWER SUPPLY) IF POWER CONTROL CABLES ARE CONNECTED

7700-54

PROCEDURE:

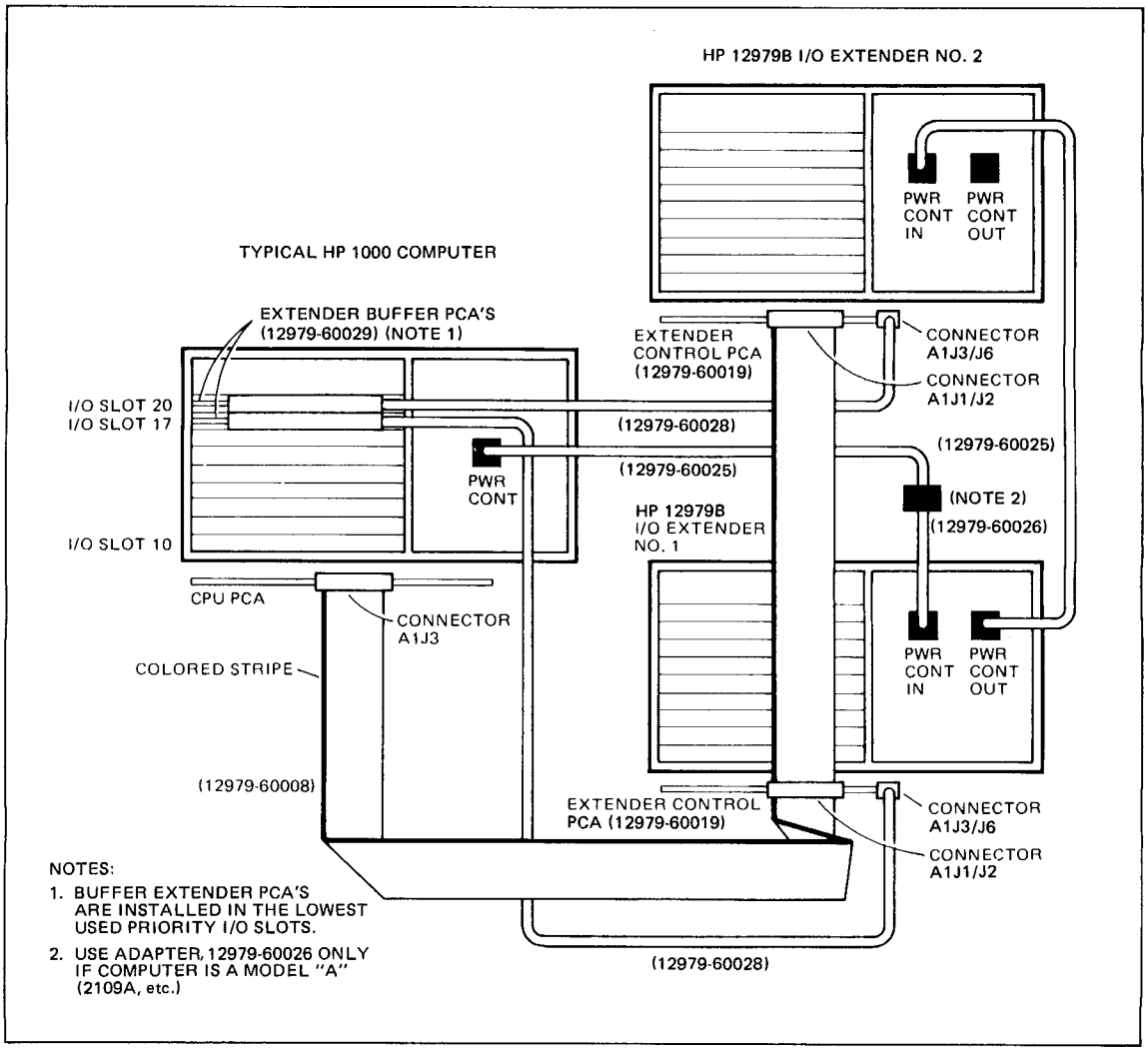
1. Set the rocker switches A1S1 to the desired select code. (Usually the same select code as the I/O buffer PCA.)

2. Set rocker switches A1S2 so that both Port A and B can receive priority from the computer.

3. Rocker switches A1S3 must not be set to lock to either Port A or B but must be set for an individual I/O bus switch select code (octal 70 to 77). Note that only the least significant bit can be set; the most significant digit is built in.

12979B INPUT/OUTPUT EXTENDER (Cont'd)

Dual I/O Extenders, Interface to Processor (Rear View)



Second I/O extender used for I/O redundancy

1. Set the rocker switches A1S1 to same base select code on both extenders.

2. Set rocker switches A1S2 so both extenders receive priority from the computer.

3. Rocker switches A1S3 on both extenders must not be set to lock either Port A or B, but must be set for an individual I/O bus switch select code (octal 70 to 77). Note that only the last significant digit can be set; the most significant digit is built in.

Second I/O extender used for additional I/O

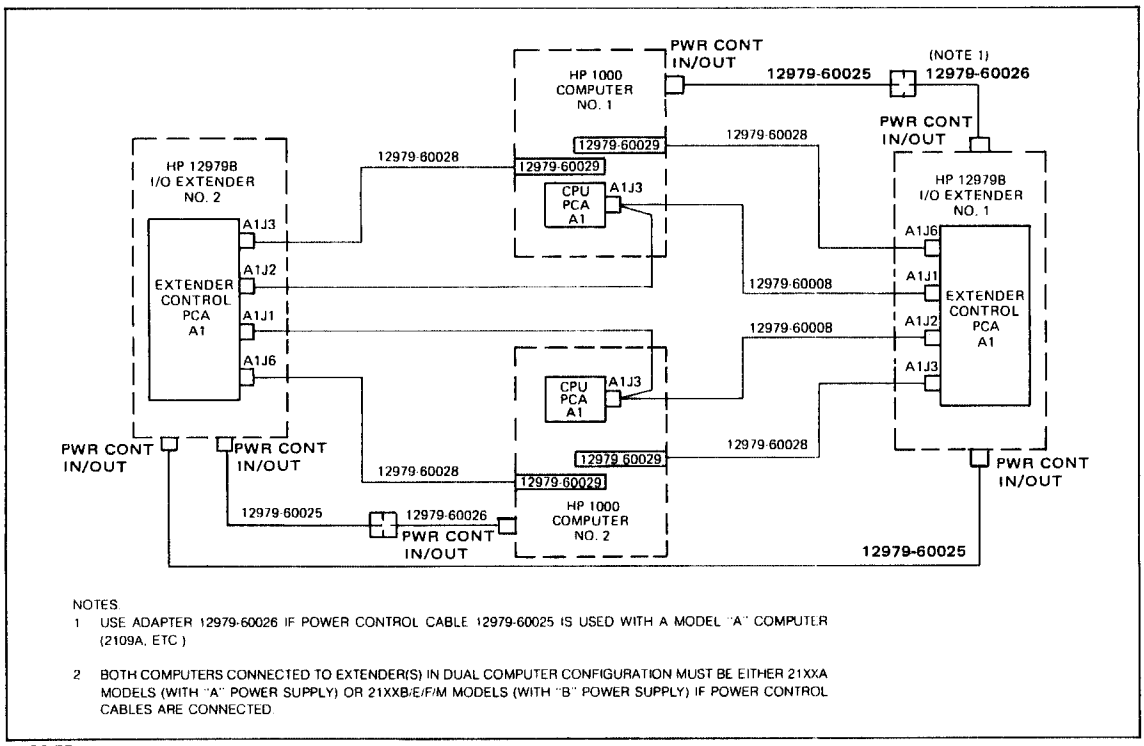
1. Set rocker switches A1S1 on each extender for sequential base select codes.

2. Set rocker switches A1S2 so that the higher priority extender receives priority from the computer and the lower priority extender receives priority from the higher priority extender.

3. Set rocker switches A1S3 so that each extender locks to Port A or B as appropriate.

12979B INPUT/OUTPUT EXTENDER (Cont'd)

Two Extenders, Two Computers



NOTES:
1. USE ADAPTER 12979-60026 IF POWER CONTROL CABLE 12979-60025 IS USED WITH A MODEL "A" COMPUTER (2109A, ETC.)
2. BOTH COMPUTERS CONNECTED TO EXTENDER(S) IN DUAL COMPUTER CONFIGURATION MUST BE EITHER 21XXA MODELS (WITH "A" POWER SUPPLY) OR 21XXB/E/F/M MODELS (WITH "B" POWER SUPPLY) IF POWER CONTROL CABLES ARE CONNECTED.

7700-55

PROCEDURE:

1. Set rocker switches A1S1 such that each extender has a unique base select code.

2. a. Second I/O Extender used for additional I/O:

   Set rocker switches A1S2 so that the higher priority extender receives priority from the computer and the lower priority extender receives priority from the higher priority extender.

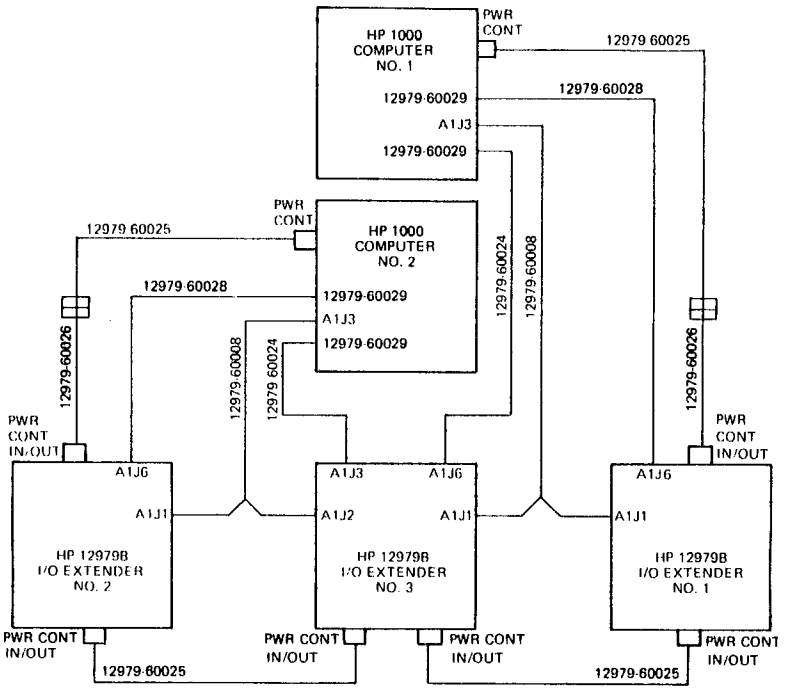
   b. Second I/O Extender used for redundancy:

   Set rocker switches A1S2 so that both extenders receive priority from the computer.

3. Rocker switches A1S3 must not be set to lock to either Port A or B but must be set for an individual I/O bus switch select code (octal 70 to 77). Note that only the least significant digit can be set; the new significant digit is built in.

12979B INPUT/OUTPUT EXTENDER (Cont'd)

Shared I/O and Independent I/O



NOTES:

1. USE ADAPTER 12979-60026 IF POWER CONTROL CABLE 12979-60025 IS USED WITH A MODEL "A" COMPUTER (2109A, ETC.)

2. BOTH COMPUTERS CONNECTED TO EXTENDER(S) IN DUAL COMPUTER CONFIGURATION MUST BE EITHER 21XXA MODELS (WITH "A" POWER SUPPLY) OR 21XXB/E/F/M MODELS (WITH "B" POWER SUPPLY) IF POWER CONTROL CABLES ARE CONNECTED.

7700-56

POWER SUPPLY CHECK

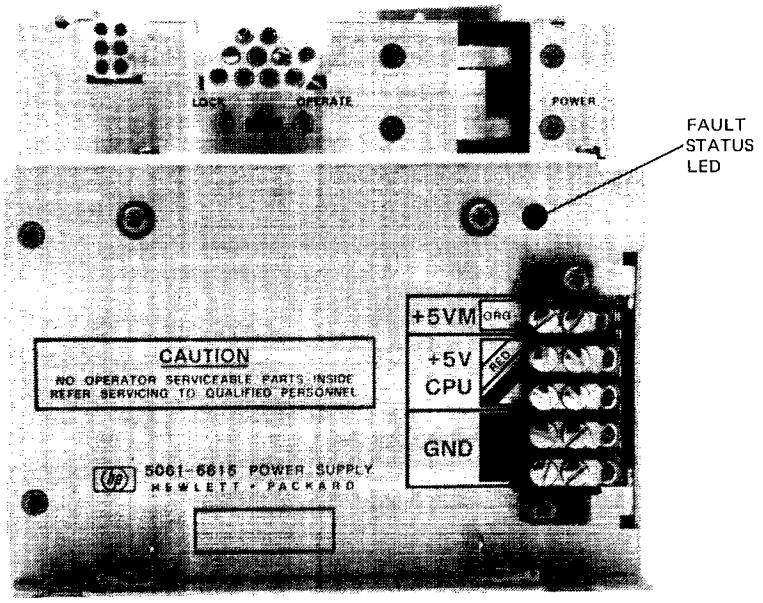
Check the power supply with all I/O PCAs installed in the extender.

Power Supply Voltage Tolerances:

Supply	Tolerance
+5V	+5.00V to +5.25V
+12V	+/- 0.60V
-2V	+/- 0.40V
-12V	+/- 0.60V
+30V	+12V, -8V

12979B INPUT/OUTPUT EXTENDER (Cont'd)

Power Supply Fault Status LED



The following tapes and reference manuals are used in the diagnostic check.

Diagnostics	Manual	Tape
Input/Output Channel	02100-90213	24318-16001
Power-Fail/Auto Restart	02100-90216	24321-16001

If the diagnostic tests indicate an error halt, refer to the troubleshooting flowcharts for the optional DCPC, run the DCPC diagnostic test also.

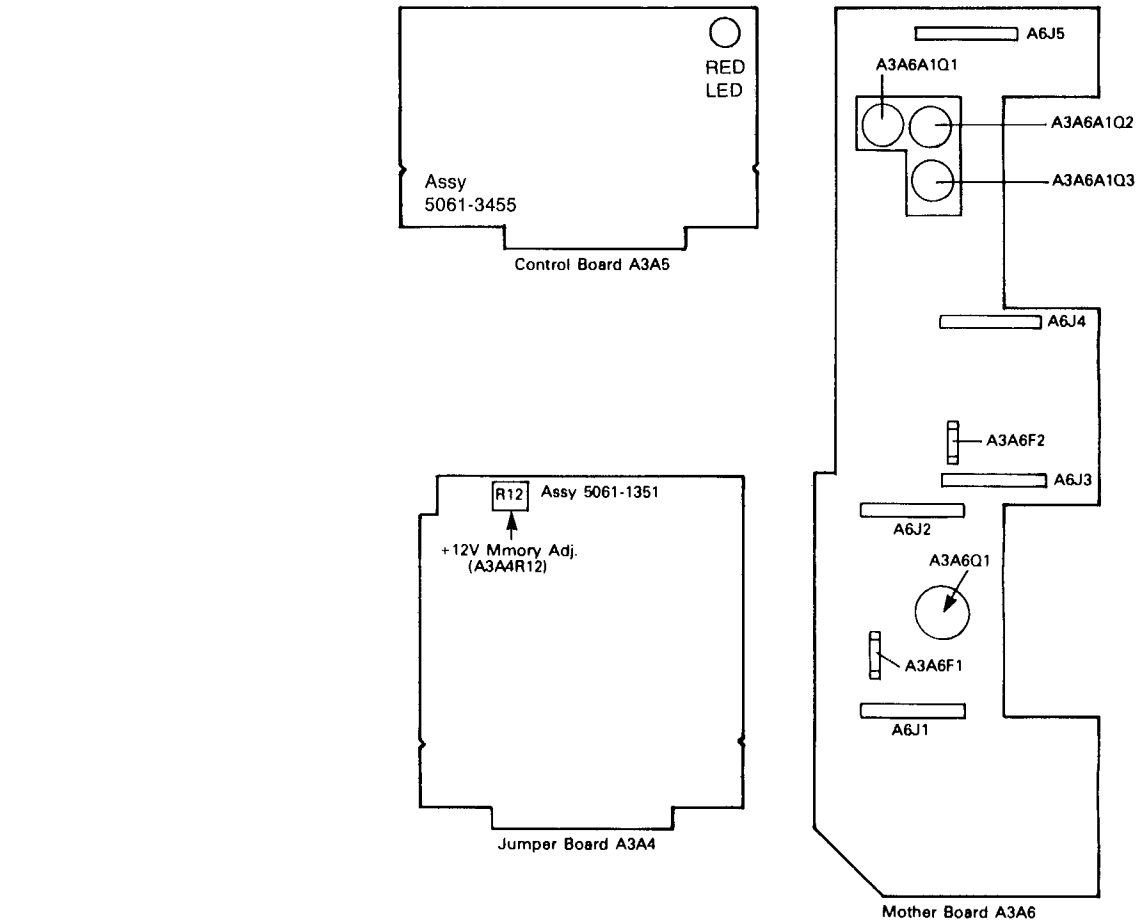
Test of I/O Slot Interrupt Capability

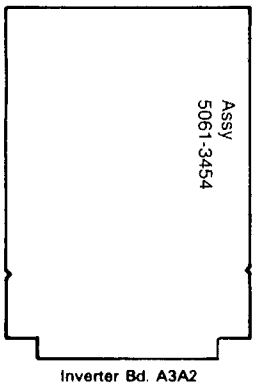
LABEL	I/O INSTRUCTION		MACHINE CODE (IN OCTAL)	COMMENTS
	OPCODE	OPERAND		
START	NOP		000000	
	CLF	00	103100	Turn off interrupt system
	STC	XX,C	1037XX	Turn on selected I/O PCA
	STF	00	102100	Turn on interrupt system
	STF	XX	1021XX	Force interrupt condition on I/O PCA
	NOP		000000	I/O PCA should interrupt
	NOP		000000	
END	JMP	START	024100	Did not interrupt, loop on program
	HLT	77	102077	I/O PCA interrupted properly (Halt in trap cell)

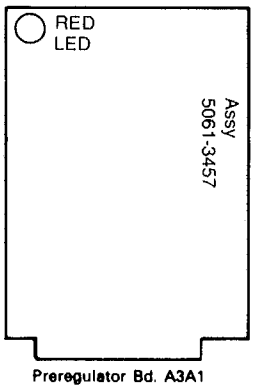
NOTE: XX is device octal select code.

12979B INPUT/OUTPUT EXTENDER (Cont'd)

PARTS LOCATION FOR 12979B POWER SUPPLY

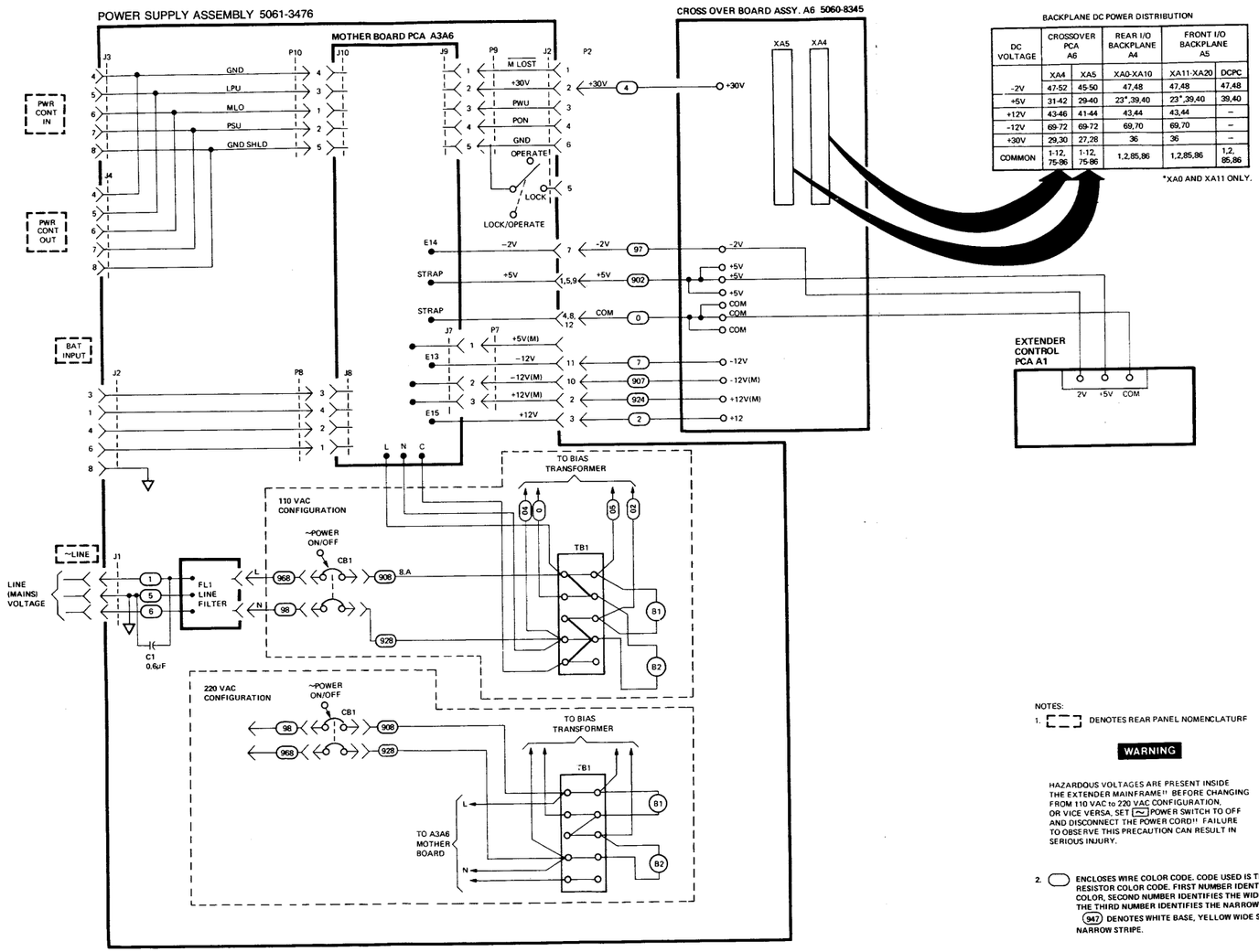






Description	New Part #
Preregulator BD, A3A1	5061-3457
Inverter Bd, A3A2	5061-3454
Jumper Bd, A3A4	5061-1351
Control Bd, A3A5	5061-3455
Mother Bd, A3A6	5061-1371
Output Regulator Bd, A3A6A1 (Mother Bd subassembly	5061-3403
A3A6A1Q3 –2V I/O Transistor	1854-0063
A3A6A1Q1-12V I/O Transistor	1854-0611
A3A6A1Q2 +12V Regulator	1813-0093

Power Supply A3, 5061-3476 & 5061-6615



7700-81A

NOTES:

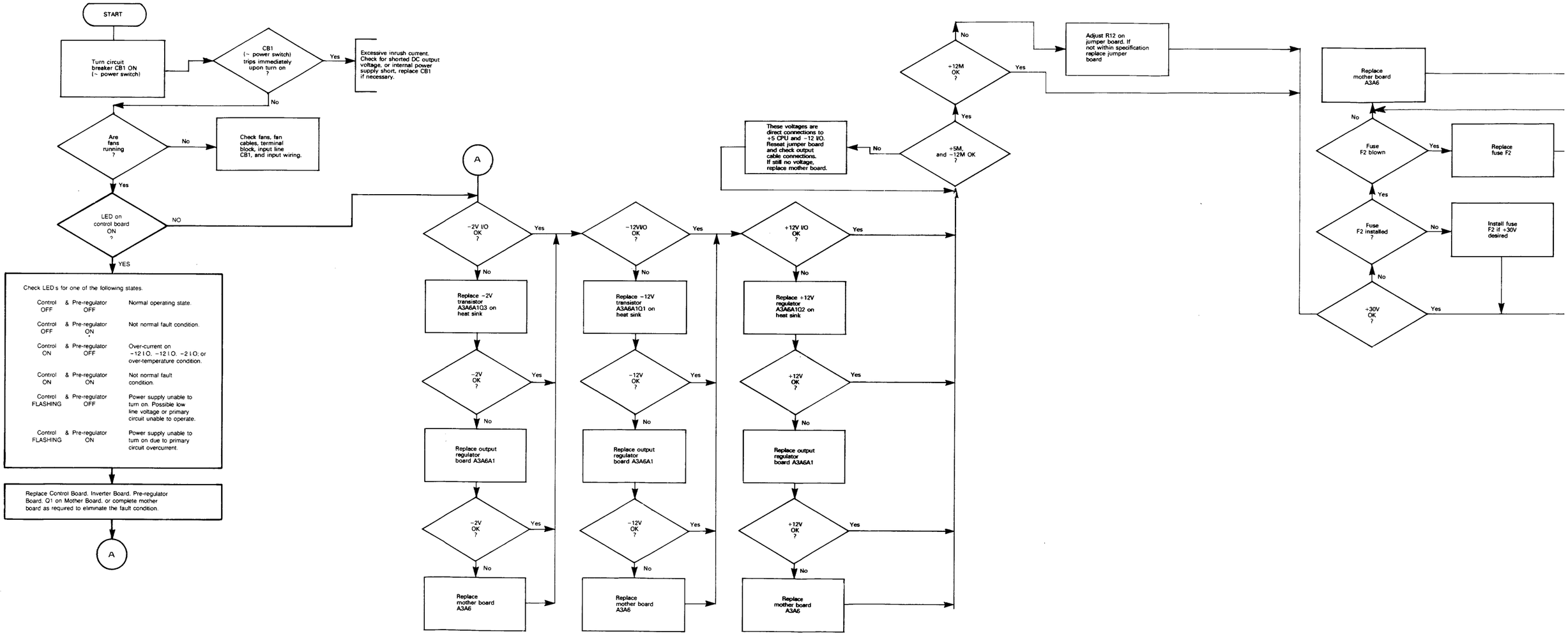
1. [ ] DENOTES REAR PANEL NOMENCLATURE

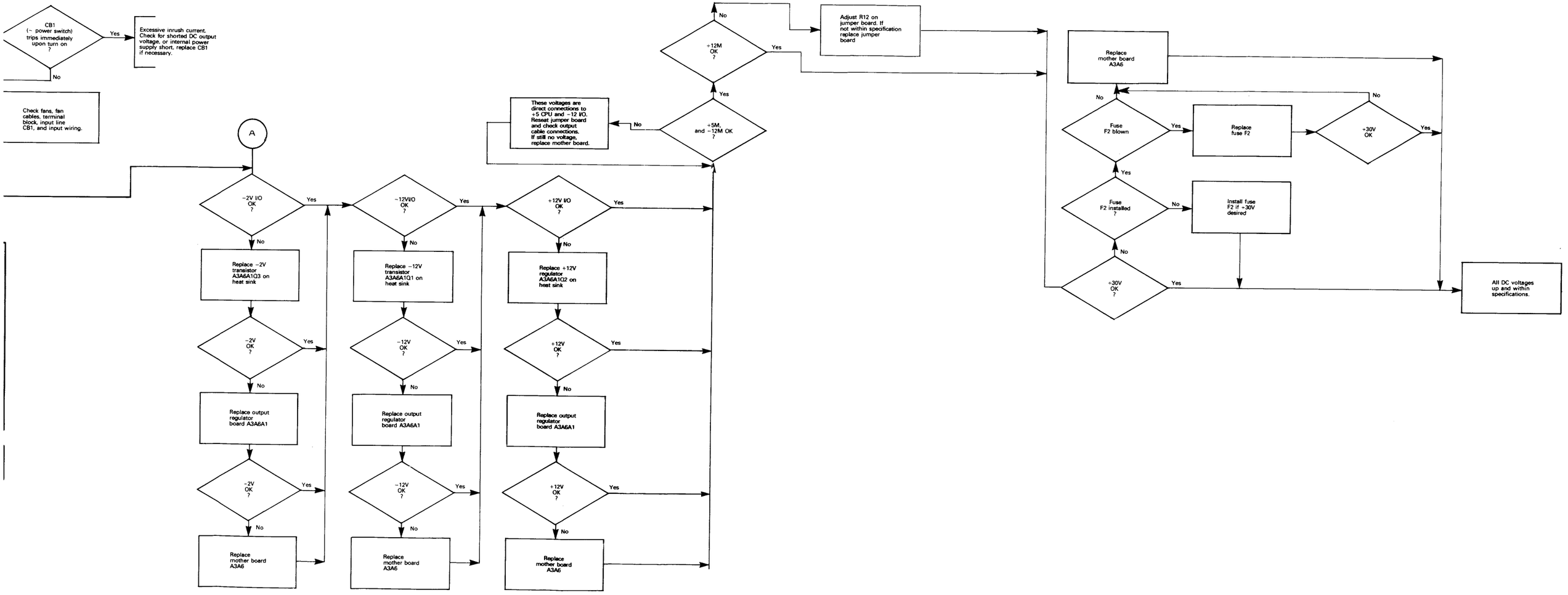
WARNING

HAZARDOUS VOLTAGES ARE PRESENT INSIDE THE EXTENDER MAINFRAME!! BEFORE CHANGING FROM 110 VAC to 220 VAC CONFIGURATION, OR VICE VERSA, SET ~ POWER SWITCH TO OFF AND DISCONNECT THE POWER CORD!! FAILURE TO OBSERVE THIS PRECAUTION CAN RESULT IN SERIOUS INJURY.

2. ( ) ENCLOSES WIRE COLOR CODE. CODE USED IS THE SAME AS THE RESISTOR COLOR CODE. FIRST NUMBER IDENTIFIES THE BASE COLOR, SECOND NUMBER IDENTIFIES THE WIDER STRIPE, AND THE THIRD NUMBER IDENTIFIES THE NARROWER STRIPE, E.G., (947) DENOTES WHITE BASE, YELLOW WIDE STRIP, VIOLET NARROW STRIPE.

12979B I/O Extender
Power Distribution Diagram


START
Turn circuit breaker CB1 ON (~ power switch)
CB1 (~ power switch) trips immediately upon turn on ?
Yes
Excessive inrush current. Check for shorted DC output voltage, or internal power supply short, replace CB1 if necessary.
No
Are fans running ?
No
Check fans, fan cables, terminal block, input line CB1, and input wiring.
Yes
LED on control board ON ?
NO
YES
Check LEDs for one of the following states.
Control OFF & Pre-regulator OFF — Normal operating state.
Control OFF & Pre-regulator ON — Not normal fault condition.
Control ON & Pre-regulator OFF — Over-current on −12 I O, −12 I O, −2 I O; or over-temperature condition.
Control ON & Pre-regulator ON — Not normal fault condition.
Control FLASHING & Pre-regulator OFF — Power supply unable to turn on. Possible low line voltage or primary circuit unable to operate.
Control FLASHING & Pre-regulator ON — Power supply unable to turn on due to primary circuit overcurrent.
Replace Control Board, Inverter Board, Pre-regulator Board, Q1 on Mother Board, or complete mother board as required to eliminate the fault condition.
A
A
−2V I/O OK ?
Yes
No
Replace −2V transistor A3A6A1Q3 on heat sink
−2V OK ?
Yes
No
Replace output regulator board A3A6A1
−2V OK ?
Yes
No
Replace mother board A3A6
−12V I/O OK ?
Yes
No
Replace −12V transistor A3A6A1Q1 on heat sink
−12V OK ?
Yes
No
Replace output regulator board A3A6A1
−12V OK ?
Yes
No
Replace mother board A3A6
+12V I/O OK ?
Yes
No
Replace +12V regulator A3A6A1Q2 on heat sink
+12V OK ?
Yes
No
Replace output regulator board A3A6A1
+12V OK ?
Yes
No
Replace mother board A3A6
These voltages are direct connections to +5 CPU and −12 I/O. Reseat jumper board and check output cable connections. If still no voltage, replace mother board.
+5M, and −12M OK ?
No
Yes
+12M OK ?
No
Yes
Adjust R12 on jumper board. If not within specification replace jumper board
Replace mother board A3A6
Fuse F2 blown
Yes
Replace fuse F2
No
Fuse F2 installed ?
Yes
No
Install fuse F2 if +30V desired
+30V OK ?
No
Yes



Troubleshooting Flowchart

MEMORIES/ACCESSORIES

MEMORIES

ACCESSORIES

DIAGNOSTICS

CURRENT DRAIN

MEMORY PRODUCT	Direct Current at				
	+5V	+5V(M)	+12V	−12V	−2V
2102B	1.2A	−0.5A	0A	0A	−0.1A
2102C	3.3A	−0.68A	0A	0A	0A
2102E	2.6A	−0.64A	0A	0A	0A
2102H	3.3A	−0.69A	0A	0A	0A
12666H 1Mb x	0.5A	0.91A	0A	0A	0A
12666H 1Mb xx	0.5A	0.76A	0A	0A	0A
12699H 256kb x	0.5A	1.07A	0A	0A	0A
12699H 256kb xx	0.5A	0.53A	0A	0A	0A
12741A 16kb	0.849A	0.48A	0.697A	0.02A	—
12746A/H 64kb	0.5A	0.57A	0A	0A	0A
12747A/H 128kb	0.5A	0.57A	0A	0A	0A
12749H 512kb x	0.5A	1.19A	0A	0A	0A
12749H 512kb xx	0.5A	0.65A	0A	0A	0A
12779A/H 256kb	0.3A	0.78A	0A	0A	0A
12780A/H 512kb	0.3A	0.78A	0A	0A	0A
12994A 4kb	.51A	.38A	.57A	.02A	—
12998A 8kb	.51A	.38A	.61A	.02A	—
13187A 16kb	.59A	.26A	.76A	.02A	—

x Operating
xx Standby

BINARY	MANUAL	TITLE
*24395-16001	24395-90001	Semiconductor Memory (21MX)
*24395-16001	24395-90003	Microcoded Memory Diagnostic (21MX)
**12892-16001	12892-90005	Mem Prot/Parity Error (2100/21MX)

*Requires UCS card for operation.
**See ACCESSORIES section under 12892B for operating procedure.

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC

1. Load Diagnostic Configurator.
2. Run PRETEST: set P-Reg = 2; S-Reg (5-0) = SC of device to execute basic I/O test; PRESET, RUN, HALT 102077.
3. Configure the Diagnostic Configurator.
4. Load the diagnostic, use DSN #102104 for 24395-16001, or DSN #102006 for 24395-16002
5. If Memory Protect is present, set Parity Error/Memory Protect switch A1S1 to INT/IGNORE; otherwise set switch A1S1 to HALT.
6. Set P = 100 (octal).
7. Set S-Reg = Configuration Switch options (Bit 2 cleared); PRESET, RUN.

NOTE

If locations 1000_8 to 7777_8 have memory failures the diagnostic may produce unpredictable results. To identify errors in this area set S-Reg bit 2 in step 7. After the Program Area Check has been executed, the entire diagnostic must be reloaded in order to return the diagnostics and vice versa.

8. To restart, set S-Reg = Configuration Switch options; P-Reg = 2000_8; PRESET, RUN. (For the 24395-60001, the program may not be restarted if the initialization section, TST07, or TST10 have been aborted.)

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Cont'd)

S-Register Switch Options — 24395-16001

S-REG BIT	MEANING IF SET
0	Abort execution at end of current test and halt 102064 to enter new test limits (must be less than 32K of memory). A-Reg = Lower limit; B-Reg = Upper limit.
1	Reserved.
2	Run Program Area Check.
3, 4	Reserved.
5	Store nonfatal errors occurring above address 17777 in the Error Table instead of halting.
6, 7	Reserved.
8	Suppress operator intervention.
9	Abort diagnostic execution at end of current test section and halt 102075. User may specify a new group of tests in the A-register. Press RUN.
	A-REG BIT / **IF SET WILL EXECUTE**
	0 — TST00 — Ones and Zeros Test. 1 — TST01 — Address Parity Test. 2 — TST02 — Marching Ones and Zeros Test. 3 — TST03 — Checkerboard Test. 4 — TST04 — Rows and Columns Test. 5 — TST05 — Disturbance Test. 6 — TST06 — Diagonal Test. 7 — TST07 — Relocating Test. 8 — TST10 — Module 0 Test. 9 — *TST11 — Galloping Read Recovery Test. 10 — *TST12 — Lonely Bit Test. 11 — *TST13 — Extended Instruction Group Test. 12 — *TST14 — Memory Protect Test. 13 — *TST15 — Intervention Refresh Test. 14 — *TST16 — Dynamic Mapping System Test. 15 — Reserved.
10, 11	Reserved.
12	Loop on all selected tests. Tests requiring operator intervention are skipped.
13	Loop on current test section.
14	Suppress error halts.
15	Halt 102076 at the end of each test section; A-Reg = test number (octal).

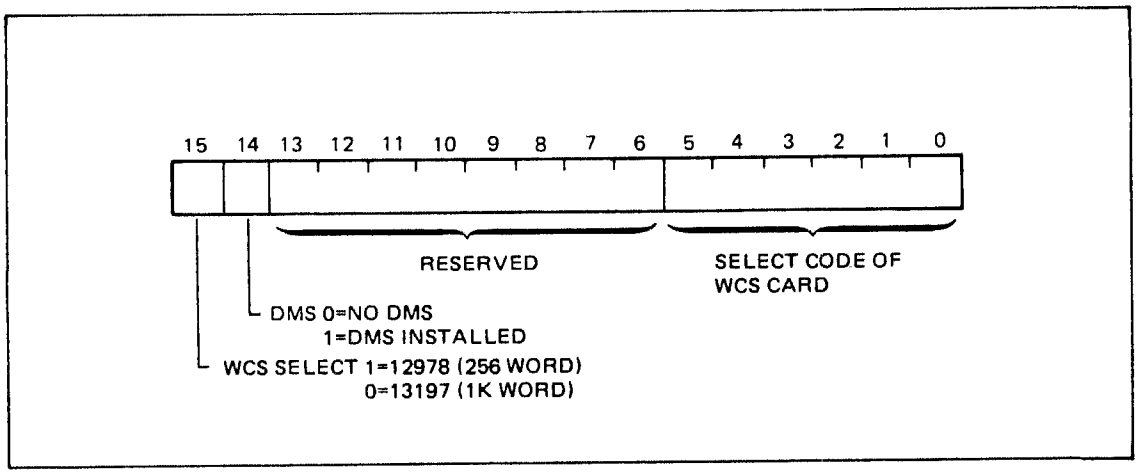
*TST 11 through TST16 are optional tests and must be selected via test selection. The default set or clearing the A-register will result in Execution of TST00 through 10. If bit 14 is set, all other selected tests will be performed on base memory, then all selected tests will be executed as subtests of TST16 in expanded memory. If only bit 14 is set, the default tests TST00 through TST10 will be performed on base memory, then on expanded memory. Anytime TST16 is executed, the maximum page number will be displayed in the switch-register as soon as execution is initiated.

DIAGNOSTICS (Continued)

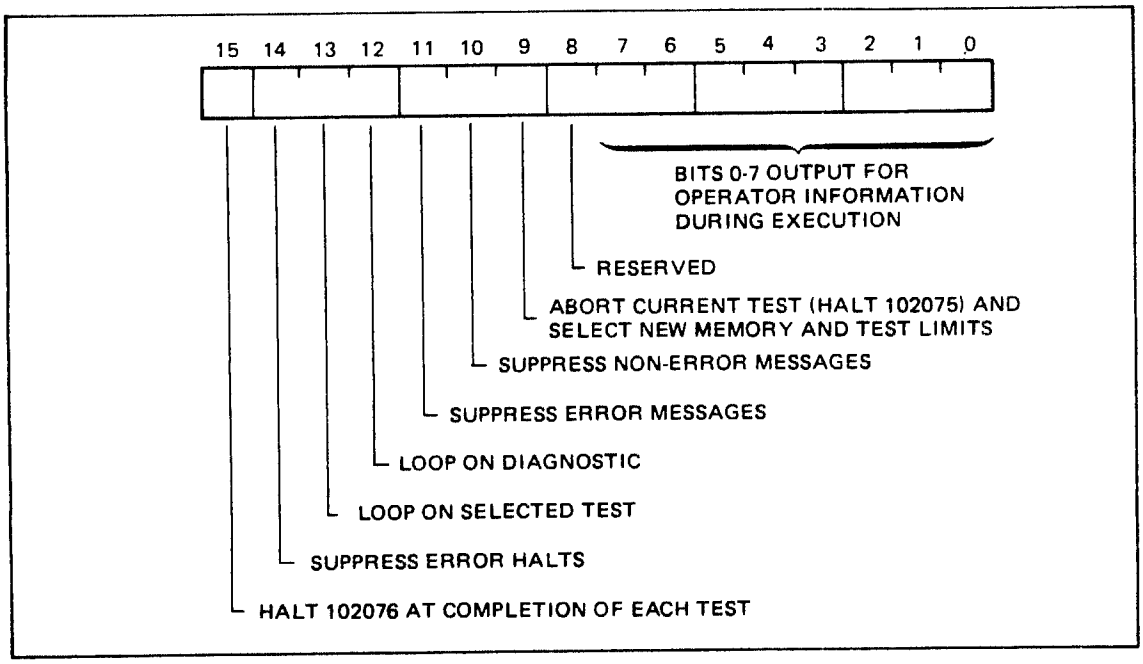
SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Cont'd)

S-Register Switch Option — 24395-16002

Configuration



Program



DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Continued)

Error and Information Halts — 24395-16001

HALT CODE (OCTAL)	TEST SECTION	MEANING
102000	TST00	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102001	TST01	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102002	TST02	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102003	TST03	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102004	TST04	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102005	TST05	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102006	TST06	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102007	TST07	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102011	TST11	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102012	TST12	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102013	TST13	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102014	TST14	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102015	TST15	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.
102016	TST16	Data error. A-register contains the data written and the B-register contains the data read. Press RUN for failing address.

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Continued)

Error and Information Halts — 24395-16001 (Cont'd)

HALT CODE (OCTAL)	TEST SECTION	MEANING
102027	ANY	Secondary error halt. A-register contains the failing address (page address if in expanded memory). B-register contains all ones if error is in base memory, or the page number if in expanded memory. Press RUN to continue.
102030	TEST CONTROL	Memory upper limit entered in B-register after halt 102065 is still greater than calculated memory size. Re-enter limit in B-register or leave current value to run tests on memory above calculated size. Press RUN.
102034	ANY	Parity error occurred above address 7777 and the program was not verifying data previously written. A-register contains the failing address (Page address if in expanded memory). B-register contains all ones if address is in base memory or page number if in expanded memory. If in TST07, the test section is aborted. Press RUN to continue.
102035	TST07, TST11, or TST12	Test selected cannot be executed due to test limits not being located on 4K main memory boundaries. Press RUN to go back to enter new test limits.
102036	TEST CONTROL	No expanded memory could be found. Press RUN to return to operator selection.
102060	TST15	Halt to allow memory to refresh itself. Press RUN to continue. Do not press PRESET. Occurs three times consecutively. In TST16, however, this halt may occur any number of times depending on memory size.
102061	ANY	Test selected cannot be run because there is only 4K of memory present.
102062	TST14	Test selected cannot be run because memory protect is not present.
102063	INITIALIZATION or TST07	Data error at destination of a move occurred. A-register contains data written and B-register contains data read. Press RUN to get failing address.
102064	TEST CONTROL	Halt to enter new test limits (less than 32K memory only). Put lower limit in A-register and upper limit in B-register, press RUN.
102065	TEST CONTROL	Memory upper limit entered in B-register greater than calculated memory. Re-enter limit in B-register or leave current value to check above calculated memory. Press RUN.

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Continued)

Error and Information Halts — 24395-16001 (Cont'd)

HALT CODE (OCTAL)	TEST SECTION	MEANING
102066	TEST CONTROL	Memory lower limit entered in A-register is larger than or equal to upper limit in B-register. Correct values and press RUN.
102067	TEST CONTROL	Memory lower limit entered in A-register is below 10000_8. Re-enter limit in A-register and press RUN.
102075	TEST CONTROL	Test selection request resulting from Switch-register bit 9 being set. Enter the desired group of tests to be run into the A-register, and press RUN. See table 3-1.
102076	TEST CONTROL	End-of-test halt resulting from Switch-register bit 15 being set. A-register contains the test number. Press RUN to continue.
102077	TEST CONTROL	Diagnostic pass complete. A-register contains the pass count. To do another pass, press RUN.
106001	ANY	Irrecoverable parity error in module 0. A-and B-register contain the address of the parity error.
106002	ANY	Erroneous memory protect error. Fix problem before restarting.
106004	INITIALIZATION, PROGRAM AREA CHECK, or TST10	Data error in memory module 0 precludes further testing. A-register contains the data written and the B-register contains the data read. Press RUN to obtain the failing address.
106005	INITIALIZATION, PROGRAM AREA CHECK, or TST10	Secondary error halt. A- and B-register both contain the failing address. Irrecoverable.
106010	INITIALIZATION	Memory determination routine wrote all ones and read something other than ones or zeros back. Fix problem and reload or set desired last word of memory address in the B-register and press RUN.
106011	INITIALIZATION	Memory determination routine could not find any memory. Fix problem before proceeding.
106012	ANY	Program destroyed. If available, see listing.
106013	INITIALIZATION	The Switch-register failed. A-register contains the data output to the Switch-register and the B-register contains the data loaded from the Switch-register. Irrecoverable.
106014	INITIALIZATION	Memory protect failed. Run memory protect diagnostic to analyze failure. Irrecoverable.

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Continued)

Error and Information Halts — 24395-16001 (Cont'd)

HALT CODE (OCTAL)	TEST SECTION	MEANING
106015	ANY	An interrupt to location 5 occurred without memory protect. Fix problem before proceeding.
106016	INITIALIZATION, PROGRAM AREA CHECK or TST10	Parity error in memory module 0 occurred during testing of module 0. A-register contains the data written and the B-register contains the data read. Press RUN to get the failing address.
106067	PROGRAM AREA CHECK	Program check complete. To run another pass, press RUN.
106075	ANY	Halt placed in unused memory to trap unwanted transfer of control to the location in the M-register. Fix problem before proceeding.
106077	ANY	Trap cell halt stored in locations 2 through 77_8. User must determine cause of erroneous interrupt or transfer of control to location in the M-register before proceeding.
107002	TST16	The page determination routine wrote all ones in a page and read back something other than all ones or all zeros. Fix problem and reload, or set desired maximum page number in the B-register and press RUN.

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Continued)

Error and Information Halts — 24395-16002

Halt Code	Test Section	Meaning or Routine where a failure occurred
102000	FRONT PANEL	Only occurs when 4K of memory is installed. This halt precedes the entry of the Front Panel microcoded routine, resulting in destruction of the diagnostic program. Press RUN to continue.
102001	FRONT PANEL	Data error (WRT.READ). Refer to paragraph 3-4.
102002	FRONT PANEL	Data error (READ). Refer to paragraph 3-4.
102003	FRONT PANEL	Data error (GAL.READ) if X-register bit 15 is set. Otherwise, operator has interrupted microcode by setting bit 9 of the S-register.
102004	FRONT PANEL	Data error (WRT.READ). Refer to paragraph 3-4.
102005	FRONT PANEL	REFRESH routine was interrupted.
102006	FRONT PANEL	Data error (READ). Refer to paragraph 3-4.
102007	——	Reserved.
102010	TST00	Data error *. Address and Pattern test Failed.
102011	TST01 through TST04	Data error* (WRT.READ)
102012	TST01 through TST04	Data error.* (READ)
102013	TST01 through TST02	Data error.* (GAL.READ)
102014	TST01 through TST04	Data error.* (WRT.READ)
102015	TST01 through TST04	REFRESH routine was interrupted.
102016	TST01 through TST04	Data error.* (READ)

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Continued)

Error and Information Halts — 24395-16002 (Cont'd)

Halt Code	Test Section	Meaning or Routine where a failure occurred
102017	——	Reserved.
102020	TST05	Data error.* Address and Pattern Test failed in Module 0.
102021	TST05	Data error* in Module 0 (WRT.READ).
102022	TST05	Data error* in Module 0 (READ).
102023	TST05	Data error* in Module 0 (GAL.READ).
102024	TST05	Data error* in Module 0 (WRT.READ).
102025	TST05	REFRESH routine was interrupted
102026	TST05	Data error* in Module 0 (READ).
102027 to 102063	——	Reserved.
102064	TST05	Parity Error interrupt during the Module 0 Test.
102065	TST00 through TST04	Parity Error* interrupt caused by the parity chip (bit 16).
102066	All	Parity Error interrupt occurred and the address of the parity error was not the test address (the A-Register contains the address)
102067	All	Memory Protect interrupt.
102070	INITIAL-IZATION	HP 12978A 256 word WCS cannot be used on a 21MX E-Series computer.
102071	INITIAL-IZATION	WCS did not load correctly (check WCS board) or wrong WCS select code may have been used. Set the P-register to 100 and reenter WCS select code.
102072	INITIAL-IZATION	Computer type specified is not a 21MX. Irrecoverable.
102073	INITIAL-IZATION	Select code specified in the S-register is less than 10 (octal). Correct S-register and press RUN.
102074	INITIAL-IZATION	Configuration complete. Set the S-register according to table 3-2 and press RUN.
102075	CONTROL	Operator has aborted current test and requested test and memory module selection by setting S-register bit 9. Refer to paragraph 3-2.

DIAGNOSTICS (Continued)

SEMICONDUCTOR/MICROCODED MEMORY DIAGNOSTIC (Continued)

Error and Information Halts — 24395-16002 (Cont'd)

Halt Code	Test Section	Meaning or Routine where a failure occurred
102076	CONTROL	Operator has requested to halt after each test by setting S-register bit 15. The A-register contains the number of the test last executed. Press RUN to continue.
102077	CONTROL	Successful termination. The A-register contains the number of passes completed. Press RUN to execute another pass.
103003	FRONT PANEL	Operator has requested to abort current test by setting bit 9 of the S-register. See paragraph 3-4.
106010	TST00	Soft Error*. Address and Pattern test failed. Refer to paragraph 3-3.
106011	TST01 through TST04	Soft Error* (WRT.READ). Refer to paragraph 3-3.
106012	TST01 through TST04	Soft Error* (READ). Refer to paragraph 3-3.
106013	TST01 through TST04	Soft Error* (GAL.READ). Refer to paragraph 3-3.
106014	TST01 through TST04	Soft Error* (WRT.READ). Refer to paragraph 3-3.
106016	TST01 through TST04	Soft Error*. (READ)
106065	TST00 through TST05	Soft Error*. Parity Error Interrupt caused by the parity chip.

MEMORY SELF TEST ON E/F-SERIES COMPUTERS

NOTE: SELF TEST SHOULD BE RUN WITH THE STOP OR CORRECT JUMPER REMOVED ON THE 2102C OR 2102H

a) set P-reg. to 000000 octal

b) set A-reg. to 100000 octal

c) press PRESET

d) to loop set LOCK/OPERATE switch to LOCK

e) press INSTUCTION STEP: As the test executes the display reg. will display the count of each 32K word segment of memory tested.

ANALYSIS OF SELF TEST USING HIGH PERFORMANCE FAULT CONTROL OR STANDARD PERFORMANCE FAULT CONTROL WITH 2102C CONTROLLER DATE CODE 1820 OR LATER

DISPLAY INDICATOR LAMPS	DISPLAY REGISTER LAMPS	PARITY LAMP	OVERFLOW LAMP	32K SEGMENT COUNT (DISPLAY REGISTER)	SINGLE BIT ERROR CORRECTION LED	FAULT LATCH LED'S	INDICATION
T-Register Lamp ON all others OFF	100000 (octal)	OFF	ON	Smooth and Consecutive	Remains ON	Remain ON 77 (octal)	Self test passes, memory system OK
T-Register Lamp ON all others OFF	100000 (octal)	ON	ON	Smooth and Consecutive	Goes OFF	Flashing ON and OFF during execution	Misconfigured or faulty check bit array module or bit 16 error on MEM MOD or faulty controller
T-Register Lamp ON all others OFF	100000 (octal)	Flashes ON but does not latch	ON	Smooth and Consecutive	Goes OFF	Latches on octal #'s does not flash	Bad check bit or parity bit on memory module
T-Register Lamp ON all others OFF	100000 (octal)	OFF	ON	Not Consecutive			Misconfigured or faulty memory module
ALL Lamps ON	177777 (octal)	ON	OFF		Goes OFF	Latches on octal #'s does not flash	Data bit failure(s)
ALL Lamps ON	177777 (octal)		ON				CPU failure

MEMORY SELF TEST ON E/F-SERIES COMPUTERS (Cont'd)

ANALYSIS OF SELF TEST USING STANDARD PERFORMANCE FAULT CONTROL WITH 2102C CONTROLLER DATE CODE LESS THAN 1820

DISPLAY INDICATOR LAMPS	DISPLAY REGISTER LAMPS	PARITY LAMP	OVERFLOW LAMP	32K SEGMENT COUNT (DISPLAY REGISTER)	FAULT LATCH LED'S	INDICATION
T-Register Lamp ON all others OFF	100000 (octal)	OFF	ON	Smooth and Consecutive		Self test passes, memory system OK
T-Register Lamp ON all others OFF	100000 (octal)	ON	ON	Smooth and Consecutive		Misconfigured or faulty check bit array module or bit 16 error on MEM MOD or faulty controller
T-Register Lamp ON all others OFF	100000 (octal)	OFF	ON	Not Consecutive		Misconfigured or faulty memory module
ALL Lamps ON	177777 (octal)	ON	OFF		Latches on octal #'s does not flash	Data bit failure(s)
ALL Lamps ON	177777 (octal)		ON			CPU failure

ANALYSIS OF SELF TEST USING HIGH PERFORMANCE OR STANDARD PERFORMANCE MEMORY 2102B OR 2102E CONTROLLERS

DISPLAY REGISTERS INDICATORS	DISPLAY REGISTER	PARITY INDICATOR	OVERFLOW INDICATOR	32K SEGMENT COUNT	INDICATION
T-Register indicator lit, all others OFF	100000 (octal)	OFF	ON	Smooth and consecutive	Memory System O.K. Return system to normal operating condition
T-Register indicator lit, all others OFF	100000 (octal)	ON	ON	Smooth and consective	Parity bit error (Bit 16)
All indicators ON	177777 (octal)		OFF		Data bit(s) error
All indicators ON	177777 (octal)		ON		CPU failure
T-Register indicator lit, all others OFF	100000 (octal)			Not consecutive	Misconfigured or faulty module

NOTE. Any other condition, run the software diagnostics.

2102B SEMICONDUCTOR MEMORY CONTROLLER

EQUIPMENT

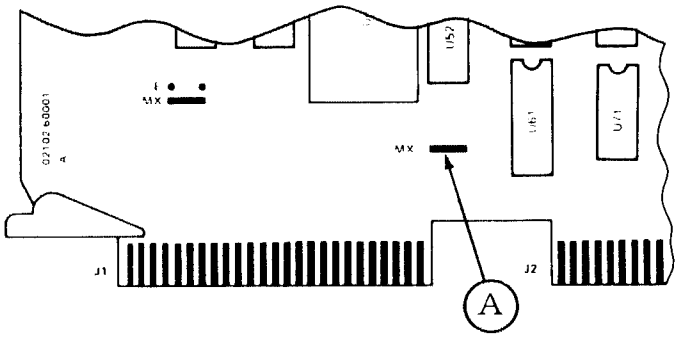
02102-60001	Memory controller PCA
02112-60016	Memory cable assembly
5955-4310	Standard Performance Memory System Install. and Service Manual

INSTALLATION NOTES

IN-1 It is recommended that the 2102B Memory Controller be installed in slot 118 (2108/2109) and slot 123 (2112/2113).

2102B Memory Controller Jumper Configurator

Revision "A" Board



Install jumpers in indicated positions

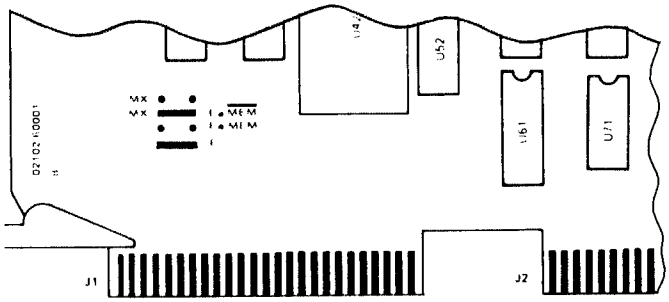
MX = 21MX M-Series Computer

E = 21MX E-Series Computer

(A) For 21MX E-Series Computer with Memory Expansion Module (MEM) not installed, also install "MX" jumper near U61.

Board as shown configured for a 21MX M-Series Computer.

Revision "B" or "C" Board



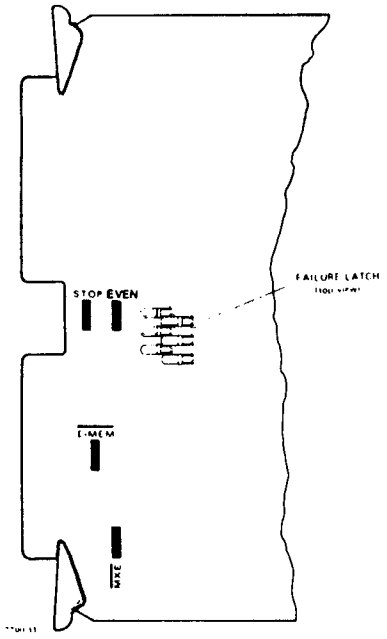
Install jumpers in indicated positions
(There will always be 2 jumpers installed)

MX = 21MX M-Series Computer
E • MEM = 21MX E-Series Computer, Memory Expansion Module (MEM) installed
E • $\overline{\text{MEM}}$ = 21MX E-Series Computer, Memory Expansion Module (MEM) Not Installed
E = 21MX E-Series Computer

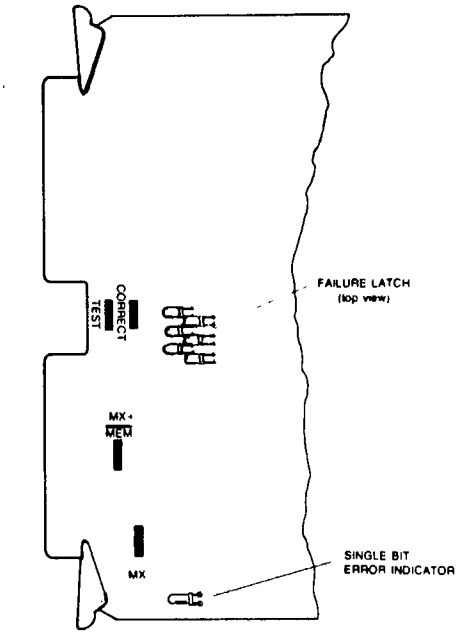
Board as shown configured for a 21MX E-Series Computer, MEM not installed.

2102C STANDARD PERFORMANCE FAULT CONTROL MEMORY CONTROLLER

Manual: 5955-4310 Standard Performance Memory Systems Install. and Service Manual



02102-60003 DATE CODE 1721



02102-60003 DATE CODE 1820 OR LATER

Configure jumpers as described in the following table:

COMPUTER	JUMPER	
	$\overline{MXE}$	$\overline{E \cdot MEM}$
HP 1000 M-Series	IN	IN
HP 1000 E-Series, Memory Expansion Module (MEM) not installed	OUT	IN
HP 1000 E-Series, Memory Expansion Module (MEM) installed	OUT	OUT

To disable Fault Control, remove jumper labeled "STOP".

EVEN jumper normally removed, Used for Memory Protect/Parity Error Diagnostic.

Configure jumpers as described in the following table:

COMPUTER	JUMPER	
	MX	$MX+\overline{MEM}$
HP 1000 M-Series	IN	IN
HP 1000 E-Series, Memory Expansion Module (MEM) not installed	OUT	IN
HP 1000 E-Series, Memory Expansion Module (MEM) installed	OUT	OUT

To disable Fault Control, remove jumper labeled "CORRECT". TEST jumper normally removed. Used for Memory Protect/Parity Error Diagnostic.

2102C FAULT LATCH INDICATIONS (With STOP Jumper)

YELLOW DIGIT	RED DIGIT	ERROR DETECTED		YELLOW DIGIT	RED DIGIT	ERROR DETECTED
X	1	Double (or greater) error, X=don't care		2	4	Bit 10
X	3	Double (or greater) error, X=don't care		3	4	Bit 11
X	5	Double (or greater) error, X=don't care		4	4	Bit 12
				5	4	Triple (or greater) error
0	0	Bit 0		6	4	Triple (or greater) error
1	0	Triple (or greater) error		7	4	Bit 19
2	0	Triple (or greater) error		0	6	Bit 13
3	0	Bit 1		1	6	Bit 14
4	0	Triple (or greater) error		2	6	Triple (or greater) error
5	0	Bit 2		3	6	Bit 18
6	0	Bit 3		4	6	Bit 15
7	0	Bit 4		5	6	Bit 17
0	2	Triple (or greater) error		6	6	Bit 16
1	2	Bit 5		7	6	Bit 21
2	2	Bit 6		0	7	Double (or greater) error
3	2	Triple (or greater) error		1	7	Double (or greater) error
4	2	Bit 7		2	7	Double (or greater) error
5	2	Triple or greater) error		3	7	Double (or greater) error
6	2	Bit 8		4	7	Double (or greater) error
7	2	Bit 20		5	7	Double (or greater) error
0	4	Triple (or greater) error		6	7	Double (or greater) error
1	4	Bit 9				

2102C FAULT LATCH INDICATIONS (With CORRECT Jumper)

YELLOW DIGIT	RED DIGIT	ERROR DETECTED		YELLOW DIGIT	RED DIGIT	ERROR DETECTED
X	1	Double (or greater) error, X=don't care		2	4	Bit 10
X	3	Double (or greater) error, X=don't care		3	4	Bit 11
X	5	Double (or greater) error, X=don't care		4	4	Bit 12
				5	4	Triple (or greater) error
0	0	Bit 0		6	4	Triple (or greater) error
1	0	Triple (or greater) error		7	4	Bit 19
2	0	Triple (or greater) error		0	6	Bit 13
3	0	Bit 1		1	6	Bit 14
4	0	Triple (or greater) error		2	6	Triple (or greater) error
5	0	Bit 2		3	6	Bit 18
6	0	Bit 3		4	6	Bit 15
7	0	Bit 4		5	6	Bit 17
0	2	Triple (or greater) error		6	6	Bit 16
1	2	Bit 5		7	6	Bit 21
2	2	Bit 6		0	7	Double (or greater) error
3	2	Triple (or greater) error		1	7	Double (or greater) error
4	2	Bit 7		2	7	Double (or greater) error
5	2	Triple or greater) error		3	7	Double (or greater) error
6	2	Bit 8		4	7	Double (or greater) error
7	2	Bit 20		5	7	Double (or greater) error
0	4	Triple (or greater) error		6	7	Double (or greater) error
1	4	Bit 9		7	7	Normal state and result of PRESET

Note: All LEDs "on" is the normal state.

2102E HIGH PERFORMANCE MEMORY CONTROLLER

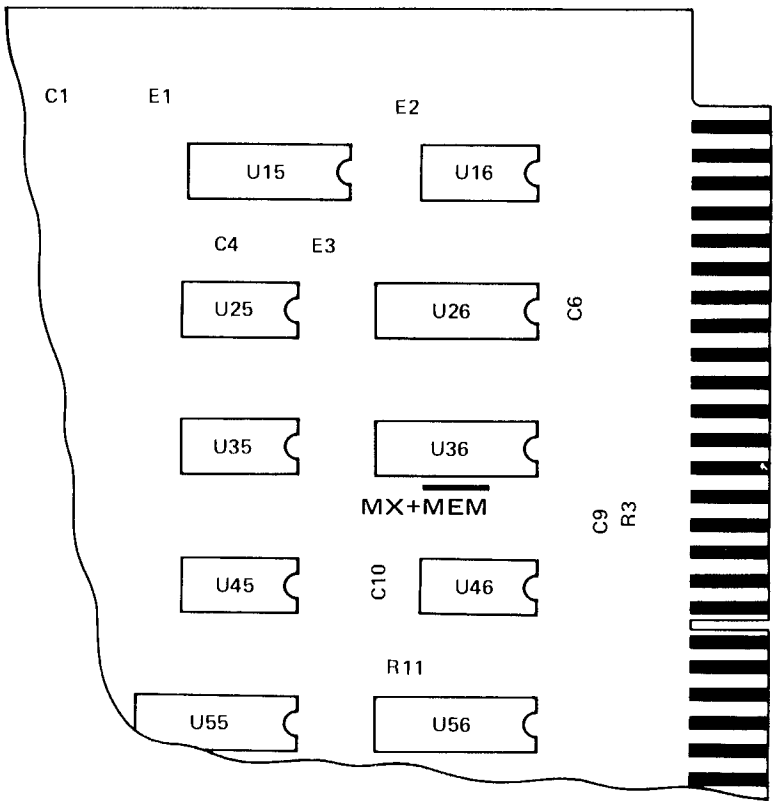
EQUIPMENT

02102-60002	Memory controller PCA
02112-60015	Memory cable assembly
5955-4311	High Performance Memory Systems Installation and Service Manual

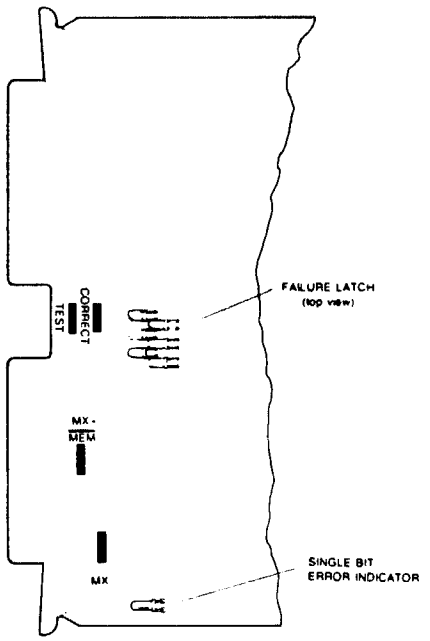
INSTALLATION NOTES

IN-1 If the Memory Expansion Module (MEM) is not installed in the E-Series computer, install jumper on controller PCA as shown in figure 51-1.

Figure 51-1. MEM Jumper Configuration



2102H HIGH PERFORMANCE FAULT CONTROL MEMORY CONTROLLER



Configure jumpers as described in the following table:

COMPUTER	JUMPER	
	MX	MX+$\overline{\text{MEM}}$
Memory Expansion Module (MEM) not installed	OUT	IN
Memory Expansion Module (MEM) installed	OUT	OUT

To disable Fault Control, remove jumper labeled "CORRECT" TEST jumper normally removed. Used for Memory Protect/ Parity Error Diagnostic.

Fault Latch Error Indications

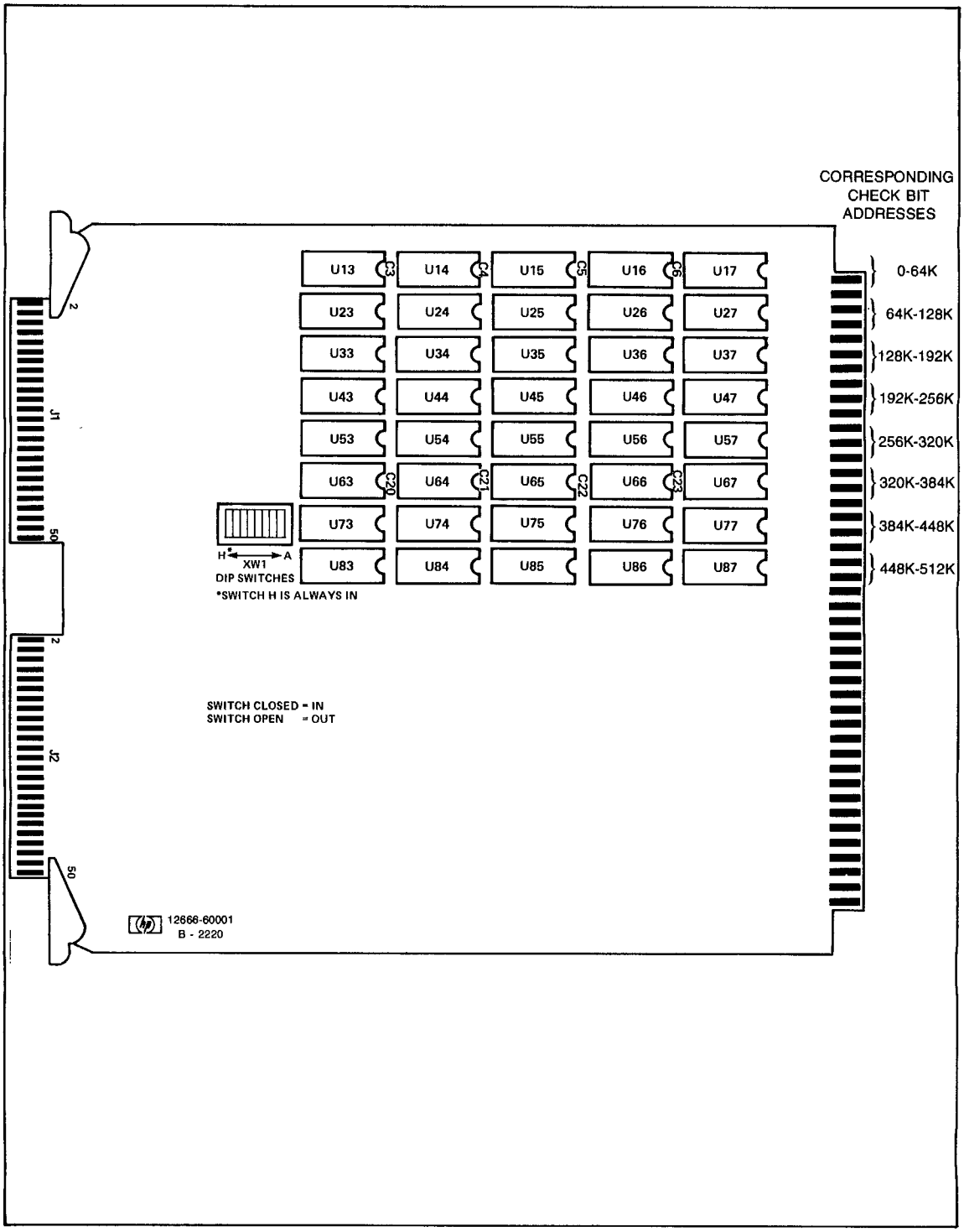
YELLOW DIGIT	RED DIGIT	ERROR DETECTED		YELLOW DIGIT	RED DIGIT	ERROR DETECTED
X	1	Double (or greater) error, X=don't care		2	4	Bit 10
X	3	Double (or greater) error, X=don't care		3	4	Bit 11
X	5	Double (or greater) error, X=don't care		4	4	Bit 12
				5	4	Triple (or greater) error
0	0	Bit 0		6	4	Triple (or greater) error
1	0	Triple (or greater) error		7	4	Bit 19
2	0	Triple (or greater) error		0	6	Bit 13
3	0	Bit 1		1	6	Bit 14
4	0	Triple (or greater) error		2	6	Triple (or greater) error
5	0	Bit 2		3	6	Bit 18
6	0	Bit 3		4	6	Bit 15
7	0	Bit 4		5	6	Bit 17
0	2	Triple (or greater) error		6	6	Bit 16
1	2	Bit 5		7	6	Bit 21
2	2	Bit 6		0	7	Double (or greater) error
3	2	Triple (or greater) error		1	7	Double (or greater) error
4	2	Bit 7		2	7	Double (or greater) error
5	2	Triple or greater) error		3	7	Double (or greater) error
6	2	Bit 8		4	7	Double (or greater) error
7	2	Bit 20		5	7	Double (or greater) error
0	4	Triple (or greater) error		6	7	Double (or greater) error
1	4	Bit 9		7	7	Normal state and result of PRESET

NOTE: Due to a CPU timing problem, the E and F-Series Fault Control Memory Controller may incorrectly indicate an error at power up. To verify correct operation of the Fault Control Memory Controller, the following CPU power on self test must be executed from the front panel.

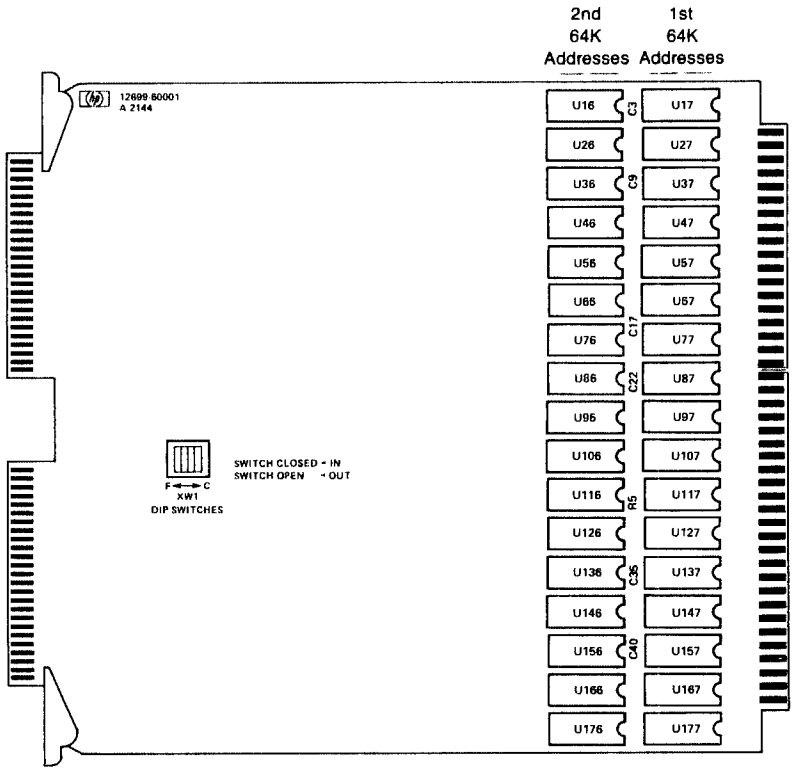
1. Set P=0
2. Set A=100000 (octal)
3. Press PRESET
4. Press INSTR/STEP

After the test is completed, all six LED's on the Fault Control Memory Controller should be on (normal condition).

12666H 512K-WORD HIGH-PERFORMANCE CHECK BIT ARRAY



12699H 128K-WORD HIGH-PERFORMANCE MEMORY MODULE

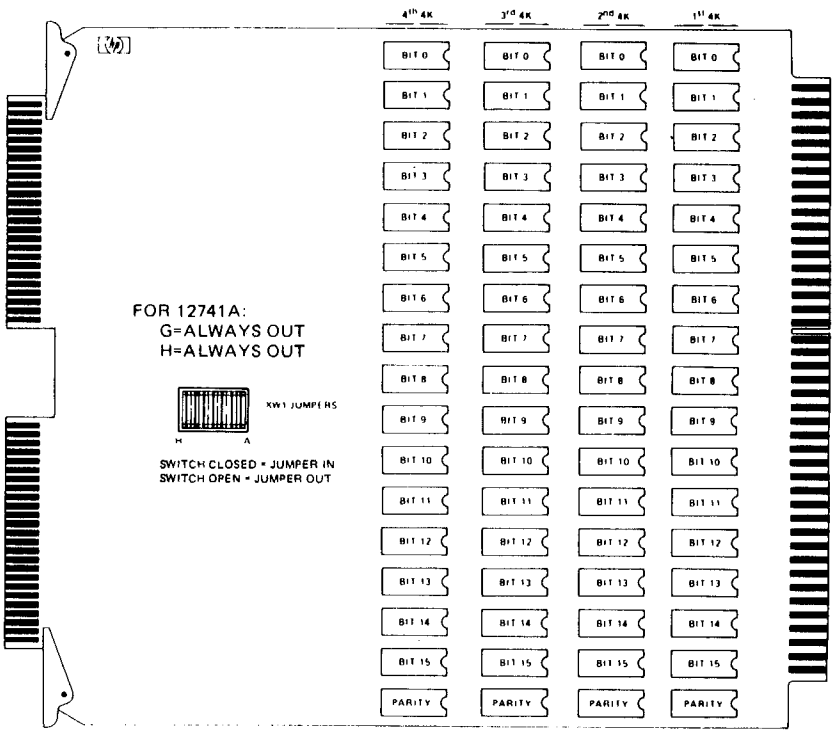


MEMORY ADDRESS ASSIGNMENT (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES			
	F	E	D	C
0-128K	IN	IN	IN	OUT
128K-256K	IN	IN	OUT	OUT
256K-384K	IN	OUT	IN	OUT
384K-512K	IN	OUT	OUT	OUT
512K-640K	OUT	IN	IN	OUT
640K-768K	OUT	IN	OUT	OUT
768K-896K	OUT	OUT	IN	OUT
896K-1024K	OUT	OUT	OUT	OUT

12741A 16K-WORD HIGH-PERFORMANCE MEMORY MODULE

5955-4311 High Performance Memory System
Installation and Service Manual

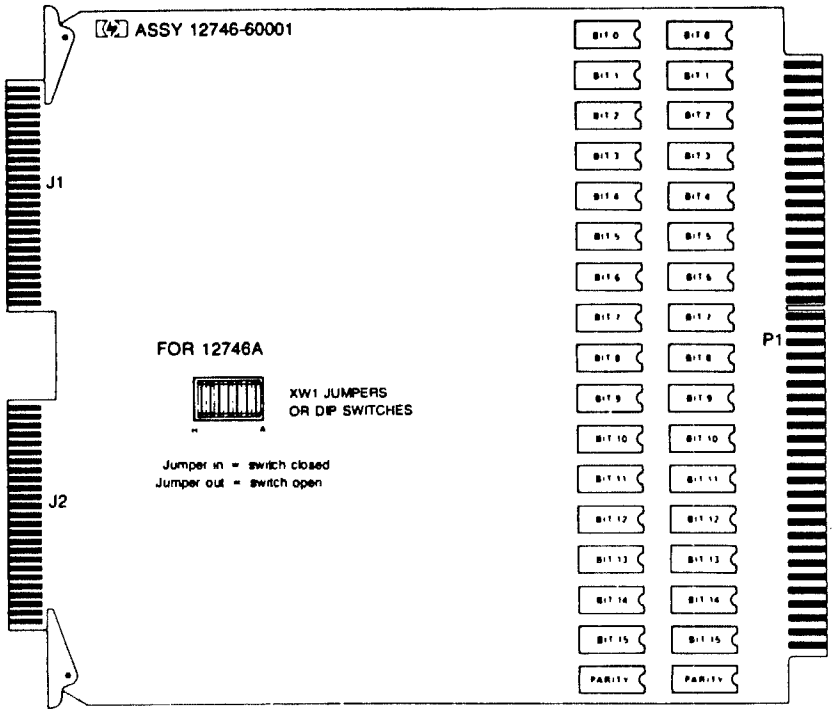
12741A MEMORY MODULE JUMPER CONFIGURATION



16K MEMORY MODULE NO.	XW1 JUMPERS							
	H	G	F (2^5)	E (2^4)	D (2^3)	C (2^2)	B (2^1)	A (2^0)
0	ALWAYS OUT	ALWAYS OUT	IN	IN	IN	IN	IN	IN
1			IN	IN	IN	IN	IN	OUT
2			IN	IN	IN	IN	OUT	IN
3			IN	IN	IN	IN	OUT	OUT
4			IN	IN	IN	OUT	IN	IN
5			IN	IN	IN	OUT	IN	OUT
6			IN	IN	IN	OUT	OUT	IN
7			IN	IN	IN	OUT	OUT	OUT
8			IN	IN	OUT	IN	IN	IN
9			IN	IN	OUT	IN	IN	OUT
10			IN	IN	OUT	IN	OUT	IN
11			IN	IN	OUT	IN	OUT	OUT
12			IN	IN	OUT	OUT	IN	IN
13			IN	IN	OUT	OUT	IN	OUT
14			IN	IN	OUT	OUT	OUT	IN
15			IN	IN	OUT	OUT	OUT	OUT
16			IN	OUT	IN	IN	IN	IN

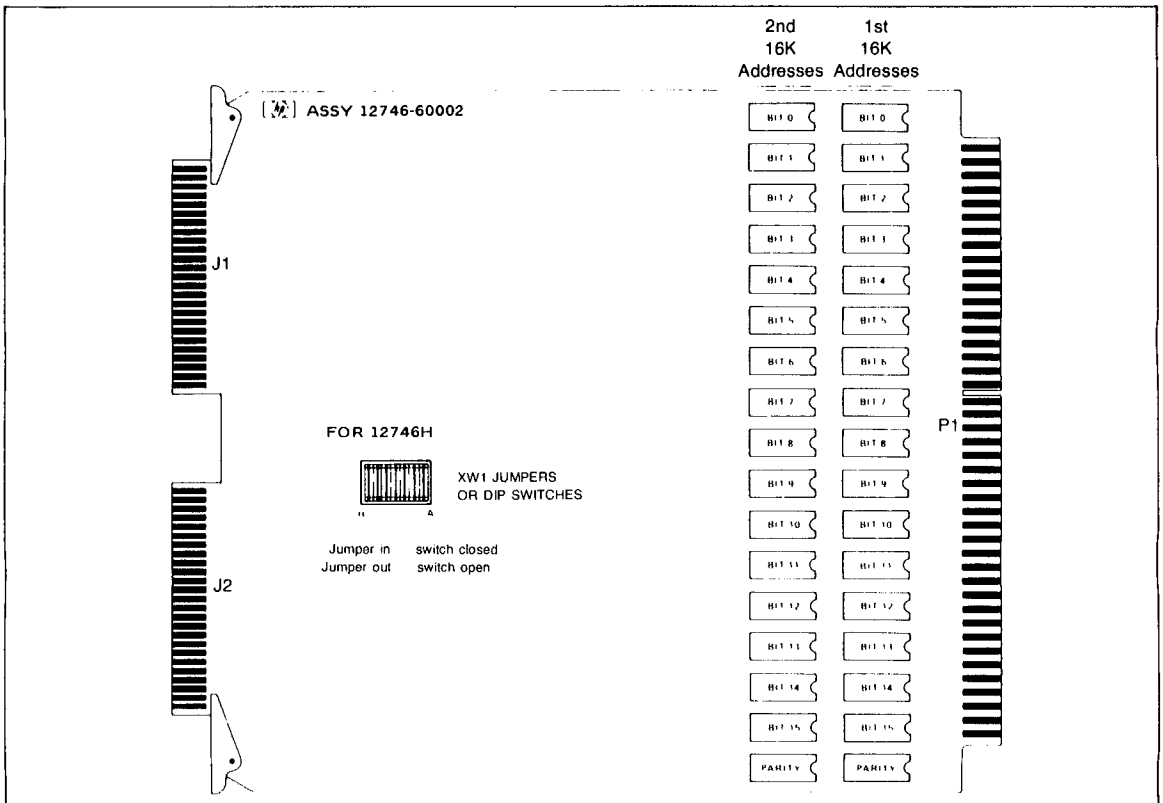
2102-2A

12746A 32K WORD STANDARD PERFORMANCE MEMORY MODULE



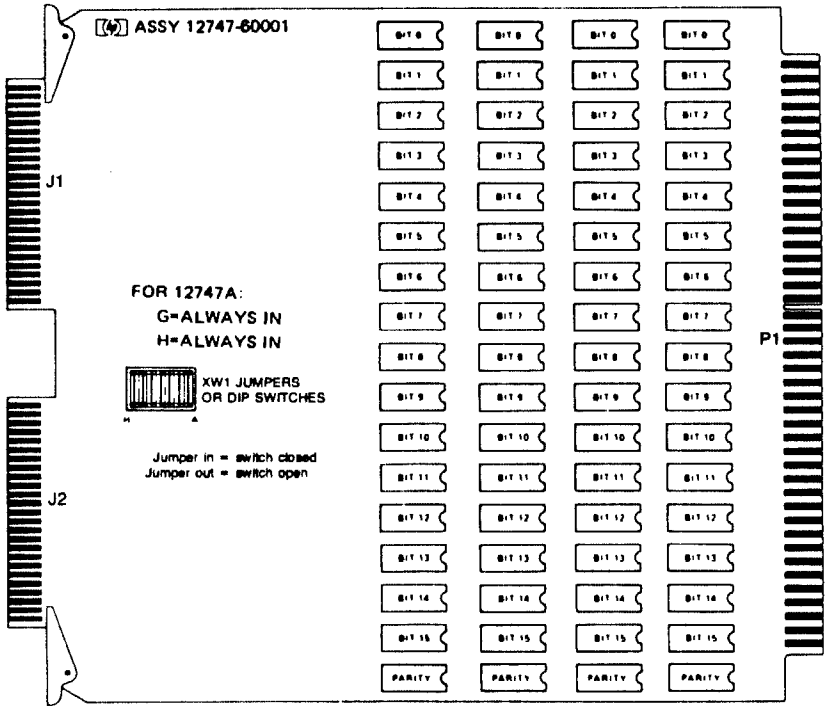
MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-32K	ALWAYS IN	ALWAYS IN	IN	IN	IN	IN	IN	ALWAYS OUT
32K-64K			IN	IN	IN	IN	OUT	
64K-96K			IN	IN	IN	OUT	IN	
96K-128K			IN	IN	IN	OUT	OUT	
128K-160K			IN	IN	OUT	IN	IN	
160K-192K			IN	IN	OUT	IN	OUT	
192K-224K			IN	IN	OUT	OUT	IN	
224K-256K			IN	IN	OUT	OUT	OUT	
256K-288K			IN	OUT	IN	IN	IN	
288K-320K			IN	OUT	IN	IN	OUT	
320K-352K			IN	OUT	IN	OUT	IN	
352K-384K			IN	OUT	IN	OUT	OUT	
384K-416K			IN	OUT	OUT	IN	IN	
416K-448K			IN	OUT	OUT	IN	OUT	
448K-480K			IN	OUT	OUT	OUT	IN	
480K-512K			IN	OUT	OUT	OUT	OUT	

12746H 32K WORD HIGH PERFORMANCE MEMORY MODULE



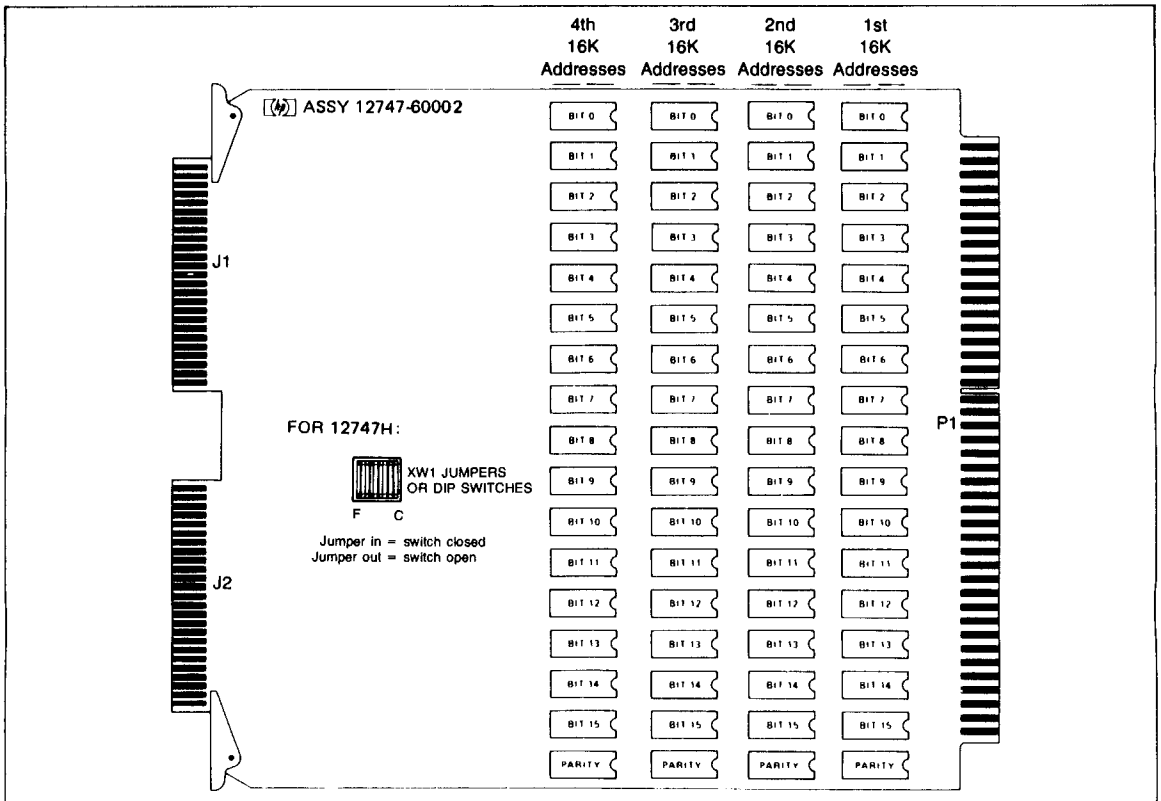
MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-32K	ALWAYS IN	ALWAYS OUT	IN	IN	IN	IN	IN	ALWAYS OUT
32K-64K			IN	IN	IN	IN	OUT	
64K-96K			IN	IN	IN	OUT	IN	
96K-128K			IN	IN	IN	OUT	OUT	
128K-160K			IN	IN	OUT	IN	IN	
160K-192K			IN	IN	OUT	IN	OUT	
192K-224K			IN	IN	OUT	OUT	IN	
224K-256K			IN	IN	OUT	OUT	OUT	
256K-288K			IN	OUT	IN	IN	IN	
288K-320K			IN	OUT	IN	IN	OUT	
320K-352K			IN	OUT	IN	OUT	IN	
352K-384K			IN	OUT	IN	OUT	OUT	
384K-416K			IN	OUT	OUT	IN	IN	
416K-448K			IN	OUT	OUT	IN	OUT	
448K-480K			IN	OUT	OUT	OUT	IN	
480K-512K			IN	OUT	OUT	OUT	OUT	

12747A 64K WORD STANDARD PERFORMANCE MEMORY MODULE



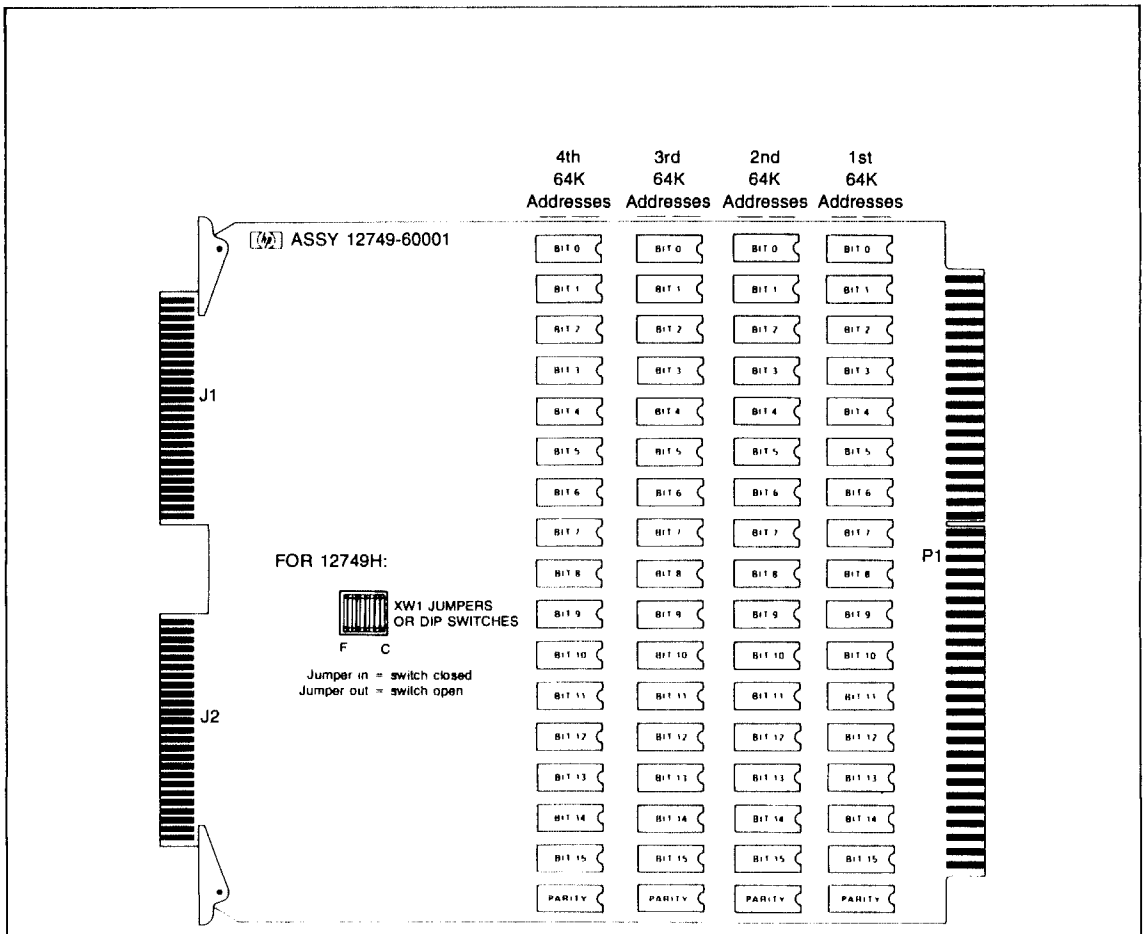
MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-64K	ALWAYS IN	ALWAYS IN	IN	IN	IN	IN	ALWAYS OUT	ALWAYS OUT
64K-128K			IN	IN	IN	OUT		
128K-192K			IN	IN	OUT	IN		
192K-256K			IN	IN	OUT	OUT		
256K-320K			IN	OUT	IN	IN		
320K-384K			IN	OUT	IN	OUT		
384K-448K			IN	OUT	OUT	IN		
448K-512K			IN	OUT	OUT	OUT		
512K-576K			OUT	IN	IN	IN		
576K-640K			OUT	IN	IN	OUT		
640K-704K			OUT	IN	OUT	IN		
704K-768K			OUT	IN	OUT	OUT		
768K-832K			OUT	OUT	IN	IN		
832K-896K			OUT	OUT	IN	OUT		
896K-960K			OUT	OUT	OUT	IN		
960K-1024K			OUT	OUT	OUT	OUT		

12747H 64K WORD HIGH PERFORMANCE MEMORY MODULE



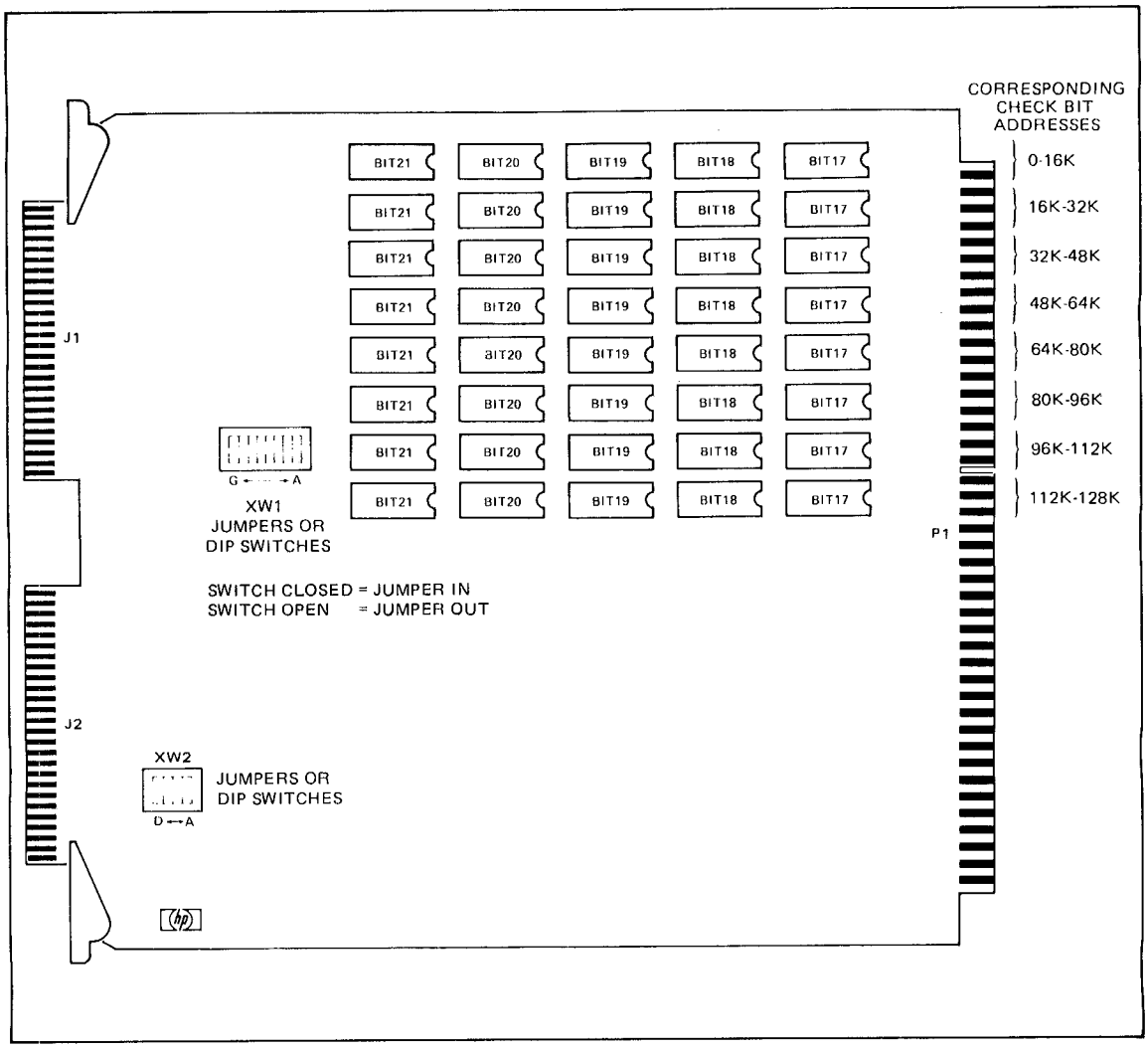
MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-64K	HARDWIRED IN	HARDWIRED OUT	IN	IN	IN	IN	HARDWIRED OUT	HARDWIRED OUT
64K-128K			IN	IN	IN	OUT		
128K-192K			IN	IN	OUT	IN		
192K-256K			IN	IN	OUT	OUT		
256K-320K			IN	OUT	IN	IN		
320K-384K			IN	OUT	IN	OUT		
384K-448K			IN	OUT	OUT	IN		
448K-512K			IN	OUT	OUT	OUT		
512K-576K			OUT	IN	IN	IN		
576K-640K			OUT	IN	IN	OUT		
640K-704K			OUT	IN	OUT	IN		
704K-768K			OUT	IN	OUT	OUT		
768K-832K			OUT	OUT	IN	IN		
832K-896K			OUT	OUT	IN	OUT		
896K-960K			OUT	OUT	OUT	IN		
960K-1024K			OUT	OUT	OUT	OUT		

12749H 256K WORD HIGH PERFORMANCE MEMORY MODULE

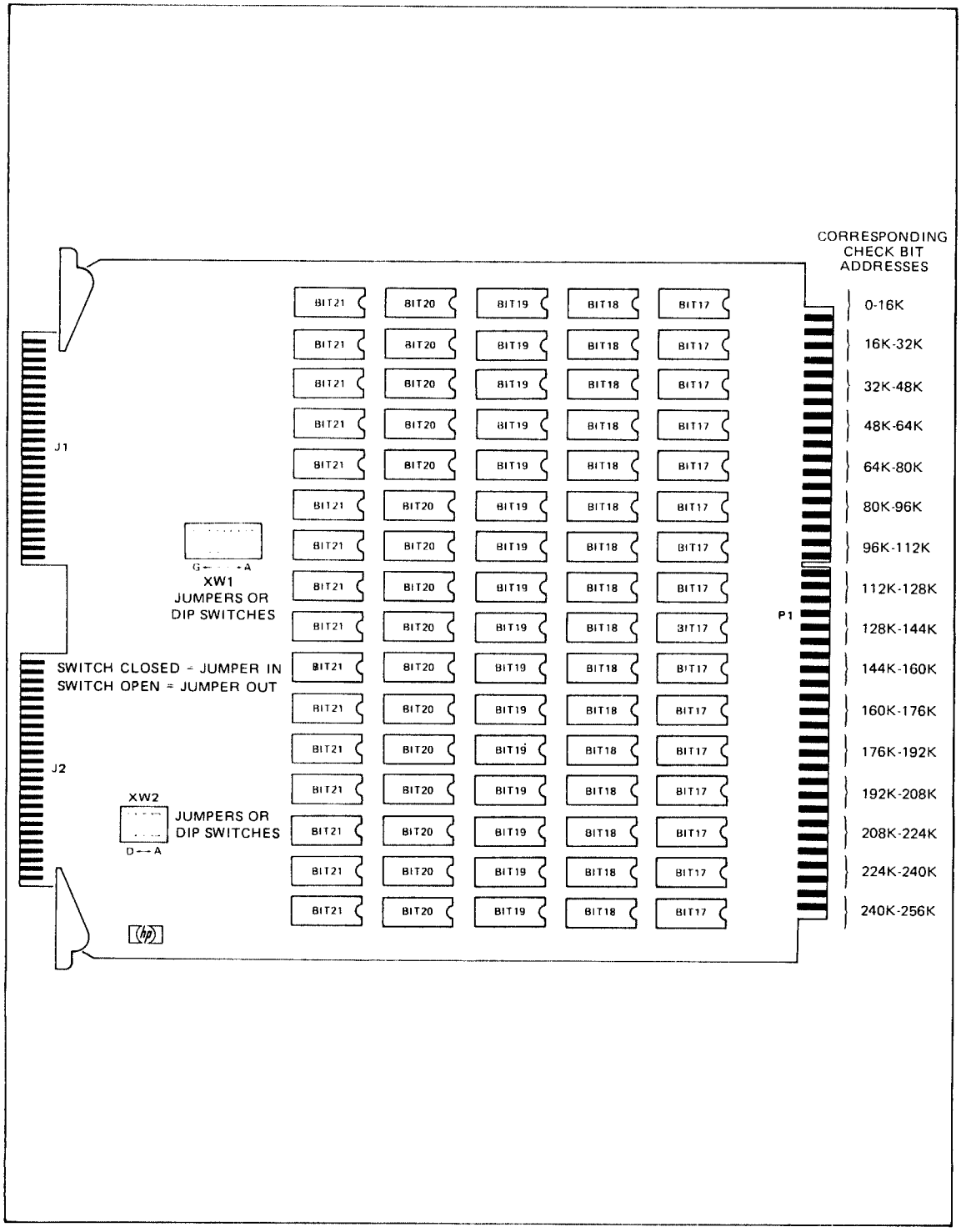


MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-256K	HARDWIRED OUT	HARDWIRED OUT	IN	IN	HARDWIRED OUT	HARDWIRED OUT	HARDWIRED OUT	HARDWIRED OUT
256K-512K			IN	OUT				
512K-768K			OUT	IN				
768K-1024K			OUT	OUT				

12779H 128K WORD HIGH PERFORMANCE CHECK-BIT ARRAY



12780H 256K WORD HIGH PERFORMANCE CHECK-BIT ARRAY



12779A/H AND 12780A/H CHECK BIT ARRAYS

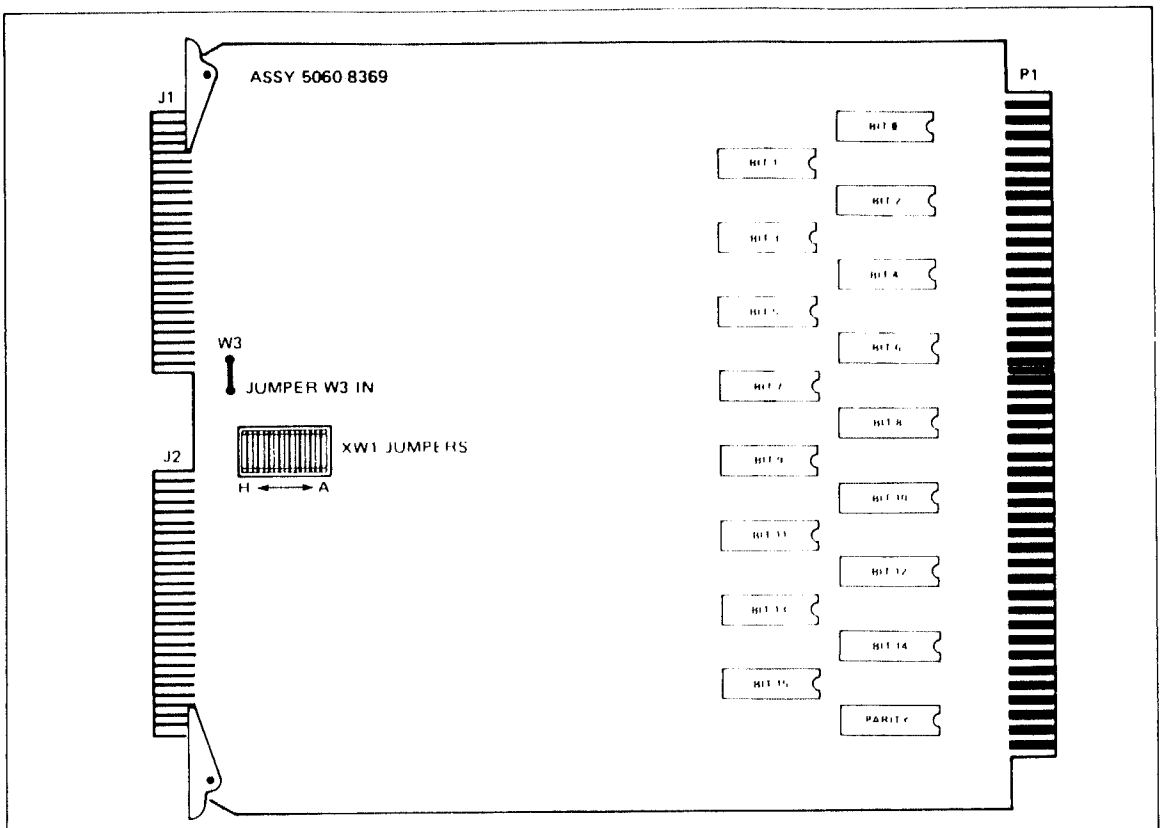
MEMORY SIZE (WORDS)	CHECK BIT ARRAY REQUIREMENTS (WORDS)	XW1							XW2			
		G	F	E	D	C	B	A	D	C	B	A
32k	12779/12780/12666	IN	IN	IN	IN	IN	IN	IN	OUT	IN	IN	OUT
64k	12779/12780/12666	IN	IN	IN	IN	IN	IN	IN	OUT	OUT	OUT	OUT
128k	12779/12780/12666	IN	IN	OUT	IN	IN	IN	OUT	OUT	OUT	OUT	OUT
192k	12779/12780/12666	IN	IN	OUT	IN	IN	IN	OUT	OUT	OUT	OUT	OUT
	+12779*/12780/12666	IN	IN	IN	IN	IN	OUT	IN	OUT	OUT	OUT	OUT
256k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	or											
	12779	IN	IN	OUT	IN	IN	IN	IN	OUT	OUT	OUT	OUT
	+12779*	IN	IN	OUT	IN	IN	OUT	IN	OUT	OUT	OUT	OUT
320k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	IN	IN	OUT	IN	IN	OUT	OUT	OUT	OUT
384k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	IN	OUT	IN	OUT	OUT	OUT	OUT	OUT
448k	12780/12666	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	IN	OUT	IN	OUT	OUT	OUT	OUT	OUT
	+12779*/12780/12666	IN	IN	IN	IN	OUT	OUT	IN	OUT	OUT	IN	IN
512k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
576k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	IN	OUT	IN	IN	IN	OUT	OUT	IN	IN
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12779/12780/12666	IN	IN	IN	OUT	IN	IN	IN	OUT	OUT	IN	IN
640k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12779/12780/12666	IN	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT
896k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12780/12666	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12780/12666	IN	OUT	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT
	+12779/12780/12666	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT	OUT
1024k	12780	IN	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	OUT	IN	OUT	OUT	OUT	OUT	OUT	OUT
	+12780	IN	OUT	OUT	OUT	OUT	IN	IN	OUT	OUT	OUT	OUT
	or											
	12666	OUT	OUT	OUT	IN	IN	IN	IN	OUT	OUT	IN	IN
	+12666	OUT	OUT	OUT	OUT	IN	IN	IN	OUT	OUT	IN	IN

NOTES: 1. Only a 12779 with Date Code *1905* or later can be used in this space.
2. Switch H in 12666H is always IN.

Note: Maximum configuration is 2Mb using the 12666H ECC Array.

12994A 4K MEMORY MODULE

Manual: 5955-4310 Standard Performance Memory Systems Installation and Service Manual.

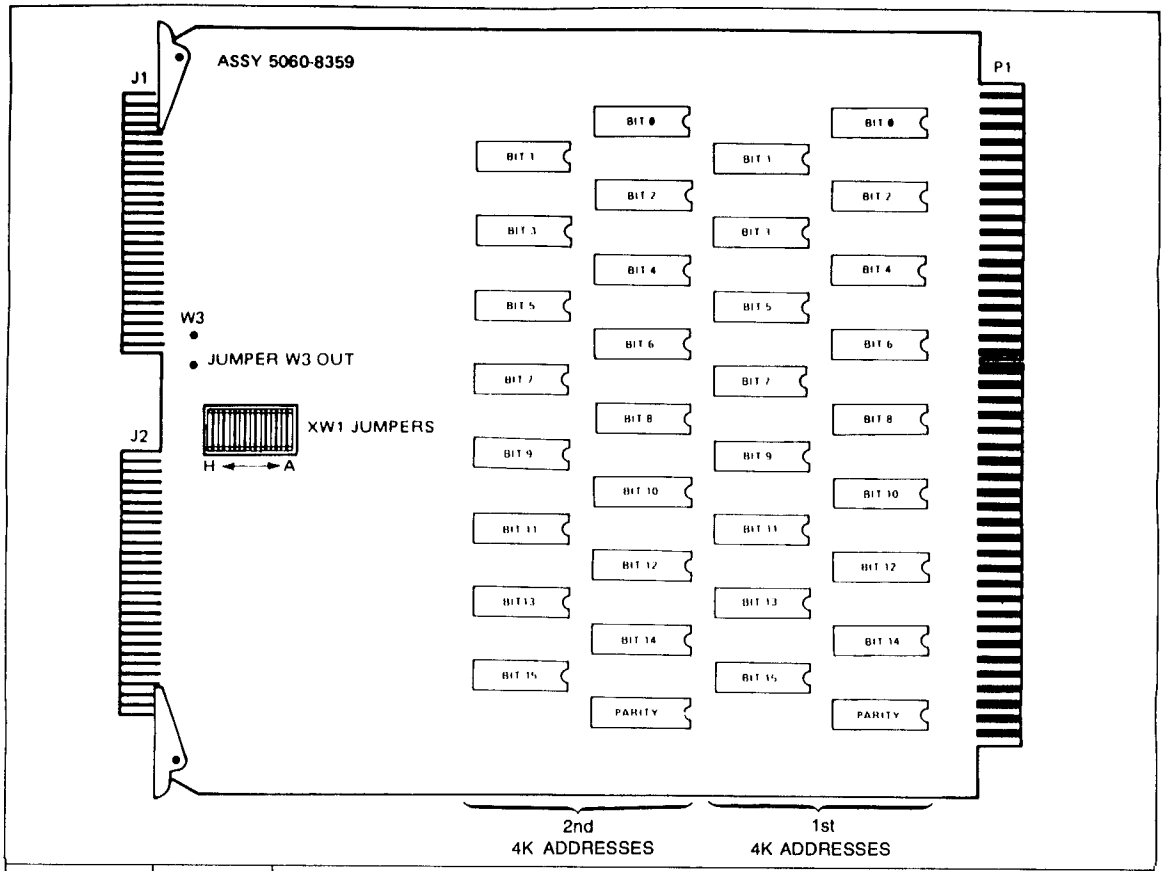


MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	W3	XW1 JUMPERS							
		A	B	C	D	E	F	G	H
0-4K	ALWAYS IN	ALWAYS IN	IN	IN	IN	IN	IN	IN	IN
8K-12K			OUT	IN	IN	IN	IN	IN	IN
16K-20K			IN	OUT	IN	IN	IN	IN	IN
24K-28K			OUT	OUT	IN	IN	IN	IN	IN
32K-36K			IN	IN	OUT	IN	IN	IN	IN
40K-44K			OUT	IN	OUT	IN	IN	IN	IN
48K-52K			IN	OUT	OUT	IN	IN	IN	IN
56K-60K			OUT	OUT	OUT	IN	IN	IN	IN
64K-68K			IN	IN	IN	OUT	IN	IN	IN
72K-76K			OUT	IN	IN	OUT	IN	IN	IN
80K-84K			IN	OUT	IN	OUT	IN	IN	IN
88K-92K			OUT	OUT	IN	OUT	IN	IN	IN
96K-100K			IN	IN	OUT	OUT	IN	IN	IN
104K-108K			OUT	IN	OUT	OUT	IN	IN	IN
112K-116K			IN	OUT	OUT	OUT	IN	IN	IN
120K-124K			OUT	OUT	OUT	OUT	IN	IN	IN
128K-132K			IN	IN	IN	IN	OUT	IN	IN

Note: This 4K module must be assigned the highest used memory addresses regardless of the memory configuration. Only one 4K module allowed per configuration.

12998A 8K MEMORY MODULE

5955-4310 Standard Performance Memory Systems Installation and Service Manual

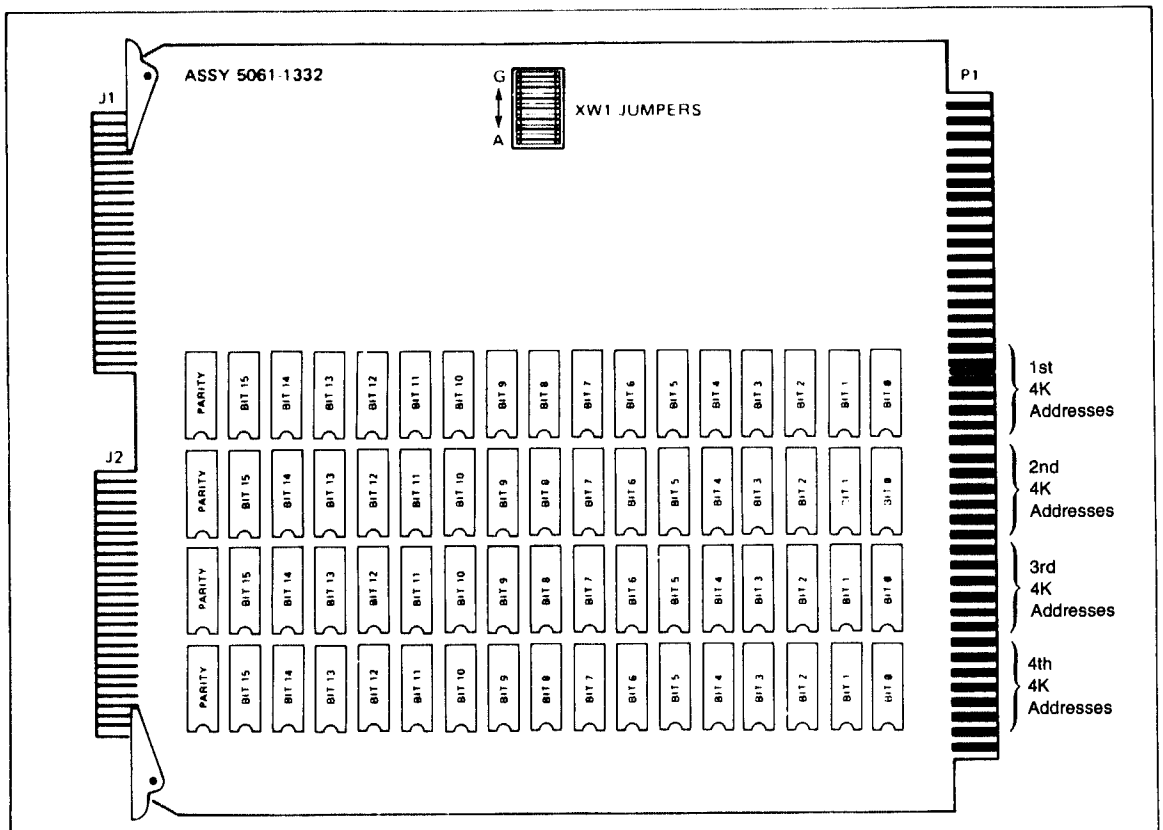


MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	W3	XW1 JUMPERS							
		H	G	F	E	D	C	B	A
0-8K	ALWAYS OUT	IN	IN	IN	IN	IN	IN	IN	ALWAYS OUT
8K-16K		IN	IN	IN	IN	IN	IN	OUT	
16K-24K		IN	IN	IN	IN	IN	OUT	IN	
24K-32K		IN	IN	IN	IN	IN	OUT	OUT	
32K-40K		IN	IN	IN	IN	OUT	IN	IN	
40K-48K		IN	IN	IN	IN	OUT	IN	OUT	
48K-56K		IN	IN	IN	IN	OUT	OUT	IN	
56K-64K		IN	IN	IN	IN	OUT	OUT	OUT	
64K-72K		IN	IN	IN	OUT	IN	IN	IN	
72K-80K		IN	IN	IN	OUT	IN	IN	OUT	
80K-88K		IN	IN	IN	OUT	IN	OUT	IN	
88K-96K		IN	IN	IN	OUT	IN	OUT	OUT	
96K-104K		IN	IN	IN	OUT	OUT	IN	IN	
104K-112K		IN	IN	IN	OUT	OUT	IN	OUT	
112K-120K		IN	IN	IN	OUT	OUT	OUT	IN	
120K-128K		IN	IN	IN	OUT	OUT	OUT	OUT	
128K-136K		IN	IN	OUT	IN	IN	IN	IN	

13187A 16K MEMORY MODULE

5955-4310 Standard Performance Memory Systems Installation and Service Manual

13187A 16K MEMORY MODULE JUMPER CONFIGURATION

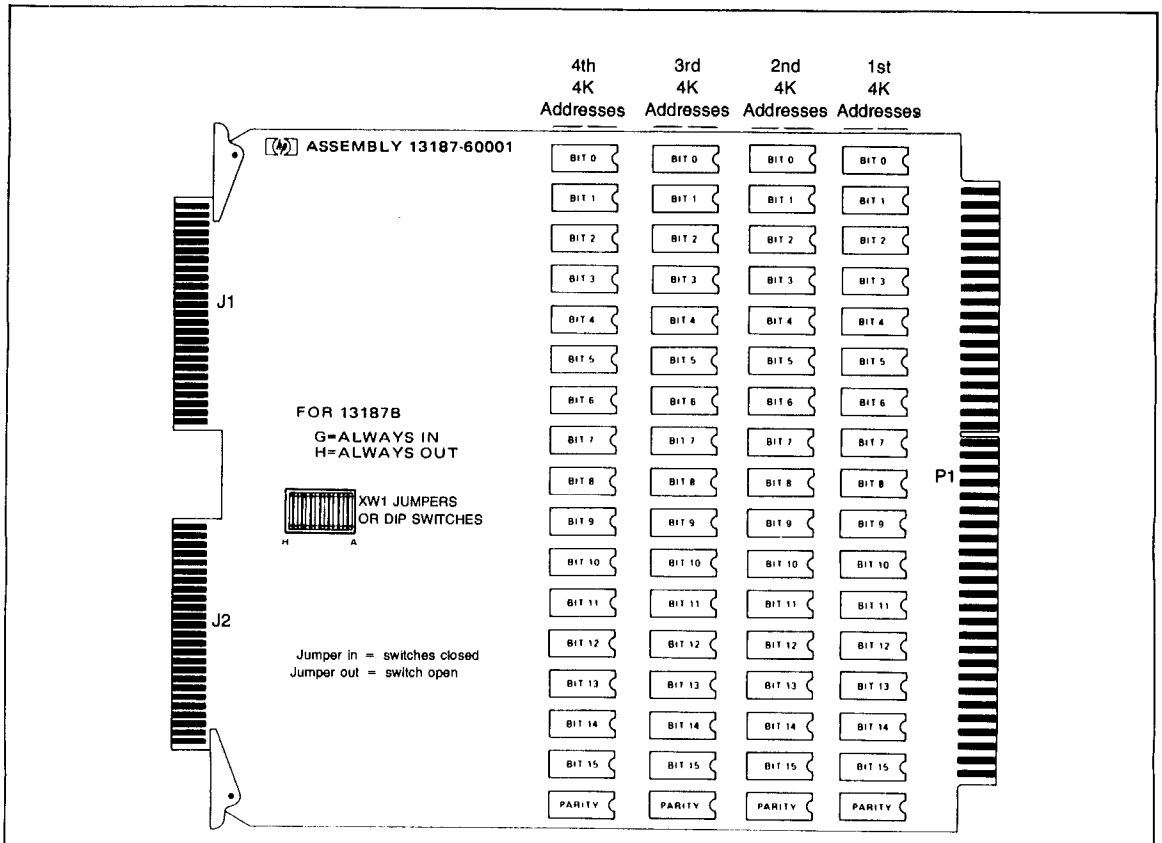


MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS						
	A	B	C	D	E	F	G
0-16K	IN	IN	IN	IN	IN	IN	ALWAYS OUT
16K-32K	OUT	IN	IN	IN	IN	IN	
32K-48K	IN	OUT	IN	IN	IN	IN	
48K-64K	OUT	OUT	IN	IN	IN	IN	
64K-80K	IN	IN	OUT	IN	IN	IN	
80K-96K	OUT	IN	OUT	IN	IN	IN	
96K-112K	IN	OUT	OUT	IN	IN	IN	
112K-128K	OUT	OUT	OUT	IN	IN	IN	
128K-144K	IN	IN	IN	OUT	IN	IN	
144K-160K	OUT	IN	IN	OUT	IN	IN	
160K-176K	IN	OUT	IN	OUT	IN	IN	
176K-192K	OUT	OUT	IN	OUT	IN	IN	
192K-208K	IN	IN	OUT	OUT	IN	IN	
208K-224K	OUT	IN	OUT	OUT	IN	IN	
224K-240K	IN	OUT	OUT	OUT	IN	IN	
240K-256K	OUT	OUT	OUT	OUT	IN	IN	
256K-272K	IN	IN	IN	IN	OUT	IN	

13187B 16K MEMORY MODULE

5955-4310 Standard Performance Memory Systems Installation and Service Manual

13187B 16K MEMORY MODULE JUMPER CONFIGURATION



MEMORY ADDRESS ASSIGNMENTS (IN WORDS)	XW1 JUMPERS OR DIP SWITCHES							
	H	G	F	E	D	C	B	A
0-16K	ALWAYS OUT	ALWAYS IN	IN	IN	IN	IN	IN	IN
16K-32K			IN	IN	IN	IN	IN	OUT
32K-48K			IN	IN	IN	IN	OUT	IN
48K-64K			IN	IN	IN	IN	OUT	OUT
64K-80K			IN	IN	IN	OUT	IN	IN
80K-96K			IN	IN	IN	OUT	IN	OUT
96K-112K			IN	IN	IN	OUT	OUT	IN
112K-128K			IN	IN	IN	OUT	OUT	OUT
128K-144K			IN	IN	OUT	IN	IN	IN
144K-160K			IN	IN	OUT	IN	IN	OUT
160K-176K			IN	IN	OUT	IN	OUT	IN
176K-192K			IN	IN	OUT	IN	OUT	OUT
192K-208K			IN	IN	OUT	OUT	IN	IN
208K-224K			IN	IN	OUT	OUT	IN	OUT
224K-240K			IN	IN	OUT	OUT	OUT	IN
240K-256K			IN	IN	OUT	OUT	OUT	OUT
256K-272K			IN	OUT	IN	IN	IN	IN

12892B MEMORY PROTECT

EQUIPMENT

12892-60003	12892B Memory Protect Card

DOCUMENTATION

P/N	MANUAL
12892-90007	12892B Installation
12892-90005	Memory Protect/Parity Error Diagnostic

ELECTRICAL SPECIFICATIONS

DC Required:

+5V	1.25A
−2V	.05A

INSTALLATION NOTES

IN-1. For HP 2109/2113 Computers, remove MX jumper on jumper block U21; leave the MX jumper installed for HP 2108/2112 Computers.

IN-2. Install into Slot 111 of Memory Backplane.

MEMORY PROTECT-PARITY ERROR DIAGNOSTIC (2100/21MX)

Paper Tape Binary 12892-16001. Date Code 1705.

Required Hardware:

a. Minimum 4K memory.
b. 2100A/S or 21MX M- or E-Series Computer.
c. DMA (DCPC) for Test 11 only.

1. If testing a 21MX computer, set switch A1S1 to INT-IGNORE and set the Memory Protect jumpers as follows:

PCA	JUMPER SETTING	COMMENTS
12892A	W1 = A	Setting used throughout entire diagnostic.
12892B	RME = OUT SEL1 = OUT INT = IN JSB = IN HLTPE = OUT MX = OUT = 21MX E-Series = IN = 21MX M-Series	Setting used for Test 00 thru 10 only.

2. If testing a 2100A/S, set switch S1 on Data Control Card A107 to PROTECT and switch S2 on I/O Buffer Card A8 to P.E. INT.

3. Load Diagnostic Configurator.

4. Configure configurator and load diagnostic.

Note: DSN = 102305

MEMORY PROTECT-PARITY ERROR DIAGNOSTIC (2100/21MX) (CONT)

5. Configure diagnostic: P-Reg = 100_8, S-Reg = Configuration options.

Configuration Options

S-REG BITS	MEANING IF SET
15	12892B under test; if clear 12892A or 2100A/S computer under test.
14*	DMS present (DMS related test will be exercised); if clear, no DMS (MEM) present.
13-6	Not used.
5-0	Select code of I/O interface to verify I/O related Memory Protect functions.

* If bit 14 = 0, tests will halt (due to bug).

6. Press PRESET, RUN. HALT 102074.

7. Set S-Reg = Switch options.

8. Press PRESET, RUN.

9. HALT 106000 (Test 10 executed).

   a. Generate even parity as follows:

      21MX — On 2102A/B Memory Controller, connect jumper wire between PAR (parity) and ↓ (ground) terminal posts.

      2100A/S — On Data Control Card A107, connect jumper wire between ODD terminal post E1 and GND terminal post E2 and connect another jumper wire between EVEN terminal post E3 and +5V terminal post E4.

   b. Set parity error and power fail/auto restart switches as follows:

      21MX — Set switch A1S1 to HLT and switch A1S2 to ARS.

      2100A/S — Set switch S2 to HALT and switch S1 to ARS.

10. Press PRESET (INT), RUN. Parity HALT 5.

11. Set parity halt switch A1S1(S2) to INT-IGNORE (P.E. INT).

12. Press PRESET (INT). Parity light should go out.

13. Press RUN. HALT 106001.

14. For the "A" Power Supply, go to Standby. For the "B" Power Supply, go to Battery Backup Enabled.

15. Remove even parity jumper(s).

16. Power on the CPU.

17. If Test 12 was selected and the E-Register flashes, press HALT, PRESET and RUN within 30 seconds.

MEMORY PROTECT-PARITY ERROR DIAGNOSTIC (2100/21MX) (CONT)

18. If Test 11 was executed and HALT 102062, change jumpers (step 15) to initial settings.

19. Press RUN. HALT 102077. (Return to step 5.)

20. Switch options:

S-REG BIT	MEANING IF SET
15	Halt 102076 (octal) at the end of each test. The A-Register contains the test number in octal.
14	Suppress error halts.
13	Loop on last test section being executed.
12	Loop on diagnostic.
11	Suppress error messages.
10	Suppress information messages.
9	Abort diagnostic execution after the current test section and halt (102075). Operator can specify a new group of test(s) in the A-Register. Then clear Switch Register bit 9 and press RUN.

A-REG BIT	TEST	IF SET WILL EXECUTE
0	00	Halt Test (MPT)
1	01	Basic Fence Test
2	02	I/O Violation Test
3	03	MPT Control Test
4	04	MPT Trap Cell Logic Test
5	05	MPT Indirect Logic Test
6	06	Memory Expansion-MPT Test
7	07	Fence and Violation Register Test
8	08	Non-Violation Instruction Test
9	09	Violation Instruction Test
10	10	Parity Error Halt and Interrupt Logic Test
11*	11	12892B Special Jumper Test
12	12	DMA Test
13	13	Preset Test (to clear MPT)

8	Suppress operator intervention tests.
7-0	Reserved.

12897B DUAL-CHANNEL PORT CONTROLLER (DCPC)

EQUIPMENT

12897-60004	12897B DCPC assy
12897-60002	Cable assy

DOCUMENTATION

P/N	MANUAL
12897-90005	12897B Installation
24322-90002	DMA-DCPC Diagnostic

12897B DUAL-CHANNEL PORT CONTROLLER (DCPC) (CONT)

ELECTRICAL SPECIFICATIONS

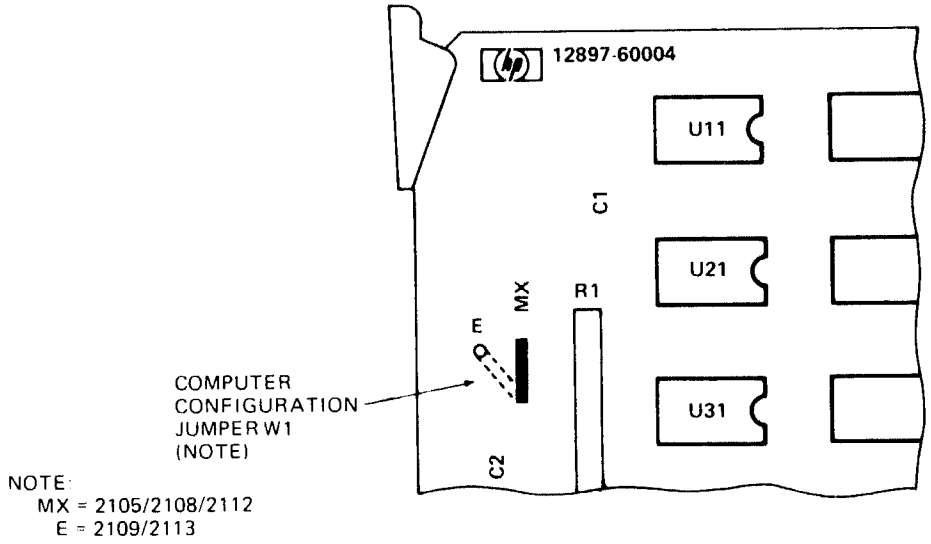
DC Required:

+5V	2.4A
−2V	.08A

INSTALLATION NOTES

IN-1. Install into Slot 110 of 21MX Memory Backplane.

IN-2. DCPC jumper configuration.



DMA-DCPC (2100/21MX) DIAGNOSTIC

Paper Tape Binary 24322-16002. Date Code 1705.

Required Hardware:

a. Minimum 4K memory.
b. DMA/DCPC — On 2100, DMA card A9 requires test connector, P/N 1251-0335 (2 x 24 pin connector).
c. 12554A*, 12597A*, 12566B*, or 12930A** interface.

*Requires test connector P/N 1251-0332. (If 12566B, connect pins 22, Z to pins 23, AA.)
**Require test connector P/N 12930-60006, and a special cable for Test 15.

1. Configure interface (for TST00 — TST14) as follows:

HP 12554A 16-BIT DUPLEX REGISTER
(Either Configuration 1 or Configuration 2 can be used)

CONFIGURATION 1		CONFIGURATION 2	
JUMPERS	POSITION	JUMPERS	POSITION
W4-W6	B	W4-W5	A
W7	A	W6-W7	B
W8-W12	IN	W8-W12	IN
W13	A (if applicable)	W13	A (if applicable)
W14	A (if applicable)	W14	A (if applicable)

DMA-DCPC (2100/21MX) DIAGNOSTIC (CONT)

HP 12597A 8-BIT DUPLEX REGISTER
(Either Configuration 1 or Configuration 2 can be used)

CONFIGURATION 1		CONFIGURATION 2	
JUMPERS	POSITION	JUMPERS	POSITION
W1-W2	A	W1-W2	B
W3-W4*	IN	W8*	IN

*W3 and W8 *must not* be installed at the same time.

MICROCIRCUIT INTERFACE

HP 12566B		HP 12566C	
JUMPERS	POSITION	JUMPERS	POSITION
W1	C or A	W1	C
W2-W4	B	W2-W4	B
W5-W8	IN	W5-W8	OUT
W9	A	W10	B
		W11	IN
		W12-W13	OUT

HP 12930A UNIVERSAL INTERFACE (12930-60001)
(These switch settings are only applicable for TST00-TST14)

SWITCH	POSITION	SWITCH	POSITION
U85S1	1	U102S1	2
S2	5	S2	7
S3	10(0)	S3	10(0)
U87S1	1	U106S1	1
S2	4	S2	5
S3	8	S3	9
U97S1	2		
S2	5		
S3	10(0)		

Note: These programmable switches are set using a screwdriver to position the contact mechanism.

Switch settings are for 12930A with diagnostic test connector (12930-60006) when running the standard test run (tests 0-14). When running test 15 set switch U85S1 to 2.

DMA-DCPC DIAGNOSTIC (CONT)

2. Load Diagnostic Configurator.
3. Configure configurator and load diagnostic.
4. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = SC of test card.
5. Press PRESET, RUN. HALT 102074.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000_8, S-Reg = Switch options, press PRESET, RUN.
9. Switch options:

<table>
<tr><th>BITS</th><th colspan="2">MEANING IF SET</th></tr>
<tr><td>0</td><td colspan="2">Abort current test when reporting error.</td></tr>
<tr><td>7-1</td><td colspan="2">Reserved.</td></tr>
<tr><td>8</td><td colspan="2">Suppress tests requiring operator intervention.</td></tr>
<tr><td>9</td><td colspan="2">Abort current diagnostic execution and halt (102075). User may specify a new group of tests in the A-Reg, clear bit 9, and then press RUN.</td></tr>
<tr><td></td><td>A-REG BIT (IF SET)</td><td>TESTS SELECTED</td></tr>
<tr><td></td><td>0
1
2
3
4
5
6
7
8
9
10
11
12
13
14</td><td>TST00 — DMA Flag test
TST01 — DMA Interrupt test
TST02 — DMA Control Reset test
TST03 — Preset test
TST04 — Priority test
TST05 — Basic Word Count Register test
TST06 — Basic Word Count Rollover test
TST07 — STC Decision Control test
TST08 — CLC Decision Control test
TST09 — DMA CLF test
TST10 — Illegal Select Code test
TST11 — Incremental Word Count Register test
TST12 — Incremental Memory Address Register test
TST13 — DMA Input Transfer test
TST14 — STC, CLF and Override test</td></tr>
<tr><td></td><td colspan="2">Note: Test 15 cannot be selected by A-register.</td></tr>
<tr><td>10</td><td colspan="2">Suppress non-error messages.</td></tr>
<tr><td>11</td><td colspan="2">Suppress error messages.</td></tr>
<tr><td>12</td><td colspan="2">Repeat all selected tests after diagnostic run is complete without halting. Also, those tests requiring operator intervention will be suppressed.</td></tr>
<tr><td>13</td><td colspan="2">Repeat last test executed (loop on test).</td></tr>
<tr><td>14</td><td colspan="2">Suppress error halts.</td></tr>
<tr><td>15</td><td colspan="2">Halt (102076) at the end of each test; A-Reg = test number (octal).</td></tr>
</table>

12991A/B POWER FAIL RECOVERY SYSTEM

EQUIPMENT

12991A		12991B	
02112-6003	Battery inverter PCA	5061-1348	Battery charge PCA
1420-0206	Battery packs	5061-1349	Battery backup PCA
02108-00007	Battery boxes	12944-60002	Battery cable
02108-00006	Battery box covers	12991-60002	Connector
9220-2070	Foam pads	12991-60001	Battery box

DOCUMENTATION

P/N	MANUAL
12991-90001	12991A Installation
12991-90004	12991B Installation
02100-90216	Power Fail/Auto Restart Diagnostic

POWER FAIL/AUTO RESTART DIAGNOSTIC

Paper Tape Binary 24321-16001. Date Code 1635.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Place ARS/ARS switch to ARS position.
4. Set S-Reg = Switch options
5. Press PRESET, RUN.
6. Terminate CPU power.
7. Restore power and press RUN.
8. To restart after HLT 77, press RUN.
9. Switch options:

Switch	Meaning If Set
0-7	Reserved to display background cycling pattern
8	Reserved
9	Reserved
10	Suppress non-error messages
11	Suppress error messages to teleprinter
12	Loop on diagnostic. Clear to print number of passes and HALT 102077_8
13	Reserved
14	Suppress HALT after each test failure (MDR = 102002_8 to 102077_8)
15	HALT execution of background program (MDR = 102076_8)

13197A WRITABLE CONTROL STORE

EQUIPMENT

13197-60001	1K Writable Control Store Board
5060-8393	Flat Cable Assy.

DOCUMENTATION

P/N	MANUAL
13197-90005	13197A WCS Reference
13197-90002	13197A WCS Diagnostic

ELECTRICAL SPECIFICATIONS

DC Required:

+5V	2.2A
−2V	.007A

INSTALLATION NOTES

IN-1. Remove jumper W1 if installing WCS in a 21MX M-Series computer.

13197A WCS DIAGNOSTIC

Paper Tape Binary 13197-16002. Date Code 1640.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: S-Reg (5-0) = WCS select code, PRESET, RUN. HALT 102074.
4. S-Reg = Switch options.
5. Press PRESET, RUN.
6. Switch options:

BITS	MEANING IF SET
6-0	Reserved.
7	Abort TST25 and end current pass of diagnostic.*
8	Suppress tests requiring operator intervention.
9	Abort diagnostic execution at end of current test section and halt 102075. User may specify a new group of tests in the A-Reg. Clear S-Reg bit 9 and press RUN.
10	Suppress non-error messages.
11	Suppress error messages.
12	Loop on diagnostic and suppress tests requiring operator intervention.
13	Repeat last test section.
14	Suppress error halts.
15	Halt 102076 at the end of each test; A-Reg = test number (octal).

*Setting of bit 7 applies only when executing TST25.

13197A WCS DIAGNOSTIC (CONT)

TEST SELECTION VIA A- AND B-REGISTERS

A-REG BIT	IF SET WILL EXECUTE
0	TST00 — Basic Load Test
1	TST01 — Command State Test
2	TST02 — Data Mode Screen Test
3	TST03 — Command State Screen Test
4	TST04 — I/O Screen Test
5	TST05 — RAM Address Rollover Test
6	TST06 — Preset Test
7	TST07 — Zeros Data Test
8	TST10 — Ones Data Test
9	TST11 — Lonely Bit Data Test
10	TST12 — RAM Address Parity Test
11	TST13 — RAM Checkerboard Test
12	TST14 — Alternate Word Data Test
13	TST15 — DCPC Test
14	TST16 — Control Memory Priority Test
15	TST17 — WCS Enable/Disable Test
B-REG BIT	**IF SET WILL EXECUTE**
0	TST20 — WCS Enable/Disable Screen Test
1	TST21 — Command State Alteration Test
2	TST22 — Block Priority Test
3	TST23 — RAM Data Test
4	TST24 — RAM MOD Decoder Test
5	TST25 — User Looping Test
6-15	Reserved

Note: If the A- and B-registers are clear, the default set of tests (TST00 through TST24) are run. TST25 is an optional test.

13305A DYNAMIC MAPPING SYSTEM AND 12731A MEMORY EXPANSION MODULE

EQUIPMENT

12731-60001	12731A Memory Expansion Module
12892-60003	12892B Memory Protect Board
	13307A Dynamic Mapping Instruction ROM's (refer to firmware section of this manual).
	One of the following accessories is required; 13304A Firmware Accessory Board Kit, for E-Series 12791A for F-Series

DOCUMENTATION

P/N	MANUAL
13305-90001	13305A DMS Installation*
12892-90005	Memory Protect/Parity Error Diagnostic
12929-90003	Memory Expansion Module Diagnostic

*Includes installation instructions for 12731A and 13307A.

ELECTRICAL SPECIFICATIONS

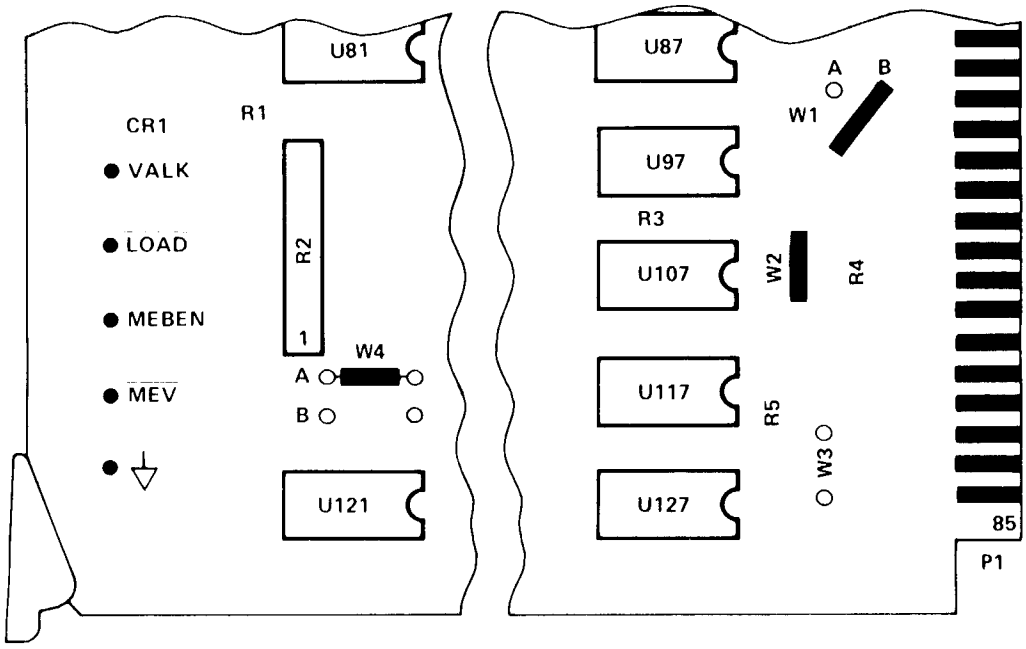
DC Required:

MODEL	+5V
13307A	.78A
12731A	3.9A
12892B	2.0A
13305A	6.68A

13305A DYNAMIC MAPPING SYSTEM AND 12731A MEMORY EXPANSION MODULE (CONT)

INSTALLATION NOTES

IN-1. Memory Expansion Module configuration jumpers:



W1 = A = 21MX Computer (2108/2112)
W1 = B = 21MX E-Series Computer (2109/2113)

W2 = IN

W3 = OUT

W4 = A = MEM remains in System Map.
W4 = B = MEM returns to same map in use prior to IAK being issued.

Note

MEM jumper W4 and Memory Protect RME jumper *must* be configured alike to respond to the RME signal. That is, if the Memory Protect RME jumper is OUT, MEM jumper W4 must be in position "A"; if the Memory Protect RME jumper is IN, MEM jumper W4 must be in position "B". If W1 is jumpered wrong, DM violations will occur.

MEMORY EXPANSION MODULE DIAGNOSTIC

Paper Tape Binary 12929-16001. Date Code 1506.

Required Hardware:

a. Minimum 16K memory
b. 12976A Dynamic Mapping System
c. 12566A/B Microcircuit Interface PCA
d. 1251-0332 Test Connector with pins 22 and 23 wired together.

1. Configure 12566A/B/C Microcircuit I/F as follows:

12566A/B		12566C	
W1	Position A	W1	Position C
W2	Position B	W2-W4	Position B
W3	Position B	W5-W8	OUT
W4	Position A/B	W9	Position A
W5-W8	Connected	W10	Position B
W9	Position A	W11	IN
		W12-W13	OUT

2. Load Diagnostic Configurator.

3. Configure configurator and load diagnostic.

4. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = SC of microcircuit interface.

5. Press PRESET, RUN. HALT 102074.

6. Set S-Reg = Switch options.

7. Press PRESET, RUN.

8. Restart: P-Reg = 2000_8, S-Reg = Switch options, press PRESET, RUN.

9. Switch options:

BIT	MEANING IF SET
15	Halt (102076) at the end of each test; A-Reg = test just completed.
14	Suppress error halts.
13	Repeat last test executed (loop on test).
12	Repeat all selected tests after diagnostic run is complete without halting. Also suppresses tests requiring operator intervention.
11	Suppress error messages.
10	Suppress information messages.
9	Abort the current diagnostic execution and halt (102075); user may at this time specify a new set of tests in the A/B-register, clear bit 9 of the Switch Register, and press RUN.
8	Suppress tests requiring operator intervention.
7-0	Reserved.

Note: Without the 12566 card, tests 15 and 20 fail, and all others are OK.

MEMORY EXPANSION MODULE DIAGNOSTIC (CONT)

A/B-Register Test Selection

A-REG BIT	IF SET WILL EXECUTE
0	Test 00 XMM Test
1	Test 01 XMS Test
2	Test 02 XMA/B Test
3	Test 03 Load/Read Maps Instructions Test
4	Test 04 Status-Fence Test
5	Test 05 Cross Store-Load-Compare Test
6	Test 06 Move Words Test
7	Test 07 Move Bytes Test
8	Test 10 Protected Mode Preset Test
9	Test 11 Violations Test (READ/WRITE/ BASE PAGE)
10	Test 12 Write Violations Test
11	Test 13 Privileged Instruction Violation Test
12	Test 14 Maps Violations Test
13	Test 15 DCPC Ports Enable Test
14	Test 16 Read Violations Test
15	Test 17 Interruptible Instructions Test
B-REG BIT	**IF SET WILL EXECUTE**
0	Test 20 DCPC Interference Test
1	Test 21 Violation Register Map Bits Test
2	Test 22 Register Completion Test
3*	Test 23 Extended Memory Test
4*	Test 24 Basic I/O Test
5-15	Reserved

*Tests 23 and 25 are not part of the standard run; these tests must be selected by the operator.

INPUT/OUTPUT

GENERAL INFORMATION

TERMINAL DATA

DISC DRIVE DATA

MAGNETIC TAPE DRIVE DATA

LINE PRINTER DATA

CARD READER/TAPE READER/PUNCH DATA

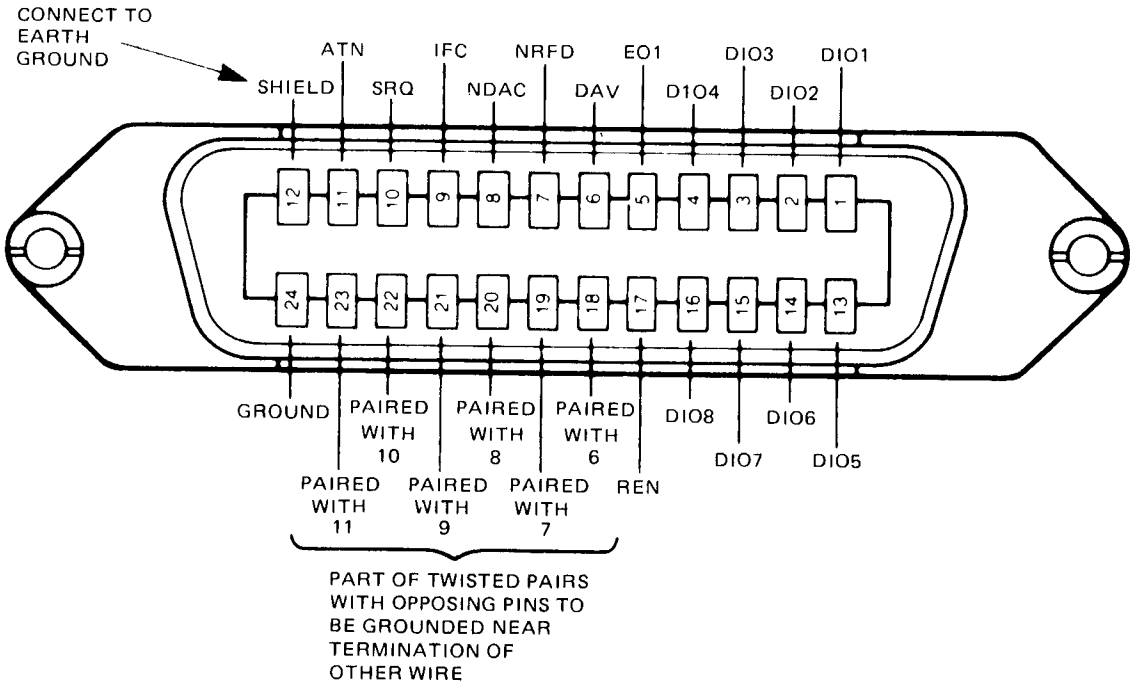
INPUT/OUTPUT

INTERFACE

RS-232C SIGNAL INTERFACE

DATA SET PIN	CIRCUIT	SIGNAL	HP MPX PIN
1	AA	Protective ground	1
2	BA	Transmitted data	3
3	BB	Received data	2
4	CA	Request to send	8
5	CB	Clear to send	22
6	CC	Data set ready	20
7	AB	Signal ground (common return)	7
8	CF	Carrier detect	4
9	—	(Reserved for testing	—
10	—	(Reserved for testing)	—
12	SCF	Secondary carrier detect	—
13	SCB	Secondary clear to send	—
14	SBA	Secondary transmitted data	12
15	DB	Transmission signal element timing (DCE source)	—
16	SBB	Secondary received data	11
17	DD	Receiver signal element timing (DCE source)	—
19	SCA	Secondary request to send	—
20	CD	Data terminal ready	6
21	CG	Signal quality detector	—
22	CE	Ring indicator	—
23	CH/CI	Data signal rate selector (DTE/DCE source)	23
24	DA	Transmit signal element timing (DTE source)	—

HP-IB Connector



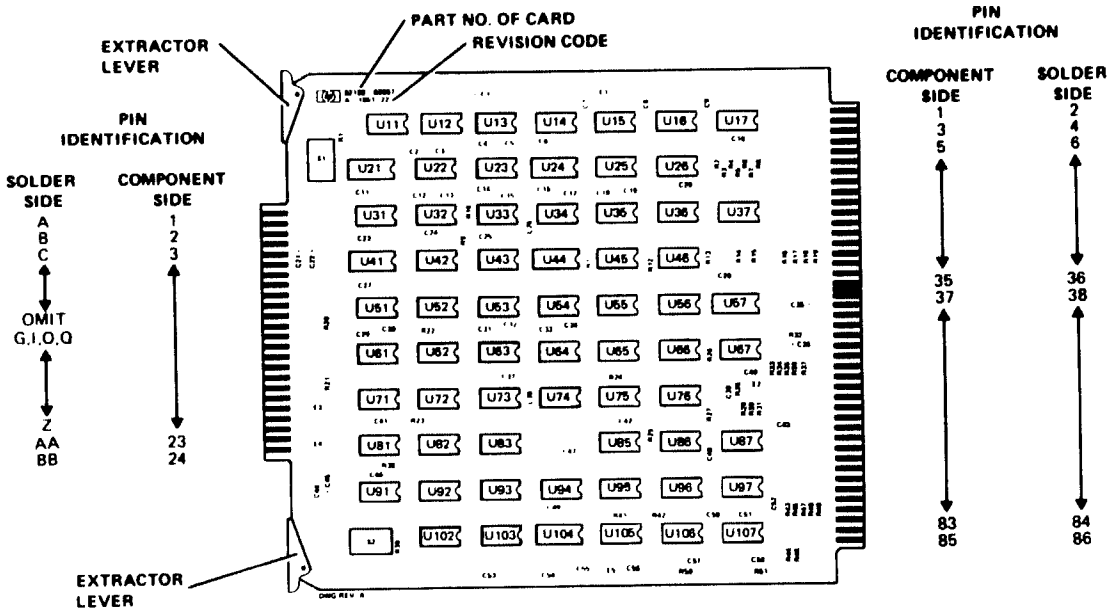
TERMINAL CABLES

	INTERFACE		CABLE NO.
2100	12889A	–	12889-60003
21MX	12889A	–	12889-60003
2600A	12966A	–	12966-60004
	12968A	–	12966-60004
	12880A	–	12880-60003
	12587B	001	12587-60010
	12920B	–	30062-60006
	12920B	–	30062-60009
	12920B	–	30062-60012
2615A	12966A	–	12966-60004
	12968A	–	12966-60004
	12920B	–	30062-60006
	12880A	–	12880-60003
	12587B	001	12587-60010
	12920B	–	30062-60009
	12920B	–	30062-60012
2640-6	12880A	–	12880-60001
2640A	12966A	001	12966-60005
	12968A	001	12966-60005
	12920B	–	02640-60043
	12920B	–	30062-60006
	12920B	–	30062-60009
	12920B	–	30062-60012
2749B	12966A	003	12966-60007
	12968A	003	12966-60007
	12920B	–	30062-60006
	12531C	001	12531-60021
	12920B	–	30062-60006
	12920B	–	30062-60009
	12920B	–	30062-60012
2762A/B	12966A	–	12966-60004
	12968A	–	12966-60004
	12531D	001	12531-60026
	12531D	002	12531-60024
	12531D	003	12531-60028
	12531D	004	02640-60058
	12587B	001	12587-60010
	12920B	–	30062-60006
	12920B	–	30062-60009
	12920B	–	30062-60012
3000	12889A	–	12889-60003
801ACU	12589A	–	12589-60004
CPU	12889A	–	12889-60003
CPU	12889A	–	12889-60003
	12920B	–	30062-60005
	12920B	–	30062-60008

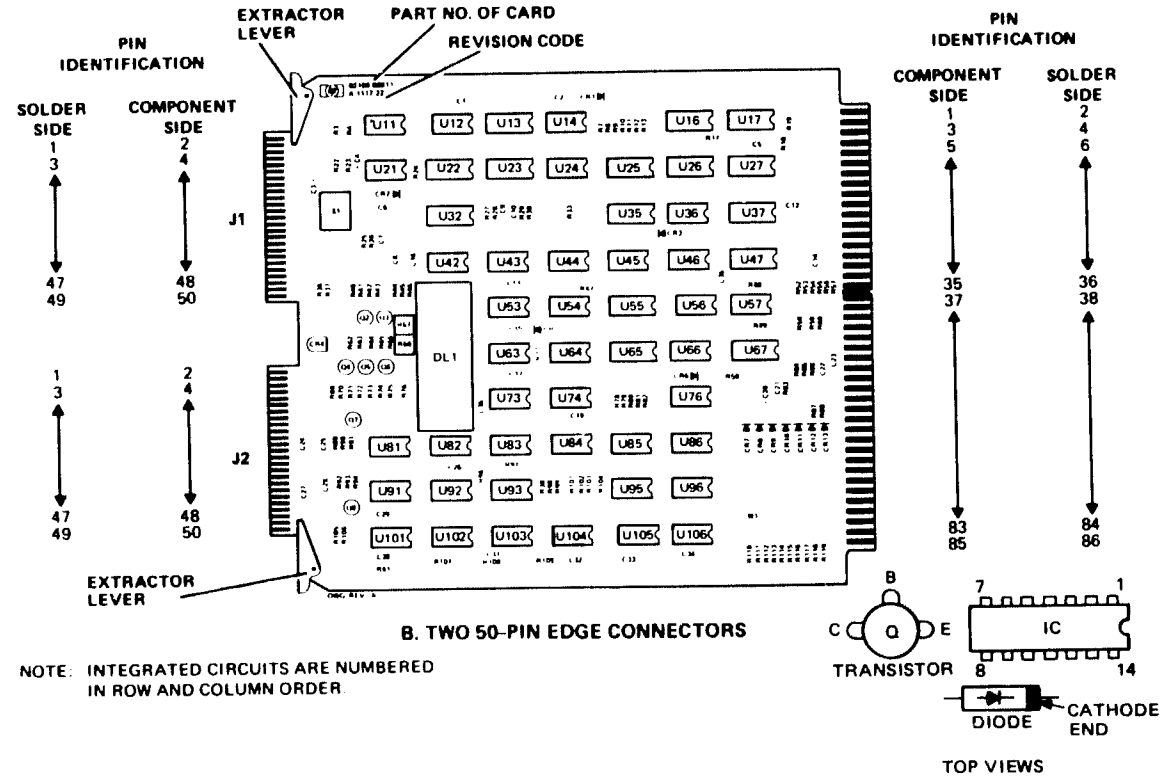
TERMINAL CABLES (Cont'd)

	INTERFACE		CABLE NO.
M103FX	12966A	002	12966-60006
	12968A	002	12966-60006
	12920B	–	30062-60004
	12531C	002	12531-60024
	12531D	002	12531-60024
	12587B	–	12587-60006
	12920B	–	30062-60007
	12920B	–	30062-60010
M201FX	12967A	–	12967-60004
	12618A	–	12618-60001
M201HX	12967A	–	12967-60004
	12618A	–	12618-60001
M202FX	12966A	002	12966-60006
	12968A	002	12966-60006
	12920B	–	30062-60004
	12587B	002	12587-60011
	12920B	–	30062-60007
	12920B	–	30062-60010
M202HX	12966A	002	12966-60006
	12968A	002	12966-60006
	12920B	–	30062-60004
	12587B	–	12587-60006
	12920B	–	30062-60007
	12920B	–	30062-60010
M208FX	12967A	–	12967-60004
	12618A	–	12618-60001
M208HX	12967A	–	12966-60004
	12618A	–	12618-60001

PRINTED-CIRCUIT CARD DETAILS



A. ONE 48-PIN EDGE-CONNECTOR



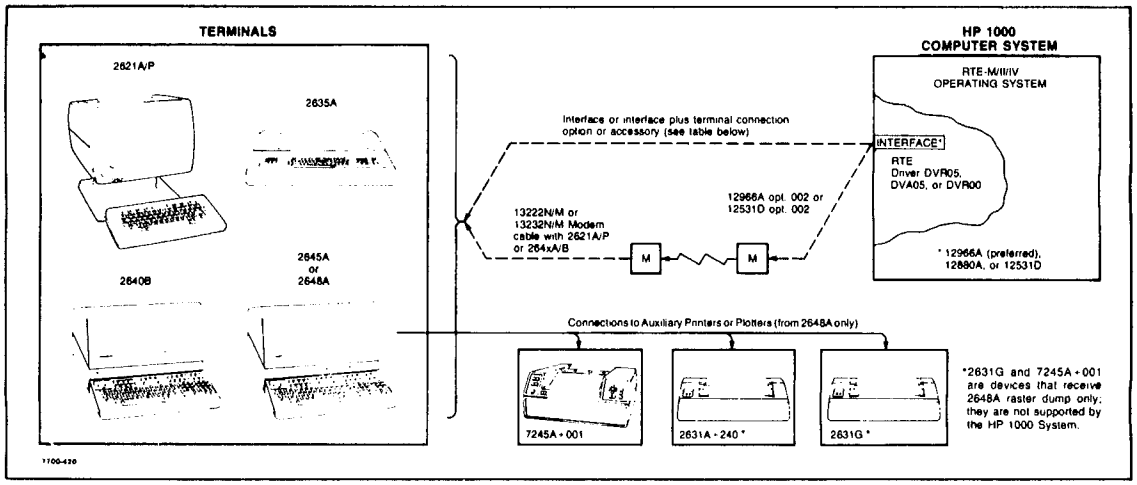
B. TWO 50-PIN EDGE CONNECTORS

NOTE: INTEGRATED CIRCUITS ARE NUMBERED IN ROW AND COLUMN ORDER

NOTE: All boards are marked with a date stamp: this stamp is updated at each rework. If no trouble is found an "X" is placed next to the date. A board with 2 "X" 's will be removed from the program.

26XX TERMINALS

INTERFACE-PER-TERMINAL CONFIGURATIONS



TERMINAL CONFIGURATIONS SUMMARY

TERMINAL Model Number & Name	H* or M*	TERMINAL CONNECTION REQUIREMENTS (IF ANY) Option	TERMINAL CONNECTION REQUIREMENTS (IF ANY) Accessory	INTERFACE Model Number & Cable Option	RTE DRIVER	MAX. DATA RATE† (char per sec)	OTHER COMPATIBLE TERMINAL OPTIONS/ACCESSORIES: Auxiliary Plotter or Plotter/ Printer	Mini-cartridge I/O Option	Mini-cartridge I/O add-on Accessory	Auxiliary Printer add-on Accessory
2621A/P Interactive Terminal	H	None	None	12966A+005	DVR05/DVA05	960	n/a	n/a	n/a	n/a
	M	None	13222N/M**	12966A+002	DVA05 only	120				
	H	None	13222C	12531D+001	DVR00	240				
				12880A	DVR00	960				
	M	None	13222N/M**	12531D+002	DVR00	120				
2635A Printing Terminal	H	051	None	12966A+001	DVR05/DVA05	180	n/a	n/a	n/a	n/a
				12966A+004	DVR05/DVA05	180	7221A			
	M	None	None	12966A+002	DVA05 only	120				
2640B CRT Display Terminal	H	None	None	12966A+001	DVR05/DVA05	240	n/a	n/a	n/a	n/a
		None	None	12966A+004	DVR05/DVA05	240	7221A			
	M	None	13232N/M**	12966A+002	DVA05 only	120				
	H	None	None	12880A+001	DVR00	240	n/a			
	M	None	13232N/M**	12531D+001	DVR00	120				
2645A Display Station	H	032‡		12966A+001	DVR05/DVA05	960	n/a	007♦	13261A & 13236B♦	2631A+ 240 & A
				12966A+004	DVR05/DVA05	960	7221A			
	M	None	13232N/M**	12966A+002	DVA05 only	120				
	H	None	None	12880A+001	DVR00	960	n/a	n/a	n/a	n/a
	M	None	13232N/M**	12531D+002	DVR00	120				
2648A Graphics Terminal	H	032‡		12966A+001	DVR05/DVA05	960	n/a	Same choices as 2645A Display Station with 12966A interface, summarized above		
				12966A+004	DVR05/DVA05	960	7221A			
	M	None	13232N/M**	12966A+002	DVA05 only	120				
	H	030‡	13260B+003‡	12966A+001	DVR05/DVA05	960	13261A, 13296A+048, & 2631G or 7245A+001	Same choices as 2645A Display Station with 12966A interface, summarized above		
	M	None	13232N/M**	12966A+002	DVA05 only	120				
	H	None	None	12880A+001	DVR00	960		n/a	n/a	n/a
	M	None	13232N/M**	12531D+002	DVR00	120				

NOTE: The 12966A interface plus DVR05/DVA05 combination is preferable to the 12880A/12531D interface plus DVR00 combination, because of the superior efficiency and much better overall system throughput that is achieved by the preferred combination.

* *H = Hardwired, local connection, M = Modem, remote connection using Bell Type 103 Data Sets or Vadic VA3400 Modems.*

** *13222N/M and 13232N/M are modem cables; the suffix N cable is for connection to U.S. modems and suffix M cable is for connection to European modems.*

† *120 characters per second is the maximum data rate for modem communications, but the actual rate will depend upon the user's choice of modem. The indicated maximum rate holds for system-to-display communication; rates to/from Mini cartridges or auxiliary printer connected to the 2645A Display Station or 2648A Graphics Terminal differ as noted in the price table descriptions.*

‡ *2645A/2648A option 032 is required only for 2645A/2648A Terminal with Mini cartridge I/O, and/or auxiliary printer.*

♦ *Terminal option 007 provides 13261A & 13236B, which are used only to provide Mini cartridge I/O for terminal without option 007.*

A *13261A is also required in terminal without Mini cartridge I/O.*

26XX TERMINALS (Cont'd)

26XX TERMINAL KEYBOARD STRAPPING OPTIONS

STRAP	STRAPPING OPTION	NORMAL OPERATION (switch closed)	OPERATION WITH STRAPPING OPTION (switch open)
A	FUNCTION KEY TRANSMISSION	ESCAPE CODE SEQUENCES GENERATED LOCALLY, NOT TRANSMITTED	ALL ESCAPE CODES TRANSMITTED
B	SPACE OVERWRITE LATCH ENABLE	SPACES TYPED WILL OVERWRITE EXISTING CHARACTERS	LATCH OFF;OVERWRITE LATCH ON;NO OVER-WRITE
C	CURSOR END-OF-LINE WRAPAROUND	CR&LF GENERATED AT END OF EACH LINE	CURSOR REMAINS IN COLUMN 80 AT END OF EACH LINE
D	LINE/PAGE	TRANSFER LINE AT A TIME IN BLOCK MODE	ENTIRE PAGES TRANSFERED IN BLOCK MODE
E	PAPER TAPE MODE	EACH RECORD BEGINS WITH LF AND ENDS WITH CR	EACH RECORD ENDS WITH CR LF
F	FAST BINARY READ	BAUD RATE SET BY BAUD RATE SWITCH	BAUD RATE SET BY COMPUTER
G	BLOCK TRANSFER HANDSHAKE	DATA TRANSFERED AFTER RECEIPT OF DC1 FROM COMPUTER	FULL HANDSHAKE BETWEEN TERMINAL AND CPU REQUIRED
H	INHIBIT DC2	DC2 ISSUED UPON RECEIPT OF DC1 DATA FOLLOWS	NO HANDSHAKE REQUIRED
J	AUTO TERMINATE	NO EFFECT	PLACE TERMINATOR BEFORE CURSOR
K	CLEAR TERMINATOR	NO EFFECT	CLEAR TERMINATOR CAUSED BY STRAP J
L	SELF TEST INHIBIT	NO EFFECT	PROHIBITS EXECUTION OF SELF TEST
M	INSERT OR DELETE CHAR	NO EFFECT	REVERSES EFFECT OR CNTL KEY ON INSERT AND DELETE
N	ESCAPE CODE TO PRINTER	NO EFFECT	ESCAPE CODES SENT TO PRINTER
P,Q	COMPATIBILITY MODE	THESE SWITCHES FIX COMPATIBILITY WITH TEKTRONIC CONTROL COMMANDS	
		P-CLOSED;Q-CLOSED	NORMAL OPERATION
		P-CLOSED;Q-OPEN	UNSCALED COMPAT.
		P-OPEN;Q-CLOSED	SCALED COMPAT.
		P-OPEN;Q-OPEN	2048 COMM BUFFER

26XX TERMINALS (Cont'd)

26XX TERMINAL KEYBOARD STRAPPING OPTIONS (Cont'd)

STRAP	STRAPPING OPTION	NORMAL OPERATION (switch closed)	OPERATION WITH STRAPPING OPTION (switch open)
R	CIRCUIT ASSURANCE	TRANSITION FROM REC STATE TO TRANSMIT STATE OCCURS AFTER CB (106) (CLEAR TO SEND) AND SB (122) SECONDARY RECEIVE DATA) GO ON WITHIN 2.6 SECS. OTHERWISE, TERMINAL RETURNS TO RECEIVE STATE.	THE TRANSITION FROM RECEIVE STATE TO TRANSMIST STATE OCCURS AFTER CB (106) (CLEAR TO SEND) GOES ON.
S,T	MAIN CHANNEL PROTOCOL	REVERSE CHANNEL PROTOCOL (BOTH SWITCHES CLOSED).	S-CLOSED, T-OPEN: MAIN CHANNEL WITH STX/ETX AS START OF DATA AND END OF DATA. S-OPEN, T-CLOSED: MAIN CHANNEL WITH EQT AS END OF DATA. S-OPEN, T-OPEN: MAIN CHANNEL WITH ETX AS END OF DATA.
U	CPU BREAK	CPU CAN INTERRUPT TERMINAL WHILE IT IS IN TRANSMIT STATE. CPU INITIATES AN ON TO OFF TRANSITION OF SB (122) (SECONDARY) RECEIVE DATA) LINE. TERMINAL RESPONDS BY TURNING OFF CA (106) (REQUEST TO SEND) AND GOING TO THE RECEIVE STATE.	TERMINAL IGNORES ALL TRANSITIONS ON SB (122) (SECONDARY RECEIVE DATA) LINE FROM MODEM IN TRANSMIT STATE.
V	CARRIER DETECT	WHEN TERMINAL IS IN RECEIVE STATE, AN ON TO OFF TRANSITION OF CF (109) (CARRIER DETECT) LINE FROM MODEM CAUSES TERMINAL TO GO INTO TRANSMIT STATE. TRANSITIONS OF CF HAVE NO EFFECT WHILE TERMINAL IS IN TRANSMIT STATE.	TRANSITIONS OF CR (109) (CARRIER DETECT) LINE HAVE NO EFFECT ON THE TERMINAL.

26XX TERMINALS (Cont'd)

26XX TERMINAL KEYBOARD STRAPPING OPTIONS (Cont'd)

STRAP	STRAPPING OPTION	NORMAL OPERATION (switch closed)	OPERATION WITH STRAPPING OPTION (switch open)
W	DATA COMM SELF TEST ENABLE	ENABLES DATA COMM SELF TEST FROM EITHER THE KEYBOARD OR ESCAPE SEQUENCE.	DISABLES DATA COMM SELF TEST. IF SELF TEST IS ATTEMPTED (BY) EITHER THE KEYBOARD OR ESCAPE SEQUENCE), THE TEST WILL BE ABORTED AND ERROR 0 WILL APPEAR ON DISPLAY.
X	DATA SPEED SELECT	HOLDS DATA SPEED SIGNAL LOW (CH (111) = 0).	SETS DATA SPEED HIGH (CH (111) = 1)
Y	TRANSMIT LED	TRANSMIT LIGHT ON KEYBOARD IS TURNED ON WHEN CB (106) (CLEAR TO SEND) LINE FROM MODEM IS HIGH. IS TURNED OFF WHEN CB (106) LINE GOES LOW.	TRANSMIT LIGHT ON KEYBOARD IS TURNED ON WHEN CC (107) (DATA SET READY) LINE FROM MODEM IS HIGH AND 13260B EXTENDED ASYNCHRONOUS COMMUNICATIONS INTERFACE PCA IS USED IS TURNED OFF WHEN CC LINE GOES LOW.
Z	PARITY	PARITY SWITCH ON TERMINAL KEYBOARD IS AFFECTED AS FOLLOWS:	
		NO PARITY: SEND 8 BITS AND RECEIVE 8 BITS. FORCE BIT 8 TO ZERO. CHECK FOR PARITY ERROR. ODD PARITY: SEND 7 DATA BITS + ODD PARITY. CHECK FOR PARITY ERROR. EVEN PARITY: SEND 7 DATA BITS + EVEN PARITY. RECEIVE 7 DATA BITS + EVEN PARITY. CHECK FOR PARITY ERROR.	NO PARITY: SEND 8 BITS AND RECEIVE 8 BITS. FORCE BIT 8 TO ONE ON SEND. NO CHECK FOR PARITY ERROR. ODD PARITY: SEND 7 BITS + ODD PARITY. RECEIVE 7 BITS. NO CHECK FOR PARITY ERROR. EVEN PARITY: SEND 7 DATA BITS + EVEN PARITY. RECEIVE 7 DATA BITS. NO CHECK FOR PARITY ERROR.

TELEPRINTER AND 12531B/C I/F DIAGNOSTIC

Paper Tape Binary 12531-16001. Date Code 1509,
Cartridge Binary 24998-13303. Date Code 1928, and 24396-13307
Date Code 2040. DSN 104003
Manual: 12531-90042

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = SC of 12531B/C I/F.
4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Restart: P-Reg = 2000_8, S-Reg = Switch options, press PRESET, RUN.
8. Switch options:

BIT	MEANING IF SET
0	Reserved.
1	Abort Sections.
2	Print *U.
3	Print '[.
4	Print ?C.
5	Punch ALL 1s — ALL 0s.
6	Read ALL 1s — ALL 0s.
7	Reserved.
8	Suppress tests requiring operator intervention.
9	Abort current diagnostic execution and halt (102075); the user may specify a new group of tests in the A-Register; clear bit 9 and press RUN.
	A-REG BIT / **IF SET WILL EXECUTE**
	0 — Test 0 — Basic I/O 1 — Test 1 — Punch 2 — Test 2 — Read 3 — Test 3 — Print 4 — Test 4 — Full Keyboard 5 — Test 5 — Free Input 6 — Test 6 — Keyboard Echo 7 — Test 7 — Oscillator Tolerance 8 — Test 10 — Alignment Routines* 15-9 — Reserved
10	Suppress non-error messages.
11	Suppress error messages.
12	Repeat all selected tests after diagnostic run has completed without halting. Tests requiring operator intervention will be suppressed.
13	Repeat last test executed (loop on test).
14	Suppress error halts.
15	Halt (102076) at the end of each test; A-Reg = Test number (octal).

*The Alignment Routines test is not included in the default tests and must be user selected to have the test run.

7900/7901 DISC DIAGNOSTIC

Paper Tape Binary 12960-16001. Date Code 1803,
Cartridge Binary 24998-13305. Date Code 1822,
and 24396-13306 Date Code 1901. DSN 151302.
Manual: 12960-90003

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg = Configuration options.

Configuration Options

BITS	FUNCTION IF SET
5-0	SC of disc interface 1.
14	0 = DMA channel 6; 1 = channel 7.

4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Restart: P-Reg = 2000_8, S-Reg = Switch options, press PRESET, RUN.
8. Switch options:

BITS	FUNCTION WHEN SET
0	Spare.
1	Skip to end of section when set.
2	Alter cylinder table and/or pattern table and/or select heads and/or change unit removal threshold and/or alter unit table. Reset to terminate requests.
3	Execute operator design program (OPDSN or Section 6).
4	Execute interactive part of S1.
5	Shorten test in S2, S3, S4 and S5.
6	Restrict cylinder selection.
7	Repeat last section.
8	Suppress spaces, print message 65 independent of bit 10 when an error occurs.
9	Halt after each section of the program.
10	All non-error messages will be suppressed, except current operation messages, message 51 and message 65 when bit 8 is set and an error occurred.
11	All messages are suppressed.
12	Print timing messages in Sections 2 and 4.
13	Loop on last step.
14	Program will not halt after each error.
15	Halt at the end of the current step.

7900/7901 DISC DIAGNOSTIC (Cont'd)

STATUS WORDS

Bit	Function
0	Any Error.
1	Data Error.
2	Drive Busy.
3	Flagged Cylinder (when write operation attempted and OVER-RIDE switch not on).
4	Address Error.
5	End of Cylinder.
6	Not Ready.
7	Not Used.
8	Seek Check.
9	Not Used
10	Write Protected (when write operation attempted).
11	Drive Unsafe.
12	Not Used.
13	Overrun.
14	First Seek.
15	Not Used.

FORMATTING

To format a new disc pack using operator design (S7), type in the following program:

```
SD,X      X = unit number
FU        (or FL for Fixed - 7900)
EN
```

NOTE: Protect/Overide switch must be in overide position for formatting.

7900/7901 DISC DIAGNOSTIC (Cont'd)

7900/7901 OPDSN PROGRAMMING

NOTES: OPERATOR INSTRUCTION LIST NOTES:

1. The AR, CD, DS, ID, IS, RD, RR, RS, SR and WD instructions include a software status check unless they are followed by a SC instruction. The expected status is zero. The SC instruction allows use of a different expected status.

2. Fieeld limits are as follows:

   a. $0 \leq$ Cylinder ≤ 202

   b. $0 \leq$ Head ≤ 3

   c. $0 \leq$ Sector ≤ 23

   d. $1 \leq$ Read or Compare Buffer Size ≤ 1024

   e. $1 \leq$ Write Buffer or Check Data Count ≤ 6144

   f. $0 \leq$ Unit Number ≤ 3

   Except for type d, no limit checks are made on numerical fields. If the limits are exceeded, fields may merge and produce unusual results (especially cylinder, head and sector). All numerical fields are decimal unless specified as octal in the instruction list.

3. Any time bit 3 of the switch register is reset, control is given back to START when the next instruction is reached.

4. An EN or LP instruction will be rejected if undefined labels exist.

5. To initialize a pack on drive X, use the following input:

```
SD,X
FU          (or FL for fixed disc — 7900)
EN
```

6. Labels are exactly two characters. All printing characters are legal. Spaces are skipped.

7. No facility is provided to restart programs.

8. Following an H16 overflow message, the program may be shortened by using the EE instruction or completely erased using the EP instruction. (Or by making sure that the diagnostic configurator is located outside of the first 8K of core.)

7900/7901 DISC DIAGNOSTIC (Cont'd)

7900/7901 OPDSN PROGRAMMING

OPERATOR INSTRUCTION LIST — S6

INSTRUCTION	FUNCTION
AR ,[CCC] ,[H] [,SS]	Address Record. Sets up the RAR. Default: RAR = 0. (CCC = cylinder, H = head, SS = sector.)
CB ,[XXXX] [,YY]	Compare Write Buffer with Read Buffer. Default case is 128 words and 1 error printout. (XXXX = word count.) (YY = allowed number of error printouts.)
CD [,XXXX]	Check Data. Default case checks 128 words (1 sector). (XXXX = word count.) End of cylinder may occur.
CE	Seek and loop on cylinder 95, 100 or 105 if switch register bits 0 and 1 are 00, 01 or 10. If the bits are 11, continue. HEAD = bit 5 * 2 + bit 4.
DB ,[XXXX] ,YYYYYY[,C]	Define Write Buffer. Default case fills 128 words. Default pattern is (XXXX = word count, YYYYYY = pattern word in octal.) If C is present and pattern is not random, the pattern is complemented in successive words. Maximum word count = 1024.
DS ,[CCC] ,[H] [,SS]	Decrement Seek. Does an initial seek to the location specified and decrements the cylinder by 1 each execution until cylinder 0. Following cylinder 0, it seeks cylinder 202. Default condition sets RAR to zero.
EE	Erase Entry. Erases last instruction entered.
EN [,LL]	End. Terminates instruction entry and starts execution (LL = label).
EP	Erase program. S6 is restarted.
FL	Format Lower Disc. 7900 only.
FU	Format Upper disc.
GO,LL	GOTO. Go to label (LL = label).

7900/7901 DISC DIAGNOSTIC (Cont'd)

7900/7901 OPDSN PROGRAMMING

INSTRUCTION	FUNCTION
HT [,XXXXXX]	Halt. Display value in A-register (XXXXXX = display value in octal).
ID , [XXXX] [,D / ,P]	Initialize Data. The override switch must be ON. If (D) is added, the sector is tagged defective. If (P) is added, the sector is tagged as protected. The default case writes 6144 words. (XXXX = word count.)
IS , [CCC] ,[H] [,SS]	Incremental Seek. Does an initial seek to the location specified and increments the cylinder by 1 each execution until it reaches cylinder 202. Following cylinder 202 seeks cylinder 0. Default condition sets RAR to zero.
LB,LL	Label. Define location of label. (LL = label.)
LP [,LL]	Loop. (Similar to EN.) Program starts at LL, but loops back to beginning.
RD [,XXXX]	Read Data (XXXX = word count).
RL	Reload. Reset RAR to last loaded value.
RR	Refine Record. A straddle erase* is performed on the sector currently contained in the RAR address.
RS	Random Seek.
RT,LL,X	Repeat. Return to the indicated label (LL = label) the indicated number of times (X = number of times to repeat in decimal).
SC [,XXXXXX]	Status Check. (XXXXXX = expected status in octal).
SD,X	Select Drive. Indicated drive is selected. (X = drive number; $0 \leq X \leq 3$.)

**STRADDLE ERASE – A special recovery procedure performed on sector to improve magnetic characteristics of data.*

7900/7901 DISC DIAGNOSTIC (Cont'd)

7900/7901 OPDSN PROGRAMMING

INSTRUCTION	FUNCTION
SR , [CCC] ,[H] [,SS]	Seek Record. Sets up the RAR and seeks to the disc location defined by the RAR (CCC = cylinder, H = head, SS = sector).
ST	Status (hardware).
VL	Verify Lower Disc. 7900 only. This instruction checks status except for bits 3 (flagged cylinder) and 10 (Write protected).
VU	Verify Upper disc. This instruction checks status except for bits 3 (flagged cylinder) and 10 (write protected).
WD [,XXXX]	Write Data (XXXX = word count).

7905/06/20/25 DISC DIAGNOSTIC

Paper Tape Binary 12962-16001. Date Code 1805.
Cartridge Binary 24998-13305, Date Code 1822 and
24396-13306 Date Code 1901. DSN 151403
Manual: 12962-90001

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg = Configuration options.

Configuration Options

BIT	FUNCTION IF SET
5-0	SC of controller interface PCA.
14	0 = DMA channel 6; 1 = channel 7.

4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Restart: P-Reg = 2000_8.
8. Switch options:

BIT	MEANING WHEN SET
0	Allow defective and spare tracks and flag a track defective if five consecutive attempts to verify that track are unsuccessful.
1	Skip to end of current test section.
2	Allow operator to alter the unit table, unit removal threshold, head table, determine status heading, alter pattern table, change decision on printing soft errors alter cylinder table, and decide whether or not MCPU mode is entered.
3	Enter OPDSN section.
4	Execute interactive tests (test section 1).
5	Skip test section 2 and shorten test in test sections 3, 4, and 5.
6	Select cylinder numbers from the cylinder table when set; from all those available on drive, when clear.
7	Loop on current test section.
8	Eliminate all blank lines between messages output, and output the pass message H65 if an error occurs during a pass in which bit 10 is set.
9	Halt (10201X) after each test section of the diagnostic is complete. Push RUN.
10	Suppress all non-error messages. Exceptions are current operation messages when an error occurs, the cylinder, head, and sector where the error occurs, and the pass message H65 on each pass where the error occurs, when bit 8 is set.
11	All messages are suppressed.
12	Print timing messages in test sections 2 (H53 AVERAGE SINGLE CYLINDER SEEK TIME X.XX) and 4 (H54 AVERAGE RANDOM SEEK TIME XXXX.X, LENGTH XXXX.X).
13	Loop on current step.
14	Program will not halt after each error.
15	Halt (102004) after the current step is complete.

7905/06/20/25 DISC DIAGNOSTIC (Cont'd)

HALT CODES

HALT	MEANING
102001	Error halt; non-information type message.
102002	Operating instruction or comment; operator action required.
102004	Orderly halt at end of current step.
102005	Push RUN to restart diagnostic.
102006	Push RUN to restart diagnostic. (See messages E50 and E103.)
10201X	Halt between sections (X = section number).
102073	Illegal select code during configuration of the diagnostic.
102074	Halt at end of diagnostic configuration.
1060XX	Trap cell interrupt. P-Reg = memory address when interrupted, XX = trap cell location.

SUMMARY OF OPDSN COMMANDS

COMMAND	FUNCTION
AI	Add instructions.
AR [, [ccc] [, [h] [,ss]]] *	Address record.
CA,LL	Call subroutine LL.
CB [, [xxxx] [,yy]]	Compare buffers.
CC [,n]	Change cylinder variable.
CH [,n]	Change head variable.
CL	Issue clear command.
CP,X,Y	Compare surface X with surface Y.
CR [, [xxxx] [, [h] [,ss]]]	Cold load read.
CS [,n]	Change sector variable.
CW,X,Y	Change word X (decimal) of write buffer to Y(octal).
DA	Request disc address.
DB [, [xxxx] [,yyyyyy [,c]]] **	Define buffer.
DC	Disable checking.
DL [,N]	Delay N milliseconds.
DR,X [,y]	Display contents of word X (or read buffer).
DS [, [ccc] [, [h] [,ss]]]	Decrement seek.
DW,X, [,y]	Display contents of word X (or write buffer).
EE	Erase last instruction entered.
EN [,II]	End instruction entry and begins program execution.

* ccc = cylinder, h = head, ss = sector.
Limits: cyl. 0-202, head 0-3; sector 0-23.

** xxx = word count, yyyyyy = pattern of word in octal. c = compliment successive words.

7905/06/20/25 DISC DIAGNOSTIC (Cont'd)

SUMMARY OF OPDSN COMMANDS (Cont'd)

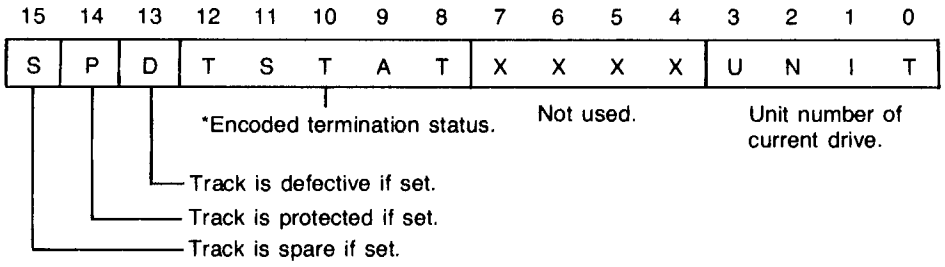
COMMAND	FUNCTION
EP	Erase present program.
EX	Exit OPDSN section.
FH	Format all heads in head table.
FN	Format surface N.
GO,LL	GOTO label LL.
HT [,xxxxxx]	Halt.
ID [, [xxxx] [,s]] d p	Initialize data.
IS [, [ccc] [, [h] [,ss]]]	Incremental seek.
LB,LL	Define a label.
LP [,II]	End instruction entry and loop on program.
LS,N	Loop on step N.
LV,LL	Leave subroutine LL.
MC [, [ccc] [, [h] [,ss]]]	Multiple CPU check.
NO	Nop.
PR,SS	Output symbol SS followed by an integer number plus 1.
RA	Request sector address.
RC	Issue a recalibrate command.
RD [,xxxx]	Transfer xxxx words from disc to read buffer.
RF [,xxxx]	Perform read full sector for xxxx words.
RI	Run instructions previously entered.
RL	Reload.
RN	Restore information stored by last SN instruction.
RO [, [xxxx] [, [±cc] [,a]]] d	Issue a read with offset.
RS	Random seek.
RT,LL,X	Return to label LL,X number of times.
RW	Read without verify.
SB,LL	Define subroutine LL.
SC	Status check.
SD,X	Select drive X.
SK [, [ccc] [, [h] [,ss]]]	Seek to cylinder, head, and sector specified.
SM [,xxxxxx]	Set file mask to xxxxxx (octal).
SN	Save current cylinder, head, and sector.
ST	Issue status command.
TB [,n]	Transfer first n words of read buffer to write buffer.
TC,CCC,X,Y	Transfer cylinder CCC from surface X to surface Y. (7905 only)
TS,X,Y	Transfer surface X to surface Y. (7905 only)

7905/06/20/25 DISC DIAGNOSTIC (Cont'd)

SUMMARY OF OPDSN COMMANDS (Cont'd)

COMMAND	FUNCTION
VD	Verify defective.
VF [,xxxx]	Verify xxxx number of sectors.
VH	Verify all heads in head table.
VN	Verify surface N.
VP	Verify protected.
VS	Verify spare.
WD [,xxxx]	Transfer xxxx words from write buffer to disc.
WF [,xxxx]	Write full sector for xxxx words.

STATUS-1 WORD

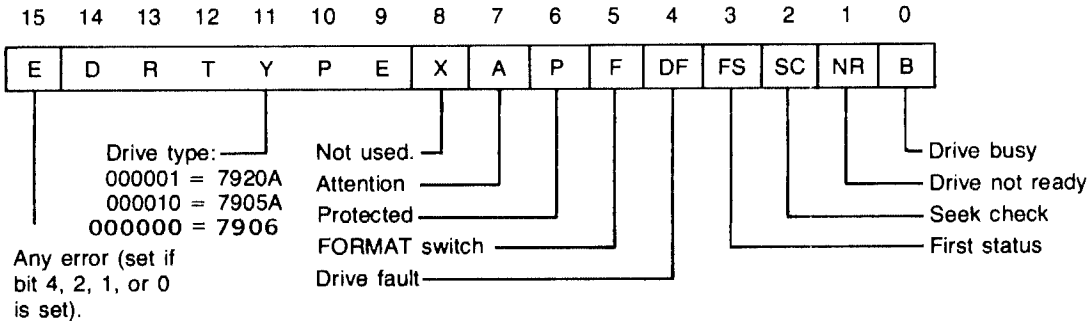


*Encoded termination status

STATUS-1 WORD (octal)	TSTAT (binary)	DEFINITION
000000	00000	No errors. (NORMAL COMPLET).
000400	00001	Illegal opcode. (ILLEGAL OPCODE).
001000	00010	Unit available. (UNIT AVAILABLE).
003400	00111	Cylinder compare error. (CYL CMP ERR).
004000	01000	Uncorrectable data error. (UNCOR DATA ERR).
004400	01001	Head-sector compare error. (HD/SEC CMP ERR).
005000	01010	I/O program error.
006000	01100	End of cylinder. (END OF CYLNDER).
007000	01110	Data overrun. (OVERRUN).
007400	01111	Possibly correctable data error. (POSS CORR DATA).
010000	10000	Illegal access to spare track. (SPR TRK ACCESS).
010400	10001	Defective track. (DEFECTIVE TRK).
011000	10010	Access not ready during data operation. (ACCSS NR DATOP).
011400	10011	Status-2 error. (STATUS-2 ERROR).
013000	10110	Attempt to write on protected or defective track. (WRT PROTEC TRK).
013400	10111	Unit unavailable. (UNIT UNAVAIL).
017400	11111	Drive attention. (DRIVE ATTNTION).

7905/06/20/25 DISC DIAGNOSTIC (Cont'd)

STATUS-2 WORD



SERVICE DATA

Verification Test

To verify a surface using operator design (TS6), type the following program:

```
SD,X      Select Drive X.
Vz        z = H, to verify all heads in head table, or
            = head number (0-2).
EN
```

Formatting

To format a surface on a drive using operator design (TS6), type the following program:

```
SD,X      Select Drive X.
Fz        z = H, to format all heads in head table, or
            = head number (0-2).
EN
```

Surface Transfer (7905 only)

Set PROTECT switch to; ON for surface Z, OFF for Y.
Set FORMAT switch to ON.

```
SD,X
TS,Z,Y    Transfer surface Z to surface Y.
EN
```

Check Transfer (7905 only)

Clear PROTECT switch for surface Z.

```
SD,X
CP,Z,Y    Z and Y same as in surface transfer.
EN
```

9885M (MASTER) FLEXIBLE DISC DRIVE

12732A/12733A FLEXIBLE DISC SUBSYSTEM

EQUIPMENT

9885M Disc Drive
12735A Computer Interface
  12735-60001 Control I/F PCA
  12735-60002 Data I/F PCA
  12735-60003 I/F Cable, 4.5m (15 ft.)
9885S Disc Drive
  09885-61617 Chaining cable 2m (6 ft.)
9164-0074 Blank disc

DOCUMENTATION

P/N	MANUAL
09885-90030	9885 Service
09885-90020	Flexible Disc Maintenance Note
12732-90005	12732A/12733A Operating & Service
12732-90001	12732A/12733A Programming
12732-90003	12732A Diagnostic Reference

IN-1. Interface PCA Jumper Configurations.

JUMPER	POSITION	
	CONTROL INTERFACE 12735-60001	DATA INTERFACE 12735-60002
W1	A	A
W2	B	A
W3	B	B
W4	B	B
W5	IN	IN
W6	IN	IN
W7	IN	IN
W8	OUT	IN
W9	B	B

IN-2. Install control and data interface PCA's in adjacent slots with the control interface PCA occupy the lower numbered slot (higher priority).

12732A/12733A FLEXIBLE DISC DIAGNOSTIC (9885 FLEX DISC DRIVE)

Paper Tape Binary 12732-16003. Date Code 1708.
Cartridge 24396-13308. Date Code 1901 and 24998-13305 Date Code 1822.
DSN 111104.

A Standard pass with no operator intervention, no errors, a sector offset of five, and no formatting requires about 20 minutes.

CAUTION

DO NOT HALT DIAGNOSTIC. Use bit 15 to terminate properly.

1. Load Diagnostic Configurator.
2. Configure configurator and load 12732 diagnostic.
3. Configure diagnostic: P-Reg = 100_8; S-Reg (5-0) = SC of Control Interface PCA.
4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.

12732A/12733A FLEXIBLE DISC DIAGNOSTIC (9885 FLEX DISC DRIVE) (Cont'd)

7. Switch options:

BITS	MEANING IF CLEAR
15-6	Standard tests in sequence one pass, no options, and no formatting unless 0, 1, 4, and 5 are set.

BITS	MEANING IF SET
0,1,4,5	Enable format-altering operations.
2	Alter patterns for TRAK test.
3*	Abort current operation and go to OPDSN input section.
6	Spare.
7	Echo console on line printer.
8	Suppress operator intervention in TEST 0 (CARD test) and TEST 4 (ERRR test).
9*	Abort current operation and go to user control section. Set A-Register bits to desired test numbers.

A-REG BIT	EXECUTE IF SET
0	TEST 00 Interface PCA's and Interrupts
1	TEST 01 Format Entire Disc
2	TEST 02 Read-Only Media Test
3**	TEST 03 Verify Test
4	TEST 04 Error Status Test
5	TEST 05 Pattern Test
6	TEST 06 Random Seek and Position
7	TEST 07 Random Seek and Write
8	TEST 08 Seek Test
9	TEST 09 Head Step-Mark Defective Test
10	TEST 10 Dump Test
11	TEST 11 DCPC Modes Test
12**	TEST 12 Non-DCPC Modes Test

10	Suppress non-error messages.
11	Suppress error messages.
12	Loop on diagnostic and suppress operator intervention in TEST 0 (CARD test) and TEST 4 (ERRR test).
13	Loop on last test.
14	Suppress halt on error.
15	Halt at the end of each test.

*Setting bits 3 or 9 during a format operation may leave the disc improperly or partially formatted.
**Optional tests.

12732A/12733A FLEXIBLE DISC DIAGNOSTIC (9885 FLEX DISC DRIVE) (Cont'd)

Function of S-Register Bits 0, 1, 4 and 5

TEST	FUNCTION FORMAT ENABLED*	FUNCTION FORMAT NOT ENABLED
TEST 1 & FALL	Formats all of disc.	No action.
TEST 4 & ERRR	Checks error reporting capability of disc including ("track not found" and "sector not found") and then formats all of disc. Disc must be previously formatted.	Checks error reporting capability of disc (except "track not found" and "sector not found"). Disc must be previously formatted.
TEST 9	Marks all tracks defective, then formats all of disc.	Steps head from track 0 to track 66.
FTRK & FX	Formats a single track.	No action.
MARK	Marks a track defective.	No action.
TEST 5 & TRAK	Writes worst case patterns in track-0 sector-0, and then rewrites original contents (no. of good tracks and sector offset).	Only sectors 1-29 of track 0 are tested. Sectors 0-29 of other tracks are tested.
WD & WX	Track-0 and sector-0 may be overwritten.	Track-0 and sector-0 may NOT be overwritten.

*Bits 0, 1, 4, and 5 set in S-Register during execution of the OPDSN statements and standard tests listed.

Summary of OPDSN Commands

COMMAND*	FUNCTION
CARD	Test interface cards and interrupts.
CB I N	Compare buffers (I = words, N = maximum errors).
CBP I N	Compare buffers, output errors on line printer (I = words, N = maximum errors).
DB	Fill output buffer with random data.
DBFK K B	Fill output buffer with octal alternating pattern. (K = odd word pattern, B = even word pattern).
DBRK I N**	Replace words I to N with octal data from console.
DBSZ	Print output buffer size.
DUMP A	Dump 128 words and compare buffers. (A = C to compare).
DLY I	Delay I milliseconds.
DX K B	Dump (K = expected status, B = mask).
ERRR	Force error status.
EP**	Erase program.
EX	Exit OPDSN.
FALL I N	Format entire disc (I = number of patterns, N = sector offset).
FTRK I N	Format track I (N = sector offset).
FX I K	Format track I (K = expected status).
GO**	Execute user program.
GOTO I†	Jump to line I.
GOSB I N†	Repeat subroutine starting at line I, N times.
LI I N	List input buffer from word I to word N.
LIP I N	List input buffer from word I to N on line printer.

12732A/12733A FLEXIBLE DISC DIAGNOSTIC (9885 FLEX DISC DRIVE) (Cont'd)

Summary of OPDSN Commands (Cont'd)

COMMAND*	FUNCTION
LO I N	List output buffer from word I to N.
LOP I N	List output buffer from word I to N on line printer.
LP**	List user program.
LPP**	List user program on line printer.
MARK K B	Mark track defective (K = expected status, B = mask).
MDIS I	Mount disc (I = number of good tracks).
MODE A I	Set mode of I/O AND DCPC (A = mode, I = DCPC channel).
MOVE I	Seek I sectors forward or backward.
MSG A S	Output four character ASCII message to console.
PRST	Preset controller and seek home.
RAND I A	I = iteration count. A = S, Z, R, W, or D for random seeks, writes, reads, or dumps.
RD I A	Read I words and compare buffers (A = C to compare).
RTN†	Return from subroutine.
RTRY I	Set up retry count.
RX I K	Read I words (K = expected status).
SD I	Set up drive number (0 to 3).
SK I N	Seek track I, sector N.
ST K B	Request status (K = expected status, B = mask).
SX I K	Seek (I = [track x 100] + sector, K = expected status).
STAT	Print last status.
STEP K B	Step head in one track (K = expected status, B = mask).
STOP†	Stop execution of OPDSN program.
TEST I	Execute standard diagnostic test I.
UX I K	Undefined command (I = "track", K = expected status).
TRAK I N	Pattern test of track I (N = number of patterns).
VRFY I A	Verify I words and compare buffers.
VX I K	Verify I words (K = expected status).
WAIT†	Wait for operator (operator enters ST or CO I).
WD I	Write I words (Negative I = write entire disc).
WX I K	Write I words (K = expected status).

* Command use requires line number for program statements and no line number for immediate execution upon CR-LF. Some commands can be used in only one of the two modes as footnoted (** = without line number, † = with line number).

** Use without line number for immediate execution.

† Use with line number in program statements.

12732A/12733A FLEXIBLE DISC DIAGNOSTIC (9885 FLEX DISC DRIVE) (Cont'd)

Status Words

BIT NO.	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
CODE	P	0	0	0	E	E	E	E	0	T	S	R	W	C	D	D

BIT	CODE	MEANING	DATA (OCTAL)
0	D	Drive Number	000000 to
1	D		000003
2	C	Change bit. PRST executed or power restored, or door is open, or door was opened since last status return.	000004
3	W	Write Protected Disc	000010
4	R	Drive Not Ready (no drive power, door open, no disc in drive)	000020
5	S	Seek or Step Complete	000040
6	T	Transfer Complete (read, write, verify, dump, format)	000100
7	0	Not Used	
	E	No Error	000000
	E	No Drive Power	000400
	E	Drive Door Open	001000
8	E	No Disc in Drive	001400
9	E	Invalid Command	002000
10	E	Sector Not Found	002400
11	E	Track Not Found	003000
	E	Data Checkword Error	003400
	E	Data Overrun	004000
	E	Verify Error	004400
12	0	Not Used	
13	0	Not Used	
14	0	Not Used	
15	P	Controller Power Off or Current Operation Not Successful	100000

Notes: All disc controller commands, except seek, return status in bits 15-0 of the data channel. Status P, shown in bit 15, is signal PSTS (bit 15 of control channel) logically inverted.

SERVICE DATA

1. For additional testing of the 12735 interface, run the General Purpose Register Diagnostic, manual P/N 24391-90001. Prior to running this diagnostic, be sure to place data interface PCA jumper W2 in position B. (Do not forget to replace jumper W2 in position A before attempting to operate the subsystem.)

7970B 9-TRACK MTU

12970A MAG TAPE SUBSYSTEM

EQUIPMENT

7970B	MTU
13181A/13181B	Interface Kit
13181-60030	Cable
9162-0025	Magnetic Tape, 731.5m (2400 ft)
8500-1251	Head Cleaner, Freon

DOCUMENTATION

P/N	MANUAL
12970-90001	12970A Subsystem
07970-90383	7970B Operating and Service
13181-90000	13181A Operating and Service
13181-90095	MTU Subsystem Diagnostic

SPECIFICATIONS

Transport

Number of tracks - nine
Density: 9-track: 800 cpi
Write Enable - supply reel ring required to write
Reel Diameter - up to 10.5 inches (266.7 mm)
Read/Write Speed - 25, 37.5, or 45 ips
Data Transfer Rate - 36 kHz (800 cpi, 45 ips)
Rewind Speed - 160 ips

Tape

Width - 0.5 inches (12.7 mm)
Thickness - 1.5 mils (0.038 mm)
Start/Stop Times - 8.33 ms (read/write) at 45 ips
End-of-Tape/Beginning-of-Tape Detection - IBM compatible

Physical Characteristics

Height: 24. in. (60.9 cm)
Width: 19 in. (48.2 cm)
Depth: 12 in. (30.4 cm) from mounting surface
Overall Depth: 15-3/4 in. (40.0 cm)
Weight: 130 lbs. (59.02 Kg) maximum

Environmental (Hardware)

Ambient Temperature - 32° to 131°F (0° to 55°C)
Relative Humidity - 20% to 80% (non-condensing)

Power

7970B:
115 or 230 VAC ±10% (switch selectable)
48 to 60 Hz single phase
400 VA maximum (high line)

Interface:
2.9A (+4.5V); 0.09A (−2V)

7970B 9-TRACK MTU (CONT)

SERVICE DATA

1. 13181A Speed-Strapping

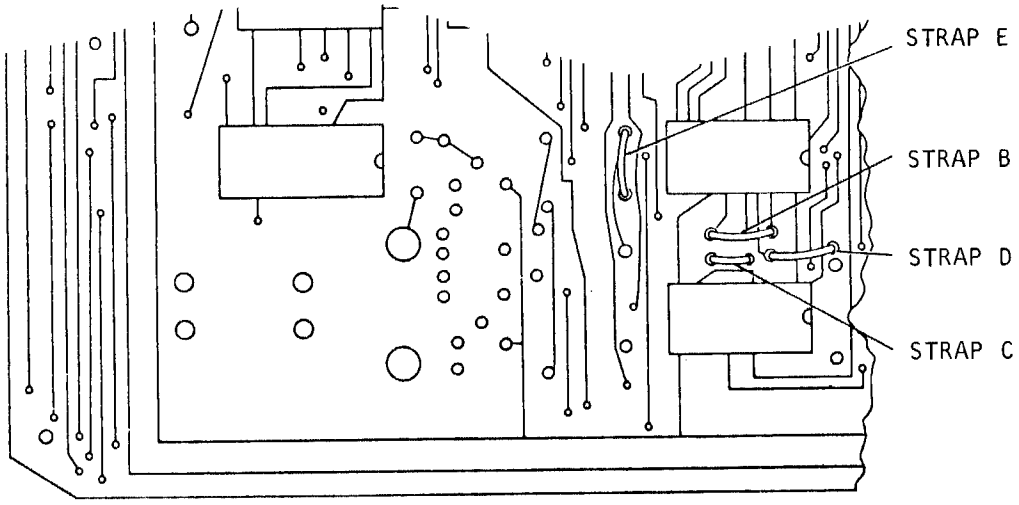
   Tape speed strapping is shown below and described as follows:

   a. For 12.5 IPS speed, use straps B, D, and E.

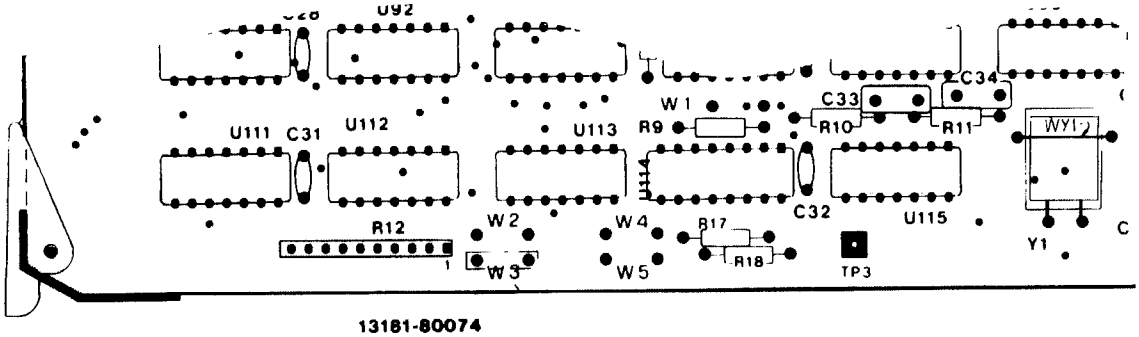
   b. For 25 IPS speed, use straps B and E.

   c. For 37.5 IPS speed, use strap D.

   d. For 45 IPS speed, use strap D and change from 300-kHz crystal (part no. 0410-0163) to 360-kHz crystal (part no. 0410-0431).



2. 13181B Speed Strapping.



13181-80074

JUMPER	TAPE SPEED IPS			
	12.5	25	37.5	45
W5	● ●			
W4		● ●		
W3	● ●		● ●	● ●
W2	● ●	● ●		
W1 *	● ●	● ●	● ●	

*No crystal change required,
W1 selects 300 kHz or 360 kHz.

7970E 9-TRACK MTU

12972A MAG TAPE SUBSYSTEM

EQUIPMENT

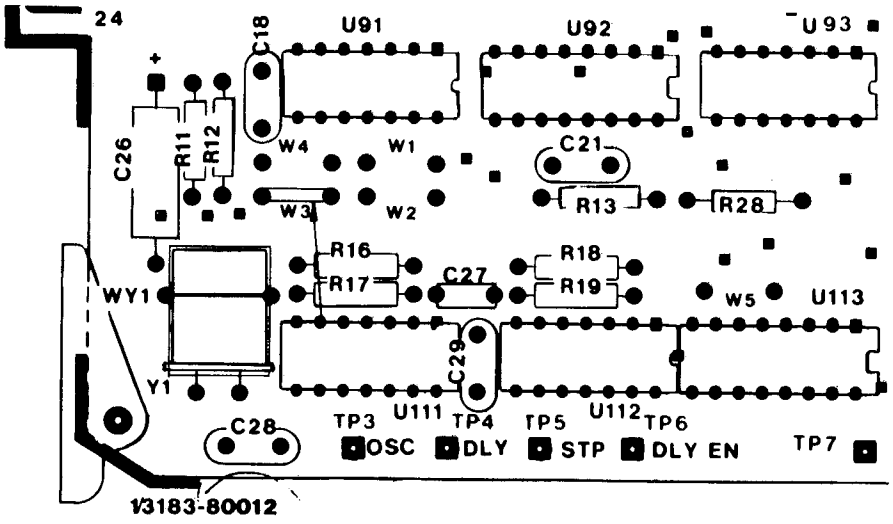
7970E	9-track, 1600 CPI, read-after-write, Mag Tape Drive
13183A/B	Interface Controller
13183-60003	Cable, 20 ft
9162-0025	Magnetic Tape, 731.5m (2400 ft)
8500-1251	Head Cleaner, Freon

DOCUMENTATION

P/N	MANUAL
12972-90001	12972A Subsystem
07970-90765	7970E Operating and Service
13183-90000	13183A Operating and Service
13181-90095	Mag Tape Subsystem Diagnostic

SERVICE DATA

13183B Strapping



JUMPER	TAPE SPEED IPS			
	12.5	25	37.5	45
W5	● ●	● ●	● ●	
W4	● ●	● ●		
W3	● ●		● ●	● ●
W2	● ●			
W1		● ●		

7970A/B/E 9-TRACK MTU DIAGNOSTIC

Paper Tape Binary 13181-16001. Date Code 2040,
Cartridge 24396-13307. Date Code 2040, and
24998-13306. Date Code 2040. DSN 112200

7970A/B INTERFACE 13181A, or

7970E INTERFACE 13183A/B

1. Load Diagnostic Configurator.
2. Configure configurator and load 7970 diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg = Configuration options.

Configuration Options

BITS	MEANING IF SET
0-5	Select code mag tape 1.
6 thru 8	Not used.
9	Non-DMA (DCPC) for 13183.
10	13181 Interface.
11	13183 Interface.
12	12.5 IPS.
13	25 IPS.
14	37.5 IPS.
15	45 IPS.

4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Restart: P-Reg = 2000_8.
8. Switch options:

SW BITS	MEANING IF SET
0-3	Unit select (if reset auto select) [auto select for multi-unit only]
4*	Use DMA (DCPC) channel 1 on all Read/Write
5*	Use DMA (DCPC) channel 2 on all Read/Write
6	Inhibit test with enbedded rewinds
7	Delete CRCC and LRCC checks (13181 only)
8	Suppress test which require operator intervention
9	Go to User Test Selection Section. Selected test in A or B register. See table below.
10	Suppress non-error messages
11	Suppress error messages
12	Loop on diagnostic
13	Loop on last test
14	Suppress error halts
15	Halt 76 at end of each test

*If DMA (DCPC) is not available, the program will override switch register setting.

7970A/B/E 9-TRACK MTU DIAGNOSTIC (Cont'd)

List of test with A/B-register settings.

A-REG BIT	TEST NO. OCT	TEST NO. DEC	TEST TITLE
0	0	0	Basic I/O
1	1	1	Initial clear controller and unit selection
2	2	2	Beginning of tape (BOT)
3	3	3	Command reject at BOT
4	4	4	Write command execution time
5	5	5	Gap command execution time
6	6	6	File mark command
7	7	7	Multiple file mark
8	10	8	Initial Write/Read
9	11	9	125125 Write/Read
10	12	10	Force data and timing error status
11	13	11	Record spacing
12	14	12	File spacing
13	15	13	Clear time check during a motion command command
14	16	14	Interrecord gap
15	17	15	Negative interrecord gap creep

B-REG BIT	TEST NO. OCT	TEST NO. DEC	TEST TITLE
0	20	16	Write/Read single rotating bit pattern
1	21	17	Write/Read channel sawtooth pattern
2	22	18	Write/Read track sawtooth pattern
3	23	19	Write/Read (non DMA) random data
4	24	20	DMA channel 1 write/read with random data
5	25	21	DMA channel 2 write/read with random data
6	26	22	Rapid write
7	27	23	Echo check on all on-line units

7970A/B/E 9-TRACK MTU DIAGNOSTIC (Cont'd)

List of test with A/B-register settings (continued)

B-REG BIT	TEST NO. OCT	DEC	TEST TITLE
8	30	24	Controller check for multi-unit operation
9	31	25	Inter-unit compatibility
10	32	26	Write ring enable
11	33	27	Rewind off-line
12	34	28	Write all ones record
13	35	29	Read an all ones record
14	36	30	Operator service routine
15	37	31	Operator Design*

*For operator design procedure consult MOD.

7970A/B/C/E 9-TRACK MTU ON-LINE ADJUSTMENTS

FOR ADJUSTMENT OF START/STOP TIME

1. Prepare 7970 diagnostic (13181-16001) for execution.
2. Set S-Reg bit 9.
3. Press PRESET, RUN. HALT 102075.
4. Clear S-Reg bit 9.
5. Set B-Reg bit 14.
6. Press PRESET, RUN. Message "H146 SELECT OP. SER". HLT 46.
7. Set S-Reg bit 2.
8. Press PRESET, RUN. Message "SELECT COMMAND". HLT 51.
9. Set S-Reg bits 3, 11, 12, 13 and 14.
10. Mount Scratch Tape and set Unit on-line.
11. Press PRESET, RUN. The tape should be starting and stopping. To vary delay, turn bits 12-14 on or off for desired timing.
12. Set S-Reg bit 15 to terminate routine. HLT 46.

7970A/B/C/E 9-TRACK MTU ON-LINE ADJUSTMENTS (Cont'd)

FOR ADJUSTMENT OF START/STOP TIME (Cont'd)

WRITE ALL ONES FOR PREAMP AND WRITE SKEW ADJUSTMENT (7970A/B with 13181 only)

1. Perform steps 1 through 8 of above procedure.
2. Set S-Reg bit 0 (write command).
3. Mount Scratch Tape and set Unit on-line.
4. Press PRESET, RUN. The unit should be writing all 1's.
5. Set S-Reg bit 15 to terminate routine. HLT 46.

Note: "B" interfaces will fail diagnostics issued prior to DSN 112200.

13181 OPDSN SUMMARY

To enter OPDSN select Test 31.

PROGRAM COMMANDS

LF	List sources statement file
LO	List user output buffer
LI	List user input buffer
IL	List user input buffer length
CF	Clear source statement file
CB	Clear user output buffer
DB	Define buffer
GO	Execute user program
BY	Exit operator design

PROGRAM CONTROL STATEMENTS

NN GOTO X Go to line X.

NN GOSB X Y Go to subroutine starting at line X and repeat it Y number of times.

NN RTN

Return to the last GOSB line number +1 (if no repeat count).

NN WAIT Wait for the operator.

NN MSG XY Output "* XY" on the console (see 7.5.6).

NN DLY X Delay further execution by X number of milliseconds.

NN TEST X Execute Test number X (where X is an octal number).

NN STOP Terminate execution of user program.

NN CNT Increments and outputs a counter each time it is executed.

Peripheral Control Statements (magnetic tape unit)

NN SR Status report of magnetic tape unit.

NN SC X Y Branches to line X if tape unit status is not equal to Y.

NN TC Execute tape unit command (see Table VII).

13181 OPDSN SUMMARY (Cont'd)

NN SFC X Y	Branches to line X if channel Y flag is clear.
NN SD X Y	Places standard data patterns in user buffer.
NN WORD X Y	Places special data pattern in user buffer.
NN RD	Reads a record.
NN WR	Writes a record.
NN COMP	Compares input buffer to output buffer.
NN CRC	Outputs current CRCC from tape unit.
NN CRCI	Computes CRCC from input buffer.
NN CRCO	Computes CRCC from output buffer.
NN LRCI	Computes LRCC from input buffer.
NN LRCO	Computes LRCC from output buffer.
NN DMA X	Read/write under DMA (DCPC) channel X.
NN DMAW	Outputs DMA (DCPC) word count.
NN INTR	Read/write with interrupt system on.
NN TRAP X Y	Fills interrupt trap cell X with jump to line Y.
NN FLAG	Read/write under skip flag method.

2607A LINE PRINTER

12987A SUBSYSTEM

EQUIPMENT

2607A	Line Printer
12845B	Interface

DOCUMENTATION

P/N	MANUAL
12987-90001	Line Printer Subsystem
12845-90011	12845B Interface
12987-90004	2607 Diagnostic Reference

2607 LINE PRINTER DIAGNOSTIC

Paper Tape Binary 24340-16001. Date Code 1446.
Cartridge Binary 24396-13305. Date Code 2026 and
24998-13304. Date Code 2026. DSN 105102
Manual: 12987-90004

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = SC of line printer.
4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.

2607 LINE PRINTER DIAGNOSTIC (Cont'd)

7. Switch options:

<table>
<tr><th>BITS</th><th>FUNCTION IF SET</th></tr>
<tr><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Suppress character "H" in dot matrix test</td></tr>
<tr><td>2</td><td>Suppress character "I" in dot matrix test</td></tr>
<tr><td>3</td><td>Suppress character "#" in dot matrix test</td></tr>
<tr><td>4</td><td>Suppress character "." in dot matrix test</td></tr>
<tr><td>5</td><td>Reserved</td></tr>
<tr><td>6</td><td>Reserved</td></tr>
<tr><td>7</td><td>Reserved</td></tr>
<tr><td>8</td><td>Suppress test requiring operator intervention</td></tr>
<tr><td>9</td><td>Abort current run and perform HALT with MDR = 102075_8; user sets bits of A-register with test selection where bit i selects test i; e.g. bit 0 set selects test 0, bit 1 selects test 1, etc. Clear switch register bit 9, press run.</td></tr>
<tr><td></td><td>
<table>
<tr><th>A-REG BITS</th><th>EXECUTE IF SET</th></tr>
<tr><td>0</td><td>Basic I/O Channel Functions</td></tr>
<tr><td>1</td><td>Manual Control</td></tr>
<tr><td>2</td><td>Ripple Print</td></tr>
<tr><td>3</td><td>Triangular Print</td></tr>
<tr><td>4</td><td>Vertical Format Control</td></tr>
<tr><td>5</td><td>Character Set</td></tr>
<tr><td>6</td><td>Dot Matrix</td></tr>
<tr><td>7</td><td>DMA</td></tr>
<tr><td>8</td><td>Operator Design</td></tr>
</table>
</td></tr>
<tr><td>10</td><td>Suppress all non error messages.</td></tr>
<tr><td>11</td><td>Suppress printing of error messages.</td></tr>
<tr><td>12</td><td>Repeat all selected tests of the diagnostic except those requiring operator intervention.</td></tr>
<tr><td>13</td><td>Repeat the currently executing test (LOOP)</td></tr>
<tr><td>14</td><td>Suppress error HLTS</td></tr>
<tr><td>15</td><td>Halt at end of each test. HLT 102076</td></tr>
</table>

2613A LINE PRINTER

12975A SUBSYSTEM

EQUIPMENT

2613A	Line Printer
12845B	Interface

DOCUMENTATION

P/N	MANUAL
02613-90010	2613A Printer Operator's
12845-90011	12845B Interface
02618-90006	2613 Diagnostic

2617A LINE PRINTER

13053A SUBSYSTEM

EQUIPMENT

2617A	Line Printer
12845B	Interface

DOCUMENTATION

P/N	MANUAL
02613-90010	2617A Printer Operators
12845-90011	12845B Interface
02618-90006	2617 Diagnostic

2618A LINE PRINTER

12983A SUBSYSTEM

EQUIPMENT

2618A	Line Printer
12845B	Interface

DOCUMENTATION

P/N	MANUAL
02618-90001	2618A Printer Operating and Service
02618-90002	2618A Printer Diagrams and Parts Breakdown
12845-90011	12845B Interface
02618-90006	2618 Diagnostic

2613/17/18 LINE PRINTER DIAGNOSTIC

Paper Tape Binary 02618-16001. Date Code 1633.
Cartridge Binary 24396-13305. Date Code 2026 and
24998-13304. Date Code 2026. DSN 145103.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = SC of line printer interface.
4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Switch options:

BIT	FUNCTION IF SET	
0 8 9	thru 7 reserved Suppress tests requiring operator intervention. Abort current diagnostic execution and HLT 102075. User may specify a new group of test in "A" register, clear bit 9 and press run.	
	A-REG BIT	**EXECUTE IF SET**
	0	Basic I/O operation
	1	Manual Control Test
	2	Ripple Print Test
	3	Triangular Print Test
	4	Vertical Format Control Test
	5	Character Set Test
	6	Over Print Test
	7	DMA Operation Test
	8	OP Design Test
10 11 12 13 14 15	Suppress non error messages. Suppress error message. Repeat all selected tests. Repeat last test executed (loop on test). Suppress error halts. Halt (102076) at end of each test.	

2767A/12653A LINE PRINTER AND I/F DIAGNOSTIC

Paper Tape Binary 12984-16001. Date Code 1611.
Manual P/N 12984-90005

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = Interface SC.
4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Restart: P-Reg = 2000_8.
8. Switch options:

<table>
<tr><th>BIT</th><th colspan="3">MEANING IF SET</th></tr>
<tr><td>7-0</td><td colspan="3">Reserved.</td></tr>
<tr><td>8</td><td colspan="3">Suppress test requiring operator intervention.</td></tr>
<tr><td>9</td><td colspan="3">Abort current test and halt (102075); specify tests in A-Reg; clear bit 9 and press RUN.</td></tr>
<tr><td></td><td>A-REG BIT</td><td>TEST</td><td>EXECUTE IF SET</td></tr>
<tr><td></td><td>0
1
2
3
3
5
15-6</td><td>00
01
02
03
04
05*</td><td>Basic I/O
Manual Control
Paper Handling and Cyclic Print
Illegal Operations
Alignment
Operator Design
Reserved</td></tr>
<tr><td></td><td colspan="3">*Must be selected by the operator.</td></tr>
<tr><td>10</td><td colspan="3">Suppress non-error messages.</td></tr>
<tr><td>11</td><td colspan="3">Suppress error messages.</td></tr>
<tr><td>12</td><td colspan="3">Repeat all selected tests. Also, suppress those tests requiring operator intervention.</td></tr>
<tr><td>13</td><td colspan="3">Repeat last test executed (loop on test).</td></tr>
<tr><td>14</td><td colspan="3">Suppress error halts.</td></tr>
<tr><td>15</td><td colspan="3">Halt (102076) at the end of each test; A-Reg = test number.</td></tr>
</table>

2892A CARD READER

12985A SUBSYSTEM

EQUIPMENT

2892A Card Reader
12924A Card Reader Interface Kit
  12924-60001 Interface PCA
  12924-60002 Cable Assembly

DOCUMENTATION

P/N	MANUAL
12985-90001	12985A Subsystem
02892-90001	2892A Operating and Service
12924-90001	12924A I/F Operating and Service
12924-90006	2892A/12924A Diagnostic

OPDESIGN

```
P = 2000
S = Bit 9 ON
WAIT 30 SEC
HALT 102075
A = BIT 6 ON
    (All OFF)
S = CLR BIT 9
PRESET — RUN
WAIT
HALT 10
```

2892A/12924A CARD READER AND I/F DIAGNOSTIC

Paper Tape Binary 12924-16001. Date Code 1537.
Cartridge Binary 24396-13307. Date Code 2040 and
24998-13306. Date Code 2040. DSN 113100.

Punched card test deck, P/N 12924-90004.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg = Configuration options.

Configuration Options

BIT	MEANING IF SET
5-0	Card Reader I/O select code.
14-9	Time Base Generator I/O select code (optional).

4. Press PRESET, RUN. HALT 102074.

2892A/12924A CARD READER AND I/F DIAGNOSTIC (Cont'd)

5. Set S-Reg = Switch options.

6. Press PRESET, RUN.

7. Restart: P-Reg = 2000_8.

8. Switch options:

BIT	MEANING IF SET	
0	Loop on Pseudo Operator Design.	OPDSN only
1	Check for ready.	
2	Read a card and put data in read buffer.	
3	Compare read buffer with standard data pattern.	
4	List read buffer.	
5	Delay 1 second between picks.	
6	Print Status.	
7	Reserved.	
8	Reserved.	
9	Abort current diagnostic execution and halt (102075); user may specify a new group of tests in the A-Reg, clear bit 9 and then press RUN.	
10	Suppress non-error messages.	
11	Suppress error messages.	
12	Repeat all selected tests. Also, those tests requiring operator intervention will be suppressed.	
13	Repeat last test executed (loop on test).	
14	Suppress error halts.	
15	Halt (102076) at the end of each test; A-Reg = test number (octal).	

2748B TAPE READER

12925A PTR SUBSYSTEM

EQUIPMENT

2748B Tape Reader
12597A-002 8-Bit Duplex Register I/F Kit
  12597-6001 Interface PCA
  12597-6004 Interface cable
  1251-0332 Test connector, 24-pin
12575C Electric Tape Winder

DOCUMENTATION

P/N	MANUAL
12925-90001	12925A Subsystem
12597-90022	12597A-002
12597-90031	Tape Reader/Punch Diagnostic

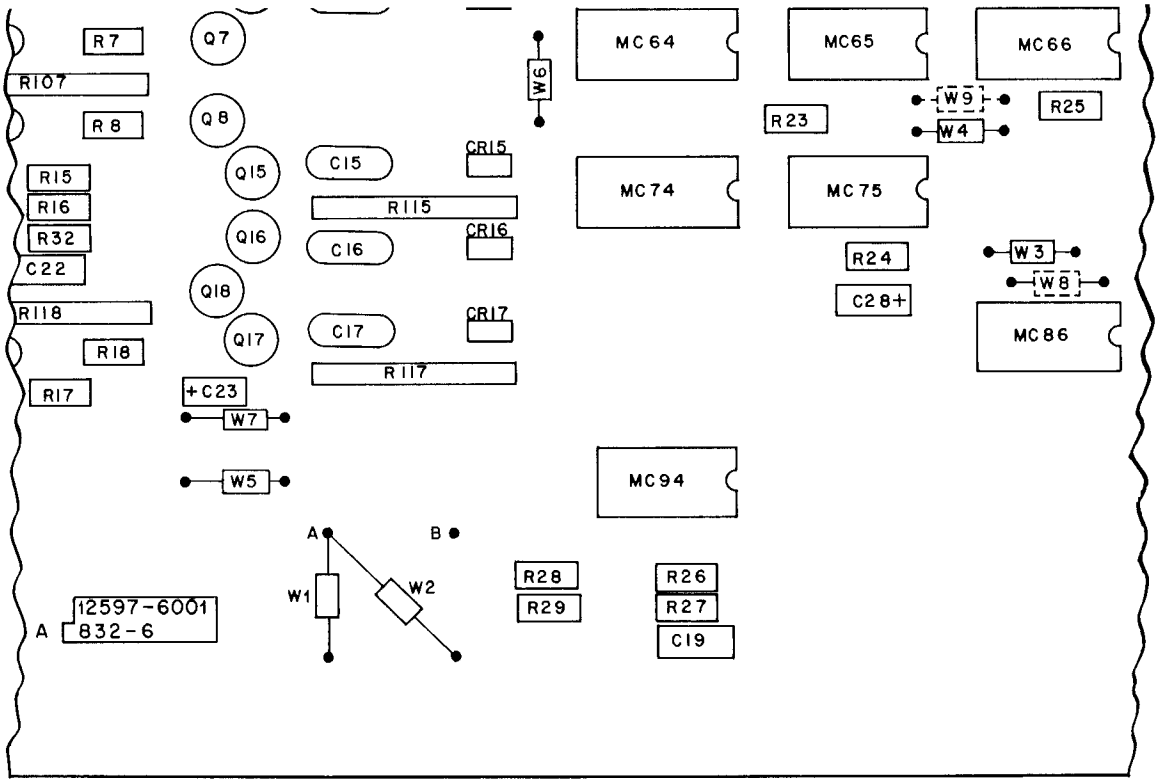
2748B TAPE READER (Cont'd)

INSTALLATION NOTES

Interface card jumper positions.

JUMPER	POSITION
W1	A
W2	A
W3	Connected
W4	Connected
W5	Connected
W6	Connected
W7	Connected
W8	Disconnected
W9	Disconnected

Interface card jumper positions.



2748B TAPE READER (Cont'd)

PHOTO READER OPERATION CHECK

Address	Mnemonic	Octal
100 B	STC PR, C	1037 PR
101	SFS PR	1023 PR
102	JMP * -1	024101
103	LIA PR	1025 PR
104	HLT	102000
105	JMP * -5	024100

PR = Photo Reader select code. When program halts, A Register contains character — just read from photo reader. Pushing RUN reads next character on tape.

2895B TAPE PUNCH

12926A TP SUBSYSTEM

EQUIPMENT

2895B Tape Punch
12597A-005 Tape Punch I/F Kit
  12597-6001 Interface PCA
  12597-60061 Interface cable
  1251-0332 Test connector, 24-pin
9280-0063 Paper Tape

DOCUMENTATION

P/N	MANUAL
12926-90001	12926A Subsystem Manual
02895-90008	2895B Operating and Service Manual
12597-90025	12597A-005 I/F Operating and Service Manual
12597-90031	Tape Reader/Punch Diagnostic Manual

INSTALLATION NOTES

Refer to installation notes for 2748B Tape Reader.

2895B TAPE PUNCH (Cont'd)

TAPE PUNCH OPERATION CHECK

Address	Mnemonic	Octal
100 B	LIA 01	102501
101	OTA TP	1026TP
102	STC TP,C	1037TP
103	SFS TP	1023TP
104	JMP *-1	024103
105	JMP *-5	024100

TP = Tape Punch select code. Will continuously punch information in Switch Register.

PHOTO READER/HIGH SPEED PUNCH DIAGNOSTIC

Paper Tape Binary 12597-16001. Date Code 1725.
Cartridge Binary 24396-13307. Date Code 2040 and
24998-13306. Date Code 2040. DSN 146200

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = Punch SC, S-Reg (11-6) = Reader SC.
4. Press PRESET, RUN. HALT 102074.
5. To punch a test tape for the reader, perform following:
   a. Set S-Reg bit 9.
   b. Press PRESET, RUN. HALT 102075.
   c. Set A-Reg bit 7.
   d. Press PRESET, RUN. HALT 102060.
   e. Turn punch ON and press RUN (tape punched). HALT 102077.
   f. Create a continuous loop with the tape punched.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000_8.

PHOTO READER/HIGH SPEED PUNCH DIAGNOSTIC (Cont'd)

9. Switch options:

BIT	FUNCTION IF SET
0	START/EXIT Tests.
1	Abort Test 3.
2	RESYNC.
3	Variable Record Length Output (TST02).
4	Time Delays between Reads.
5	2737 Reader (TST11).
6	2753 Punch (TST12).
7	Loop on TST11 and TST12.
8	Suppress tests requiring operator.
9	Abort current test and halt 75. Enter new tests, clear bit 9, and press RUN.
	A-REG BIT / **EXECUTE IF SET**
	0 — 0* BIO on punch I/F 1 — 1* BIO on Reader I/F 2 — 2* Punch all Character Combos 3 — 3* Verify all Character Combos 4 — 4* Continuous Loop Read Delays 5 — 5* Continuous Loop Variable Lengths 6 — 6* Punch/Verify 7 — 7 Punch loop (doesn't work on TTY Punch) 8 — 10 Punch S-Reg contents. 9 — 11 Reader Speed Test 10 — 12 Punch Speed Test 11 — 13 2753 Status Test 12 — 14 2895 Manual Functions Test
	*Default tests.
10	Suppress non-error messages.
11	Suppress error messages.
12	Repeat selected tests and suppress tests requiring operator.
13	Repeat last test executed.
14	Suppress Error Halts.
15	Halt 76 at end of each test; A-Reg = test number.

12531C/D HIGH SPEED TERMINAL INTERFACE KIT

Equipment

12531D:	12531-60022	Teleprinter Interface
12531D:	12551-60025	High Speed Terminal Interface Kit

12531C Options:

001:	Add 12531-60021	EIA Terminal Cable, 7.6m
002:	Add 12531-60024	Cable for Bell type 103A Modem

12531D Options:

001:	Add 12531-60026	Interconnect Cable for EIA devices
002:	Add 12531-60024	Cable for Bell type 103A Modem
004:	Add 02640-60058	Cable for certain 264X terminals

Documentation

12531-90033	12531C Operating and Service Manual
12531-90038	12531D Operating and Service Mnaual

12531C DIAGNOSTIC — TELEPRINTER

Paper Tape Binary 12531-16001. Date Code 1509.
Cartridge Binary 24396-13307. Date Code 1901, and
24998-13303. Date Code 1922. DSN 104003.
Manual: 12531-90042

12531D DIAGNOSTIC — TERMINALS

To verify operation of the 12531D card, perform the on-line diagnostic test for the I/O device connected to the card.

12539C TIME BASE GENERATOR

EQUIPMENT

12539-60003	12539C TBG Card

DOCUMENTATION

P/N	MANUAL
12539-90008	12539C Operating and Service
12539-90011	12539B/C TBG Diagnostic

ELECTRICAL SPECIFICATIONS

DC Required:

+5 volts	0.76 Amp
−2 volts	0.016 Amp

Base Intervals:

0.1	millisecond
1	millisecond
10	milliseconds
0.1	second
1	second
10	seconds
100	seconds
1000	seconds
1 min. 40	second
16 min. 40	second

Stability:
2 parts in 10^6 per week

Temperature Effects:
20 parts in 10^6 over the temperature range of 15°C to 35° (59° to 95°F)

Total Stability:
1/2 second per 24-hour day

12539B/C TBG DIAGNOSTIC

Paper Tape Binary 12539-16001. Date Code 1830.
Cartridge Binary 24396-13303. Date Code 1830, and
24998-13302. Date Code 1926. DSN 103301.

Required Hardware:

a. Minimum 4K memory

b. 12539B TBG with jumper W1 in position A or B, or 12539C with jumpers W1 and W2 in position A or B.

1. Load Diagnostic Configurator.

2. Configure configurator and load diagnostic.

3. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = Configuration options.

12539B/C TBG DIAGNOSTIC (Cont'd)

Configuration Options

BITS	12539B BOARD	12539C BOARD
0-5	Select code of 12539B/C board.	Select code of 12539B/C board.
6-13	Reserved.	Reserved.
14	Clear.	Clear if W1 in position A; set if in position B.
15	Clear if W1 in position A; set if in position B.	Clear if W2 in position A; set if in position B.

4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Restart: P-Reg = 2000_8, S-Reg = Switch options, press PRESET, RUN.
8. Switch options:

BIT	MEANING	
0-7	Reserved.	
8	Suppress tests requiring operator intervention.	
9	Abort current diagnostic execution and halt (102075); the user may specify a new group of tests in the A-register. Then clear bit 9 and press RUN.	
	A-REG BIT	**EXECUTE IF SET**
	0	Test 00 BASIC I/O
	1	Test 01 0.1 Millisecond Relative Time
	2	Test 02 1.0 Millisecond Relative Time
	3	Test 03 10 Milliseconds Relative Time
	4	Test 04 100 Milliseconds Relative Time
	5	Test 05 1 Second Relative Time
	6	Test 06 10 Seconds Relative Time
	7	Test 07 100 Seconds Relative Time
	8	Test 10 1000 Seconds Relative Time
	9	Test 11 Logic Test
	10	Test 12 Time Tolerance Test
	11 to 15	Reserved
10	Suppress non-error messages.	
11	Suppress error messages.	
12	Repeat all selected tests after diagnostic run has completed without halting. Message "PASS XXXXXX" will be output before looping unless bit 10 is set or a teletype is not present. Also, those tests requiring operator intervention will be suppressed.	
13	Repeat last test executed (loop on test).	
14	Suppress error halts.	
15	Halt (102076) at the end of each test; the A-register will contain the test number in octal.	

12539B/C TBG DIAGNOSTIC (Cont'd)

SERVICE INFORMATION

1. Output frequency at test point E4 is 1-MHz ± 0.5 Hz. Adjust capacitor C19.

2. Jumper W2 must be in position A for proper operation.

12554A/12554A-001 16-BIT DUPLEX REGISTER

Equipment

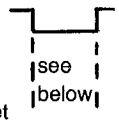
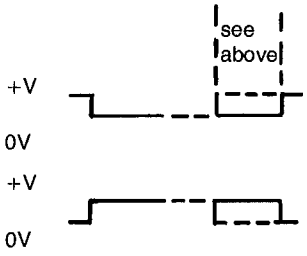
12554A:	12554-60023	16-Bit Duplex Register Card — Pos. Logic
12554A-001:	12554-60024	16-Bit Duplex Register Card — Neg. Logic
Both Cards:	5060-8339	Connector Kit, 48-pin

Documentation

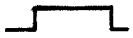
12554A:	12554-90021	Operating and Service Manual
12554A-001:	12554-90022	Operating and Service Manual

12554A/12554A-001 16/BIT DUPLEX REGISTER (Cont'd)

RELOCATABLE JUMPERS

12554A Jumper Positions for Operation		
SIGNAL AND FUNCTION	**JUMPER**	**POSITION**
Device Flag +V 0V 		
Set flag buffer FF and reset command FF on leading edge.	W4 W5 W6	B B A or B
Set flag buffer FF and reset command FF on trailing edge.	W4 W5 W6	A B A
Set flag buffer FF trailing edge, reset command FF on leading edge.	W4 W5 W6	B A A
Command FF Reset (W4/W5 have no affect)	W6	C
Device Command Signal 	W7 W7	A B

12554A/12554A-001 16-BIT DUPLEX REGISTER (Cont'd)

12554A-001 Jumper Positions for Operation		
SIGNAL AND FUNCTION	**JUMPER**	**POSITION**
Device Flag 		
Set flag buffer FF and reset command FF both on leading edge.	W4 W5 W6	A A A or B
Set flag buffer FF and reset command FF on trailing edge.	W4 W5 W6	B B A or B
Set flag buffer FF on leading edge, reset command FF on trailing edge.	W4 W5 W6	B A A
Set flag buffer FF on trailing edge, reset command FF on leading edge.	W4 W5 W6	A B A
Command FF Reset (W4/W5 have no affect)		
Device Command Signal		
0V  −V	W7	A
0V  −V	W7	B

12554A AND 12554A-001 DIAGNOSTIC

Use the 24391 General Purpose Register Diagnostic. Refer to the information provided at the end of the Input/Output Section.

Manual: 24391-90001

12554A (Positive Logic) Jumper Combinations for Diagnostic					
	Under Combination Number				
	1	**2**	**3**	**4**	**5**
W4	B	B	A/B	A	A
W5	B	A	A/B	A	B
W6	A/B	A	C	A/B	A
W7	A	A	A/B	B	B

12554A AND 12554A-001 DIAGNOSTIC (Cont'd)

12554A-001 (Negative Logic) Jumper Combinations for Diagnostic					
	Under Combination Number				
	1	2	3	4	5
W4	A/B	A	A/B	A/B	B
W5	A	A	A/B	B	A
W6	B	A	C	B	A
W7	B	B	A/B	A	A

12560A DIGITAL PLOTTER INTERFACE KIT

Equipment

12560-6001	Digital Plotter Interface Card
12560-6004	Interface Cable
12560-9001	Operating and Service Manual

12560A DIAGNOSTIC

Manual: 12560-90029 12560A Digital Plotter Interface Diagnostic

Paper Tape Binary: 12560-16001 Date Code 1540. Cartridge Binary 24396-13307 Date Code 1901. DSN 107000.

Note: Be sure that the pen writes before starting the diagnostic.

Halts: 102075 (octal) S-reg bit 9 was set. Select test.
102076 (octal) S-reg bit 15 was set. End of test.
102077 (octal) End. If not, consult error and message table.

12560A DIGITAL PLOTTER INTERFACE KIT (Cont'd)

Switch Register Options:

Bit	Meaning If Set
0-6	Reserved for Pseudo Op Design.
7	Not Used.
8	Suppress tests requiring operator intervention.
9	Abort current diagnostic execution and halt (102075).
10	Suppress non-error messages.
11	Suppress error messages.
12	Repeat selected tests after run is complete.
13	Repeat last test executed (loop on test).
14	Suppress error halts.
15	Halt (102076) at the end of each test. A-register holds the test number.

Test Selection Summary

A-Register Bit	If Set Will Execute
0	Test 00 BI-O Test
1	Test 01 One-Shot Test
2	Test 03 Octagon Test (over draw)
3	Test 03 Octagon Test (over draw)
4	Test 04 Pseudo Opdesign
5-15	Reserved

12566B/C MICROCIRCUIT INTERFACE CARD

Equipment

This card has been manufactured in several versions as follows:

12566-60024	12566B	Ground True Microcircuit
12566-60025	12566B	Positive True Microcircuit
12566-60031	12566C	Microcircuit (old version)
12566-60032	12566C	Microcircuit (new version)
5060-8339		Connector Kit, 48-pin
5180-1905		Cable with 36-pairs of wire, 4.6m
1251-0332		Test Connector, 24-pin

Documentation

12566-90015	12566B Microcircuit Interface Kit Operating and Service Manual
12566-90032	12566C Interface Manual

12566B/C Jumper Positions for Operation

JUMPER	POSITION 12566B	POSITION 12566C	FUNCTION
W1	A	A	Ground "true" device command signal.
W1	B	B	Positive "true" device command signal.
W1	C	none	Ground "true" device command pulse using the party line FF. The pulse is from the leading edge of T6 to the following T3.
W1	none	C	Ground "true" device command from the leading edge of T6 as either a signal (W10-A) or pulse (W10-B). If a pulse it, ends at T3.
W1	none	D	Same as W1-C except that a positive "true" signal/pulse is produced.
W2	A	A	Senses a positive going edge of the device flag to clear device command FF and signal/pulse. In 12566C, for W1-C/D, then W2-A/B/C will clear the device command according to W10-A.
W2	B	B	Same as W2-A except that a negative going edge is sensed.
W2	C	C	Clears device command FF and signal/pulse on leading edge of T2.
W3	A	A	Sets flag buffer FF on sensing "positive" going edge of the device flag. Used in conjunction with W5, W6, W7, and W8.
W3	B	B	Senses "negative" going edge of the device flag, otherwise same as W3-A.

12566B/C MICROCIRCUIT INTERFACE CARD (Cont'd)

12566B/C Jumper Positions for Operation (Cont'd)

JUMPER	POSITION 12566B	POSITION 12566C	FUNCTION
W4	A	A	Data Output Enabled to I/O device on set of the data FF and disabled at T5.
W4	B	B	Data Output Enabled continuously.
W5,W6 W7,W8	ALL IN	ALL OUT	Input bits associated with jumpers are latched after device flag signal/pulse. W5 (bits 0-3), W6 (bits 4-7), W7 (bits 8-11), W8 (bits 12-15).
W5,W6 W7,W8	ALL OUT	ALL IN	Input bits associated with jumpers are continuously available to card from I/O device. See above for bits.
W9	A	A	Device command signal/pulse clears upon either CLC or CRS.
W9	B	B	Device command singal/pulse clears upon CRS only.
W10	none	A	If W1 is positioned to C or D, then W10-A allows W2-A/B/C and W9-A/B to provide the party line device command (pulse) clear conditions.
W10	none	B	If W1 is positioned to C or D, then W10-B causes the party line device command pulse to end at T3.
W11	none	OUT	For positive "true" output data.
W11	none	IN	For negative "true" output data.
W12	none	IN	Input data is positive "true".
W12	none	OUT	Input data is negative "true".
W13	none	IN	The OTA/OTB signal generates device command and output data enable.
W13	none	OUT	Makes the 12566C backwards compatible with the 12566B.

12566B/C DIAGNOSTIC

Use the 24391 General Purpose Register Diagnostic. Refer to the end of the Input/Output Section for information on this subject.

Manual: 24391-90001

Test Connector: 1251-0332. Modify by connecting pin Z/22 to pin AA/23.

JUMPER POSITIONS FOR DIAGNOSTIC

Jumper	12566B	12566C
W1	C	C
W2	B	B
W3	B	B
W4	B	B
W5	IN	OUT
W6	IN	OUT
W7	IN	OUT
W8	IN	OUT
W9	A	A
W10	NA	B
W11	NA	OUT
W12	NA	OUT
W13	NA	OUT

Note: Jumpers not listed may be in any position described in the operating and service manual.

12587B ASYNCHRONOUS DATA I/F DIAGNOSTIC

Paper Tape Binary 12587-16001. Date Code 1552.
Cartridge Binary 24396-13304, Date Code 1928, DSN 103003.
Manual P/N 12587-90013.

1. Install test connector, P/N 12587-60009.
2. Load Diagnostic Configurator.
3. Configure configurator and load diagnostic.
4. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = Interface SC, S-Reg (14) = Set if I/F jumpered for 2 stop bits, S-Reg (15) = Set if I/F jumpered for high speed mode. (Incorrect selection of bits 14 and 15 will result in error E103.)
5. Press RUN. HALT 102074.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000_8.
9. Switch options:

BIT	MEANING IF SET
6-0	Reserved.
7	Omit PRESET test.
8	Omit Clock Frequency test.
9	Reserved.
10	Suppress non-error messages.
11	Suppress error messages.
12	Repeat all tests.
13	Repeat last test executed.
14	Suppress error halts.
15	Halt after each test.

12597A 8-BIT DUPLEX REGISTER INTERFACE KIT

Equipment

12597-6001 8-Bit Duplex Register Card

5060-8339 Connector Kit, 48-pin

1251-0332 Test Connector, 24-pin

12597-9002 Operating and Service Manual

Relocatable Jumpers

Jumper	Position	Function
W1	A	Command FF clears on negative-going edge of Device Flag signal.
W1	B	Command FF clears on positive-going edge of Device Flag signal.
W2	A	Flag Buffer FF sets on negative-going edge of Device Flag signal.
W2	B	Flag Buffer FF sets on positive-going edge of Device Flag signal.
W3	Connected	Device Command signal will be ground "true" (W8 must be disconnected).
W4	Connected	Input storage register will be loaded by the Device Flag.
W8	Connected	Device Command signal will be positive "true" (W3 must be disconnected).
W9	Connected	Input storage register will be loaded by an STF signal.
Note: Jumpers W5, W6, and W7 must be kept in their original positions.		

12597A DIAGNOSTIC

Use the 24391 General Purpose Register Diagnostic. Refer to the end of the Input/Output Section for Information on this subject.

Manual: 24391-90001

JUMPER POSITIONS FOR DIAGNOSTIC

Use any one of the two combinations allowed:

Jumper	Comb. 1	Comb. 2
W1	A	B
W2	A/B	A/B
W3	Connected	Removed
W4	Connected	Connected
W8	Removed	Connected
W9	Removed	Removed

Note: All other jumpers must remain in the factory installed position.

12618A SYNCHRONOUS DATA SET I/F KIT

Equipment

12621-60001	Synchronous data set (Receive) I/F PCA.
12622-60001	Synchronous data set (Transmit) I/F PCA.
12618-60001	Branched cable assembly.
12621-60005	Test connector assembly.
12622-60005	Test connector assembly.

Documentation

12621-90001	Operating and service manual (Receive Card).
12622-90001	Operating and service manual (Transmit Card).
12618-90001	Operating and service manual (Kit).

12621-60001 RECEIVE (ONLY) I/F DIAGNOSTIC

Paper Tape Binary 12621-16001. Date Code 1532.
Cartridge Binary 24396-13304, Date Code 1928, and 24998-13303, Date Code 1928. DSN 103012
264X Minicartridge P/N 24396-13304.
Diagnostic Manual P/N 12621-90008.

1. Install test connector, P/N 12621-60005.
2. Load Diagnostic Configurator.
3. Configure configurator and load diagnostic.
4. Configure diagnostic: P-Reg = 100B, S-Reg = Interface SC.
5. Press PRESET, RUN. HALT 102074.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000B.
9. Switch options:

BIT	MEANING IF SET
8-0	Spare.
9	Suppress start and stop messages.
10	Run PRESET test within BI/O.
11	Suppress all messages.
12	Repeat diagnostic program.
13	Repeat last test executed.
14	Suppress error halts.
15	Halt at end of each test.

12618A SYNCHRONOUS DATA SET I/F KIT (Cont'd)

12622-60001 TRANSMIT (ONLY) I/F DIAGNOSTIC

Paper Tape Binary 12622-16001. Date Code 1532.
264X Minicartridge P/N 24396-13304.
Diagnostic Manual P/N 12622-90008.
DSN: Refer to Diagnostic Reference Table.

1. Install test connector, P/N 12622-60005:
   Pin 2,B to 20,X
   4,D to 23,AA or 19,W
   1,A to 21,Y
   3,C to 22,Z
2. Load Diagnostic Configurator.
3. Configure configurator and load diagnostic.
4. Configure diagnostic: P-Reg = 100B, S-Reg (5-0) = Interface SC.
5. Press PRESET, RUN. HALT 102074.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000B.
9. Switch options:

BIT	MEANING IF SET
0	Reserved.
1	Skip Basic I/O test.
2	Skip Function/Status test.
3	Skip Test Sync/Non-Sync test.
4	Skip Auto-Sync On test.
5	Skip Auto-Sync Off test.
6	Skip Auto-Sync Pattern test.
7	Repeat last subtest executed.
8	Halt at end of current subtest.
9	Suppress start and stop message.
10	Run PRESET subtest in BI/O test.
11	Suppress all console device messages.
12	Repeat diagnostic program.
13	Repeat last test executed.
14	Suppress error halts.
15	Halt at end of current test.

12621A RECEIVE I/F DIAGNOSTIC

Refer to information on the 12621-60001 in the 12618A section.

12622A TRANSMIT I/F DIAGNOSTIC

Refer to information on the 12622-60001 in the 12618A section.

12771A COMPUTER SERIAL I/F KIT

Equipment

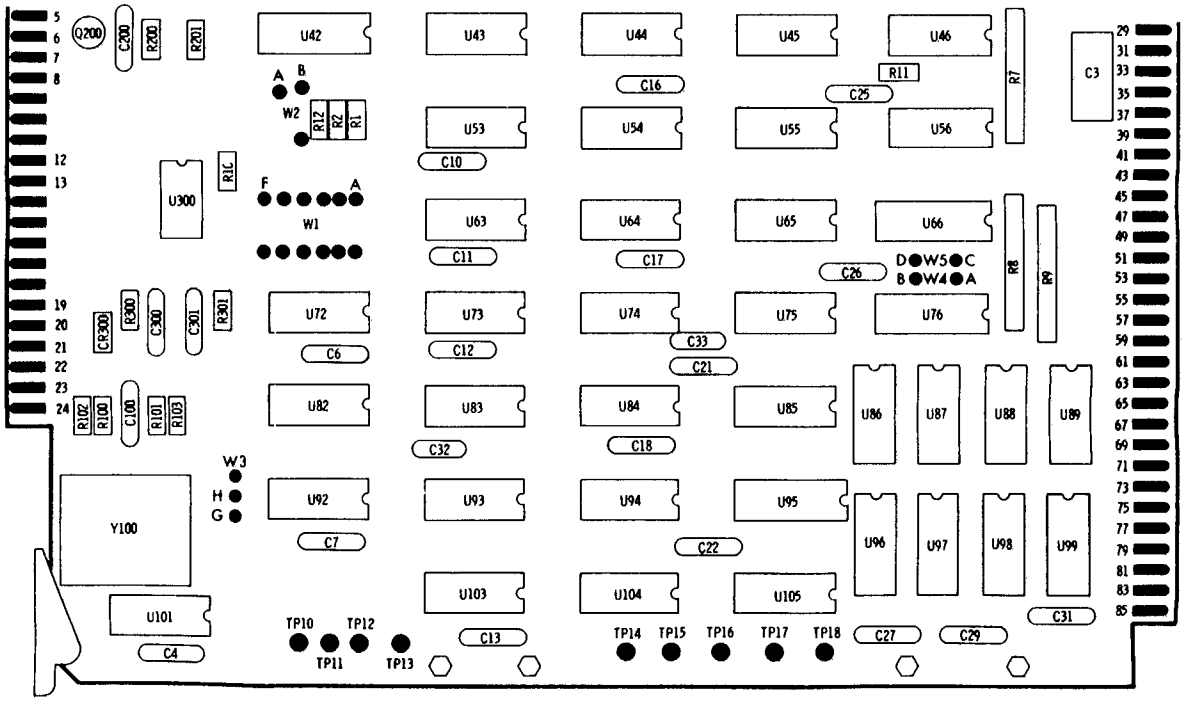
2	12665-60001	Computer serial I/F PCA's.
1	12665-60002	12-foot male I/F cable.
1	12665-60003	12-foot female I/F cable.
2	12665-60004	Diagnostic hoods.

Note: The diagnostic is supplied with DS software.

Documentation

2	12665-90001	Operating and service manuals (one for each terminal).

JUMPER POSITIONING



JUMPER W1: Cable length:

LINE LENGTH (FT)	K BYTES/ SEC	W1 POSITION
0 to 600	62.5	A
601 to 1,200	39.2	B
1,201 to 4,000	22.4	C
4,001 to 5,400	12.1	D
5,401 to 7,300	6.3	E
7,301 to 10,000	3.2	F

12771A COMPUTER SERIAL I/F KIT (Cont'd)

JUMPER W2: Type of operation:

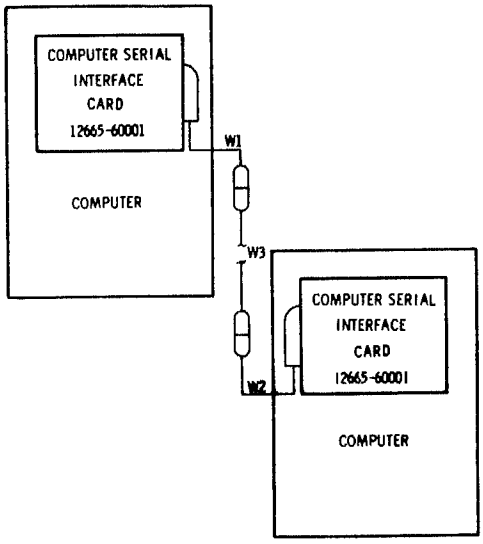
Position A — Computer-to-computer operation. (19 bit communication words)
Position B — Computer-to-coupler/controller. (14 bit communication words)

JUMPERS W3,W4,W5: Even/Odd parity select:

Even parity — W3,W4,W5 in positions G, A-B, C-D.
Odd parity — W3,W4,W5 in positions H, A-D, B-C.

Note: Hardwired at factory in even parity positions.

CABLES



CABLE W1: 12-foot male I/F cable P/N 12665-60002.

CABLE W2: 12-foot female I/F cable P/N 12665-60003.

CABLE W3: Communication cable, or user fabricated cable, or various combinations of these cables oriented to mate with connectors of W1 and W2. HP cables available for use here are:

HP 91720A: 250-foot Communication cable (with unassembled connectors)
HP 91721A: 250-foot Communication cable (with assembled connectors)

HP 91720A and HP 91721A OPTIONS:
001: Adds 250 feet to cable length for total of 500 feet.
002: Adds 725 feet to cable length for total of 975 feet.

12771A COMPUTER SERIAL INTERFACE DIAGNOSTIC

Paper Tape Binary P/N 29005-60001.
(Furnished as part of Distributed Systems Software)

1. Check the positions of W1 through W5.
2. Install an 86-pin card extender, P/N 02116-63216.
3. Install I/O card in the extender.
4. Install test connector, P/N 12665-60004.
5. Load diagnostic.
6. Set P-Reg = 000002B.
7. Set S-Reg = Switch options.
8. Press PRESET, RUN. HALT 102077.
9. On card, connect jumper wire from TP18 to gnd. (Do not turn off computer.)
10. Press PRESET, RUN. HALT 102076.
11. Restart: P-Reg = 000002B.
12. Switch options:

BITS	SETTING	MEANING OF SETTING
15,14	00	Required setting.
13	0	Non-DMA.
	1	*DMA.
12		Communication word size:
	0	19-bit; W2 set to A.
	1	*14-bit; W2 set to B.
11-9		Microseconds of bit time:
	000	1 (W1 in position A).
	001	2 (W1 in position B).
	010	4 (W1 in position C).
	011	8 (W1 in position D).
	100	16 (W1 in position E).
	101	32 (W1 in position F).
	110	Illegal. (Gives HALT 03)
	111	Illegal. (Gives HALT 03)
8-6		Computer type:
	000	Illegal. (Gives HALT 01)
	001	2116.
	010	2100.
	011	2114/2115.
	100	HP 1000 M-Series.
	101	HP 1000 E-, F-Series.
	110	Illegal. (Gives HALT 01)
	111	Illegal. (Gives HALT 01)
5-0		Select Code for the card:
	000000 thru 000111	Illegal. (Gives HALT 02)
	001000 thru 111111	Legal.

*Bits 12 and 13 may not be set at the same time.

12773A COMPUTER MODEM INTERFACE KIT

Equipment

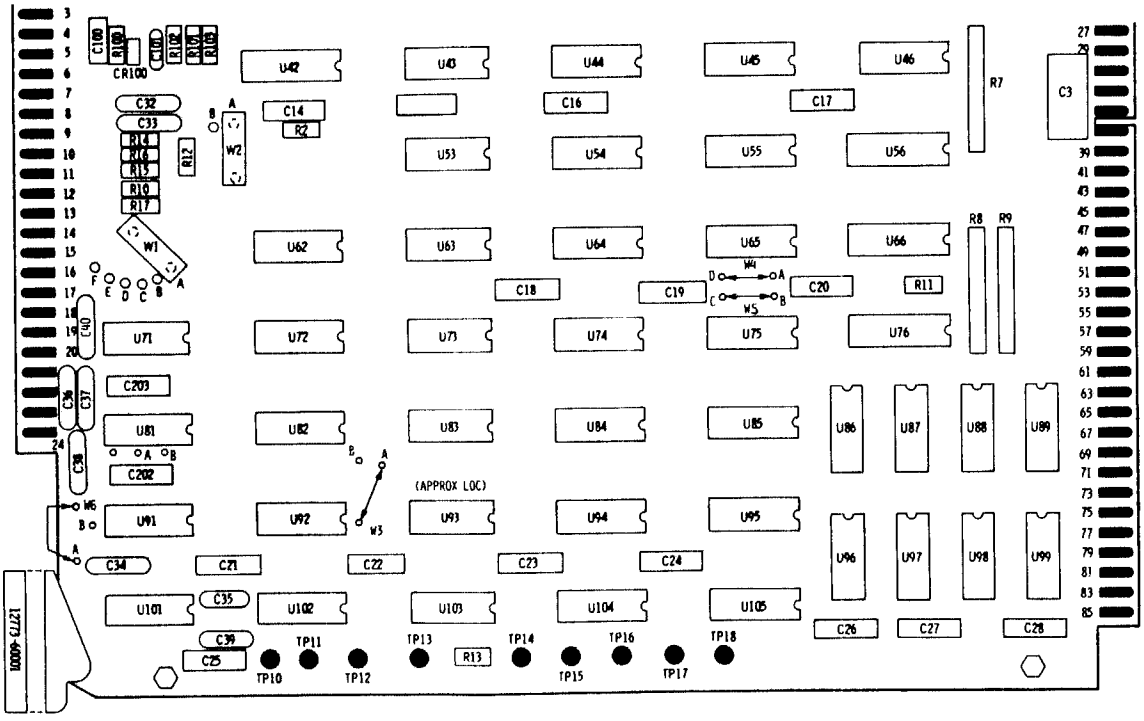
12773-60001	Modem I/F PCA.
12773-60002	12-foot male I/F cable.
12773-60003	Diagnostic hood.
29024-60001	Software diagnostic paper tape.

Documentation

12773-90001	Operating and service manual.

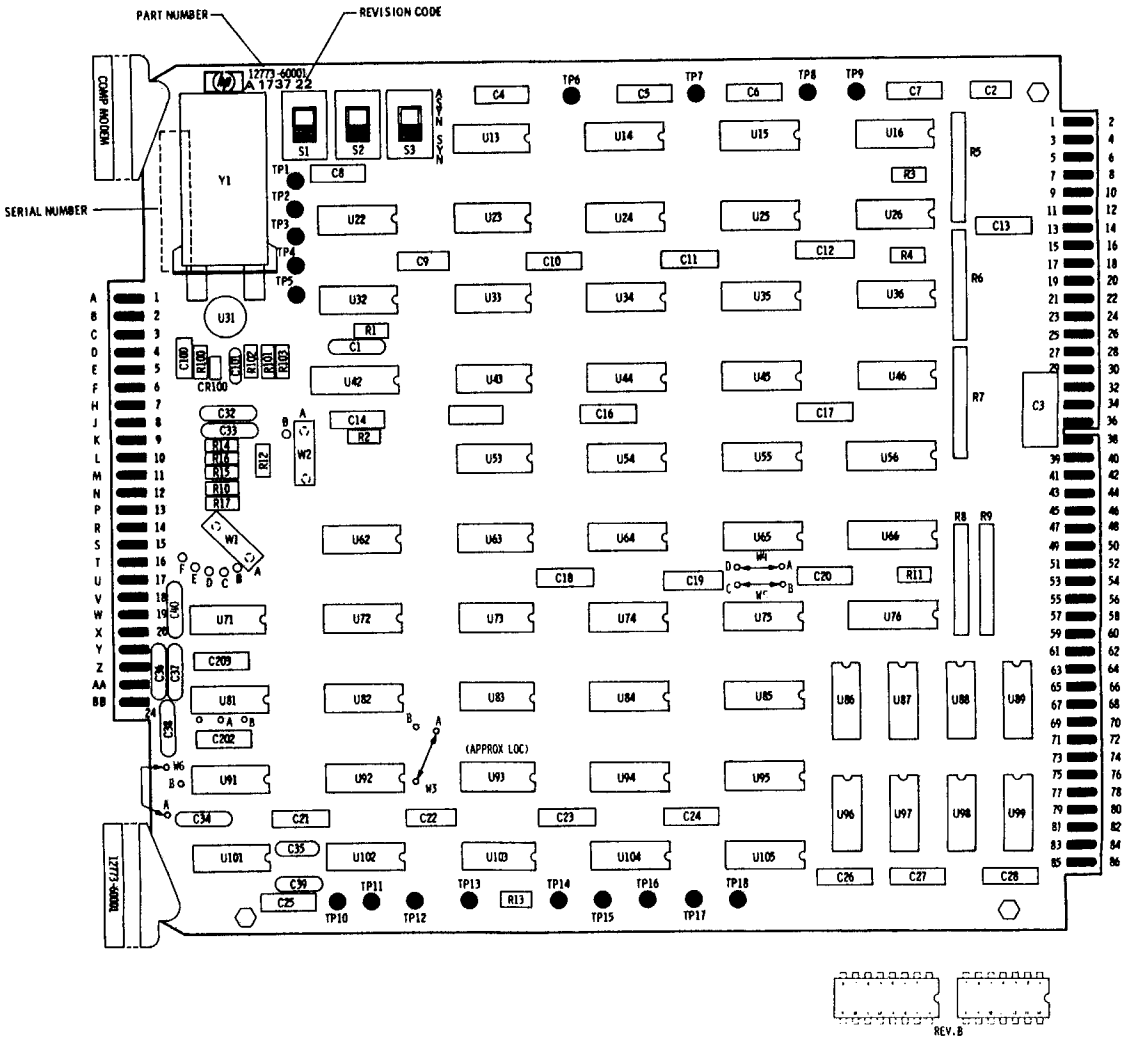
12773A JUMPER POSITIONS

Original Version Of Card



12773A COMPUTER MODEM INTERFACE KIT (Cont'd)

Present Version Of Card



JUMPER W1: Data Rate:

W1 POSITION	APPROXIMATE* RATE (bps)	DATA SETS
A**	1800	202***
B	1200	202
C	600	202
D	300	103A
E	150	103A
F	75	103A

* Asynchronous data transfer rates.
** Use 120 kHz crystal.
*** Conditioned telephone line.

12773A COMPUTER MODEM INTERFACE KIT (Cont'd)

JUMPER W2: Type of operation:

Position A — Computer-to-computer operation. (19-bit communication words)
Position B — Computer-to-couple/controller. (14-bit communication words)

JUMPER W3: Parity select for Receiver circuits:

Even Parity — W3 to A.
Odd Parity — W3 to B.

JUMPERS W4,W5: Parity select for Transmitter circuits:

Even Parity — W4 from A to D, W5 from B to C.
Odd Parity — W4 from A to C, W5 from B to D.

JUMPER W6: High/Low Baud Rate select:

Low — W6 to A.
High — W6 to B.

SWITCHES

S1,S2,S3: SYN for synchronous operation.
ASYN for asynchronous operation.

12773A COMPUTER MODEM INTERFACE DIAGNOSTIC

Paper Tape Binary P/N 29024-60001.

1. Check positions of jumpers W1 through W5.
2. Set switches S1, S2, and S3 to ASYN.
3. Install 86-pin extender, P/N 02116-63216.
4. Install card in extender.
5. Note select code of I/O slot.
6. Install Diagnostic Hood on card edge connector.
7. Set P-Reg = 000002B; S-Reg = Switch options.
8. Press PRESET, RUN. HALT 102077.
9. On card, connect jumper wire from TP18 to gnd. (Do not turn off computer.)

12773A COMPUTER MODEM INTERFACE DIAGNOSTIC (Cont'd)

10. Press PRESET, RUN. HALT 102076.

11. Disconnect jumper between TP18 and gnd.

12. Switch options:

BITS	SETTING	MEANING OF SETTING
15,14	00	Required setting.
13	0	Non-DMA
	1	*DMA
12		Communication word size:
	0	19-bit (W2 set to A)
	1	*14-bit (W2 set to B)
11-9	000 thru 101	Legal.
	110	Illegal. (Gives HALT 03)
	111	Illegal. (Gives HALT 03)
8-6		Computer type:
	000	Illegal. (Gives HALT 01)
	001	2116.
	010	2100.
	011	2114/2115.
	100	HP 1000 M-Series.
	101	HP 1000 E-, F-Series.
	110	Illegal. (Gives HALT 01)
	111	Illegal. (Gives HALT 01)
5-0		Select Code for card:
	000000 thru 000111	Illegal. (Gives HALT 02)
	001000 thru 111111	Legal.

*Bits 12 and 13 may not be set at the same time.

12790A MULTIPOINT TERMINAL I/F

Equipment

1	5061-1389	Multipoint terminal I/F PCA.
4		Microcode ROM's, P/N's 12790-80036 through 12790-80039.
1	5061-1393	I/F cable for direct connection.

Documentation

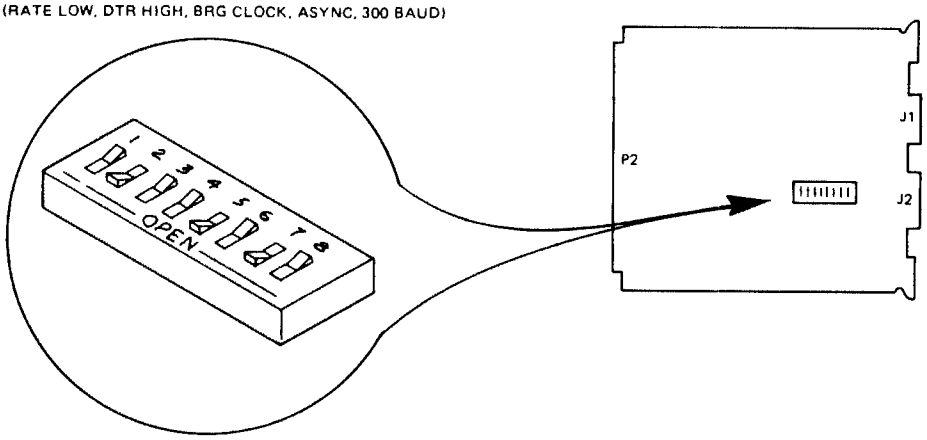
1	12790-90001	Multipoint terminal I/F reference manual.
	91730-90002	Multipoint terminal I/F subsystem user's guide (not supplied with product).

Option

001	Substitutes modem cable, part no. 5061-1391, for direct connection cable.

Configuration Switch

TYPICAL CONFIGURATION
(RATE LOW, DTR HIGH, BRG CLOCK, ASYNC, 300 BAUD)



MICROCODE CONFIGURATION SETTINGS					
SWITCH NO.* 1	2	3	4	MODEM LATCHES	NOTES
0				CH,CCITT-111	"RATE SEL" INITIALLY HIGH
1					"RATE SEL" INITIALLY LOW
	0			CD	"DATA TERMINAL READY" INITIALLY HIGH
	1				"DATA TERMINAL READY" INITIALLY LOW
		0		CLOCK	MODEM CLOCK (SYNCHRONOUS)
		1			BRG CLOCK (ASYNCHRONOUS)
			0	SYNC	SYNCHRONOUS MODE.
			1	ASYNC	ASYNCHRONOUS MODE.

SWITCH NO. 5	6	7	8	ASYNC BAUD RATE**	SYNCHRONOUS CLOCK OUTPUT (J2 PIN 13)
0	1	0	1	300	2.4 kHz OUTPUT
0	1	1	0	600	4.8 kHz OUTPUT
0	1	1	1	1200	9.6 kHz OUTPUT
1	0	0	0	1800	14.4 kHz OUTPUT
1	0	0	1	2400	19.2 kHz OUTPUT
1	0	1	0	3600	28.8 kHz OUTPUT
1	0	1	1	4800	38.4 kHz OUTPUT
1	1	0	0	7200	57.6 kHz OUTPUT
1	1	0	1	9600	76.8 kHz OUTPUT
1	1	1	1	19.2k	153.6 kHz OUTPUT

*SWITCH CLOSED IS LOGICAL 0.
SWITCH OPEN IS LOGICAL 1.
**BAUD RATE AS USED IN THE MTI IS EQUIVALENT TO "BITS PER SECOND."

12790A MULTIPOINT TERMINAL I/F SELF TEST

Located in on-board firmware.

1. Connect terminal or modem cable to MTI.
2. HALT computer.
3. Load code for LIB (Load Into B) into A-Reg. This is 1065sc (octal) where sc is the select code or slot number of the card.
4. Clear the B-Reg.
5. Press PRESET.
6. Set P-Reg = 000000B.
7. Press INSTRUCTION STEP.
8. LED on card will turn on during test and go out only if test passed. Check test results in B-Reg:

STATUS WORDS (OCTAL)	MEANING
100000	Self Test completed successfully.
100001	Failed Vector Latch Test.
100002	Failed RAM Address Register Test.
100003	Failed Control Latch Test.
100004	Failed: Baud rate generator not functioning or no interrupts.
100005	Failed: Interrupt not cleared by output of Vector Latch.
100006	Failed: Interrupt not cleared by control pulse.
100007	Failed RAM Test.
100008	Failed: 10 Hz Oscillator not functioning.

12792A MULTIPLEXER

Equipment

5061-3415	Multiplexer Interface
12792-80001	Multiplexer Firmware
5061-3467	80-pin Connector Kit

Documentation

P/N	Manual
12792-90001	Installation and Reference
12792-90002	User's
12792-90003	Configuration Guide
12792-18999	Numbering Catalog

12792A MULTIPLEXER DIAGNOSTIC

Relocatable File %MUXST: Cartridge 12792-13302
Memory Based File !MUXST: Cartridge 12792-13302

Off-Line Diagnostic:

1. Put diagnostic tape in system console tape drive and position it to !MUXST. (Use index of first file).

2. Set S-register bits as follows:
   15-14 to address of the 12992C loader ROM; 11-6 to S.C. of system console; and 13, 12, 5-0 to 0.

3. PRESET, IBL, RUN.

4. !MUXST loads. Halt 102077B = successful load.

5. To Execute, store P=2, PRESET, RUN. The interactive DIAG section runs and asks for the MUX select code, etc.

6. After complete, DIAG may be restarted by typing "RU, DIAG". DIAG can be aborted by typing "OF, DIAG,!".

7. If a test fails a test number is output. See list below for Test Failed meanings.

On-Line Diagnostic:

1. Put diagnostic tape in system console and position it to %MUXST.

2. Store %MUXST on a disc cartridge using the ST command

3. CAUTION: Before running the diagnostic, be sure that all active sessions on all devices connected to the MUX are terminated. The program name set up by LOADR is called DIAG. DIAG can be run from any terminal including a MUX terminal. To run type "RU.DIAG". Execution is in the interactive mode.

12792A MULTIPLEXER DIAGNOSTIC (Cont'd)

#N indicates failures as follows:

#N	TEST FAILED
1	Z80 CPU
2	EPROM
3	RAM
4	Z80 DMA
5	Z80 CTC
6	Z80 SIO Port 7
7	Z80 SIO Port 6
8	Z80 SIO Port 5
9	Z80 SIO Port 4
10	Z80 SIO Port 3
11	Z80 SIO Port 2
12	Z80 SIO Port 1
13	Z80 SIO Port 0
14	MUX-to-host latch circuit

Notes: Certain failures such as SIO chips or "cable hood not attached" results in a message "MUX LOOPING IN TEST NUMBER #N" where N has the same meaning as in the list above.

The message "NO RESPONSE FROM THE MUX" indicates that DIAG cannot communicate with the MUX board. If the select code number entered is correct, you must assume that the board failed.

12793A/B BISYNC MODEM INTERFACE KIT

Equipment (A Version/B Version)

5061-3418/4913	Programmable Serial Interface Card
91750-80005/80016	BISYNC Firmware ROM
91759-80006/80017	BISYNC Firmware ROM
5061-3424/4914	EIA RS-232-C Modem Cable (5 meter)
5061-3453/4916	Diagnostic Hood
12793-90001	12793A Installation and Service Manual
12826-91001	PSI Manual (12793B)
5955-7627	BISYNC Firmware Manual (12793B)

Note: The 12793A and 12793B are the same except that 12793B is compatible with CCITT standards V.10, V.11, V.28.

Options

001 Firmware upgrade discount for previously purchased firmware.
002 Replace RS-232-C cable with RS-449 cable part no. 5061-3436/4923.

12793A/B BISYNC MODEM INTERFACE KIT (Cont'd)

ROM FIRMWARE PARTS

Various vendor PROM part numbers from Intel and TI were used for the ROMs. Jumper XW1A through XW1G adapt the card to the possible combinations. If the ROMs are changed and different from those originally on the card, consult the PSI manual for configuration.

DIP Switches

12793A/B Switch Assignments

SWITCH	FUNCTION
1	Must be open.
2	Closed for external clock (for use with a synchronous modem). Open for internal clock (for use with a modem eliminator).
3	Closed for Ring Detect. Open for immediate TR (auto-answer). For specific modem needs, refer to modem documentation. Must be open for use with a modem eliminator.
4,5	Not used.
6,7,8	Select clock rate.

12793A/B Clock Rate Selection (Settings for Internal Clock Only)

SWITCH SETTINGS 6,7,8	CLOCK RATE (bps)	
		NOTE:
OOO	300	X = closed side depressed = logic "1"
OOX	1200	O = open side depressed = logic "0"
OXO	2400	
OXX	4800	
XOO	9600	
XOX	19200	
XXO	57600	
XXX	*230000	

* Not used with BISYNC firmware.

Firmware Self Test

The firmware self-test is executed everytime there is power-up or PRESET is pushed. It is recommended that the node is quiesced before powering down to allow completion of pending DS transactions. Use command RU,DSMOD followed by /Q for the DSMOD prompt. Test results are made available to the driver. Run DSINF to check the test result and, with the LU command, check the information returned (LU,# ,AL).

LEDs on the card also indicate successful test completion: LED0 through LED2 should be lit (LED3 is clock selection where it is lit for external clock).

12793A/B BISYNC MODEM INTERFACE KIT (Cont'd)

Modem Diagnostic Hood

1. Quiesce the node: Run DSMOD and on the following DSMOD prompt, enter /Q, then off the power.
2. Remove the interface cable and install the diagnostic hood.
3. Restore power and the self-test executes. Results are returned to the driver. Run DSINF and check the information returned with the LU command (LU,# ,AL).
4. Remove power, and replace the hood with the modem cable.
5. Restore power and reinitialize the system and DS software.

12794A/B HDLC MODEM INTERFACE

Equipment (A Version/B Version)

5061-3418/4913	Programmable Serial Interface Card
91750-80008	HDLC Firmware ROMs
91750-80009	HDLC Firmware ROMs
5061-3124/4914	EIA RS-232-C Modem Cable (5 meters)
5061-3425	Loop-back verifier hood
12974-90001	12974A Installation and Service Manual
12826-91001	PSI Manual (B version)
5955-7626	HDLC Firmware Manual (B version)

Note: The 12794A and 12794B are the same except that the 12794B complies with the CCITT standards V.28, V.10, and V.11.

Options

001 Upgrade discount for replacing previously purchased firmware.
002 Replace the RS-232-C cable and verifier hood with an RS-449 modem cable (5061-3436) and hood (5061-3441).

ROM FIRMWARE PARTS

Various vendor PROM part numbers from Intel and TI were used for the ROMs. Jumpers XW1A through XW1G adapt the card to the possible combinations. If the ROMs are changed and different from those originally on the card, consult the manual for configuration.

12794A/B HDLC MODEM INTERFACE (Cont'd)

DIP Switches

12794A/B Switch Assignments	
SWITCH	**FUNCTION**
1	Closed to enable forced cold load (FCL)/slave request. Open to disable.
2	Closed to select 1024 byte information field. Open to select *128 byte information field. BOTH ENDS OF THE LINK MUST HAVE THIS SWITCH SET THE SAME TO AVOID DATA OVERRUN.
3,4,5	Not used.
6,7,8	Transmission clock rate.
* 128 byte information field is the recommended configuration for minimizing frame retransmissions.	

12794A/B Transmission Clock Rate		
SWITCH SETTINGS 6,7,8	**CLOCK RATE (bps)**	
OOO	300	NOTE:
OOX	1200	X = closed = logic "1"
OXO	2400	O = open = logic "0"
OXX	4800	
XOO	9600	
XOX	19200	
XXO	57600	
XXX	230000	

Firmware Self Test

The firmware self-test is executed everytime there is power-up or PRESET is pushed. It is recommended that the node is quiesced before powering down to allow completion of pending DS transactions. Use command RU,DSMOD followed by /Q for the DSMOD prompt. Test results are made available to the driver. Run DSINF to check the test results and, with the LU command, check the information returned (LU,# ,AL).

LEDs on the card also indicate successful test completion: LED0 through LED2 should be all off after the test and before the DS software has been initialized. LED0 is lit in normal operation and indicates that it is logically connected to another interface.

12794A/B HDLC MODEM INTERFACE (Cont'd)

Modem Diagnostic Hood

1. Quiesce the node: Run DSMOD and on the following DSMOD prompt enter /Q, then off the power.
2. Remove the interface cable and install the diagnostic hood.
3. Restore power and the self-test executes. Results are returned to the driver. Run DSINF and check the information returned with the LU command (LU,# ,AL).
4. A further test is to send a message to the card and have it loop back on itself. To configure the card to talk to itself, run DSMOD. Enter CN, and DSMOD will prompt for the network security code, enter code, DSMOD prompts for node number to change so enter local node number. DSMOD will display the current routing vector for the local node which should be LU 0. After the prompt for a new configuration, enter the LU no. of the card having the loop-back verifier hood. Now enter /E in reponse to a request for the next node number and another /E to exit DSMOD.
5. Run REMAT and execute some REMAT commands as described below.
6. Run DSMOD and reconfigure the local node to again specify LU 0.
7. Remove power, and replace the hood with the modem cable.
8. Restore power and reinitialize the system and DS software.

Communications Link Check

Exercise a few REMAT commands:

1. RU,REMAT

   REMAT will prompt with a $ for commands referred to the local node and # for remote node reference (another HP 1000).

2. $SW<NODE1,NODE2,SC

   The SW instruction defines the action and destination nodes. Set NODE1 to the node number of the neighbor node to be exercised. Set NODE2 to the local node's number. SC is the security code of the network.

3. #TI OR #TM

   These commands will obtain the time from the remote node, thus checking the link. TI is for M/E/F-Series computers and TM for L-Series computers. Or try a DL or CL command to get a directory or cartridge list.

4. #EX to Exit.

12821A DISC INTERFACE

Equipment

12821-60001	Disc Interface Card
59310-60002	Cable Assembly (3.69 metres)
12992H	Loader ROM

Manuals

12821-90006	12821A Installation and Service Manual
12992-90001	Loader ROM Installation and Service Manual
12821-90002	12821A ICD Disc Interface Diagnostic Manual

12821A DISC INTERFACE DIAGNOSTIC

Paper Tape Binary 12821-16001. Date Code 1928.
Cartridge Binary 24396-13304, Data Code 1928 and 24998-13302, Date Code 1928.
DSN 103024.

Two interfaces and two interface cables are required to run the complete diagnostic. The M/E/F computer should have DCPC.

The diagnostic has two modes of operation: Console Mode and the Non-console Mode. The diagnostic will automatically execute in either the console or non-console mode according to whether a console was specified or not during the configuration with the diagnostic configurator. Since running this diagnostic has many considerations and switch selections, thus it is not included here. Please use the 12821A Diagnostic Manual for instructions.

12825A HDLC DIRECT-CONNECT INTERFACE KIT

Equipment

5061-3432	Programmable Serial Interface Card
91750-80008	HDLC Firmware ROM.
91750-80009	HDLC Firmware ROM.
5061-3422	Interface Cable (5 metres) with Male Connector
5061-3432/4908	Interface Cable (5 metres) with Female Connector
5061-3425/3421	Loop-back Verifier Hoods, two.
12825-90001	12825A Installation and Service Manual
12826-91002	PSI Manual (Replaces 12825A manual)
5955-7626	HDLC Firmware Manual (Replaces 12825A Manual)

Options

001	Upgrade discount for later firmware.
002	Delete both standard cables, and delete the verifier hoods.
003	Add 5061-3437, a 75 metre extension cable with connectors.

12825A HDLC DIRECT-CONNECT INTERFACE KIT (Cont'd)

Transmission Clock Rate Selection		
SWITCH SETTINGS 8,7,6	**CLOCK RATE (bps)**	
OOO	300	NOTE:
OOX	1200	X = closed = logic "1"
OXO	2400	O = open = logic "0"
OXX	4800	
XOO	9600	
XOX	19200	
XXO	57600	
XXX	230000	
Note: The communications computers can be set to different speeds.		

Switch Assignments	
SWITCH	**FUNCTION**
1	Closed to enable forced cold load (FCL)/slave request. Open to disable.
2	Open to select 1024 byte information field. Closed to select *128 byte information field. BOTH ENDS OF THE LINK MUST HAVE THIS SWITCH SET THE SAME TO AVOID DATA OVERRUN.
3,4,5	Not used.
6,7,8	Select transmission clock rate.
* 128 byte information field is the recommended configuration for minimizing frame retransmissions.	

ROM FIRMWARE PARTS

Various vendor PROM part numbers from Intel and TI were used for the ROMs. Jumpers XW1A – XW1G and XW2A – XW2D are used to adapt the card to the possible combinations. If the ROMs are changed and different from those originally on the card, consult the PSI manual for configuration.

Firmware Self Test

The firmware self-test is executed everytime there is power-up or PRESET is pushed. It is recommended that the node is quiesced before powering down to allow completion of pending DS transactions. Use command RU,DSMOD followed by /Q for the DSMOD prompt. Test results are made available to the driver (to check, run DSINF and with the LU command check the information returned (LU,# ,AL).

12825A HDLC DIRECT-CONNECT INTERFACE KIT (Cont'd)

Loop-Back Verifier Diagnostic Hood

1. Quiesce the node: Run DSMOD and on the following DSMOD prompt enter /Q, then off the power.
2. Remove the interface cable and install the diagnostic hood.
3. Restore power and the self-test executes. Results are returned to the driver. Run DSINF and check the information returned with the LU command (LU,# ,AL).
4. A further test is to send a message to the card and have it loop back on itself. To configure the card to talk to itself, run DSMOD. Enter CN, and DSMOD will prompt for the network security code, enter code, DSMOD prompts for the node number to change so enter local node number. DSMOD will display the current routing vector for the local node which should be LU 0. After the prompt for a new configuration, enter the LU no. of the card having the loop-back verifier hood. Now enter /E in response to a request for the next node number and another /E to exit DSMOD.
5. Run REMAT and execute some REMAT commands as described below.
6. Run DSMOD and reconfigure the local node to again specify LU 0.
7. Remove power, and replace the hood with the modem cable.
8. Restore power and reinitialize the system and DS software.

Communications Link Check

Exercise a few REMAT commands:

1. RU,REMAT

   REMAT will prompt with a $ for commands referred to the local node and # for remote node references (another HP 1000).

2. $SW<NODE1,NODE2,SC

   The SW instruction defines the action and destination nodes. Set NODE1 to the node number of the neighbor node to be exercised. Set NODE2 to the local node's number. SC is the security code of the network.

3. #TI OR #TM

   These commands will obtain the time from the remote node, thus checking the link. TI is for M/E/F-Series computers and TM for L-Series computers. Or try a DL or CL command to get a directory or cartridge list.

4. #EX to Exit.

12830A DATA-LINK SLAVE INTERFACE

Equipment

5061-4902	Data Link Slave Interface Card
5180-1957/1965	Data Link Slave Firmware
1818-1114	Static RAM, 1K × 8
5061-4903	Data Link Interface Card (5 metres)
5061-4909	Diagnostic Test Connector
12830-13301	Diagnostic Software

Manual

12830-90001	Installation and Service Manual

Configuration

SWITCH SET 1 (OPEN#1)

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1
MODE CLK INT+	MODE LINK END+	MODE SYNC+	BAUD RATE BIT 2	BAUD RATE BIT 1	BAUD RATE BIT 10	DEVICE ID BIT 4	DEVICE ID BIT 3

MODE:
SW6=1 — Synchronous with X1 clock; SW6=0 — Asynchronous with X16 clock.
SW7=1 — Selects HPDL interface (12830); SW7=0 — Selects RS232 interface.
SW8=1 — Select 12830A internal clock; SW8=0 — Selects external clock.

SWITCH SET 2 (OPEN#1)

SW8	SW7	SW6	SW5	SW4	SW3	SW2	SW1
DEVICE ID BIT 2	DEVICE ID BIT 1	DEVICE ID BIT 0	GROUP ID BIT 4	GROUP ID BIT 3	GROUP ID BIT 2	GROUP ID BIT 1	GROUP ID BIT 0

BAUD RATE			
SW5	**SW4**	**SW3**	**RATE (SYNC. OR ASYNC)**
1	1	1	300
1	1	0	600
1	0	1	1200
1	0	0	2400
0	1	1	4800
0	1	0	9600
0	0	1	19200

12830A DATA LINK SLAVE INTERFACE DIAGNOSTICS

Manual: Same as for installation and service.

Cartridge Tape Binary 12830-13301

Self Test: The firmware self-test checks the card every time that power is applied and when PRESET is pressed.

Preparing for Diagnostic:

1. Install the Diagnostic Test Connector
2. Set switches as follows:

   SWITCH SET 1: SW1 — SW2 OPEN
   SW4 — SW6 CLOSED
   SW7 — SW8 OPEN

   SWITCH SET 2: ALL OPEN

Loading Diagnostic Program:

1. Reset computer.
2. Hard reset the terminal and insert cartridge into left CTU.
3. Set S bits 15-14 to loader ROM socket number.
4. Set S bits 11-6 to select code of terminal (12 octal).
5. PRESET, RUN.
6. Set P to 100 (octal).
7. Terminal should display:

   12830A DATA LINK DIAGNOSTIC — REV XXXX

   READY
   >

8. RUN

Commands:

?? — Displays HELP and lists available tests.

EX — Exit diagnostic

LD — Disable loop mode

LE — Enable loop mode

PD — Disable message printing

PE — Enable message printing

RF — Run tests 1 through 10

SC — Sets select code of DSLI card

12834A BISYNC DIRECT CONNECT INTERFACE KIT

Equipment

5061-3432	Programmable Serial Interface Card
91750-80017	BISYNC Firmware ROM
91750-80018	BISYNC Firmware ROM
5061-3422	Direct Connect Interface Cable (5 metres)
5061-3460	Direct Connect Diagnostic Hood

Options

001	Upgrade discount for the latest revision of firmware.
002	Delete 5061-3422 Cable.

Manual

12834-90001	Installation and Service (old)
12826-91002	MEF PSI Interface Hardware Reference Manual
5955-7627	BISYNC Protocol Firmware Manual

Switch Configuration

SWITCH	FUNCTION - UP TO DC 2027	FUNCTION - DC 2213
1	Must be open	Not defined
2	Open for int. clock	Open for int. clock or closed for ex. clock
3	Open for immediate TR	Open for immediate TR
4	Not used	Open for direct connect interface (needs int. clock). No connect timeout.
5	Not used	Not used
6 - 8 below	Transmission clock rate (closed is logic 1)	Transmission clock rate (closed is logic 1)
00	300	300
001	1200	1200
010	2400	2400
011	4800	4800
100	9600	9600
101	19200	19200
110	57600	57600
111	Not used	Not used

12834A BISYNC DIRECT CONNECT INTERFACE KIT (Cont'd)

ROM FIRMWARE PARTS

Various vendor PROM part numbers from Intel and TI were used for the ROMs. Jumpers XW1A — XW1G and XW2A — XW2D are used to adapt the card to the possible combinations. If the ROMs are changed and different from those originally on the card. consult the manual for configuration.

Firmware Self Test

The firmware self-test is executed everytime there is power-up or PRESET is pushed. It is recommended that the node is quiesced before powering down to allow completion of pending DS transactions. Use command RU,DSMOD followed by /Q for the DSMOD prompt. Test results are made available to the driver (to check, run DSINF and with the LU command check the information returned (LU,# ,AL).

LEDs on the card also indicate successful test completion: LED0 is on the right. LEDs 0-2 should be all off after the test and before the DS software has been initialized. LED3 when lit indicates the clock selected is external.

Direct Connect Diagnostic Hood Test

1. Quiesce the node: Run DSMOD and on the following DSMOD prompt enter /Q, then off the power.
2. Remove the interface cable and install the diagnostic hood.
3. Restore power and the self-test executes. Results are returned to the driver. Run DSINF and check the information returned with the LU command (LU,# ,AL).
4. Run RMOTE and execute some RMOTE commands as described below.
5. Remove power, and replace the hood with the modem cable.
6. Restore power and reinitialize the system and DS software.

Communications Link Check

Exercise a few RMOTE commands:

1. RU,RMOTE

   RMOTE is a program that handles operator commands for an HP 1000 to an HP 3000 in a DS network. RMOTE prompts with a $ sign, the remote 3000 prompt is #.

2. $SW

   Transfer command to the remote 3000 system. A second SW will transfer execution back to the 1000.

3. #HELLO<ACCOUNT NAME>

   Log onto a 3000 account. A log-on message should be displayed.

4. #SHOWJOB command will display all sessions that are active.

5. #EX commands logs off from the 3000 and exit RMOTE.

12889A HARDWIRED SERIAL INTERFACE

EQUIPMENT

12889-60001	Hardwired serial I/F PCA.
1813-0046	15 MHz oscillator.
12889-60004	Hardwired serial I/F cable assembly. (10-feet, 304.8 centimeters)

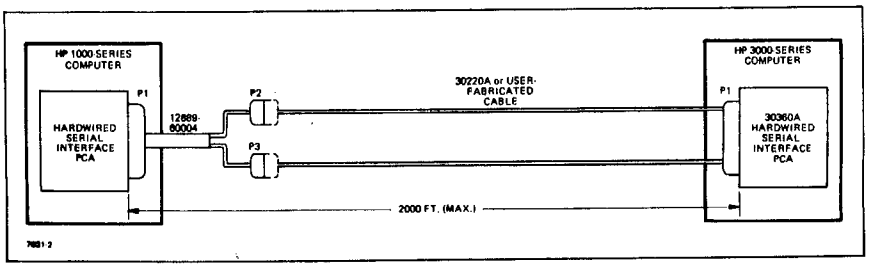
OPTION

001: Replaces 15 MHz oscillator with 7.5 MHz oscillator P/N 1813-0052.

DOCUMENTATION

12889-90001 Installation and service manual.

CONFIGURATION



12889A HARDWIRED SERIAL INTERFACE DIAGNOSTIC

Paper Tape Binary P/N 24335-16001. Date Code 1717.
Cartridge Binary 24396-13306, Date Code 1830 and 24998-13303, Date Code 1928.
DSN 103207
Manual P/N 02100-90169.

1. For single-CPU/single-HSI mode, connect the two ends of the HSI cable assembly together. For dual-CPU/dual-HSI mode, connect the two cable assemblies together.
2. Load Diagnostic Configurator, binary object tape P/N 24296-60001, manual P/N 02100-90157.
3. Configure configurator and load disgnostic.

NOTE

In dual-CPU/HSI mode, load configurator and diagnostic into each CPU.

4. Configure diagnostic: P-Reg = 100B, S-Reg (5-0) = Interface SC, and S-Reg (8) = Clear if single mode; set if dual mode.
5. Press PRESET, RUN.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. If in dual mode and halt 106000, start transmitter and receiver at the same time.
9. Restart: P-Reg = 2000B.

12889A HARDWIRED SERIAL I/F DIAGNOSTIC (Cont'd)

10. Switch options:

BIT	FUNCTION WHEN SET
0	Reserved.
1	When set in Dual Mode, CPU acts as receiver. (When clear, CPU acts as transmitter.)
2	Abort receiver wait loop (first set then clear). If bit not cleared within 15 seconds, the CPU will abort the receive mode with bit set.
3-7	Reserved.
8	Output all messages to line printer (line printer must have been configured in the configurator).
9	Abort at end of test with halt 102075_8. User may specify a new group of tests in the A-Register.

A-REG BIT	TEST	EXECUTE IF SET
0	TST00	Header Message
1	TST01	Basic I/O, Interrupt Circuitry
2	TST02	Basic I/O, Interrupt Off
3	TST03	Basic I/O, Interface PCA Flag Test
4	TST04	Basic I/O Select Code Screen Test
5	TST05	Basic I/O, Interrupt Hold Off
6	TST06	Basic I/O, Interface PCA Control Test
7	TST07	Basic I/O, Preset
8	TST08	100 Word Transfer without interrupt and DCPC (DMA)
9	TST09	100 Word Transfer with interrupt and without DCPC (DMA)
10	TST10	Watch Dog Timer Test
11	TST11	Checks CLC
12	TST12	CRC Testing after 100 Word Transfer
13	TST13	Handshake Mode Verification*
14	TST14	Listen/Repeat Mode Verification*
15	TST15	Tag Bit and Interrupt of DCPC (DMA) Transfer*

*Not applicable if diagnostic executed in single mode.

10	Suppress non-error messages.
11	Suppress error messages.
12	Loop on all selected tests. Tests requiring manual intervention are omitted.
13	Loop on last test.
14	Suppress error halts.
15	Halt at end of each test with 102076_8. A-Register holds test number.

12920B ASYNCHRONOUS MULTIPLEXER

EQUIPMENT

12920-60001	Upper Data PCA
12920-60002	Lower Data PCA
12921-60003	Data Cable (12 ft.)
12922-60001	Control PCA*
12922-60003	Control Cable (12 ft.)*
30062-60016	Connector Panel
30062-60003	Test Cable

*Items comprising 12920B-001 Multiplexer.

DOCUMENTATION

P/N	MANUAL
12920-90007	12920B Reference and Application
12920-90009	12920A/B I/F Diagnostic Reference

SPECIFICATIONS

PARAMETERS	REQUIREMENTS			
CURRENT REQUIRED FROM COMPUTER:	Lower Data PCA (Part No. 12920-60002) Amperes	Upper Data PCA (Part No. 12920-60001) Amperes	Control PCA (Part No. 12922-60001) Amperes	Total
+12 Volt Supply	0.085	0.0	0.156	0.241
-12 Volt Supply	0.120	0.121	0.236	0.477
+4.5 Volt Supply	2.04	2.05	1.44	5.53
-2 Volt Supply	0.125	0.031	0.102	0.258

INSTALLATION NOTES

IN-1. On lower data PCA (P/N 12920-60002), ensure jumper wire W1 is in position "A". (Jumper wire W1 is located on the upper right-hand corner of the PCA.)

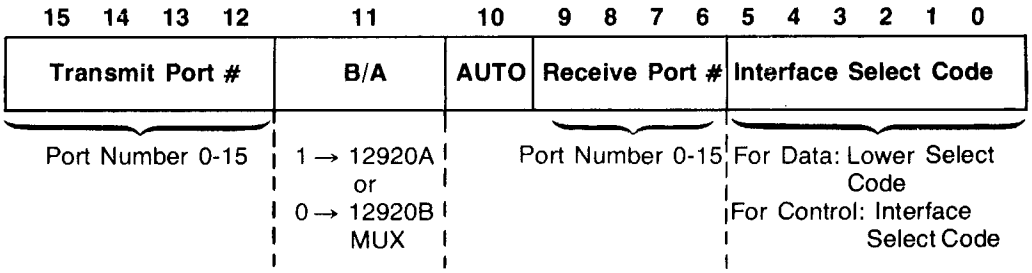
IN-2. The lower and upper data PCA's must be inserted into adjacent slots. The lower data PCA must be installed in the higher numbered slot (lower select code).

12920A/B MULTIPLEXER I/F DIAGNOSTIC

Paper Tape Binary 12920-16001, 16002. Date Code 1644 and 1644.

1. Load Diagnostic Configurator.
2. Configure configurator and load one of the 12920A/B diagnostic tapes.
3. Configure diagnostic: P-Reg = 100_8; S-Reg = Configuration options.

CONFIGURATION OPTIONS



NOTE: If bits 12-15 and 6-9 are zero diagnostic will assume auto mode. A port is defined as one of the 16 connectors J0-J15 on the connector panel No. 30062-60002.

12920A/B MULTIPLEXER I/F DIAGNOSTIC (Cont'd)

4. Press RUN. HALT 102074 (HALT 102072 indicates port number input error)

5. Set S-Reg = Switch options.

6. Press RUN.

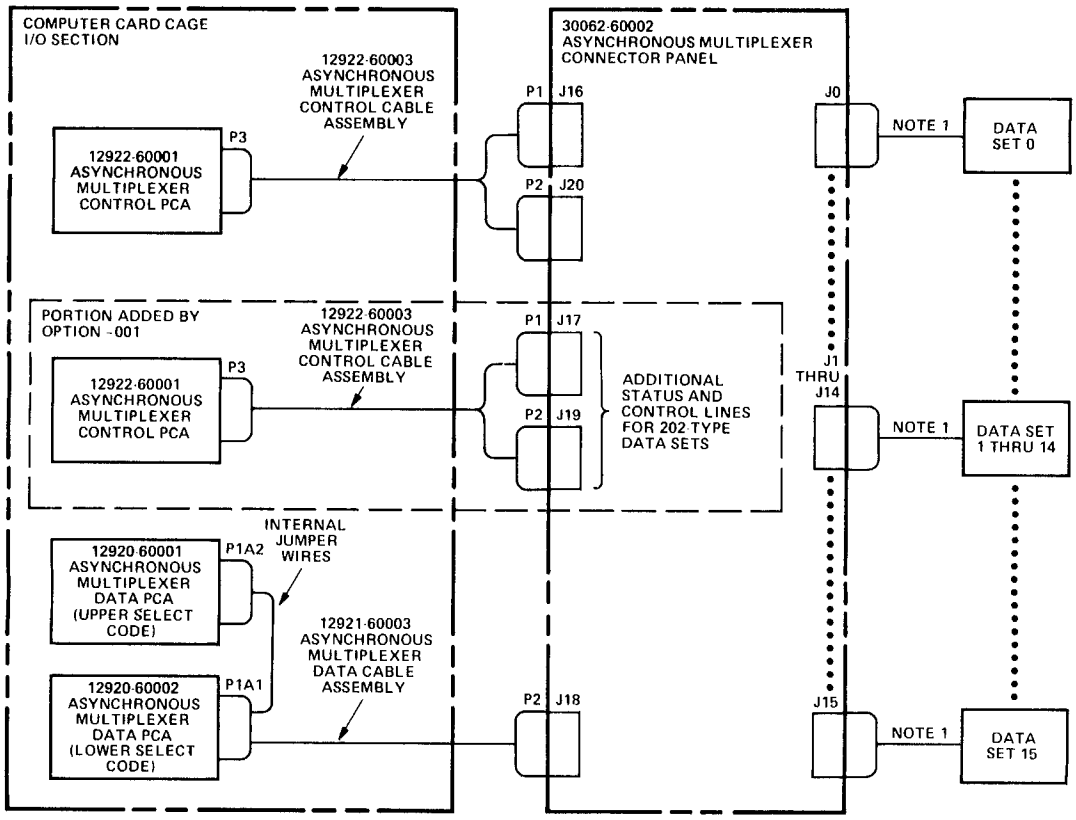
7. Switch options:

<table>
<tr><th>BIT</th><th colspan="2">MEANING IF SET</th></tr>
<tr><td>0-7</td><td colspan="2">Reserved.</td></tr>
<tr><td>8</td><td colspan="2">Suppress tests requiring operator intervention.</td></tr>
<tr><td>9</td><td colspan="2">Abort current test and halt (102075); user may specify a new group of tests in the A-Reg, clear bit 9 and then press RUN.</td></tr>
<tr><td></td><td colspan="2">For 12920-16001 (DATA) tape</td></tr>
<tr><td></td><td>A-REG BIT</td><td>MEANING IF SET</td></tr>
<tr><td></td><td>0
1
2
3
4
5
6
7</td><td>Test 00 BI-O Test
Test 01 Send/Receive Test
Test 02 Break Test
Test 03 Parity Test
Test 04 Diagnostic
Test 05 Echo Test
Test 06 Echo Test
Test 07 Character Lost Test</td></tr>
<tr><td></td><td colspan="2">For 12920-16002 (CONTROL) tape</td></tr>
<tr><td></td><td>A-REG BIT</td><td>MEANING IF SET</td></tr>
<tr><td></td><td>0
1
2
3
4
5</td><td>Test 00 BI-O
Test 01 Address Register Test
Test 02 Command and Register Test
Test 03 Command Register Addressing Test
Test 04 Status Interrupt Test
Test 05 Scan Test</td></tr>
<tr><td>10</td><td colspan="2">Suppress non-error messages.</td></tr>
<tr><td>11</td><td colspan="2">Suppress error messages.</td></tr>
<tr><td>12</td><td colspan="2">Repeat all selected tests. Also, suppress tests requiring operator intervention.</td></tr>
<tr><td>13</td><td colspan="2">Repeat last test executed (loop on test).</td></tr>
<tr><td>14</td><td colspan="2">Suppress error halts.</td></tr>
<tr><td>15</td><td colspan="2">Halt (102076) at the end of each test; A-Reg = test number.</td></tr>
</table>

12920A/B MULTIPLEXER I/F DIAGNOSTIC (Cont'd)

SERVICE DATA

1. Multiplexer Simplified Connection Diagram



NOTES:

1. DATA SET CONNECTOR CABLES ARE FABRICATED AS REQUIRED. REFER TO PARAGRAPH 2-8
2. THE ASYNCHRONOUS MULTIPLEXER TEST CABLE, PART NO. 30062-60003, IS CONNECTED BETWEEN ANY TWO DATA SET CONNECTORS (J0 THRU J15) WHEN RUNNING DIAGNOSTIC PROGRAMS.
3. REFER TO THE INTERCONNECTING DIAGRAM, FIGURE 2-4 FOR CONNECTOR PIN NUMBERS.

12930A UNIVERSAL INTERFACE KIT

Equipment

Kit	PCA Part No.	Diagnostic Connector†	Interconnecting Cable	Priority Jumper PCA
12930A	12930-60001	12930-60013	8120-1895*	02116-6110
Option 001	12930-60004	12930-60014	8120-1895*	02116-6110
Option 002	12930-60005	12930-60015	8120-1895*	02116-6110
Option 003	12930-60004	12930-60014	12930-60012**	02116-6110

† Diagnostic connector wiring lists are given in Appendix B of the General Purpose Register Diagnostic Reference Manual.

* 7.6 metre cable. Former part no. 12930-60007.
** 15.2 metre cable for 2894A Reader/Punch.

12930A DIAGNOSTIC

Use the 24391 General Purpose Register Diagnostic. Refer to the end of the Input/Output Section for Information on this subject.

Manual: 24391-90001

Different jumper switch settings are required for each of the tests (TST 08, 09, 10, and 11). At the beginning of 09, 10, and 11 the CPU will halt and request a change in jumpers. The switch settings to be changed from the previous test are asterisked (*). The appropriate test connectors will be required for TST 11.

SWITCH POSITIONS FOR DIAGNOSTIC

Use any one of the two combinations allowed:

Switch	Test 00-08	Test 09	Test 10	Test 11
U85 S1	1	1	1	1
S2	6	6	5*	5
S3	10	10	9*	8*
U87 S1	1	1	1	1
S2	5	5	5	5
S3	8	8	8	8
U97 S1	1	1	1	1
S2	5	5	5	4*
S3	10	10	10	9*
U102 S1	2	2	2	2
S2	7	7	7	6*
S3	10	10	10	10
U106 S1	1	1	1	2*
S2	6	5*	5	5
S3	9	9	9	10*

12936 PRIVILEGED INTERRUPT FENCE DIAGNOSTIC

Paper Tape Binary, 12936-16001. Date Code 1643.
Manual P/N 12936-90003.

Hardware required:

a. Minimum 4K memory.
b. Two standard I/O interfaces.
c. 12936 Privileged Interrupt PCA.
d. I/O jumpers to effect unbroken priority.

1. The SC of the first standard I/F must be less than the SC of the 12936 PCA which must be less than the SC of the second standard I/F. The priority chain from SC 10 to the SC of the second standard I/F must be maintained.

2. Load Diagnostic Configurator.

3. Configure configurator and load diagnostic.

4. Set S-Reg (11-6) = SC of second standard I/F, S-Reg (5-0) = SC of first standard I/F.

5. Press PRESET, RUN. HALT 102070.

6. Set S-Reg (5-0) = SC of 12936 PCA.

7. Press RUN. HALT 102074.

8. Set S-Reg = Switch options.

9. Press PRESET, RUN.

10. Restart: P-Reg = 2000_8.

12936 PRIVILEGED INTERRUPT FENCE DIAGNOSTIC (Cont'd)

11. Switch options:

<table>
<tr><th>S-REG BIT</th><th colspan="3">MEANING IF SET</th></tr>
<tr><td>15</td><td colspan="3">Halt 102076 (octal) at the end of each test; A-Reg = test number.</td></tr>
<tr><td>14</td><td colspan="3">Suppress error halts.</td></tr>
<tr><td>13</td><td colspan="3">Loop on last test section being executed.</td></tr>
<tr><td>12</td><td colspan="3">Loop on diagnostic.</td></tr>
<tr><td>11</td><td colspan="3">Suppress error messages.</td></tr>
<tr><td>10</td><td colspan="3">Suppress information messages.</td></tr>
<tr><td>9</td><td colspan="3">Abort diagnostic execution after the current test section and halt (102075). Operator can specify a new group of test(s) in the A-Reg. Then clear Switch Register bit 9 and press RUN.</td></tr>
<tr><td></td><td>A-REG BIT</td><td>TEST</td><td>IF SET WILL EXECUTE</td></tr>
<tr><td></td><td>0</td><td>00</td><td>High SC Interrupt Test</td></tr>
<tr><td></td><td>1</td><td>01</td><td>Low SC Interrupt Test</td></tr>
<tr><td></td><td>2</td><td>02</td><td>Set Control/Clear Control Fence Channel Test</td></tr>
<tr><td></td><td>3</td><td>03</td><td>Clear Control and Flag With Preset Test</td></tr>
<tr><td></td><td>4</td><td>04</td><td>No Action: Flag and Control Cleared Test</td></tr>
<tr><td></td><td>5</td><td>05</td><td>High SC: Flag Cleared and Control Set Test</td></tr>
<tr><td></td><td>6</td><td>06</td><td>High SC: Flag and Control Set Test</td></tr>
<tr><td></td><td>7</td><td>07</td><td>High SC and Interrupt: Flag Set and Control Cleared Test</td></tr>
<tr><td></td><td>8</td><td>08</td><td>Low SC/Fence Priority Test</td></tr>
<tr><td></td><td>9</td><td>09</td><td>Scope Loop Test (Not part of standard tests.)</td></tr>
<tr><td>8</td><td colspan="3">Suppress operator intervention tests.</td></tr>
<tr><td>7-0</td><td colspan="3">Reserved.</td></tr>
</table>

12966A BUFFERED ASYNCHRONOUS DATA COMMUNICATIONS INTERFACE

EQUIPMENT

12966-60004	Buffered Asynchronous Data Set PCA
12966-60004	Interconnecting Cable Assembly (ICA), 50 feet
12966-60003	Test Connector
12966-60008	Option 001 (Direct Cable to HP 264X) — ICA, 50 feet
12966-60006	Option 002 (Modem Cable) — ICA, 50 feet
12966-60007	Option 003 (Direct Cable to HP 2749B) — ICA, 50 feet
12966-60014	Option 105 (Direct Cable to 262X. RFI qualified 9600 baud) — ICA, 16.4 ft (5m).
12966-60015	Option 106 (2626A or 2635B, RFI qualified, hardwired 9600 baud) — ICA, 16.4 ft (5m).
12966-60016	Option 107 (Direct Cable to 264X, RFI qualified, hardwired 9600 baud) — ICA, 16.4 ft (5m).

12966A BUFFERED ASYNCHRONOUS DATA COMMUNICATIONS INTERFACE (Cont'd)

DOCUMENTATION

P/N	MANUAL
12966-90001	12966A I/F Reference
12966-90004	12966A Diagnostic Reference

SPECIFICATIONS

Power Consumption

+5-volt supply:	1.95A nominal, 3A maximum
+12-volt supply:	18 mA nominal
−2-volt supply:	66 mA nominal, 100 mA maximum
−12-volt supply:	59 mA nominal

INSTALLATION NOTES

IN-1. Jumper Connections for Baud Transfer Rates

BAUD RATE	BIT PATTERN	CONNECT +5V (PIN 8) TO PINS:	CONNECT SIGNAL GROUND (PINS 1, A, 24, OR BB) TO PINS:
External Clock (X16)	0000	—	12, 13, 14, 15
50	0001	14	12, 13, 15
75	0010	13	12, 14, 15
110	0011	13, 14	12, 15
134.5	0100	12	13, 14, 15
150	0101	12, 14	13, 15
300	0110	12, 13	14, 15
600	0111	12, 13, 14	15
900	1000	15	12, 13, 14
1200	1001	14, 15	12, 13
1800	1010	13, 15	12, 14
2400	1011	13, 14, 15	12
3600	1100	13, 15	13, 14
4800	1101	12, 14, 15	13
7200	1110	12, 13, 15	14
9600	1111	12, 13, 14, 15	—

12966A ASYNCHRONOUS DATA I/F DIAGNOSTIC

Paper Tape Binary 12966-16001. Date Code 1519.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: R-Reg = 100_8, S-Reg (5-0) = 12966A I/F SC.
4. Press PRESET, RUN. HALT 102074.
5. Install test hood, P/N 12960-60003.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000_8.
9. Switch options:

BIT	MEANING IF SET	
0-1	Reserved.	
2	Report all errors. If clear, suppress excessive error reports.	
3-7	Reserved.	
8	Suppress tests requiring operator intervention.	
9	Abort current test and halt (102075); user may specify a new group of tests in the A-Reg, clear bit 9 and then press RUN.	
	A-REG BIT	**TEST EXECUTE IF SET**
	0	Test 00 BASIC I/O
	1	Test 01 MASTER RESET
	2	Test 02 MODEM STATUS
	3	Test 03 REF. & ENABLE COMMANDS
	4	Test 04 FIFO BUFFER
	5	Test 05 CHARACTER COUNTER
	6	Test 06 SPECIAL CHARACTER RAM
	7	Test 07 UART TRANSMIT
	8	Test 10 UART RECEIVE
	9	Test 11 BAUD RATE SELECT
	10	Test 12 OVER-RUN AND PARITY ERR
	11	Test 13 DCPC/DMA
	12-15	Reserved.
10	Suppress non-error messages.	
11	Suppress error messages.	
12	Repeat all selected tests. Also, suppress tests requiring operator intervention.	
13	Repeat last test executed (loop on test).	
14	Suppress error halts.	
15	Halt (102076) at the end of each test; A-Reg = test number.	

12967A SYNC DATA I/F DIAGNOSTIC

Paper Tape Binary 12967-16001. Date Code 1438.
Manual P/N 12967-90001.

1. Install test connector, P/N 12967-60003.
2. Load Diagnostic Configurator.
3. Configure configurator and load diagnostic.
4. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = Interface SC, S-Reg (13-6) = SYNC character bit configuration (switch assembly U101).
5. Press PRESET, RUN. HALT 102074.
6. Set S-Reg = Switch options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000_8.
9. Switch options:

BIT	MEANING IF SET	
1-0	Reserved.	
2	Report all errors.	
7-3	Reserved.	
8	Suppress tests requiring operator intervention.	
9	Abort current test and halt (102075); specify tests in A-Reg; clear bit 9 and press RUN.	
	A-REG BIT	**EXECUTE IF SET**
	0	TEST 00 Basic I/O
	1	TEST 01 Master Reset
	2	TEST 02 Modem Status
	3	TEST 03 Arm and Mask Commands
	4	TEST 04 Internal Control State
	5	TEST 05 Data Path
	6	TEST 06 Receive Mode
	7	TEST 07 Transmit
	8	TEST 10 Receive
	9	TEST 11 DMA/DCPC
10	Suppress non-error messages.	
11	Suppress error messages.	
12	Repeat all selected tests. Also, suppress tests requiring operator intervention.	
13	Repeat last test executed.	
14	Suppress error halts.	
15	Halt (102076) at the end of each test; A-Reg = test number.	

12968A ASYNCHRONOUS COMMUNICATIONS I/F DIAGNOSTIC

Paper Tape Binary 12968-16001. Date Code 1602.
Manual P/N 12968-90003

1. Install test connector, P/N 12966-60003.
2. Load Diagnostic Configurator.
3. Configure configurator and load diagnostic.
4. Configure diagnostic: P-Reg = 100_8, S-Reg (5-0) = Interface SC.
5. Press PRESET, RUN. HALT 102074.
6. Set S-Reg = Switch Options.
7. Press PRESET, RUN.
8. Restart: P-Reg = 2000_8.
9. Switch options:

BIT	MEANING IF SET
1-0	Reserved.
2	Report all errors.
7-3	Reserved.
8	Suppress tests requiring operator intervention.
9	Abort current test and halt (102075); specify tests in A-Reg; clear bit 9 and press RUN.

A-REG BIT	TEST	EXECUTE IF SET
0	00	Basic I/O
1	01	Master Reset
2	02	Modem Status
3	03	Reference and Enable Commands
4	04	Character Counter
5	05	UART Transmit
6	06	UART Receive
7	07	Baud Rate Select
8	10	Over-run and Parity Error
9	11	DCPC
15-10	—	Reserved

10	Suppress non-error messages.
11	Suppress error messages.
12	Repeat all selected tests. Also suppress those tests requiring operator intervention.
13	Repeat last test executed (loop on test).
14	Suppress error halts.
15	Halt (102076) at the end of each test; A-Reg = test number.

59310A/B INTERFACE BUS I/F DIAGNOSTIC

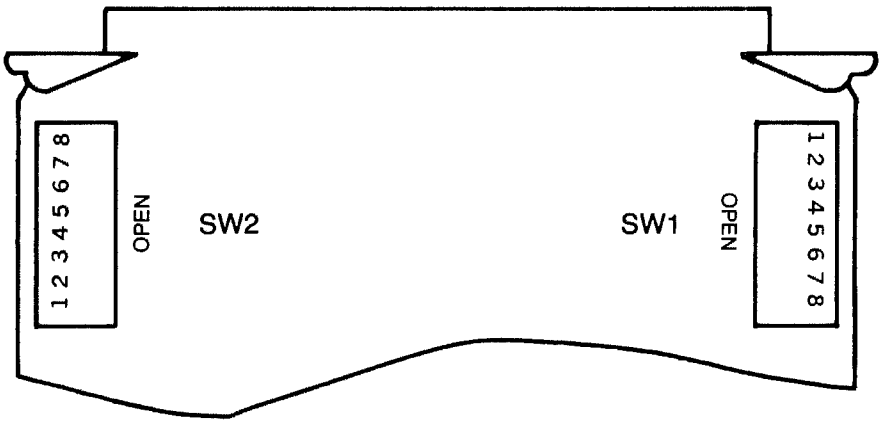
Paper Tape Binary 59310-16001. Date Code 1728.
Manual P/N 59310-90061.

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Set P-Reg = 100_8, S-Reg (5-0) = First IBI select code, and S-Reg (11-6) = Second IBI select code (optional).
4. Press PRESET, RUN. HALT 102070.
5. Set S-Reg (5-0) = First IBI MYADDR, and S-Reg (11-6) = Second IBM MYADDR. (The REN and IFC jumpers must be open.)
6. Press PRESET, RUN. HALT 102071.
7. Set S-Reg (7-0) = First IBI Service Request Identification, and S-Reg (15-8) = Second IBI S.R.I.
8. Press PRESET, RUN. HALT 102074.
9. Set S-Reg = Switch options.
10. Press PRESET, RUN.
11. Restart: P-Reg = 2000_8.
12. Switch options:

BIT	MEANING IF SET
0	Execute cable test.
1	Use first IBI select code in troubleshooting.
2	Use second IBI select code in troubleshooting.
3	Do Parallel Poll Request Test.
7-4	Reserved.
8	Suppress Preset Test.
9	Reserved.
10	Suppress non-error messages.
11	Suppress error messages.
12	Loop on diagnostic.
13	Reserved.
14	Suppress error halts.
15	Reserved.

59310A/B INTERFACE BUS I/F DIAGNOSTIC (Cont'd)

59310B SWITCH CONFIGURATION



SW2

1	LSB
2	BUS ADDR, OCTAL
3	BUS ADDR, OCTAL
4	BUS ADDR, OCTAL
5	MSB
6	REN OPEN→ENABLED
7	IFC OPEN→ENABLED
8	SHIELD CNX-CONNECTED

CLOSED = 0
OPEN= 1

SW1

1	PARALLEL POLL I.D. CODE
2	PARALLEL POLL I.D. CODE
3	PARALLEL POLL I.D. CODE
4	PARALLEL POLL I.D. CODE
5	(NORMALLY ALL "OFF" OPEN)
6	(NORMALLY ALL "OFF" OPEN)
7	(NORMALLY ALL "OFF" OPEN)
8	(NORMALLY ALL "OFF" OPEN)

NOTE: SET ONLY ONE SWITCH "ON" AT A TIME CORRESPONDING TO DI01-DI08.

GENERAL PURPOSE REGISTER DIAGNOSTIC

Paper Tape Binary 24931-16001. Data Code 1813. Cartridge Binary 24396-13301, Date Code 1901 and 24998-13301, Date code 1926. DSN 143300
Manual P/N 24391-90001.

Interfaces tested: 12551B/12554A/12566B/12566G/12589A/12597A/12602B/12849A/12589A/ 12875B/12930A

1. Load Diagnostic Configurator.
2. Configure configurator and load diagnostic.
3. Configure diagnostic: P-Reg = 100_8, S-Reg = Configuration options.

Configuration Options

BIT		MEANING IF SET
0-5	S.C.	Set to select code of interface under test.
6		Reserved.
7	HP 12930A	Universal interface kit (standard, option 001 or option 002 is under test).
8	HP 12589A	Automatic Dialer interface kit is under test.
9		Relay Register has data read-back capabilities (12551B-01).
10	HP 12551B	Relay Register is under test (12551B or 12551B-01).
11	HP 12597A	8-bit duplex register interface bit is under test (12597A ground true/ positive, 12597A-001 negative true/ground, or 12597A-002, -003 or -005).
12		Set if W5 of 12849A is removed (W4 must be in positive B), cleared if W5 is installed (W4 may be in positive A or B).
13		Set if 12849A-001, positive true, cleared if 12849A, ground true.
14		Set if W10 on 12849A is in positive B (PON ground true), cleared if W10 on 12849A is in positive A (PON positive true).
15	HP 12849A	Controller Microcircuit interface kit 12849A or 12849A-001 is under test.
The default case (bits 7 through 15 cleared) is for the HP 12554A, HP 12566B, HP 12602B or the HP 12875B interface.		

4. Press PRESET, RUN. HALT 102074.
5. Set S-Reg = Switch options.
6. Press PRESET, RUN.
7. Restart: P-Reg = 2000_8.

GENERAL PURPOSE REGISTER DIAGNOSTIC (CONT)

8. Switch options:

BIT	MEANING IF SET
0	Increment test pattern by one.
1	Output test pattern to interface (OTA SC).
2	Encode test pattern (STC SC,C)
3	Wait for flag (SFS SC) (E042-possible).
4	Input pattern from interface (LIA SC).
5	Compare input with output test pattern (E034-possible).
6	Loop on opdesign selection.

(Bits 0–6: OPDSN Instructions)

7	Reserved.
8	Suppress Preset test.
9	Abort current diagnostic execution and halt (102075); the user may specify a new group of tests in the A-Reg, then clear bit 9 of the Switch Register and press RUN. This may also be used after error halt 102034 or 102042.

A-REG BIT	TEST	EXECUTE IF SET	
0	00	Basic I/O (BI-O) Test	
1	01	Pattern Test (Relay Reg only)	
2	02	Command Test (Relay Reg only)	
3	03	Data Buffer Test (all cards except the Relay Reg and Auto Dialer)	
4	04	Control Signals Test (12849A only)	
5	05	I/O Test	Auto Dialer only
6	06	Multiline Test	Auto Dialer only
7	07	Dialer turn on, wait, turn off test	Auto Dialer only
8	08	Command/Status and Data Test without STC	Universal Interface only
9	09	Command/Status and Data Test with STC	Universal Interface only
10	10	Command Channel Test	Universal Interface only
11	11	Data Channel and power on circuit test	Universal Interface only
12	12	Pseudo Opdesign	
13-15	Reserved		

10	Suppress non-error messages.
11	Suppress error messages.
12	Repeat all selected tests. Also, the Preset test (in BI-O) will be suppressed.
13	Repeat last test executed (loop on test).
14	Suppress error halts.
15	Halt (102076) at the end of each test; A-Reg = test number.

PARTS

FUSES

SIZE	TYPE	PART NUMBER	SIZE	TYPE	PART NUMBER
0.2	SLOW	2110-0235	4A	SLOW	2110-0014*
0.25A	SLOW	2110-0201	4A	SLOW	2110-0365
0.25A	MED	2110-0004*	4A	MED	2110-0055*
0.5A	SLOW	2110-0202	5A	SLOW	2110-0030*
0.5A	MED	2110-0012*	5A	MED	2110-0010*
1A	SLOW	2110-0007*	6A	MED	2110-0056*
1A	MED	2110-0001*	6A	SLOW	2110-0016*
1A	FAST	2110-0516	8A	SLOW	2110-0383
1.5A	SLOW	2110-0304	8A	SLOW	2110-0035*
1.5A	MED	2110-0043	8A	MED	2110-0342
2A	SLOW	2110-0303	8A	MED	2110-0036*
2A	MED	2110-0006*	10A	MED	2110-0051*
2A	MED	2110-0002*	10A	SLOW	2110-0037*
2.5A	SLOW	2110-0380	15A	SLOW	2110-0025*
2.5A	MED	2110-0083	15A	MED	2110-0048*
3A	MED	2110-0003*	15A	SLOW	2110-0054
3A	SLOW	2110-0029*	20A		2110-0459
			12A	MED	2110-0250

* Denotes a type commonly used by HP

LAMPS COMMONLY USED IN HP EQUIPMENT

PART NUMBER	BULB #	VOLTAGE/CURRENT	USED IN
1535-0655	24D	--	2883/2888
1535-2610	7327	--	2762A/B
1536-2890		6V 40 mA	2607
1535-3153	3024	--	2613/2617 (old type)
1535-3663	394	--	2613/1617 (old type)
2140-0035	345	6V	2116
2140-0039	328	6V	2892/2893
2140-0068	330	14V	2618
2140-0094	Leads	5V	7200 Sector XDCR
2140-0203	428	5V	7970B/E Photo Sense
2140-0209	328	14V	7970B/E
2140-0256	370	18V	7260/7261
2140-0315	--	--	2748 Read Head Lamps
2140-0343	330	14V	7900/05/06/20/25
2140-0364	783BP	5V	2100
2140-0383	1819	28V	29402B Cabinet Power

SWITCHES

DESCRIPTION	PART NUMBER
2100 Panel	3101-1531
21MX/21MXE	
White	5040-6076
Gray	5040-6077
Bracket for Switches	02108-40002

TELETYPE

Ribbon	9283-0002
Tape Spool	1530-1436
TTY Kit	5080-6610

DISC SCRATCH PACKS & CS/80 TAPE

2870	12536A
2883/2884	12868A
7900/7901	12869A
7905/06	12940A
7920	13394A
7925	13356A
7908/14	88140S
7911/12	88140L or 88140S
7935	97935A
9885	9164-0074
9121/9133	92191A
9895A	92195A

MAGNETIC TAPE

IBM Alignment	9162-0027
1200' Magnetic Tape	9162-0026
2400' Magnetic Tape	9162-0025

LIGHT EMITTING DIODES

21MX-M	1990-0733
21MX-E/F	1990-0529

SUPPLIES

2621P Thermal Paper	9270-0638, 24 rolls
2608 Ribbon	02608-60038
2610 Ribbon	1535-2098

MISCELLANEOUS

Spring Contact	02108-00014
Switch Retainer	02108-40002
21MX "B" Pwr Sup Battery	0950-1596
7970 Take-up Reel	1490-0738
48-pin Connector Kit	5060-8339
21MX CPU Blank Loader PROM	1816-0015

2613A LINE PRINTER

Format Tape Punch	9164-0023
Blank Format Tape	4114-0371
Standard Format Tape 6 LPI	02613-80001
Standard Format Tape 8 LPI	02618-80003
Paper Fanfold 1516 Bond	9320-1659
Adhesive, Carriage Tape	0470-0391
Static Tinsel	0960-0585
Connector Puller	8710-0580

2100A/S NEW AND EXCHANGE ASSEMBLY PART NUMBERS

New

02100-60014	A1 Timing and Control	02100-60073
02100-60002	As Rom Control	02100-60069
02100-60004	A3 Microinstruction Decoder 1	02100-60071
02100-60022*	A4 Microinstruction Decoder 2	02100-60075
02100-60112	A4 Microinstruction Decoder 2	02100-60115
02100-60001	A5 Arithmetic/Logic	02100-60068
02100-60003	A6 Instruction Register Decoder	02100-60070
02100-60024	A7 I/O Control	02100-60076
02100-60007	A8 I/O Buffer and Memory Protect	02100-60072
12895-60001	A9 Direct Memory Access	12895-60087
02100-60012	A101, A104, A109, A112 X-Y Driver/Switch	02100-60083
5060-8331	A102, A103, A110, A111 Core Stack/Sense Amplifier	5060-8332
02100-60009	A105, A108 Inhibit Driver	02100-60080
02100-60010	A106 Inhibit Driver Load	No Exchange
02100-60011	A107 Data Control	02100-60082
02100-60015	A24 Front Panel Board	02100-60074
02100-60017	A24 Front Panel Assy (Option 001)	No Exchange
02100-60053	A25 Power Supply Assy (Non UL Approved)	02100-60077
02100-60053**	A25 Power Supply Assy (UL Approved)	02100-60116

2155A

02155-60001	A112 I/O Extender 1	No Exchange
02155-60002	A111 I/O Extender 2	02155-60016
02155-60003	A10 I/O Extender in 2100A/S	02155-60017
12896-60001	A110 Direct Memory Access	No Exchange

* Order 02100-60112 for new board.
** Should not be replaced with non UL approved supply.

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST

SECTION I-CPU'S

NOTE: 5061-1341 WAS THE ORIGINAL NUMBER ASSIGNED TO THE E-SERIES CPU BOARD. THE ASSIGNED EXCHANGE BOARD NUMBER FOR THE SAME PART WAS 5061-1369. DURING THIS TIME, THE SIX BASE SET FIRMWARE (MICROCODE) ROMS WERE INSTALLED AND INCLUDED ON ALL CPU BOARDS. WHEN THE F-SERIES COMPUTER SYSTEM WAS RELEASED, THE "E" CPU BOARD WAS ALSO USED AS THE CENTRAL PROCESSOR ASSEMBLY. SINCE THE F-SERIES "FLOATING POINT" INSTRUCTIONS CONTAIN MICROCODE THAT IS TAILORED SPECIFICALLY FOR CONTROLLING THE FPP ALU AND CONTROL BOARDS, THE ONLY DIFFERENCE BETWEEN THE "E" AND "F" CENTRAL PROCESSORS BECAME THE SIX BASE SET/EIG/FL.PT. FIRMWARE ROMS. TO AVOID CONFUSION WHEN PRODUCING THE "E" OR "F" SERIES CPU ASSEMBLIES WITH THE DIFFERENT BASE SET/EIG/FL.PT. ROMS , A NEW NUMBER (5061-1400) WAS ASSIGNED TO THE PROCESSOR BOARD. THIS NUMBER WOULD NOW REFERENCE THE CPU ASSEMBLY WITHOUT ROMS. THESE ROMS ARE THEN INSTALLED AS THE CPU ASSEMBLY ENTERS THE "E" OR "F" PRODUCTION LINES RESPECTIVELY. THE EXCHANGE NUMBER WAS ALSO CHANGED TO 5061-1390. AS THE CPU ASSEMBLIES ENTER THE EXCHANGE BOARD PIPELINE, THE ROMS, WHETHER THEY ARE "E" OR "F" SERIES, SHOULD BE TAKEN OFF EACH CPU ASSEMBLY BY THE CUSTOMER AND RETAINED FOR USE WITH THE NEW EXCHANGE ASSEMBLY. THUS, ALL FOUR OF THESE NUMBERS (5061-1341, 5061-1369, 5061-1400, AND 5061-1390) REFERENCE THE SAME PHYSICAL CPU BOARD. ALL FOUR NUMBERS ARE INCLUDED IN THE FOLLOWING SECTION FOR HISTORICAL REFERENCE PURPOSES.

NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
5060-8352	5060-8371	M-SERIES CPU	2105A 2108A/B, 2112A/B	1838h
5061-1341	5061-1369 5061-1390	E-SERIES CPU	2109A/B, 2113A/B	1827c
5061-1400	5061-1390	F-SERIES CPU	2109B, 2113B, 2111/17F	2301

(continued)

HARDWARE HISTORY LIBRARY

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION II-HARDWARE FLOATING POINT PROCESSOR

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
	12740-60001	12740-69001	FL. PT ALU BOARD	2111/17F	2012a
OB	12740-60002	12740-69102	FL. PT CONTROL BD	2111/17F	2033b
	12740-60003	NONE	FL. PT POWER SUPPLY MOTHER BOARD	2117F	2039a
	12740-60004	NONE	FL. PT BACKPLANE	2117F	1815b
OB	12740-60005	12740-69005	FL. PT PWR SUPPLY REGULATOR BOARD	2117F	2105
	12740-60006	NONE	FL. PT PWR SUPPLY LOGIC BOARD	2117F	2108
	12740-60007	12740-69007	FL. PT PWR SUPPLY ASSEMBLY	2117F	2108
	12740-60025	12740-69025	FL. PT CONTROL BD	2111/17F	2315
	12740-60026	12740-69026	FL. PT POWER SUPPLY REGULATOR BOARD	2111/17F	2305

SECTION III-MEMORY CONTROLLERS

OB	5060-8360	5060-8374	MEMORY CONTROLLER	2102A	1623
	02102-60001	02102-69001	STD MEM CONTROLLER	2102B	1830
	02102-60002	02102-69002	HS MEM CONTROLLER	2102E	2010
	02102-60003	02102-69103	STD FC MEM CONTRLR	2102C	2112
	02102-60004	02102-69004	HS FC MEM CONTRLR	2102H	2010

SECTION IV-MEMORY MODULES

OB	5060-8369	5060-8378	8KB MEMORY MODULE	12994A	1758
OB	5060-8359	5060-8373	16KB MEMORY MODULE	12998A	1750
OB	5061-1332	5061-1337	32KB MEMORY MODULE	13187A	2011
OB	13187-60001	5061-1337	32KB MEMORY MODULE	13187B	2011
	12666-60001	12666-69001	HS FC 1MB CHECK	12666H	2220
	12699-60001	12699-69001	HS 256KB MEM MOD	12699H	2144
	12741-60001	12741-69001	HS 32KB MEMORY MOD	12741A	2011
OB	12746-60001	12746-69001	HD 64KB MEMORY MOD	12746A	2011b
	12746-60002	12746-69002	HS,HD 64KB MEM MOD	12746H	2220b
OB	12747-60001	12747-69001	HD 128KB MEM MOD	12747A	2011b
	12747-60002	12747-69002	HS,HD 128KB MEM MOD	12747H	2220b
	12749-60001	12749-69001	HS 512KB MEM MOD	12749H	2144
OB	12779-60001	12779-69001	STD FC 256KB CHECK BIT ARRAY MODULE	12779A	2011b
	12779-60002	12779-69002	HS,FC 256KB CHECK BIT ARRAY MODULE	12779H	2220b

(continued)

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION IV-MEMORY MODULES (cont.)

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
OB	12780-60001	12780-69001	STD FC 512KB CHECK BIT ARRAY MODULE	12780A	2011b
	12780-60002	12780-69002	HS FC 512KB CHECK BIT ARRAY MODULE	12780H	2220b

SECTION V-BACKPLANES

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
	02105-60002	NONE	I/O BACKPLANE	2105A	1518
	02105-60005	NONE	MEMORY BACKPLANE	2105A	1518
	02108-60007	NONE	I/O BACKPLANE	2108A/B, 2109A/B	1727
	5061-1382	NONE	MEMORY BACKPLANE	2108A/B, 2109A/B	1713
OB	02108-60021	NONE	MEMORY BACKPLANE	2108A	1520
	02112-60001	NONE	I/O BACKPLANE	2112A/B, 2113A/B	1724
OB	02112-60002	NONE	MEMORY BACKPLANE	2112A	1518
	5061-1383	NONE	MEMORY BACKPLANE	2112A/B, 2113A/B	1713
	02111-60004	NONE	2111 FPP BACKPLANE	2111F	1826

SECTION VI-PANEL ASSEMBLIES

	5061-1343	5061-1372	FRONT PANEL	2109A/B, 2113A/B, 2111F,	2005c
	5060-8343	5060-8372	FRONT PANEL	2105A, 2108A/B, 2112A/B	1911b
	02108-60028	NONE	REAR PNL ASSEMBLY (FOR "A" SUPPLY)	2108A, 2109A	N/A
	02112-60009	NONE	REAR PNL ASSEMBLY (FOR "A" SUPPLY)	2112A, 2113A	N/A

(continued)

HARDWARE HISTORY LIBRARY

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION VII-EXTENDERS

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
	02100-60060	NONE	TERMINATOR CARD	12979A/B 2100/05A	1131
	12979-60002	NONE	I/O EXT FRONT BACKPLANE	12979A/B	1705
	12979-60003	NONE	I/O EXT REAR BACKPLANE	12979A/B REV B REV C	 1705 2105
	12979-60005	12979-60016	I/O EXT CONTROLLER	12979A	1518
OB	12979-60018	12979-69018	I/O EXT BUFFER IF	12979A	1647
	12979-60019	12979-69019	I/O EXT CONTROLLER	12979B	2014
OB	12979-60022	12979-69022	I/O EXT BUFFER IF	12979A/B	1730
	12979-60029	12979-69029	I/O EXT BUFFER IF	12979A/B	2014
	12990-60001	NONE	MEM EXT BACKPLANE	12990A/B	1510
	12990-60003	NONE	MEM EXT REAR PANEL	12990A	N/A

SECTION VIII-CROSSOVERS

OB	5060-8345	NONE	"A" CROSSOVER	2105A, 2108A, 2112A, 2109A, 2113A	1518
	5061-1388	NONE	"B" CROSSOVER	2108B, 2112B, 2109B, 2113B, 2111F, 2117F	1837
	12979-60001	NONE	I/O EXT CROSSOVER	12979A/B	1616a

SECTION IX-POWER FAIL SYSTEMS

"A" SUPPLY POWER FAIL SYSTEM

	02112-60003	02112-69003	BATT BD 2112A,2113A	12991A	1603
	5060-8347	NONE	BATT BD 1 2105A, 2108A, 2109A	12944A	1624
	5060-8353	NONE	BATT BD 2 2105A, 2108A, 2109A	12944A	1353

(continued)

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

"A" SUPPLY POWER FAIL SYSTEM (cont.)

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
	5060-8346	5060-8376	BATT OUTPUT BD 2105A,2108A,2109A	12944A	1624
"B" SUPPLY POWER FAIL SYSTEM					
	5061-1348	5061-1378	BATT CHARGER BD ("B" SUPPLY)	12944B, 12991B	1808
OB	5061-1349	5061-1379	BATT BACKUP BD ("B" SUPPLY)	12944B, 12991B	1833
	5061-1352	NONE	BATTERY STATUS ASSEMBLY	12944B, 12991B	2222
	5061-6609	5061-6610	BATTERY BACKUP BOARD ("B" SUPPLY)	12944B, 12991B	2238
SECTION X-POWER SUPPLIES					
"A" POWER SUPPLY					
	02105-60012	02105-69012*	PS MAIN ASSEMBLY	2105A	2038
	5061-1354	NONE	LOWER PS BD	2105A	2023
	5061-3403	NONE	OUTPUT REG PS BD	5061-1356	1643
	5061-1355	NONE	UPPER PS BD	2105A, 2108A, 2109A	1836c
OB	5060-8354	NONE	LOWER PS BD	2105A	1630
OB	5060-8355	NONE	UPPER PS BD	2105A	1617
	02108-60023	02108-69023*	PS MAIN ASSY	2108A, 2109A	2023
OB	5060-8348	NONE	LOWER PS BD	2108A, 2109A	1630
OB	5060-8349	NONE	UPPER PS BD	2108A, 2109A	1617
	02112-60006	02112-69007*	PS MAIN ASSEMBLY	2112A, 2113A	2146
	02112-60004	NONE	LOWER PS BD	2112A, 2113A	1720
	02112-60005	NONE	UPPER PS BD	2112A, 2113A	1836
	02112-60008	NONE	RISER PS BD	2112A, 2113A	1725b

* A CROSSOVER BOARD IS PROVIDED UNDER THE EXCHANGE PART NUMBER.

(continued)

HARDWARE HISTORY LIBRARY

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

"B" POWER SUPPLY

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
OB	5061-1344	5061-1375	INVERTER PS BD	5061-1356	2020
OB	5061-1345	5061-1376	CONTROL PS BD	5061-1356	
				REV A/B	1818
				REV C/D	2020
OB	5061-1347	5061-1377	PREREG PS BD	5061-1356	1905
	5061-1351	NONE	JUMPER PS BD	5061-1356	1842
	5061-1356	5061-3401	LCPS ASSY	2108B, 2112B, 2109B, 2113B, 2111F, 2117F, 12979B, 12990B	2043
OB	5061-1371	5061-1380	MOTHER PS BD	5061-1371	
				REV A	1811
				REV B	2202a
				REV C	2305
	5061-3403	NONE	OUTPUT REG PS BD	5061-1356	2108a
	5061-3454	NONE	INVERTER PS II	5061-3476	2108
	5061-3455	NONE	CONTROL PS II	5061-3476	2305
	5061-3457	NONE	PRE-REGULATOR PS II	5061-3476	2108a
OB	5061-3476	5061-3477	"B" POWER SUPPLY II	2108B, 2109B, 2111F, 2112B, 2113B, 2117F, 12979B, 12990B	2204
	5061-6615	5061-6616	"B" POWER SUPPLY III	2108B, 2109B, 2111F, 2112B, 2113B, 2117F, 12979B, 12990B	2305
	12990-60002	12990-69002	MEMORY EXTENDER PS	12990A	1709
	12990-60007	NONE	MEMORY EXT UPPER PS	12990A	1709
	12990-60008	NONE	MEMORY EXT LOWER PS	12990A	1709
	12990-60005	NONE	MEMORY EXT RISER BD	12990A	1627

(continued)

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XI-OPTIONS/ACCESSORIES

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
OB	12897-60001	12897-60003	DCPC (M-SERIES)	12897A	1548
	12897-60004	12897-69004	DCPC (M/E/F-SERIES)	12897B	1649
	12898-60001	12898-60002	I/O EXT DCPC	12898A	1647
OB	12892-60001	12892-60002	MEM PROTECT (M-SERIES)	12892A	1704
	12892-60003	12892-69003	MEM PROTECT (M/E/F-SERIES)	12892B	1727a
OB	5060-8362	5061-1334	MEMORY EXP. MODULE M-SERIES)	12976A	1652
	12731-60001	12731-69001	MEMORY EXP. MODULE (M/E/F-SERIES)	12731A	2305
	5060-8391	NONE	USER CONTROL STORE	12945A	1353
	5061-1339	5061-1370	FIRMWR ACCESSORY BD	13304A	2002a
OB	12908-60006	12908-60007	.25KW WCS	12908A, 12978A	1708
	13047-60001	NONE	2KW UCS	13047A	1851
	13197-60001	13197-60002	1KW WCS	13197A	2001a
	12791-60001	12791-69001	FIRMWARE EXPANSION MODULE	12791A	1850a
	12909-60005	NONE	PROM WRITER M-SERIES ONLY	12909B	1641
	5060-8400	5061-1320	BASE SET ROM BD (M-SERIES)	2105A, 2108A/B, 2112A/M	1741
	5061-1373	5061-1398	FFP/DMI ROM BD (M-SERIES)	12976B-OPT 3, 12977B	2049
OB	5061-1328	5061-1329	FFP I (M-SERIES)	12976A-OPT 3, 12977A	1550
OB	5060-8380	5061-1330	FFP II + DMI (M-SERIES)	12976A, 12976A OPT 3, 12977A	1516
	5061-1374	5061-1399	DMI (ONLY) ROM BD (M-SERIES)	12976B, 12778B	2049
	91740-60002	91740-69002	DS/1000 ROM BD (M-SERIES)	91740A	1913

NOTE: DS/1000 (91740A) SOFTWARE MUST BE REVISION 1813 OR GREATER. ROM PART #'S ARE 91740-80052 THRU 91740-80063. THE LOADER ROM IS 91740-80048. INSTALLATION MANUAL IS 91740-90007 (3/79). E-SERIES DS/1000-IV ROMS ARE USED FOR M-SERIES DS/1000-IV ROMS.

(continued)

HARDWARE HISTORY LIBRARY

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XIII-FIRMWARE (E-SERIES)

FIRMWARE TYPE	PART NUMBER AND DATE CODE	PRODUCT
BASE SET: (SET 6)	5090-0600, 5090-0564, 5090-0596 CPU BOARD LOCATION (U21,41,81)	2109A/B, 2113A/B
EIG/FL.PT: (SET 2)	5090-0566, 5090-0567, 5090-0568 CPU BOARD LOCATION (U23,43,83)	2109A/B, 2113A/B
BASE SET & EIG/FL.PT: (SET 1)	02113-80003, 02113-80004, 02113-80005 CPU BOARD LOCATION U23,43,83) COMBINATION OF BS SET 6 AND EIG/FL.PT SET 2 IN THREE (3) 8K ROMS. MICROCODE DOES NOT CHANGE. (REFER TO SECTION VII FOR COMPATIBILITY REQUIREMENTS).	2109A/B, 2113A/B
(SET 2)	02113-80006, 02113-80007, 02113-80008	
FFP: (SET 4) 1K AND 4K ROMS	5090-0589, 5090-0590, 5090-0591 13306-80013, 13306-80014, 13306-80015, 13306-80016, 13306-80017, 13306-80018,	13306A, 2111F, 2117F
DMI: (SET 4) 1K ROMS	13307-80027, 13307-80028, 13307-80029, 13307-80030, 13307-80031, 13307-80032	13307A, 2111F, 2117F
DMI/FFP: (SET 1) 4K ROMS	5090-0589, 5090-0590, 5090-0591 13307-80033, 13307-80034, 13307-80035	13306B, 13306B OPT 100, 13307B
RTE-IVB EMA (SET 1)	92067-80001, 92067-80002, 92067-80003 ALL ROMS ARE E/F-SERIES COMPATIBLE	92067/8

(continued)

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XIII-FIRMWARE (E-SERIES) (cont.)

FIRMWARE TYPE	PART NUMBER AND DATE CODE	PRODUCT
RTE-6/VM OS (SET 1)	92084-80001, 92084-80002, 92084-80003 ALL ROMS ARE E/F-SERIES COMPATIBLE	92084A
RTE-6/VM OS (SET 2)	92084-80001, 92084-80102, 92084-80003 ALL ROMS ARE E/F-SERIES COMPATIBLE	92084A
RTE-6/VM EMA/VMA (SET 1)	92084-80004, 92084-80005, 92084-80006 ALL ROMS ARE E/F-SERIES COMPATIBLE	92084A
DS/1000: (SET 6)	91740-80067 REV 2003, 91740-80068 REV 2003, 91740-80069 REV 2003 ALL DS/1000 ROMS ARE E/F-SERIES COMPATIBLE.	91740B

NOTE: DS/1000 (91740B) ARE ROMS INSTALLED IN POSITIONS C4, C5, OR C6 ON FAB ASSEMBLY. SOFTWARE MUST BE REV 1813 OR GREATER. LOADER ROM IS 91740-80048. INSTALLATION MANUAL IS 91740-90009 (3/79).

DS/1000-IV: -BISYNC -HDLC	91750-80010, 91750-80011 91750-80008, 91750-80009 ALL DS/1000-IV ROMS ARE M/E/F-SERIES COMPATIBLE.	12793B 12794A,

SECTION XIV-FIRMWARE (F-SERIES)

NOTE: SEVERAL OF THE INDIVIDUAL F-SERIES FIRMWARE MODULES (BASE SET, SIS AND FFP) ARE NOT BACKWARD COMPATIBLE WITH OLDER VERSIONS OF THE SAME MODULES:

1. F-SERIES BASE SET (BS), SET 2, REQUIRES F-SERIES FAST FORTRAN PROCESSOR (FFP), SET 2, (OR VICE VERSA) FOR CORRECT OPERATION. F-SERIES BASE SET, SET 1, REQUIRES F-SERIES FFP, SET 1, FOR CORRECT OPERATION.

(continued)

HARDWARE HISTORY LIBRARY

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XIV-FIRMWARE (F-SERIES) (cont.)

2. IT IS RECOMMENDED THAT SCIENTIFIC INSTRUCTION SET, SET 3, BE USED INSTEAD OF SET 2 BECAUSE OF A MINOR "BUG" DISCOVERED IN SET 2 SHORTLY AFTER ITS RELEASE. THESE TWO SETS, IN ALL OTHER ASPECTS, ARE IDENTICAL. SIS SETS 2 & 3 ARE COMPATIBLE WITH BOTH F-SERIES BASE SET AND FFP COMBINATIONS.

FIRMWARE TYPE	PART NUMBER AND DATE CODE	PRODUCT
BASE SET: (SET 2)	12740-80019 12740-80020 12740-80021 CPU BOARD LOCATIONS U21,41,81	2111F, 2117F
(SET 1)	12740-80014 12740-80015 12740-80016 CPU BOARD LOCATIONS U21,41,81	
EIG/FL.PT: (SET 2)	12740-80022 12740-80023 12740-80024	2111F, 2117F
(SET 1)	12740-80011 12740-80012 12740-80013 CPU BOARD LOCATIONS U23,43,83	
BASE SET & EIG/FL.PT (SET 1)	02117-80001, 02117-80002, 02117-80003, CPU BOARD LOCATIONS U23,43,83 COMBINATION OF BS SET 2 AND EIG/FL.PT SET 2 IN THREE (3) 8K ROMS. MICROCODE DOES NOT CHANGE.	2111F, 21117F
(SET 2)	02117-80016, 02117-80017, 02117-80018	

(continued)

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XIV-FIRMWARE (F-SERIES) (cont.)

FIRMWARE TYPE	PART NUMBER AND DATE CODE	PRODUCT
SIS: (SET 3) 4K ROMS	12823-80013, 12823-80014 12823-80015, 12823-80016 12823-80017, 12823-80018	
(SET 4) 8K ROMS	12823-80019, 12823-80020 12823-80021	
DMI: (SET 4)	SAME AS E-SERIES DMI ROMS, SEE E-SERIES DMI ROMS	2111F, 2117F
FFP: (SET 2)	5090-1615, 5090-1616, 5090-1617, 5090-1618, 5090-1619, 5090-1620, 5090-1621, 5090-1622, 5090-1623	2111F, 2117F,
(F-SERIES SET 1) & (E-SERIES SET 4)	F-SERIES FFP ROMS SET 1 ARE THE SAME AS E-SERIES FFP ROMS SET 4.	
FFP/DMI: (SET 1)	5180-0141, 5180-0142, 5180-0143	2111F, 2117F
VIS: (SET 1) 4K ROMS	12824-80001, 12824-80002, 12824-80003, 12824-80004, 12824-80005, 12824-80006	12824A
(SET 2) 8K ROMS	12824-80007, 12824-80008 12824-80009	

NOTE: E-SERIES RTE-IVB EMA, RTE-6/VM OS AND EMA/VMA, DS/1000, AND DS/1000-IV ARE USED FOR F-SERIES RTE-IVB EMA, RTE-6/VM OS AND EMA/VMA, DS/1000 AND DS/1000-IV ROMS.

(continued)

HARDWARE HISTORY LIBRARY

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XV-LOADER ROMS

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCIPTION	PRODUCT	DATE CODE
OB	1816-0863	NONE	7900/7901/2883	12992A	
OB	1816-0869	NONE	7905/7906/7920	12992B	
OB	1816-0857	NONE	264X	12992C 2109/13B, 2111/17F	
	12992-80002	NONE	7905/7906/7920/7925 RPL COMPATIBLE	12992B	
OB	1816-0962	NONE	7970	12992D	
OB	1816-1051	NONE	9885 RPL COMPATIBLE	12992E	
	12992-80003	NONE	7900/01 RPL COMPATIBLE	12992F	
	12992-80004	NONE	7906H/10H/20H/25H RPL COMPATIBLE	12992H	
	12992-80005	NONE	7908/11/12 RPL COMPATIBLE	12992J	
	1816-0426	NONE	MAG TAPE REFORMATTING SYSTEM	2022	
OB	1816-0420	NONE	PAPER TAPE	12992K, 2105A, 2108A/B, 2112A/B, 2109A/B, 2113A/B, 2111F, 2117F	
	12992-80006	NONE	7970	12992D	
	12992-80007	NONE	9885 RPL COMPATIBLE	12992E	
	12992-80008	NONE	7900/76901/2883	12992A	
	12992-80009	NONE	264X	12992C, 2109/13B, 2111/17F	
	12992-80010	NONE	PAPER TAPE	12992K	
	5081-2361	NONE	7900/05/06/20/25	2105A, 2108A/B, 2112A/B, 2109A/B, 2113A/B, 2111F, 2117F	
	91740-80048	NONE	DS/1000 RPL COMPATIBLE	91740A/B	1826, 1923
	91750-80007	NONE	DS/1000-IV RPL COMPATIBLE	91750A	

(continued)

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XVI-I/O INTERFACES

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
OB	12531-6001	12531-6002	TTY INTERFACE IF	12531B	821
	12531-60022	12531-60023	TELEPRINTER IF	12531C	1810
	12531-60025	12531-60027	HIGH SPEED TERM IF	12531D	1810
OB	02116-6002	02116-6027	TAPE READER IF	12532A	1810
OB	02116-6045	02116-6241	TAPE PUNCH IF	12536A	902
OB	12539-60001	12539-60002	TIME BASE GEN IF	12539B	1147
	12539-60003	12539-60004	TIME BASE GEN IF	12539C	1945
	12539-60005	12539-69005	TIME BASE GEN IF	12539C	2010
OB	02116-6006	02116-6229	GENL PURPOSE REG IF	12549A	708
OB	02116-6139	02116-6252	RELAY REGISTER IF	12551A	738
	12551-6001	12551-60021	RELAY REG IF	12551B	810
	12551-6002	12551-60022	RELAY REG IF (READ BACK)	12551B-001	810
	12554-60023	12554-60025	16-BIT DUP REG IF (POS TRUE)	12554A	939
	12554-60024	12554-60026	16-BIT DUP REG IF (NEG TRUE)	12554A-001	939
	12555-60001	12551-60002	D/A CONVERTER IF	12555B	1138
	12556-6002	NONE	40-BIT OUT REG IF (POSITIVE)	12556B	1208
	12556-60022	NONE	40-BIT OUT REG IF (NEGATIVE)	12556B-002	1208
OB	12560-6001	12560-60041	PLOTTER IF	12560A	1810
OB	12565-60001	12565-60004	DISC FILE (2883/4)	12560A	1030
OB	12565-60002	12565-60005	DISC FILE (2883/4)	12565A	1030
OB	12566-6001	12566-60021	16-BIT MICROCKT IF (NEGATIVE)	12566A	926
OB	12566-6002	12566-60022	16-BIT MICROCKT IF (POSITIVE)	12566A-002	926
OB	12566-60024	12566-60026	16-BIT MICROCKT IF (NEGATIVE)	12566B	1613
OB	12566-60025	12566-60027	16-BIT MICROCKT IF (POSITIVE)	12566B-002	1613
OB	12566-60031	12566-69031	16-BIT MICROCKT IF	12566C	2202
	12566-60032	12566-69032	16-BIT MICROCKT IF	12566C	2222
OB	12587-60001	12587-60003	ASYNC DATA SET IF	12587A	1145
	12587-60004	12587-60008	ASYNC DATA SET IF	12587B	1101
	12589-6001	12589-6003	AUTO DIALER IF	12589A	1003
	12597-6001	12597-6003	8-BIT DUPLEX REG IF (POSITIVE)	12597A	832
	12597-6002	12597-6006	8-BIT DUPLEX REG IF (NEGATIVE)	12597A-001	832

(continued)

HARDWARE HISTORY LIBRARY

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XVI-I/O INTERFACE (cont.)

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
	12604-60001	12604-60009	DATA SOURCE IF	12604B	1418
	5060-6282	NONE	BREADBOARD I/O IF	12620A	1012
	12621-60001	12621-60003	SYNC DATA SET IF (RECEIVER)	12621A	1120
	12622-60001	12622-60003	SYNC DATA SET IF (TRANSMIT)	12622A	1402
OB	12653-60002	12653-60003	LINE PRINTER IF	12653A	1024
	12665-60001	12665-60011	COMPTER SERIAL IF	12665A/ 12771A	1737
	12735-60001	12735-69001	FLEX DISC IF 1	12735A	1632
	12735-60002	12735-69002	FLEX DISC IF 2	12735A	1632
	12755-60001	12755-69001	PROG PACER CARD IF	12755A	1652
	12773-60001	12773-60004	COMPUTER MODEM IF (KIT)	12773A	1737
	02116-6110	NONE	JUMPER CARD IF	12777A	632
	5061-1389	5061-3402	MULTIPOINT IF	12790A	1838
	5061-3415	5061-3488	8-CHANNEL MUX I/F	12792A	2026
	5061-3418	5061-3442	PROGRAMMABLE SERIAL MODEM I/F	12793A, 12794A	2022
	12821-60001	12821-69001	DISC INTERFACE	12821A	1942
	5061-3432	5061-3462	PROGRAMMABLE SERIAL DIRECT CONNECT I/F	12825A	2027
OB	12880-60001	12880-60002	CRT TERMINAL IF	12880A	1810
OB	12882-60001	12882-60003	CARD READER IF	12882A	1040
	12889-60001	12889-60002	HARDWIRED SERIAL IF (KIT)	12889A	1608
	12920-60001	12920-60003	ASYNC MUX IF (USC)	12920B	1438
	12920-60002	12920-60004	ASYNC MUX IF (LSC)	12920B	1501
	12922-60001	12922-60002	ASYNC MUX (CONTRL)	12920A/B	1220
	12930-60001	12930-60003	UNIVERSAL IF (DIFF)	12930A	1214
	12930-60004	12930-60010	UNIVERSAL IF (GND)	12930A-001	1214
	12930-60005	12930-60011	UNIVERSAL IF (POS)	12930A-002	1214
	12936-60001	NONE	PRIV INTRRPT FENCE (DOS OP SYSTEM ONLY)	12936A	1315
	12966-60001	12966-60002	ASYNC DATA IF	12966A	2216a
	12967-60001	12967-60002	SYNC DATA IF	12967A	1503
	12968-60001	12968-60002	ASYNC DATA IF	12968A	1901
	13037-60023	13037-69023	DISC CONTROLLER IF (7905/06/20/25)	13175A/B	1635
OB	13037-60003	13037-69003	DISC CONTROLLER IF (7905/06)	13178A	1628

(continued)

DATE CODE LIST

HP 1000 M/E/F-SERIES NEW & EXCHANGE ASSEMBLY DATE CODE LIST (cont.)

SECTION XVI-I/O INTERFACES (cont.)

	NEW PART NUMBER	EXCHANGE PART NUMBER	DESCRIPTION	PRODUCT	DATE CODE
OB	13037-60013	13037-69013	DISC CONTROLLER IF (7905/06)	13187A	1628
	13037-60023	13037-69023	DISC CONTROLLER IF (7905/06/20/25)	13178B/C	1635
	13181-60010	13181-60011	MAG TAPE DATA IF 2	13181A	1540
	13181-60040	13181-60021	MAG TAPE CTL IF 1 27.5 IPS & LOWER	13181A	1651
	13181-60070	13181-60071	MAG TAPE CTL IF 1 45 IPS	13181A	1651
	13183-60001	13183-60008	7970E MAG TAPE 2	13183A	1243
	13183-60004	13183-60009	7970E MAG TAPE 1	13183A	1750
	13210-60000	13210-60006	DISC DRIVE IF 2 (7900/7901)	13210A	1740
	13210-60004	13210-60005	DISC DRIVE IF 1 (7900/7901)	13210A	1740
	13210-60009	13210-69009	DISC DRIVE IF 1 (7900/7901)	13210A	1740
	59310-60101	59310-69101	HP-IB I/O IF	59310B	1826
	91000-60001	91000-60003	A/D CONVERTER IF	91000A	1620
OB	91200-60001	91200-69001	VIDEO DISPLAY IF	91200A	1607
	91200-60007	91200-69007	VIDEO DISPLAY IF	91200B	1845

OPERATING SYSTEMS

TIMESHARE

2026 COMSYS

RTE

GENERAL BACKUP PROCEDURES

ON-LINE DISC BACKUP PROGRAMS

OPERATING SYSTEMS

OFF-LINE PROGRAMS

HP 2000 COMPUTER SYSTEM
SOFTWARE REVISION 1628 AND LATER

I/O CONFIGURATION

Main Processor

SELECT CODE	REQUIRED	INTERFACE
10 & 11	*	Processor Interconnect
12	*	System Console (2762/2754)
13	*	TBG (12539C)
14	*	First Disc Controller a. If 7900/2883 use 14 and 15. b. If 7905 or 7920 use 14 only.
15	(See Note 1)	Second Disc Controller.
16 & 17		Mag Tape Controller.

I/O Processor

Select Code assignments depend on USER configuration.

SUGGESTED CONFIGURATION

SELECT CODE	NOTE	INTERFACE
10	2	TBG
11 - 13	3	MUX
14 & 15		Processor Interconnect
16	Up to 7 each	LP/CR/PP/PR/RP/SL

Note 1: Select Code 15 through 26 can be used by disc controllers (Provided the number of disc-drives does not exceed 8) and mag tape controller. There must be NO open I/O channels between the controllers.

Note 2: If a Synchronous Modem Interface is to be used, it must receive a high priority. It uses Select Code 10 & 11 and pushes the others down by 2 Select Codes.

Note 3: If 2 sets of multiplexors are used, 6 contiguous Select Codes must be used.

I/O DEVICES SUPPORTED ON THE 2000 COMPUTER SYSTEM

TERMINAL TYPE	USER TERMINALS
0	HP 2749A Teleprinter Terminal Teletype ® model 33 ASR Terminal Teletype ® model 38 ASR Terminal IBM 2741 Communication Terminal HP 3071A Transaction Terminal
1	HP 2640A Interactive Display Terminal HP 2644A Interactive Display Terminal
2	HP 2640A Interactive Display Terminal (in block mode) HP 2644A Interactive Display Terminal (in block mode)
3	HP 2600A Keyboard-Display Terminal
4	HP 2762A/B Terminal General Electric TermiNet 300 General Electric TermiNet 1200
5	Teletype ® model 37 ASR Terminal
6	General Electric TermiNet 30
7	Texas Instruments Silent 700 Series KSR Electronic Data Terminal
8	Execuport 300 Data Communications Transceiver Terminal

IBM 2741 COMMUNICATION TERMINAL

Note

This terminal MUST be connected to the computer over telephone lines. In addition, it MUST be equipped with the following features:

a. Interrupt, Receive (IBM #4708) and Transmit (IBM #7900) associated with the terminal's ATTN key.

b. Dial-up (IBM #3255) to enable system connection through a 103A type modem or acoustic coupler.

c. The "ATTN" Key is used to get the "PLEASE LOG IN" message. Refer to the *HP 2000 Basic Reference Manual* (22687-90001) and the *HP 2000 Operator's Manual* (22687-90005).

Line Printers

1. HP 2607A
2. HP 2610A
3. HP 2613A
4. HP 2614A
5. HP 2617A
6. HP 2618A
7. HP 2767A

Paper Tape Reader

1. HP 2748A/B

Card Readers

1. HP 2892A
2. HP 7261A

Synchronous Modem

1. HP 12618A

Reader Punch

1. HP 2894A

Paper Tape Punches

1. HP 2753B
2. HP 2895A

Mag Tape

1. 7970B/E 9 Trk (4 each)

Serial Link Terminal

1. HP 3070A
2. HP 3071A

HP 2000 DATA COMMUNICATIONS

1. IBM RJE
   a. MRJE W/S Emulator
   b. 2770/2780/3780 Terminal Emulator

2. CDC RJE
   a. UT 200

3. 2000 to 2000 Communication

4. 2780 to 2780 Data Communications

2100 CROSS LOADING PROCEDURE

(For loading TSB LOADER into the main CPU.) (21MX series boots directly from the MCP tape.)

For 2100 processors, perform the following:

Note

See Appendix D to verify you have the proper BBL installed in the I/O processor.

a. You were supplied a single paper tape containing two programs: a magnetic tape bootstrap loader and a cross loader program (22687-16001, Rev. 1536). Place this tape into the paper tape reader, ensuring the feed holes on the tape are inserted toward the front panel. Set the POWER and READ switches.

b. On the I/O processor, press HALT, INTERNAL PRESET, and EXTERNAL PRESET.

c. On the I/O processor, select the P-register and clear the display. Set the bits according to the memory size of your I/O processor as follows:

MEMORY	LOCATION	SET BITS
16K	037750	13 through 5, 3
24K	057750	14, 12 through 5, 3
32K	077750	14 through 5, 3

d. On the I/O processor, press LOADER ENABLE and then RUN. The first program is read from the paper tape and the processor halts with 102077_8 displayed. Any other halt codes indicate failure to read the paper tape properly. In this case, restart the procedure at step a.

e. On the main processor, press HALT, INTERNAL PRESET, and EXTERNAL PRESET.

f. On the main processor, select the P-register and clear the display. Set bits 14 through 6 (077700_8).

g. On the main processor, press LOADER ENABLE and RUN. Nothing happens.

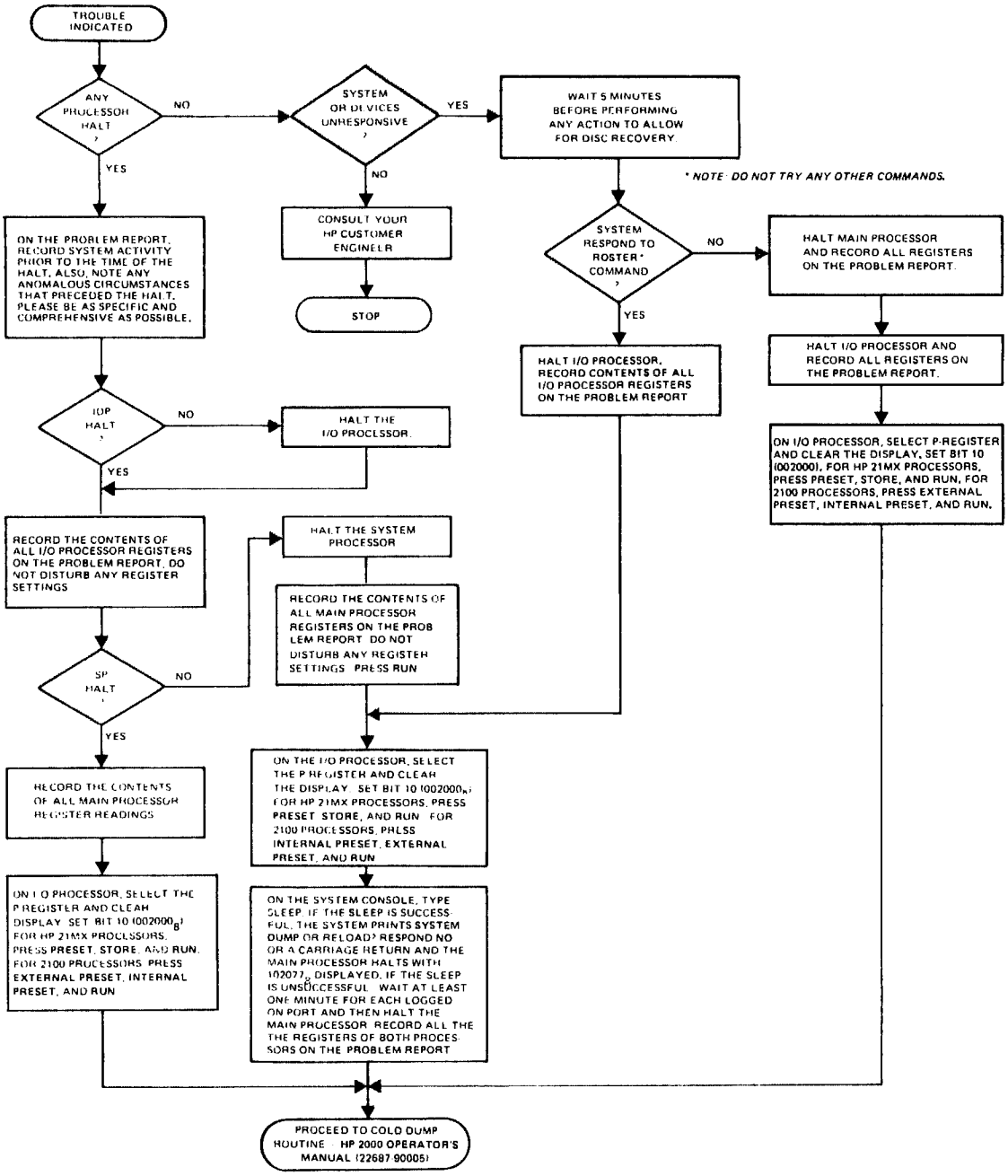
h. On the I/O processor, select the P-register and clear the display. Set bit 1 (000002_8).

i. On the I/O processor, press RUN. The second program is read from the paper tape into main processor memory. Both processors halt with 102077_8 displayed. Any other halt codes indicate a failure and the procedure should be restarted at step a.

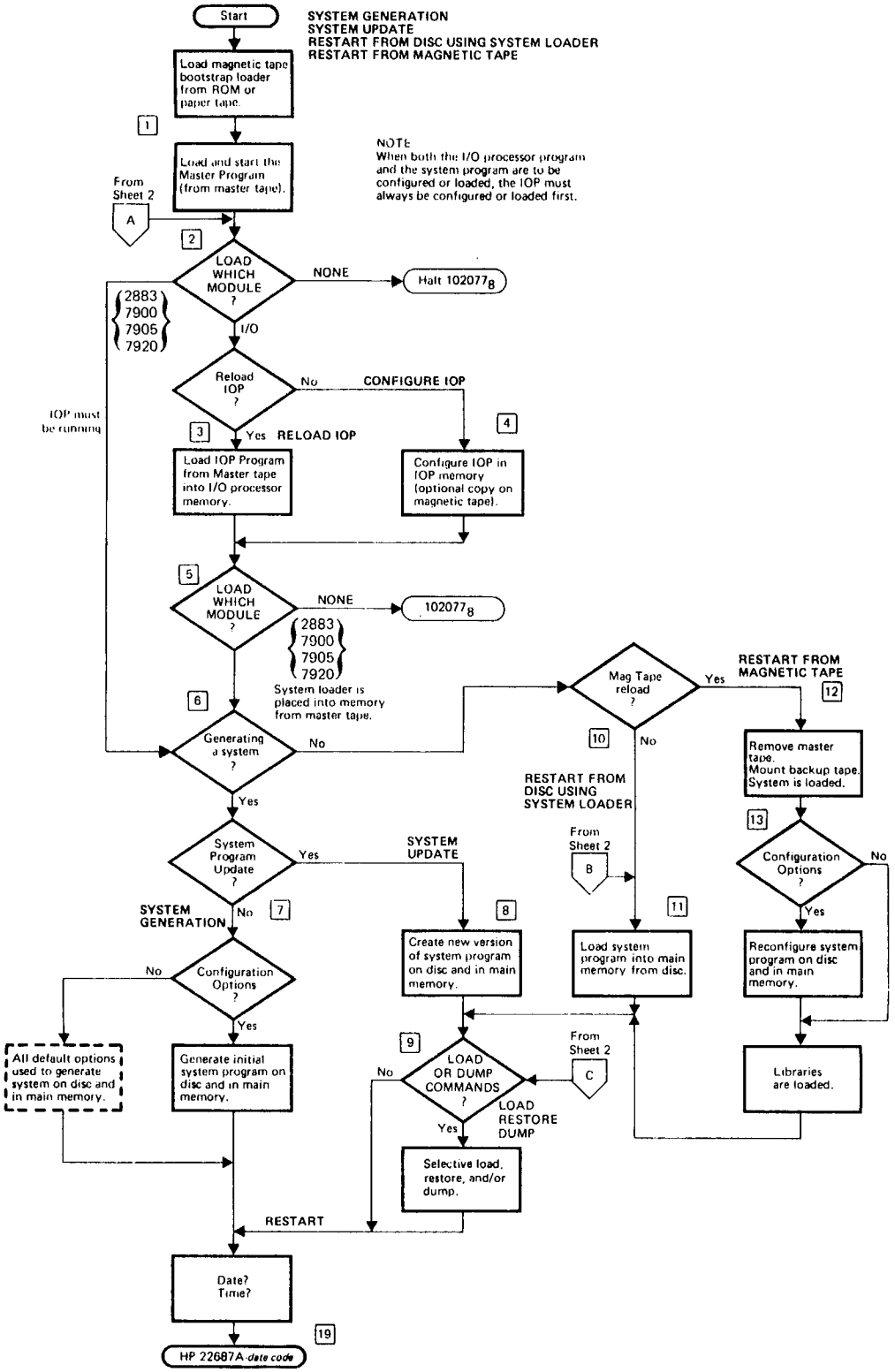
SYSTEM RECOVERY

Refer to Section V of the *HP 2000 Operator's Manual* (22678-90005).

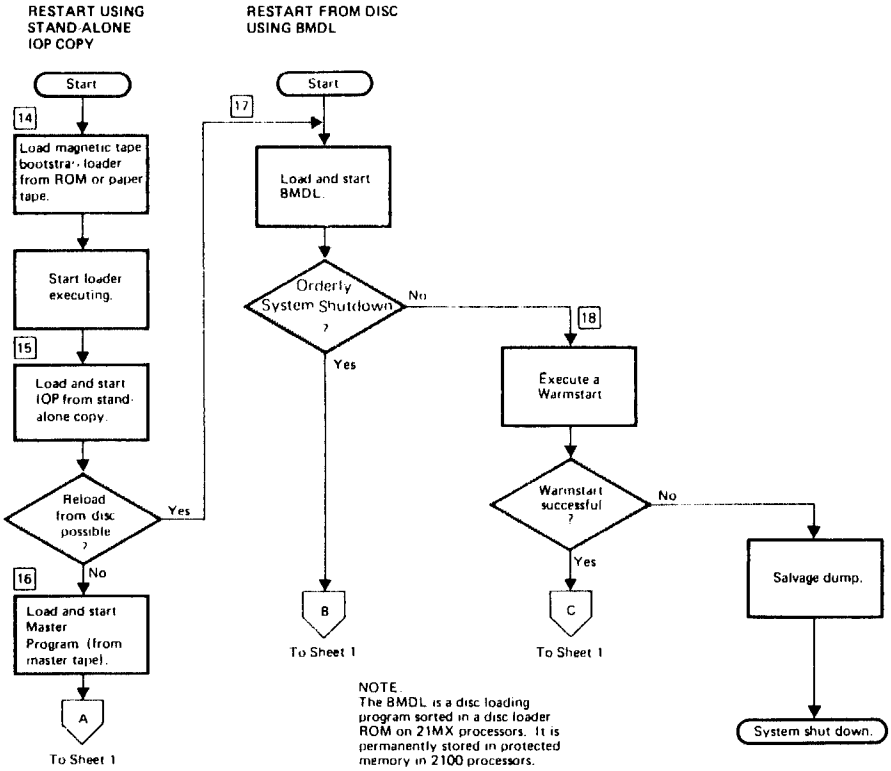
COLD DUMP PROCEDURES



HP 2000 COMPUTER SYSTEM FLOWCHART



HP 2000 COMPUTER SYSTEM FLOWCHART (Cont'd)



TOGGLE-IN PROGRAM TO TEST INTERCONNECT KIT

I/O PROCESSOR

	4	102004	HLT	4		
	5	102005	HLT	5		
	XX	024103	JMP	103	Incoming data interrupt	XX high priority
S.A.	100	102100	STF	0	Turn on interrupt	low select code
	101	1037XX	STC	XX,C	Set up read on SC XX	of interconnect kit.
	102	024102	JMP	*	Hang fire	
	103	1025XX	LIA	XX	Read data from SC XX	
	104	102601	OTA	01	Display data	
	105	1026YY	OTA	YY	Write data to SC YY	YY low priority
	106	1037YY	STC	YY,C	Execute write	upper select code
	107	024101	JMP	101	Go do-it again	of interconnect kit.

SYSTEM PROCESSOR

	4	102004	HLT	4	
	5	102005	HLT	5	
	10	024107	JMP	107	Incoming data interrupt
	B reg = 125252				Initial data pattern
S.A.	100	102100	STF	0	Turn on interrupt
	101	060001	LDA	B	Get data for output
	102	102601	OTA	01	Display data for XFER
	103	102611	OTA	11	Write data to IOP
	104	103711	STC	11,C	Execute it
	105	103710	STC	10,C	Set up read from IOP
	106	024106	JMP	*	Hang fire
	107	102510	LIA	10	Got round trip data
	110	050001	CPA	B	Is this what I sent IOP?
	111	024113	JMP	113	Yes
	112	102022	HLT	22	No! halt
	113	007000	CMB		Complement B-Reg
	114	024101	JMP	101	Go do it again

Notes:
1. Start IOP first at 100_8.
2. Halt 22, A-Reg=bad data, B-Reg=good data.
3. You do not have to disturb cables for testing.
4. All bits alternated every pass.
5. SP S-Reg displays transmitting data.
6. IOP S-Reg displays received data.

2000 SYSTEM PREVENTIVE MAINTENANCE

GENERAL INFORMATION

I Minimum Division Requirements

System Usage	Perform Maintenance
One 8 hour shift	24 weeks/6 months
Two 8 hour shifts	24 weeks/6 months
Three 8 hour shifts	24 weeks/6 months

II Usage Effects:

Customer use varies from site to site which may cause the Customer Engineer to decrease the time interval between PM periods in order to improve reliability. Experienced Customer Engineers may perform monthly PM's in order to detect minor problems, maintain maximum up time and improve user satisfaction.

III Environmental Effects:

A dirty contaminated area should be monitored by an Account Customer Engineer to determine if additional PM's are required. The Account Customer Engineer and the District Customer Engineer Manager will determine if an additional charge should be added to the BMMC or appropriate action be instituted due to environmental effects on unit reliability. Such decision is at the discretion of the DCEM.

IV Training Required:

Operator: Read operators manual
Customer Engineer: 2000, Level 100

V Minimum System Performance Requirements:

In order to assure you of good system performance and maximum satisfaction with Hewlett-Packard Computer Products, we have developed the following guidelines for minimum acceptable system performance that you should expect from your Hewlett-Packard equipment. If your system does not meet any one guideline, please contact your Customer Engineer as soon as possible. Hewlett-Packard will work to resolve your problem in the shortest period of time possible.

1. Downtime must be less than 5%. This is based on your service contract hours of coverage. Example: If you have 40 hours a week coverage, you should expect to be down less than 8 hours total per month.

2. System failures, halts or hangs must be less than 5 per month.

3. If an intermittant problem has not been resolved within 2 weeks.

NOTE

There may be additional local guidelines. If you have any questions regarding those guidelines, or exactly what constitutes downtime, please contact your local HP Representative.

2000 SYSTEM PREVENTIVE MAINTENANCE (Cont'd)

VI Customer PM Functions Prior to Scheduled HP PM:

1. It is suggested that you contact your account CE a few days prior to your PM. Your CE may need to bring parts that are usually stocked at the local office and may be needed for your PM. Please be prepared to supply your CE with the following information:

   a. Provide feedback to your CE on overall equipment performance.

   b. Indicate if there are any burned out lamps, broken switches, or any hardware deficiencies that are affecting smooth operation.

2. Please be fully backed up when your CE arrives. There is a possibility that your data may be destroyed during disc verification. Be prepared, if necessary, to perform a reload after the PM is completed.

VII Customer PM Functions:

Vacuum all mainframe filters once a month.

PROCEDURE

1. Reboot System
   2100: P=77750, RUN→ 102077, RUN
   21MXXM: S=041400 (typical), STORE, PRESET, IBL, RUN→ 102077, RUN
   21MXE: S=101400 (typical), STORE, PRESET, IBL, RUN→ 102077, RUN
   2754? Yes or No
   Date? Julian Date/Year (i.e., 136/81)
   Time? HR:MIN (i.e., 22:15 - 1015 p.m.)

2. Enable special dump feature on system
   On console: DUMP-60

3. Log on to A000 account from user terminal
   On user terminal:CR, LF→ PLEASE LOG ON
   HELLO-A000, password, terminal type

2000 SYSTEM PREVENTIVE MAINTENANCE (Cont'd)

Terminal Models Representative of Terminal Types

Terminal Type	Representative Terminal
0	HP 2749A Teleprinter Terminal Teletype Model 33 ASR Terminal Teletype Model 38 ASR Terminal HP 3071A Transaction Terminal
1	HP 2640A Interactive Display Terminal HP 2644A Interactive Display Terminal
2	HP 2640A Interactive Display Terminal (in block mode) HP 2644A Interactive Display Terminal (in block mode)
3	HP 2600A Keyboard-Display Terminal
4	HP 2762A/B Terminal General Electric TermiNet 300 General Electric TermiNet 1200
5	Teletype Model 37 ASR Terminal
6	General Electric TermiNet 30
7	Texas Instruments Silent 700 Series KSR Electronic Data Terminal
8	Execuport 300 Data Communications Transceiver Terminal
9	IBM 2741 Communication Terminal

A terminal type (0-8) entered with the HELLO command is associated with each of the nine ASCII code terminals. Type 9 is associated with non-ASCII generating terminals, the type need not be specified, but is returned if requested by the SYS function.

4. Dump the ADT and check for proper format. (No repeats or ASCII characters)
   On terminal:DUMP-ADT

5. Log off on terminal (BYE)

6. Sleep system. On console: SLEEP
   SYSTEM DUMP OR RELOAD? CR→ 102077

7. Perform hardware preventive maintenance

8. Reboot system

9. Run on-line verification program (Installation Manual 19700-90007)
   On user terminal: CR, LF→ PLEASE LOG ON
   HELLO - Z100, password, terminal type
   SYSTEM LOG ON MESSAGE
   EXECUTE - VERITE
   WHICH TEST? BASIC
   - Basic - to test system
   - Loop - to execute BASIC in a loop
   - Device - to test a device, i.e., MT0, LP0, CR3, etc.

10. Log off terminal upon completion of testing (BYE)

11. Dump system status report. On console: STATUS

2000 SYSTEM PREVENTIVE MAINTENANCE (Cont'd)

SUPPORT INFORMATION

Off-Line Diagnostics

02100-90157	Diagnostic Configurator Manual
24396-13501	7970B Mag Tape
24396-13601	7970E Mag Tape
24396-13001	7900 Disc
24396-13101	7905 Disc
5060-8340	24 Pin Connector Kit (DMA Test Hood)
30062-60003	MUX Text Hood (Wire per S. Note HP 12921A-1)

SYSTEM SOFTWARE

Master Configuration & Program Tapes (MCP Tapes)

22689-16001	TSB Loader Bootstrap Tape
22687-10001	HP 2000 Operating System (21MX) mag tape 800 bpi
22687-10002	HP 2000 Operating System (2100) mag tape 800 bpi
22687-11001	HP 2000 Operating System (21MX) mag tape 1600 bpi
22687-11002	HP 2000 Operating System (2100) mag tape 1600 bpi
1816-0532	13206A Microcode for 2100 Computer
1816-0533	
1816-0534	
1816-0535	
1816-0536	
1816-0537	
13207-60001	13207A Microcode for 21MX Computer
1816-0996	22702A Microcode for 21MX-E Computer
1816-0997	(Note: A firmware accessory board is required
1816-0998	for the 21MX-E: part no. 13304A)
1816-0999	
1816-1000	
1816-1001	

HP 2000/ACCESS (REV 1812) "SYSTEM" STATEMENT MAIN PROCESSOR PATCH

This patch prevents faulty system statement crashes.

This patch need to be installed every time the software is updated.

1. Sleep the system to tape then to disc.
2. Reload from MCP tape.
3. Load the correct module for your disc.
4. Before responding to the system generation prompt set bit 15 of the S-Register, then respond yes.
5. Respond yes to the "update" prompt.

2000 SYSTEM PREVENTIVE MAINTENANCE (Cont'd)

6. System will begin to read the MCP tape. Then it will halt with 102015. Press run four times (after pressing run each time wait for the computer to halt with 102015 before continuing).

	Old Data
7. Set the M-Register to 075172, press store	
8. Set the T-Register to 027317, press store	063175
9. Set the M-Register to 075317, press store	
10. Set the T-Register to 063175, press store	006004
11. Set the T-Register to 065577, press store	160001
12. Set the T-Register to 006003, press store	004361
13. Set the T-Register to 171603, press store	034036
14. Set the T-Register to 027246, press store	034036
15. Set the S-Register to 000000, press store	

16. Press run.

17. The system will read in the rest of the system software and prompt with "Load or Dump Commands" proceed to bring the system up in the normal manner.

18. After doing this update it is wise to sleep the system so as to get a good copy of the system software out to tape.

ORDERING 2000 PRODUCTS AFTER DISCONTINUANCE

After the discontinuance date, consideration will be given to special orders for certain HP 2000 products. Acceptance of any special order will be dependent upon several factors, including availability of component parts, factory resources and management approval. All such orders will be subject to remaining support life for each product as outlined in this HP 2000 Discontinuance policy.

Product Number	Description
19700B	HP 2000 Computer System
19665A	HP 2000F Upgrade to HP 2000
22699A	CAI/2000 (IMF, IDF, MATH)
22700A	FCOPY/2000
22694A	CIS/2000 *
22701A	EDITOR/2000
20243A	SDE/2000
20240A	TSP/2000
22687A	HP 200 MCP (Operating System Software)

* CIS/2000 was originally sold with training included. There will NOT be any training included with this product.

ORDERING 2000 PRODUCTS AFTER DISCONTINUANCE (Cont'd)

SPECIAL DOCUMENTATION

Part Number	Description
19700-90004	HP 2000 Site Planning Workbook
19700-90005	HP 2000 Site Preparation Workbook
19700-90007	HP 2000 Installation Manual
22687-90020	HP 2000 Internal Maintenance Specification Manual
22687-10006	HP 2000 Source Code 800 bpi Mag Tape
22687-10007	HP 2000 Source Listings 800 bpi Mag Tape
22687-11006	HP 2000 Source Code 1600 bpi Mag Tape
22687-11007	HP 2000 Source Listings 1600 bpi Mag Tape

2000 SYSTEM CONTRIBUTED LIBRARY

The HP 2000 Contributed Library comprises five volumes and an Addendum which updates volumes I-IV:

Volume I	Data Handling, Testing, Debugging and Programming Aids
Volume II	Math & Numerical Analyses, Probability & Statistics, and Scientific Engineering Applications
Volume III	Management Science, Operations Research, Business
Volume IV	Education
Volume V	Games
Addendum	To Volumes I-IV

Your Customer may order a complete library package (tapes and manuals), or individual components as indicated:

Part Number	Description
36600-10901	800 bpi Library Package-One magnetic tape and Six manuals for Vol I-V and Addendum
36600-11901	1600 bpi Library Package-One magnetic tape and Six manuals for Vol I-V and Addendum
36600-10001	800 bpi magnetic tape-software only, Vol I-V and Addendum
36600-11001	1600 bpi magnetic tape-software only, Vol I-V and Addendum
36600-90001	Manual Package for Volume I-V and Addendum
36000-91001	Manual for Vol I
36000-91002	Manual for Vol II
36000-91003	Manual for Vol III
36000-91004	Manual for Vol IV
36000-91005	Manual for Vol V (What to Do After you Hit Return)
36000-92001	Manual for Addendum to Vol I-V

SYSTEM CONFIGURATION

I/O Slot Assignments for the required interface boards for the standard 2026 system and for various optional devices are shown below. Optional devices are indicated by an asterisk (*) and must be replaced by a jumper board (HP Part No. 02116-6110) if not being configured.

HP 7905 Standard Configuration

SLOT NO.	DEVICE
10	SYNC (RECV) (12618A) ASYNC = (12587B)
11	SYNC (SEND) (12618A) JUMPER IF ASYNC
12	TIME BASE GENERATOR (12539C)
13	*2645 CRT (12966A-002)
14	*2645 CRT (12966A-002)
15	GEN. PURPOSE I. O. (12620A)
16	*PAPER TAPE READER (12597)
17	*PUNCH (12597)
20	*LINE PRINTER (12845B)
21	SYSTEM CONSOLE (12531 OR 12880)
22	DISC (13037A)
23	*MAG TAPE (13181A/13183A)
24	*MAG TAPE (Second Board)
25	*CARD READER (12985A)

SUPPORTED DEVICES

The following equipment is supported as part of the HP 2026 Data Entry/Communications System.

Standard System

HP 21MX-E Computer (32K)
HP 7905 Disc Drive(s) (up to 8) (15M byte each)
HP 2645 CRT Display Station system console
Non-HP Modem

Optional Equipment

HP 2645 CRT Display Station terminal(s)
HP 7970 Magnetic Tape Subsystem(s) (800 or 1600 bpi)
HP 2607 200-lpm Line Printer
HP 2613 300-lpm Line Printer
HP 2617 600-lpm Line Printer
HP 2618 1200-lpm Line Printer
HP 2892 Card Reader
HP 2895 Paper Tape Punch
HP 2748 Paper Tape Reader
HP 2762A Console/Printer (30 cps)

GENERAL NOTES

DISC ORGANIZATION

The system supports up to eight HP 7905 Disc Drives on one disc controller. Each drive contains three software subchannels: one on the fixed platter and two on the removable cartridge.

As received from the factory, all of subchannels 0, 1, and 2 contain copies of the system, with a label indicating the release.

If additional disc drives are installed on the system, the additional subchannels must be formatted before they can be used. Additional removable cartridges to be used on the system must also be formatted. Follow the instructions in HP 2026 User's Manual to format discs as necessary.

The system (software) disc is generally on subchannel 2. However, this is a customer option.

SELECTED SYSTEM DIRECTIVES

"Directives" or commands are entered on the system console. All system Directives must begin with a colon (:). An "at" symbol (@) on the console means that the computer is waiting for another system Directive.

Command	Meaning
:GO	Resume a suspended operation.
:LI,U,6	List the Directory Information of all User files on all active subchannels on the printer.
:LI,U,6,FILE1	List the Directory Information of the user file named "FILE1" on the printer.
:PU,FILE1	Purge "FILE1" from the Directory.
:RP	Repack all active subchannels.
:RUN,name	Run the program named "name".
:SS	Enable "system search" capacity.
:TR	Determine the next available track and the number of bad tracks on the current subchannel.
:UD	Interrogate the current user subchannel.
:UP.xx	Declare a device (EQT# = xx) available for use after an I/O Error.

PROGRAM MNEMONICS

Standard mnemonics or "device designators" have been given to each of the commonly used pieces of equipment on the system. Most of the programs require operator responses from the following list:

DESIGNATOR	DEVICE
LP	System Printer
CN	Console
T1	Mag Tape #1 (unit 0)
T2	Mag Tape #2 (unit 1)
D1	Disc Work Area #1
D2	Disc Work Area #2
DB	Data Base File
SF	Source File
PR	Paper Tape Reader
PN	Paper Tape Punch
PT	Paper Tape
LI	Library File
CR	Card Reader

All console directives and responses must be followed by a Carriage Return, Line Feed.

All CRT inputs and responses must be followed by pressing the ENTER key on the CRT terminal. This action causes the computer to read the information displayed on the screen.

BOOTSTRAPPING

"Bootstrapping" is the procedure by which a copy of the Operating System is loaded from the disc into the memory of the computer.

1. Turn on all equipment. If the computer RUN light is on, press HALT.

2. Press REGISTER SELECT, as required, to select the S-Register. The S light will be on once the S-Reg is selected.

3. Press CLEAR DISPLAY.

4. For HP 7905 Disc Systems, press buttons 1, 7, 10, 12, and 15 if the HP 2026 programs are stored on subchannel 2 (the fixed platter):

   1 001 010 010 000 010

   Press buttons 0, 7, 10, and 14 if the programs are stored on subchannel 1:

   0 100 010 010 000 001

   Press buttons 7, 10, and 14 if the programs are stored on subchannel 0:

   Press buttons 7, 10, and 14 if the programs are stored on subchannel 0:

   0 100 010 010 000 000

5. Press STORE.

6. Press PRESET.

7. Press IBL, and the bootstrap program will be loaded from the ROM (Read-Only Memory).

8. Press RUN on the computer.

9. The DISPLAY REGISTER should now look like this:

   1 000 010 000 111 111

   where 1 = "on"
   and 0 = "off"

   If it does not, go back to step 2 above.

10. Press RUN, and the operating system will be loaded from disc into the memory of the computer.

11. The following message will be typed on the console:

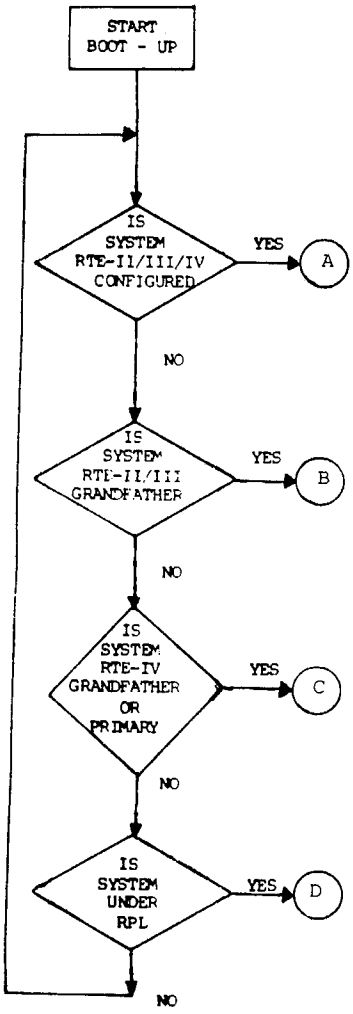
    "SUBCHAN=nn" (indicates the subchannel to which you have bootstrapped.
    "LBL=label" "Label" is a code word used to identify the software version.)
    "@"

12. If more than one disc subchannel is used on the system, tell the operating system by typing ":SS,x,y, . . . " where x and y are the subchannels to be used (including the one to which you bootstrap).

    The system is now ready to accept a "RUN Directive" for the program that is desired. For example:

    :RUN,COMSYS

RTE BOOT-UP PROCEDURES SUMMARY



STANDARD BOOT

A

1. S-Register:

15 - 14	12	11 - 6	** 2 - 0
ROM Address	7900 = 0 7905/06/20/25 = 1	Disc S.C.	Head #

2. STORE, PRESET, IBL, PRESET, and RUN.
3. System console prints "SET TIME".
4. System runs "Welcom" file.

RTE-II/III GRANDFATHER BOOT

B

1. Do step #1 of A above.
2. Press STORE, PRESET, IBL, PRESET, and RUN.
3. CPU Halts with a 102077 (octal).
4. S-Register:

15 - 12	11 - 6	5 - 0
Cleared	T.B.G. S.C.	CRT S.C.

5. Press STORE, PRESET, and RUN.
6. System console prints "SET TIME".
7. System runs "Welcom" file.

RTE-IV/RTE-6/VM RECONFIGURATION BOOT

C

1. S-Register:

15 - 14	12	11 - 6	5	** 2 - 0
ROM Address	7900 = 0 7905/06/20/25 = 1	Disc S.C.	1 = Reconfigure	Head #

2. Press STORE, PRESET, IBL, PRESET, and RUN.
3. CPU halts with a 102077 (octal).
4. S-Register:

15	11 - 6	5 - 0
SET = 1	Disc S.C.	CRT S.C.

5. Press STORE and RUN.
6. System console prints "LIST LU?".
   Answer: 1<cr>
7. System console will output the current I/O configuration and ask if you wish to Reconfigure (YES/NO).
8. You now can Reconfigure the I/O or Memory from this point on.
9. When configuration is complete the system will run "Welcom" file.

RPL (AUTOMATIC) BOOT

D

1. With the LOCK/OPERATE switch inside the CPU set to LOCK, RTE will boot-up AUTOMATICALLY when all power is ON.

** Head for 7905/06/20/25 or
Subchannel for 7900: Removable = 1
Fixed = 0

SLOW-BOOT PROCEDURE FOR RTE-II/III SYSTEMS

1. Load in the ROM loader.

2. Patch ROM loader to halt after the boot extension is loaded but before it is executed:
   Location: 077775B
   Patch: 102077B

3. Execute the ROM boot from its starting location (usually 77700B). When the HALT 77 occurs, the RTE boot extension is in memory (if the hardware is working correctly).

4. Patch the RTE boot so that it halts before jumping into the system code:
   Location: 2016B
   Patch: 102077B

5. Execute the boot extension from location 2175 (see the listings following this section).

6. Because the boot extension moves itself to a higher location in memory, the halt at location 2016 will occur in higher memory. When it occurs, patches can be made to the system if desired. It is also possible to check a couple locations at this point to ensure that the system has been loaded correctly. A good check can be made by looking at a couple of locations on the base page:

Location	Contents
1651	Number of EQT entries
1653	Number of logical units
1674	Select code of the TBG

RTE TURN ON

HP 2100 COMPUTER SERIES

Disc Loader

a. If the absolute RTE system is on subchannel 0 or 1 and starts on track 0, set the S-register to one of the following starting addresses:

   077750 for 32K
   057750 for 24K
   037750 for 16K

b. Enable the loader and push RUN (bootstrap tape is not required). The system will halt with 102077 displayed. Push RUN again.

c. When the absolute RTE system has been loaded into memory, it prints the following message:

   SET TIME

d. Set the clock to current time using the TM operator request. Any other request starts the clock at 8:00 on the approximate release date.

Paper Tape Loader

a. Load the bootstrap tape into memory using the basic binary loader. Starting octal addresses are:

   077700 for 32K
   057700 for 24K
   037700 for 16K

b. Set P-register to 100_8.

c. Push RUN.

d. When the absolute RTE system has been loaded into memory, it prints the following message:

   SET TIME

e. Set the clock to current time using the TM operator request. Any other request starts the clock at 8:00 on the approximate release date.

HP 21MX COMPUTER SERIES

Start Up

a. On the operator panel, set key-operated switch to OPERATE.

b. Press left half (◄) or right half (►) of register Select switch to select S-register.

c. Press CLEAR DISPLAY and set bits 6 through 11 to octal select code of tape reader if paper tape bootstrap is to be used. If the absolute RTE system is on subchannel 0 or 1 and starts on track 0, the disc loader can be used. Set bits 6 through 11 to octal select code of disc.

d. Set bits 15 and 14 to select the appropriate ROM loader.

15	14	13	12	
0	0	0	0	Paper Tape
1	0	0	0	7900
1	0	0	1	7905

e. Press STORE then IBL.

f. If required, place bootstrap in tape reader and turn it on.

RTE TURN ON (Cont'd)

g. Press PRESET then RUN. (For paper tape, system halts with 102077 displayed: set P-register to 100_8 - the starting address of the bootstrap, then press RUN.)

h. When the absolute RTE system has been loaded into memory, it prints the following message:

SET TIME

i. The RTE FMGR is scheduled, control passes to the first file labelled WELCOM.

j. Set the clock to current time using the TM operator request. Any other request starts the clock at 8:00 on the approximate release date.

ERROR HALTS DURING TURN-ON

The following halts can occur during use of the bootstrap.

102011

Cause	Recovery Action
Disc error status is in the A-Register.	Check that the disc drive is ready-push RUN to retry.

102031

Same as above. Occurs during execution of disc-resident part of boot-strap.	Check that the disc drive is ready-push RUN to retry.

RTE-II/III ERROR HALTS

The following halts can occur during use of the bootstrap.

Halt Code	Cause	Recovery Action
102011	Disc error status is in the A-Register.	Check that the disc drive is ready-push RUN to retry.
102031	Same as above. Occurs during execution of disc-resident part of bootstrap.	Check that the disc drive is ready-push RUN to retry.

SCHEDULING THE CONFIGURATOR FROM BOOTSTRAP LOADER
(RTE-IV/RTE-IVB/RTE-6/VM)

A bootstrap loader can be used to load the boot extension into memory, e.g., the 264x Cartridge Tape Loader ROM (12992C). To load, proceed as follows:

1. Select the S-Register for display on the computer front panel.

2. Press CLEAR DISPLAY.

3. Set the S-Register as follows:

Bits	Enter
0-5	0 (reserved)
6-11	Input device select code
12-13	0 (reserved)
14-15	Loader ROM selection for input devices

4. Press PRESET, IBL, PRESET, and then RUN. Boot file will be loaded from the device specified.

5. When HLT 77B occurs, set the P-Register to 100B.

6. For MAC/ICD discs, set the S-Register to zero to signify no change.

Bits	Enter
0-5	Console select code
6-11	Disc select code
12-14	0 (reserved)
15	1 for reconfiguration

SCHEDULING THE CONFIGURATOR FROM DISC LOADER ROM
(RTE-IV/RTE-IVB/RTE-6/VM)

Disc loader ROMs:

MAC RPL compatible - 12992B
ICD RPL compatible - 12992H
CS80 RPL compatible - 12992J

NOTE

The Boot Extension is assumed to reside on physical track 0, sector 0 of the system disc.

1. Select the S-Register.

2. Press CLEAR DISPLAY.

3. Set the S-Register as follows:

Bits	Enter
0-2	Surface number for MAC/ICD disc, & unit number for CS/80 disc
3-4	0 (reserved)
5	1 for reconfiguration (0 for no reconfiguration)
6-11	Disc select code
12	1 for MAC/ICD disc, 0 for CS/80 disc
13	0 (reserved)
14-15	Loader ROM selection for disc

4. Press STORE.

5. Press PRESET, IBL, PRESET and RUN.

6. Following the HLT 77B (successful load), set the S-Register:

Bits	Enter
0-5	Console select code
6-11	Disc select code
12-14	0 (reserved)
15	1 for reconfiguration (0 for no reconfiguration)

7. Press PRESET and RUN to perform reconfiguration processes.

RTE-IVA/IVB Error Halts

HLT	Meaning	User Action
4	Power-fail occurred and power-fail automatic restart is enabled.	Restart system boot-up procedure.
5	Memory protect switch was set and memory parity error occurred.	Restart system boot-up procedure.
10B	FMGR or D.RTR cannot be scheduled at startup because these is not a large enough partition (issued by the system).	Restart system boot-up and redefine memory to include a partition large enough for FMGR or D.RTR.
11B	Attempt was made to re-execute a non-RPL compatible ROM Loader Part #12992A, Bootstrap Loader, or Disc Loader ROM detected a disc error (check A-Register for error status).	Reload the ROM Loader or Bootstrap Loader before re-executing.
22B	One of the following conditions was encountered: 1. $CNFG cannot find an ID segment for Configurator extension $CNFX. 2. $CNFX is not a Type 3 program. 3. A contiguous memory block of three good pages cannot be found in the user partition area.	Restart system boot-up procedure. If memory reconfiguration is desired $CNFX must be permanently loaded as a Type 3 program and there must be at least 3 good pages of contiguous memory in the user partition area.
30B	Error was encountered in the disc I/O process by one of the RPL-compatible ROM Loaders Part #12992B & 12992F. If the disc is a 7900, the disc status is displayed in the A-Register. If the disc is a 7905/20, the disc status word 1 is displayed in the B-Register and disc status word 2 in the A-Register.	Retry the system boot-up procedure.
31B	Error encountered in the disc I/O process by the Boot Extension. If the disc is a 7900, the disc status is displayed in the A-Register. If the disc is 7905 or 7920, the disc status word 1 is displayed in the B-Register and disc status word 2 is displayed in the A-Register.	Retry the system boot-up procedure.
55B	An EQT with the equipment type code of console cannot be found.	Restart boot-up procedure with a console for which an EQT is generated in the system.

RTE-6/VM Error Halts

Halt	Meaning and User Action Required
4	Meaning: Power-fail occurred and power-fail automatic restart is enabloed. Action: Restart system boot-up procedure.
5	Meaning: Memory protect switch was set and memory parity error occurred. Action: Restart system boot-up procedure.
6	Meaning: A partition was found not properly linked into an operating system partition list. The operating system may be corrupt or a bug may exist. Action: Reboot the system and if the problem persists, call your HP representative.
10B	Meaning: FMGR or D.RTR cannot be scheduled at startup because there is not a large enough partition (issued by the system). Action: Restart system boot-up and redefine memory to include a partition large enough for FMGR and D.RTR.
11B	Meaning: Attempt was made to re-execute a non-RPL compatible ROM Loader Part #12992A, Bootstrap Loader, or Disc Loader ROM detected a disc error. For CS/80 discs: ROM Loader (12995J) could not bring in the boot extension. Action: Reload the ROM Loader or Bootstrap Loader before re-executing, or check A-Register for status. For CS/80 discs: check that the correct unit was specified in the S-Register at boot-up. If so, run diagnostics to isolate disc proglem.
20B	Meaning: Uninstalled memory halt. The system will halt if memory has been defined but is not installed. The system checks pages from the beginning of the user partitions through the end of the memory stack. The frist page it finds deby the user but not physically installed will cause the HLT 20 instruction to be executed. The first uninstalled page number will be displayed in the A- and B-Registers. Action: Reconfigure memory such that the amount of memory specified in the reconfiguration is less than or equal to the amount of physically installed memory.
21B	Meaning: See HP representative. This halt may also appear in the T-Register as 105355.

RTE-6/VM ERROR HALTS (Cont'd)

Halt	Meaning and User Action Required
22B	Meaning: One of the following conditions was encountered: 1. $CNFX is not a Type 3 program. 2. A contiguous memory block of three good pages cannot be found in the user partition area. Action: Restart system boot-up procedure. If memory reconfiguration is needed, $CNFX must be permanently loaded as a Type 3 program and there must be at least three good pages of contiguous memory in the user partition area. If $CNFG cannot find the ID segment for $CNFX, the system will boot-up with no memory reconfiguration.
30B	Meaning: Error was encountered in the disc I/O process by one of the RPL-compatible ROM Loaders Part No. 12992B and 12992F. If the disc is a 7905/20, the status word 1 is displayed in the B-Register and disc status word 2 in the A-Reg. Action: Retry the system boot-up procedure.
31B	Meaning: Error encountered in the disc I/O process by the Boot Extension. If the disc is a 7905 and 7920, the disc status word 1 is displayed in the B-Register and disc status word 2 is displayed in the A-Register. For CS/80 discs: A-Register contains the failed status word number and B-Register contains the status indicated by A. "A=1" implied reject error, "A=2" is a fault error, "A=3" is an access error, "A=4" is an information error. Action: Retry the system boot-up procedure. For CS/80 discs: retry or run diagnostics to isolate disc error.
55B 56B, or 57B	Meaning: While dispatching a program the operating system encountered an unexplainable condition. The operating system may be corrupt or a bug may exist. Action: Reboot the system and if the problem persists call your HP representative.

BACKUP OVERVIEW

The table below summarizes all the current backup programs supported by DSD, as well as a few widely used non-supported ones. The table indicates whether the program is on or off-line, the type of disc which can be used (H-Series discs use a 12821A disc interface), the type of backup media, if it is possible to spare tracks, which versions of RTE will support the programs, and whether the program can be used to backup the system LUs (LU 2 and LU 3).

BACKUP UTILITY MATRIX

Prog Name	On/ Off Line	MAC DISCS 7900 7901	5/6/ 20	'25	H-Disc CS80 6/20/ 25		Save Media	Spar Fix	Verf ?	RTE ?	LU2 LU3	Data Meth	Page No.
DSKUP	Off	yes	yes	Y*	no	no	D/T	yes	yes	all	yes	TRK	86-1
SAVE	On	yes	yes	Y*	no	no	tape	no	yes	all	yes	TRK	85-4
RSTOR	On	yes	yes	Y*	no	no	tape	no	yes	all	no	TRK	85-5
COPY	On	yes	yes	Y*	no	no	disc	no	yes	all	Y**	TRK	85-5
VERFY	On	yes	yes	Y*	no	no	D/T	no	yes	all	Y**	TRK	85-3
DISK	Off	no	yes	yes	yes	no	D/T	yes	NO	4/6	yes	TRK	86-7
LSAVE	On	no	yes	yes	yes	no	tape	no	yes	4/6	yes	TRK	85-8
USAVE	On	no	yes	yes	yes	no	tape	no	yes	4/6	yes	TRK	85-9
LCOPY	On	no	yes	yes	yes	no	disc	no	yes	4/6	Y**	TRK	85-10
RESTR	On	no	yes	yes	yes	no	tape	no	no	4/6	no	TRK	85-9
BCKOF	Off	yes	yes	yes	yes	yes	D/T/L	yes	yes	6	yes	TRK	86-13
PSAVE	On	yes	yes	yes	yes	yes	D/T/L	no	yes	6	yes	TRK	85-13
PRSTR	On	yes	yes	yes	yes	yes	D/T/L	no	yes	6	yes	TRK	85-14
PCOPY	On	yes	yes	yes	yes	yes	disc	no	yes	6	yes	TRK	85-16
READT	On	yes	yes	yes	yes	yes	tape	no	no	4/6	no	TRK	85-18
WRITT	On	yes	yes	yes	yes	yes	tape	no	no	4/6	no	TRK	85-17
READR	On	yes	yes	yes	yes	dsk	T/C	no	yes	4/6	Y+	file	85-19
SAVER	On	yes	yes	yes	yes	dsk	T/C	no	yes	4/6	Y+	file	85-20
FC	On	yes	yes	yes	yes	dsk	T/L	no	yes	4/6	Y+	file	85-22
JSAVE	On	yes	yes	yes	yes	yes	tape	no	no	4/6	no	TRK	85-24
JRSTR	On	yes	yes	yes	yes	yes	tape	no	no	4/6	no	TRK	85-26
MFGET	On	yes	yes	yes	yes	yes	tape	no	no	4/6	no	file	85-27

NOTE

Programs JSAVE, JRSTR, and MFGET are not supported, all others are supported by DSD.

DESCRIPTION OF BACKUP UTILITY MATRIX

The column marked "Spar fix" means that sparing can be handled by the listed utility. Otherwise, bad tracks can be fixed with the FORMT or FORMC utility (RTE-IV or RTE-6/VM), or the disc diagnostic. Off-line utilities do not care which RTE version is on the disc, but the on-line versions may or may not load due to opsystem limitations. For example, SAVE and RSTOR LOAD and RUN on any M/E/F Series RTE System, but PSAVE and PRSTR are too large to run on RTE-II/III and RTE-IV lacks some libraries to load them on-line.

Abbreviations for media:

D = disc
T = magtape (ie, 797x series)
C = CTU (terminal cassette)
L = Linus (CS/80 tape)

BACKUP OVERVIEW (Cont'd)

Conditional "yes" abbreviations:
Y* means yes if later revisions.
Y** means yes if destination LU is not LU 2 or LU 3.
Y+ means yes for files only (not the opsystem area).

The column LU 2/LU 3 means that the contents of LU 2 or LU 3 can be saved or restored. In most cases, restoring LU 2 or LU 3 on-line with a TRK by TRK backup is not recommended or even possible. The file by file utilities will restore files but not opsystem areas. For session systems, the user must also have write-access to LU 2 or LU 3 to restore files. In all cases, LU 2 and LU 3 can be saved on-line and restored off-line (!DSKUP/!DISK/!BCKOF).

There are 2 sets of separate verify programs: VERFY (which is used by SAVE/RSTOR) and JVRFY (which is used by older versions of JSAVE/JRSTR. The PSAVE set of programs schedules FORMT or FORMC to verify the disc (which is not a true verify-just a media check).

Compatibility is shown by grouping the related utilities together. The following lists show which utilities are read/write compatible tape formats. All utilities on one line recognize or create compatible records.

!DSKUP/SAVE/RSTOR/VERFY
!DISK/LSAVE/USAVE/RESTR
!BCKOF/PSAVE/PRSTR (!BCKOF also knows !DSKUP and !DISK tapes too).
READT/WRITT
JSAVE/JRSTR/JVRFY (JRSTR/MFGET will read WRITT tapes too)
READR/SAVER
FC

Between M/E/F Series computers and L/A-Series, only two formats are usable:

1. FC (RTE-IV/6) can move FMGR type files between systems on magtape, and Linus tape (RTE-6/VM and L/A-Series only).

2. The FMGR "ST" command (e.g., ST,WELCOM,8) will write data to/from magtapes and CTUs that is 100% RTE-compatible. However, the Linus tapes (CS/80) are treated as discs and "ST" is rejected. Another advantage to "ST" is that it will work with FCOPY on the 3000.

CHOOSING THE RIGHT BACKUP

RTE-II, RTE-III, RTE-IVA AND NON ICD DISC

If customer has mag tape - Use the on-line SAVE program. Perform a UNIT SAVE for entire discs, LU saves for individual disc LUs. This will create an off-line restore compatible mag tape with track sparing capability.

If customer has no mag tape, but multiple disc drives - Perform an off-line UNIT COPY with track sparing. You will need the system track map (found in system generation listing).

If customer has no mag tape and no multiple disc drives - Use the off-line !DSKUP program. Be sure to use version 1926 or higher. Refer to the section on single disc backup.

CHOOSING THE RIGHT BACKUP (Cont'd)

RTE-IVB AND NON 7900 DISC

If customer has mag tape - Use the on-line LSAVE or USAVE programs.

If customer has no mag tape - Use the off-line !DISC for ICD discs. Otherwise use !DSKUP so that disc copies can be verified. Refer to the section on single disc backup.

Single Disc Backup

A system with a single 7905/06 disc is a not supported system configuration, but never-the-less you will more than likely have to backup such a system.

1. To save the fixed platter (head 2 for 7905, heads 2 & 3 for 7906) insert a scratch cartridge on which to save the subchannels. All defective tracks must have been previously spared using the off-line disc diagnostic or FORMT utility with RTE-IVB. The cartridge MUST be error free.

2. Load and run the off-line utility !DISK for ICD discs and !DSKUP for other discs.

3. Perform a FROM-TO SAVE, specifying only the actual LU tracks. DO NOT specify the spare track pools. This means that a FROM-TO 0-411 will not work since it may attempt to save spared tracks also. Do this for each LU on the bottom to save the information from the lower platter to the removable pack. Since FROM-TO saves do not do track sparing, the removable platter must be error free. It is suggested to save entire surfaces by just redefining the head number (for a 7906 copy heads 2 and 3 to heads 0 and 1; for a 7905 copy head 2 to head 0 or 1).

4. Now to save the removable cartridge. Insert the system cartridge to be saved. For a 7906 perform a FROM-TO SAVE of heads 0 and 1 (removable) to heads 2 and 3 (fixed). Remove the system cartridge and insert the backup cartridge. Now perform a FROM-TO SAVE to copy the information on the fixed platter back up to the removable cartridge. For a 7905 disc which only has one head on the fixed platter, the copy down and copy up operation to save the removable platter will have to be performed twice.

RTE-6/VM

If a customer has mag tape - Use the PSAVE program.

If the customer has no mag tape - Use the PCOPY program.

PSAVE (SA in off-line mode) saves discs to tape. PRSTR (RE in off-line mode) restores the saved tapes to disc. PCOPY (CO in off-line mode) copies from disc to disc.

If the off-line mode, BCKOF schedules the appropriate utility.

Compatibility:

These utilities replace the ICD/MAC and 7900 backup utilities. Tapes created by PSAVE are not compatible with these utilities, but PRSTR can read ICD/MAC or 7900 utility formats. Also these utilities are not compatible with tapes created by READT/WRITT, READR/SAVER, FC, or other file backup utilities.

You cannot transfer between discs with different track sizes unless you use utility FC to transfer the files individually or in groups, rather than track-by-track (on-line only).

!BCKOF/PSAVE/PRSTR

Disc Drive Source Destination Compability

Source	Destination 7900	7905	7906	7910	7920	7925	CS/80
7900	O.K.	*	*	N/A	*	N/A	+
7905	*	O.K.	O.K.	N/A	O.K.	N/A	+
7906	*	*	O.K.	N/A	O.K.	N/A	+
7910	N/A	N/A	N/A	O.K.	N/A	N/A	+
7920	*	*	*	N/A	O.K.	N/A	+
7925	N/A	N/A	N/A	N/A	N/A	O.K.	+
CS/80	+	+	+	+	+	+	O.K.

CS/80 Discs include the 7908, 7911, 7912, 7914 and 7933.

N/A Not available.

* If restore is off-line, you must supply subchannel definition.

\+ Logical track sizes for the CS/80 sealed discs have been set at 96 sectors per track. This is variable, so any CS/80 source can go to any CS/80 destination off-line. On-line operations use the current subchannel definitions.

TRACK SPARING

RTE-IVB/RTE-6/VM

Use the on-line program FORMT. This can only be run on RTE-IVB, revision 2001 or later. FORMT cannot be loaded or run on any other operating system or earlier revision code due to driver changes. Load the program as follows:

RTE-IVB

```
:RU,LOADER
/LOADR:  SZ,17  (override program size req.)
/LOADR:  LI,$DSCLB  (utility library)
/LOADR:  RE,%FORMT  (search)
/LOADR:  END
```

RTE-6/VM

```
:RU,LOADR
/LOADR:  SZ,18
/LOADR:  RE,&FORMT
/LOADR:  SE,$DSCLB
/LOADR:  END
```

CAUTION

No other program should access the disc LU which is being used by format. The INitialize and SPare tasks lock all disc drives with the game EQT as the disc LU being accessed for both MAC and ICD discs. Therefore, the system's performance is downgraded during execution of FORMTs "IN" tasks. Since "SP" takes place very quickly, sparing a track should present no particular problem.

The run command string to format a 9885 floppy is:

```
:RU,FORMT,log lu,FO,disc lu,n
```

using n as the fill sector value (0-28). A fill value of n=1 is recommended. The run command string to initialize a hard disc is:

```
:RU,FORMT,log lu,IN,disc lu
```

TRACK SPARING (Cont'd)
RTE-IVB/RTE-6/VM

The run command string to spare a bad track, where "track" is the logical bad track number within the disc LU, is:

```
:RU,FORMT,log lu,SP,disc lu,track
```

where:

log lu = LU of the terminal being used interactively by the program FORMT. Default is the user terminal.
disc lu = LU of the disc (a positive integer). With session monitor, the disc LU must be previously BEFORE in our SST. For initializing, it cannot be LU 2 or LU 3.

The program can also be run interactively (this is recommended mode). To run FORMT interactively, enter RU,FORMT and the program will prompt for the task you want to perform.

```
TASK?
```

Type one of the following:

```
SP  (spare a track - hard disc only)
IN  (initialize - hard disc only)
FO  (format a floppy - floppy disc only)
EN  (end)
??  (prints a list of all valid responses)
```

Typing EN, /E, or EX terminates FORMT.

INITIALIZE AN LU

The initialization process prepares an ICD or MAC hard disc cartridge LU for use. The previous contents of the disc are overwritten with a pattern of all zeroes. Bad tracks are spared to the spare pool at the end of the disc cartridge LU. The disc must have been previously formatted. The directory track will be overwritten, therefore the following steps are recommended.

1. The disc LU must be defined in your SST.

2. Dismount the disc LU (FMGR DC,<LU>,RR command) and make sure no one is using the same LU. This can be verified using the CLAL command.

3. Invoke the initialization function which writes zeroes on the disc LU using the IN command. (Use the FO command for flexible discs.)

4. After initialization, the disc LU must be mounted with the complete FMGR MC command. For complete command field definitions, refer to the Terminal User's Guide, or the RTE-IVB Quick Reference Guide. For all default values, use MC,<LU,,,,,<cr>.

SPARE A TRACK

Sparing applies to individual tracks discovered while the disc is in use (i.e., reported by RTE-IVB, RTE-6/VM, or when running FOrmat with the VErify option). A spare track is substituted for the defective track and as much data copies from the bad track as possible. Offset head reads are used in the recovery process and it is often possible to completely recover the data. In cases where this is not possible, usually only a single block will be lost.

TRACK SPARING (Cont'd)

RTE-IVB/RTE-6/VM

After inputting an invalid parameter and/or in the interactive mode, FORMT asks:

TRACK TO BE SPARED?

Entering ?? to the query returns to you the track range for the LU. Then enter the track (logical track) found defective on the disc LU. If the track number of a good track is entered, it will be spared also and will use up a spare track unnecessarily. If the track does not lie within the bounds of the disc LU specified, the messages are displayed.

INVALID TRACK #

ENTER BAD TRACK #X - XXXX

The program copies data block by block from the bad track to the spared track. If all the information on the track cannot be recovered, the following warning messsage is issued and FORMT continues:

WARNING! ALL INFORMATION ON TRACK NOT SUCCESSFULLY RECOVERED

NOTE

Due to the complex procedure used to attempt recovery, sparing one track can take up to 3 minutes. However, if data recovery is at all possible, it will be performed.

RTE-II, RTE-III, RTE-IVA

The fastest way to spare a bad track under RTE 2,3,4A systems is to use !DSKUP off-line to perform an LU copy to itself. (Note: Some early versions of !DSKUP (pre-1940) required the "D" bit to be set. Current versions normally spare a track when it has a track map and finds the destination track cannot be written to successfully.)

To perform an LU copy to itself, the task is a UNIT copy with track sparing. The UNIT (in this case) will be defined with just one LU. Only 4 values are needed: number of tracks, starting cylinder number, starting head number, and number of surfaces. This is the same data needed for the system generation and should be copied directly from the current system generation listing. The source unit (drive number) and the destination unit will be the same and ALWAYS verify. (You need specify only the one disc subchannel or LU and then enter "/E".) If a bad track without "D" bit is encountered, the utility will ask about continuing. Answer YES. Otherwise, the spare track message is issued automatically. the verify pass will indicate the sparing was done correctly. If the !DSKUP program will not spare the track, use the disc diagnostic to set the "D" bit and then run !DSKUP to spare the track. Although the diagnostic could be used to spare a track, too, it is too complex to be considered a reliable method.

NOTE

The data from the defective track is not saved in the spare track! Also, the !DSKUP program has no way of knowing the size of the spare track area. If only 5 spares are available, but 9 tracks were spared, the data on the next LU will be lost. Typical error counts for 7905/7906 disc platters is 5-10 bad tracks for 2 heads. Any more than this indicates a disc, head or media problem. Do not jump into spare tracks until it is confirmed that only a couple of tracks need sparing.

SAVE, RESTORE, COPY, VERIFY

ON-LINE DISC BACKUP UTILITY PROGRAMS FOR 7900, 7905/06/20/25 MAC DISCS USING THE 13037B/C DISC CONTROLLER

These programs are supported with the following hardware:

* 7900 Disc Drives (disc driver DVR31)
* 7905/06/20/25 Disc Drives (13037 MAC disc controller, disc driver DVR32)
* 7970 (9 track) magnetic tape
* Consoles using DVR00 or DVR05 (264X, 262X)

Any kind of on-line save can be restored off-line. The table below shows the permitted save-restore combinations. Data saved off-line cannot be restored on-line. If such a restore is attempted, the utility prints OFF-LINE SAVE, CANNOT BE RESTORED ON-LINE and aborts. Verify is run interactively from SAVE, RESTORE and COPY.

NOTE

Older versions (pre 1926) could not save 7925 discs. It is not possible to copy data from a 7925 disc to a non-7925 disc with these utilities. Only a file-oriented (not track-oriented) utility can be used due to track size differences.

You can perform either UNIT or LU transfers on-line by running SAVE, RESTORE, or COPY. Because the transfer of data is done in a logical mode (on-line, under RTE), the formats of the source and destination disc types do not have to be the same. This is not true of off-line transfers. You transfer data between devices using the programs listed in the On-line Data Transfer Program table below.

CAUTION

If you want an exact duplicate of a disc from an on-line transfer, you must run the utilities while there is no other system activity affecting the disc. The utility programs do not check if anyone else is using the disc concurrently. For example, if an open FILE MANAGER is saved, it will be open whe restored.

SAVE,RESTORE,COPY,VERIFY (Cont.)

7900/MAC DISC UTILITY APPLICATIONS

FUNCTION	MODE TYPE	ON-LINE	OFF-LINE
SAVE	LU	Saves all tracks on one subchannel (not just FMGR files) Off-line restore will do track sparing.	Not available
SAVE	UNIT	No need for track map table information if track sparing. If you restore off-line you can get track sparing.	Can define track map table with any # of subchannels (like multiple LU saves). Can get sparing.
SAVE	FR-TO	Not available	Saves all tracks within specified bounds. Bounds need not fall at subchannel divisions.
RESTORE	LU	Restore all tracks on one subchannel without shutting down system.	On-line LU save can be restored off-line. Track sparing is done.
RESTORE	UNIT	For peripheral disc units (not LU 2 or LU 3) you can restore without shutting down system.	Only way to restore a UNIT save containing LU2 or LU3. On-line UNIT save can be restored off-line to get track sparing.
RESTORE	FR-TO	Not available	Restore tracks designated by FR-TO save.
COPY	LU	For fast backup of disc LUs if no magnetic tape unit is available.	Not available
COPY	UNIT	Backup with multiple disc drives if no magnetic tape unit is available.	Disc unit backup with multiple disc drives if no magnetic tape unit is available. Also to initialize cartridges with track sparing (disc diagnostics must be performed prior to this utility to insure successful initialization).
COPY	FR-TO	Not available	For disc backup (see on-line LU copy).

SAVE,RESTORE,COPY,VERIFY (Cont.)

7900/MAC SAVE-RESTORE COMBINATIONS

RESTORE / SAVE	ON-LINE		OFF-LINE
	LU	UNIT	
On-Line LU	X		X
On-Line Unit		X	X
Off-Line Unit			X
Off-Line FROM-TO			X

7900/MAC ON-LINE DATA TRANSFER PROGRAMS

DESTINATION / SOURCE	7900	7905,7906,7920	7925	TAPE
7900	COPY	COPY	COPY*	SAVE
7905 7906 7920	COPY	COPY	COPY*	SAVE
7925	NA	NA	COPY	SAVE
MAGNETIC TAPE				
SAVE OF 7900	RSTOR	RSTOR	RSTOR*	
SAVE OF 7905 7906 7920	RSTOR	RSTOR	RSTOR*	
SAVE OF 7925	NA	NA	RSTOR	

NA - Not allowed

* Only 6144 words per track transferred

The on-line utility programs are distributed to customers as four relocatable prorgrams and a library of relocatable subroutines as part of the grandfather disc. The utilities can be loaded either during system generation or by the LOADR.

When you load the disc backup utility programs into an RTE-IVA/B system during generation or on-line using the LOADR, you must override the size and increase the partition size as follows:

Program	File Name	2048 word buffer	track size buffer
SAVE	%SAVE	8 pages	14 pages
RSTOR	%RSTOR	8 pages	15 pages
COPY	%COPY	8 pages	14 pages
VERFY	%VERFY	8 pages	20 pages

When you load the backup utilities into a RTE-III system during generation or on-line using the LOADR, you must override the program size and increase the partition size as follows:

Program	2048 word buffer	6144 word buffer
SAVE	8 pages	11 pages
RSTOR	8 pages	12 pages
COPY	8 pages	11 pages
VERFY	8 pages	15 pages

SAVE,RESTORE,COPY,VERIFY (Cont.)

For RTE-II systems, the minimum background area is 5600 words for SAVE and COPY, and 6300 words for RSTOR. Add 4100 words for a 6144 word buffer without verify. For 6144 word buffer with verify, the minimum background area is 13400 for all three utilities.

RTE-II/III LOADING

When using the loader, move the utility program to the LG area and run LOADR. For RTE-III, the program sizes given above must be specified in the runstring ("fmt", parameter 4) of the RU,LOADR command. If the library %DBKLB was not generated into the system, the loader will suspend itself. To satisfy the undefined externals, move the on-line utility library %DBKLB (part no. 92060-16043) into the LG area by using GO, LOADR with options (GO,LOADR,2,,1 is recommended).

RTE-IVA/B LOADING

For loading the utilities under RTE-IV, proceed as follows:

```
:RU,LOADR
/LOADR:  SZ,xx          xx = size override (see previous tables)
/LOADR:  LI,%DBKLB      Library to be searched by loader
/LOADR:  RE,%xxxxx      xxxxx = Program to be loaded
/LOADR:  END
```

SAVE

To run the save utility, use the RU or ON command. For example:

```
RU,SAVE,console,type,source,destination [,disc]
```

where:

console	= logical unit number (LU) for operator console. Default is 1 or the LU provided by the multi-terminal monitor.
type	= type of save: 0 for LU save (default), 1 for UNIT save.
source	= for LU save this is the source subchannel LU (no default) for UNIT save this is the source disc drive unit (default is 0).
destination	= destination mag tape LU. Default is 8.
disc	= source disc type (UNIT save only). Input 7900, 7905, 7906, 7920, or 7925.

If a parameter is not acceptable, SAVE prints an appropriate error message and asks for a new value. The first question the program asks is whether you want a 6144 word buffer. If there is adequate room, SAVE asks if you want verification. The utility prompts for a file ID (a 72 character string written on the mag tape's header record) and the file number where the information is to be stored (a number from 1 to 8). The program then performs the operations you specified, printing a STOP message when done.

SAVE,RESTORE,COPY,VERIFY (Cont.)

RESTORE

To run the RESTORE utility, use the RU or ON as follows:

```
RU,RSTOR,console,type,source,destination [,disc]
```

where:

console	= operator console LU. Default is 1 or the LU provided by the multi-terminal monitor.
type	= type of restore: 0 for LU restore (default), 1 for UNIT restore. Must match type of save.
source	= source mag tape LU. Default is 8.
destination	= for a LU restore this is the subchannel LU (no default) for a UNIT restore this is the destination disc drive unit (default = 0).

If a parameter is not acceptable, RSTOR prints an appropriate error message and asks for a new value. The first question the restore program asks is the file number (1 to 8) on your mag tape. After you enter the number, the program prints the file ID of that file and asks if it is the correct one. If you answer no, RSTOR suspends itself so you can mount another tape. After restarting the program with GO,RSTOR, you are asked for the file number again. Once the correct file is found, you are asked whether you want the data verified. If the type of restore does not match the type of save (recorded in the tape file's header record), RSTOR aborts. Otherwise program restores the data and prints a stop message when it is done.

LU 2 or LU 3 may only be restored off-line. If the source is to large, the RSTOR will not be done and an error message is printed. If the source LU was smaller than the destination LU, the directory tracks will not be moved. This means the restored disc cannot be mounted in the normal manner (see MC command in the FMGR manuals).

COPY

To run the copy utility use the RU or ON commands as follows:

```
RU,COPY,console,type,source,destination
```

where:

copy	= operator console LU. Default is 1 or the LU provided by the multi-terminal monitor.
type	= type of copy: 0 for LU copy (default), 1 for UNIT copy.
source	= for a LU copy this is the source LU (no default) for a UNIT copy this is the source disc drive unit (default = 0).
destination	= for a LU copy this is the destination LU (no default) for a UNIT copy this is the destination disc drive unit (default = 0).

If a parameter is not acceptable, COPY prints an appropriate error and asks for a new value. The first question the program asks is whether you want a 6144 word buffer. If there is adequate room, the program asks if you want verification. If you specified an LU copy, you are asked the types of the source and destination discs. If the disc track maps are compatible and you are not writing on system discs (LU 2 or LU 3), the operations are performed and a stop message is printed. Unless the disc LUs are exactly the same size, the user must mount the copied disc LU in a special manner if it contains a disc directory (see the MC command in the Terminal User's Guide).

SAVE,RESTORE,COPY,VERIFY (Cont.)

ERROR MESSAGES

MESSAGE	MEANING AND ACTION
PARTITION SIZE TOO SMALL	The partition in which the utility program is running cannot hold a 2048 word buffer. The program's partition size must be 8 pages or more for SAVE, COPY, and RSTOR. The program is aborted.
WARNING-PARITION SIZE TO SMALL FOR VERIFY W/6144 WORD BUF	The partition in which the utility program is running cannot hold two 6144 word buffers. If you want to verify your data, do not specify the large buffer.
FOLLOWING DISC LU# IMPROPER, ENTER AGAIN	The logical unit number specified is invalid; it does not belong to a valid disc type. Enter the correct disc LU#.
FOLLOWING DISC DRIVE# IMPROPER, ENTER AGAIN	The disc drive (unit number) is invalid. For 7900 discs, enter a number between 0 and 3. For discs other than 7900 enter a number between 0 and 7.
FOLLOWING DISC TYPE IMPROPER, ENTER AGAIN	Invalid disc type specification. Enter 7900, 7905, 7906, 7920, 7925.
IMPROPER MT LU#, LU#=?	The mag tape logical unit number is invalid. Enter a new value.
NO WRITE RING, WRITE ENABLE MT	The write ring is missing from the mag tape during a save operation. Put the write ring on and restart the utility with the GO command.
IMPROPER FILE#	The mag tape file number is not between 1 and 8. Enter a new value.
FILE NOT FOUND	The file number specified is greater than the number of files on the mag tape. Mount another tape, if necessary, and restart the utility with the GO command. Specify the correct file number.
EOT REACHED, MOUNT NEW TAPE	The entire mag tape has been read. Mount the next tape and restart the utility with the GO command.
FOLLOWING TRACK MAP TBL NOT FOUND	The entry point for the table describing the track map information ($TB31 for 7900 and $TB32 for other than 7900) for the source or destination disc unit cannot be found. The utility is aborted (system generation problem).
ASSIGN LU# TO FOLLOWING SUBCHNL	The indicated subchannel is defined in the track map table but is not assigned an LU number. Assign an LU number with the LU command and restart the utility with the GO command.
SOURCE & DEST TRACK MAP INFO NOT COMPATIBLE	One of the conditions described under Format Compatibility is not satisifed. Destination disc LU is too small or wrong type.

SAVE,RESTORE,COPY,VERIFY (Cont.)

ERROR MESSAGES (Cont.)

MESSAGE	MEANING AND ACTION
SAVE TYPE NOT SAME AS RESTORE TYPE	The type of restore is not the same as the type of save recorded in the file's header record. RSTOR is aborted. Usually the tape is not a standard save tape.
OFF-LINE SAVE, CANNOT BE RESTORED ON-LINE	The data was saved off-line and cannot be restored on-line. RSTOR is aborted.
DEST SUBCHNL IS LU2 OR LU3	Logical unit 2 or 3 is the destination subchannel for an LU restore or copy operation or is the destination subchannel for a unit copy or restore operation. The utility is aborted.
WARNING-WRITING ON PROTECTED TRACKS	RSTOR or COPY is writing on protected tracks. This can be ignored if the disc format switch is on. (If it is off, the protected tracks are not restored.) It means that the disc at one time had another operating system on those tracks. Data is restored without problems if the format switch is on.
DISC ERROR AT FOLLOWING TRCK & LU#	The number of words actually transferred is not equal to the number of words requested to be or transferred to or from the disc (usually a hardware failure). The utility is aborted.
SAVE WAITING FOR MT LU LOCK RSTOR WAITING FOR MT LU LOCK	SAVE or RSTOR is waiting to lock the mag tape LU. Operation will continue when the mag tape LU is locked (check WHZAT for someone else using the mag tape).
MISSING REC FOR FOLLOWING TRCK & LU#	During a restore operation a record was missing on mag tape. Records are sequentially recorded. A record was not in order (hardware error or an invalid save).
WARNING-VERIFY NOT DEFINED OR PARTITION SIZE TOO SMALL	The verify programs not defined or its partition is not large enough. VERFY must be RP'ed or otherwise have an active ID segment, otherwise, no verify is done.
VERIFY ERROR AT TRACK ttt & LU11	Data read from or written to the given track location does not verify. The utility continues.
IMPROPER TRCK MAP INFO	Subchannels for source or destination disc unit not defined in the track map table. The The utility is aborted.
SAVE ABORTED RSTOR ABORTED COPY ABORTED	The utility program has been aborted because of one of the conditions listed above.
??	Carriage return prior to input or input device has timed-out waiting for a response. Re-enter input.

LSAVE, USAVE, RESTR, LCOPY

LOADING THE ON-LINE UTILITIES

To load, the 2 libraries needed must be specified in this manner:

```
:RU,LOADR
   /LOADR:  LI,$DKULB
   /LOADR:  LI,$DSCLB
   /LOADR:  SZ,nn
   /LOADR:  re,%xxxxx
   /LOADR:  END
```

where nn is the page size increase and xxxxx is the program name. The size requirements for the on-line utility programs are:

```
LSAVE  17 pages
USAVE  17 pages
RESTR  16 pages
LCOPY  14 pages
```

MAG TAPE INFORMATION

The on-line saves and restore perform their operations starting at the current tape position. The tape is not rewound before or after a save or restore so you can save more than one LU or subchannel per mag tape. Use the FMGR command CN to position the mag tape.

When using the verify option with USAVE or LSAVE, the mag tape EQT should have a time-out value of zero to indicate no time-out. This will allow enough time to backspace a large file.

LSAVE

LSAVE is used to save on disc LU or subchannel onto mag tape. Ths RUN command format for LSAVE follows (if optional parameters are omitted, commas must be used as place holders):

```
:RU,LSAVE,log lu,disc lu,mt lu,VE,title
```

where:

log lu	= LU of the device where messages are sent. Optional parameter, default is the session LU of your terminal.
disc lu	= positive LU of the disc subchannel to be saved. Under Session Monitor, the disc LU must be in your SST (session switch table).
mt lu	= LU of the mag tape drive. Optional parameter, default = 8.
VE	= to verify the tape file after a save, enter VE to verify; NO for no verify. (Optional parameter: default=NO. Recommend that a VE is always entered.)
title	= Up to 40 characters of label information stored in the tape header, to identify the tape file. The utility also places the date and runstring preceding the title in the header for additional identification. Optional parameter, no default.

To have the program prompt you for the parameters, just enter "RU,LSAVE". Enter a valid response to each question or a SPACE and RETURN to take the default value. To stop the program enter /E, EN, or EX in response to a program question. This is recommended since comma counting can be error prone.

When the program has completed, it will print the number of tracks saved on the logical device.

LSAVE,USAVE,RESTR,LCOPY (Cont.)

USAVE

USAVE saves all of the subchannels associated with a disc unit (disc drive). The save is done according to the track map table currently defined in the system. The data is saved starting at the current tape position and the tape is not rewound before or after the save.

The RUN command format for USAVE is as follows (if optional parameters are omitted, commas must be used as place holders):

```
:RU,USAVE,log lu,disc lu,mt lu,VE,title
```

where:

loglu	= LU of the device where messages are sent. Optional parameter, default is the session LU of your terminal.
disc lu	= LU of any disc subchannel on the unit to be saved. USAVE will search the track map table and save all subchannels on the same unit as the LU given. The LU must be available to the user (in SST with Session Monitor).
mt lu	= LU of the mag tape drive. Optional parameter, default=8.
VE	= Verify the tape file after the save. Enter VE to verify; NO for no verify. (Optional parameter: default=NO. Verify is always recommended.)
title	= Up to 40 characters of information are stored in the tape header to identify the tape file. The utility appends this information to the date and the runstring in the tape header for identification.

To have the program prompt you for the parameters just enter "RU,USAVE". Enter a valid response to each question or a SPACE and RETURN to take the default value. To stop the program enter /E, EN, or EX in response to any program question. When the program has completed, it will print the number of tracks saved from each LU of the disc unit. Interactive mode is recommended since comma counting can be error prone.

RESTR

RESTR returns data saved on mag tape by USAVE or LSAVE to disc. RTE will not permit you to restore the system disc (LU 2 or LU 3). If LU 2 or LU 3 are included on a USAVE file, RESTR will skip LU 2 or LU3 and continue restoring the remaining subchannels.

Track sparing and initialization will not be performed. Use FORMT, revision 2001 or later.

The RUN command format for RESTR is as follows. If optional parameters are omitted, commas must be used as place holders.

```
:RU,RESTR,log lu,disc lu,mt lu,DE
```

where:

log lu	= LU of the device where messages are sent. Optional parameter default is the session LU of your terminal.
disc lu	= Destination disc LU of the restore. If the file being restored was saved with LSAVE, RESTR will restore the tape file to this disc LU. If the tape file was saved with USAVE, the track map table of the current system must match the track map table of the USAVE system as recorded in the tape header. In restoring either a USAVE tape file or a LSAVE tape file, the disc being restored must have the same track size (words per track) as the source save disc.
mt lu	= LU of the mag tape drive. Optional parameter, default=8.
DE	= Do not confirm the mag tape header. The program will list the tape file header and restore the disc LU or unit without further operator intervention (primarily for batch operation).

LSAVE,USAVE,RESTR,LCOPY (Cont.)

RESTR

If the DE option is not specified, the program lists the tape file header and asks for confirmation (recommended):

The response may be:

```
YE[S]          - restore the mag tape file to the disc.
NO             - move the tape forward to the next file,
                 print it's header, and ask to continue.
EN,/E, or EX - stop the program.
```

Enter /E, EN, or EX to any question to stop the program.

If the source LU on the tape file has more or less tracks than the destination LU, the program prints the decimal track sizes to your terminal:

```
xxxx TRACKS IN SOURCE LU
yyyy TRACKS IN DEST. LU
OK TO PROCEED?
```

If you enter "YES", the program copies tracks until it has restored the last track of the destination LU or the last track of the source file LU, whichever is smaller.

CAUTION

When restoring a disc LU with FMGR files and directory track(s), be careful if you try to restore a disc LU with less tracks than the source LU. The directory track may not be copied (the disc could not be mounted). Conversely, to restore to a disc LU with more tracks, you must do a complete FMGR MC command (by specifying the actual last track as restored) to recover the valid directory. In the MC command, specify the last track number restored from the source disc LU. This must be done every time that the restored LU is mounted.

LCOPY

LCOPY can copy one disc LU to another disc LU. The source and destination LU may or may not be subchannels at the same disc unit but the source and destination track size (words per track) must be the same.

Track sparing and initialization are not performed on-line. Use FORMT, revision 2001 or later.

The RUN command format for LCOPY is as follows:

```
:RU,LCOPY,source disc LU,destination disc LU
```

where:

```
source disc LU      = LU of the disc subchannel to copy from
destination disc LU = LU of the disc subchannel to copy to (cannot be LU 2 or
                      LU 3).
```

All parameters are required in the runstring. There are no defaults. Messages are always output to your terminal. LU 2 or LU 3 may be source disc LUs but never destination LUs.

LSAVE,USAVE,RESTR,LCOPY (Cont.)

LCOPY

If the source LU has more or fewer tracks than the destination LU, the program prints the decimal track sizes to your terminal.

```
xxxx TRACKS IN DEST LU
yyyy TRACKS IN SOURCE LU
OK TO PROCEED?
```

If you enter Yes, the program copies tracks until is has copied the last track of the source LU or has copied to the last track of the destination LU, whichever LU is smaller.

CAUTION

When restoring a disc LU with FMGR files and directory track(s), be careful if you try to restore a disc LU with less tracks than the source LU. The directory track may not be copied (the disc could not be mounted). Conversely, to restore to a disc LU with more tracks, you must do a complete FMGR MC command (by specifying the actual last track as restored) to recover the valid directory. In the MC command, specify the last track number restored from the source disc LU. This must be done every time that the restored LU is mounted.

ERROR MESSAGES

MESSAGE	MEANING AND ACTION
BAD TRACK AT:	TRACK # CYL HEAD UNIT/ADDR xxxx cccc hhhh uuuu The track is defective or ten tries have been made to read or write without success. Program continues operation. Off-line restore and copy will spare bad tracks automatically. The FORMT utility may also be used to spare bad tracks.
CANNOT RESTORE TO LU2 OR LU3	Attempt to restore LU 2 or LU 3 is not allowed. Program stops.
ILLEGAL DISC LU	LU specified for disc does not belong to a valid disc type or is not in your SST. Re-enter the number.
ILLEGAL MT LU	LU specified for MT does not belong to a valid MT device type or is not specified in your SST. Re-enter the number.
ILLEGAL VERIFY PARAMETER-DEFAULT TO NO VERIFY	The verify parameter is valid, program assumes no verify and continues operation.
MAG TAPE DOWN	The LU for the MT indicates "DOWN" status. Up the EQT for the LU.
MAG TAPE OFF LINE	The mag tape unit is off-line. Re-run the program program when the tape is ready.
MT LU LOCKED	The mag tape LU is locked to another program. Program stops.
MT PARITY ERROR	Program encounters parity error from the mag tape. Program stops.

LSAVE,USAVE,RESTR,LCOPY (Cont.)

ERROR MESSAGES

MESSAGE	MEANING AND ACTION
MT XMIT ERROR	The number of words transferred to or from the MT is zero. Check the EQT, driver and select code and restart the program.
TAPE EOF ILLEGAL	Program reaches end-of-tape on mag tape unexpectedly on a RESTORE operation. Program stops.
TAPE FORMAT ERROR	Header information in the mag tape does not match the expected format (possibly wrong tape is mounted).
TRACK MAP TABLES DO NOT MATCH	For on-line UNIT restore operation, the track map table saved in MT header must match the one in the current system. Program stops.
TRACK SIZES NOT EQUAL	Copy or restore to a disc with different track size (words per track) as the source disc is not allowed. Program stops.
SEEK ERROR	Hardware disc seek check error occurs. Program continues operation. Insure that the track map table matches the disc model and the UNIT/address.
WRITE RING MISSING	The write ring is missing from the mag tape during a SAVE operation. Put the write ring on and re-run the program.
WRITING ON PROTECTED TRACKS	On-line restore program encounters a track that is protected. Program continues operation although tracks will not be restored on the disc (if the format switch is off). This may occur when restoring to an old previously used disc pack where another Op System used to reside.
VERIFY DATA ERROR-TRK X	An error has occurred while verifying on logical track number X.

PSAVE, PRSTR, PCOPY

The on-line utility programs PSAVE, PRSTR, and PCOPY run under RTE-6/VM. Each can be run interactively. PSAVE does not lock the cartridge during the save operation. To restore a disc on-line, dismount all LUs on it. LU 2 and LU 3 cannot be dismounted and will be skipped in restoration. The environment and disc drives supported are the same as for WRITT and READT.

The on-line utilities %PSAVE, %PRSTR, and %PCOPY are loaded interactively as:

```
:RU,LOADR
 /LOADR: FM,CP        !format current page links
 /LOADR: OP,LB        !load program as large background
 /LOADR: SZ,27
 /LOADR: RE,%COMM
 /LOADR: RE,%PSAVE    !load PSAVE, or
 /LOADR: RE,%PRSTR    !load PRSTR, or
 /LOADR: RE,%PCOPY    !load PCOPY
 /LOADR: RE,$ONLIN    !load routine to resolve references needed
                      !only in off-line utility
 /LOADR: SE,$BCKUP    !load system-independent physical backup
                      !library relocatable modules
 /LOADR: SE,$DTCLB    !load CS/80 disc library relocatable modules
 /LOADR: SE,$PLIB     !load Pascal library relocatable modules
 /LOADR: SE           !search system libraries to assure that
                      !$BEGGT is relocated last
 /LOADR: RE,$BEGGT    !this set of routines should be relocated
                      !last, as it can be overlaid for use as
                      !an I/O buffer
 /LOADR: /E
```

The PSPAR utility, scheduled by PRSTR and PCOPY when the VErify option is selected, is loaded as:

```
:RU,LOADR
 /LOADR: FM,CP
 /LOADR: OP,LB
 /LOADR: SZ,20
 /LOADR: RE,%COMM
 /LOADR: RE,%PSPAR
 /LOADR: RE,$ONLIN
 /LOADR: SE,$BCKUP
 /LOADR: SE,$DTCLB
 /LOADR: SE,$PLIB
 /LOADR: /E
```

You can also use the LOADR command files #PSAVE, #PRSTR, #PCOPY, and #PSPAR to load the physical backup utilities into memory and then use the SP command to place them on any disc LU. The program LINK or LOADR can be used to load the utilities.

PSAVE

PSAVE saves one disc LU, a group of disc LUs or an entire disc unit to tape transports or tape cartridges. As an option, you can save an entire disc unit in CS/80 pushbutton-restorable format.

```
[RU,]PSAVE[,input[,srceLU[,destLU[,file#[,opts[,hcpy[,title]]]]]]]
```

where:

input - is the LU (or file) from which the parameter inputs are to be read.

srceLU - is the LU of the disc subchannel to be saved. If the UN (unit save) option is specified, the srce LU parameter is a target to the unit and may be any LU on the disc. If the MU (multiple save) option is specified, this parameter is meaningless and will be ignored. In any other case, this is a required parameter.

PSAVE, PRSTR, PCOPY (Cont'd)

PSAVE

destLU - is the LU of the tape transport or tape cartridge to receive the saved data.

file# - is the integer number to be assigned to the saved file. This parameter specifies the start location on the tape for the save. Before writing, file# - 1 tape files are skipped from the start of the tape. The default is to the current tape position for tape transports or file #1 for CS/80 cartridges.

opts - are any of the following two-character ASCII option codes:

VE Turn on verify option. Track sparing is done only when the verify option is specified.

LU Save is to be an LU save.

UN Save is to be a disc unit save. The source LU parameter can be any LU on the disc unit.

PB Unit save in CS/80 pushbutton-restorable format. The destination LU must be a CS/80 cartridge, and the source LU must be a CS/80 disc. PSPAR must be loaded into memory for this option.

MU Multiple LU saves in one pass. The source LU parameter should be omitted; PSAVE will prompt for the source LUs. All LUs must be from the same class of discs, such as all MAC disc LUs.

hcpy - is the LU of the device on which information about the save is to be printed as a record of the save operation. The default is to your log device.

title - is the title (to a maximum of 40 ASCII characters) that will be placed in the tape header.

If you enter at least one parameter in the runstring, PSAVE defaults all optional parameters and prompts you for all required parameters not included in the runstring.

PRSTR

NOTE

When restoring tapes saved using the ICD/MAC or 7900 utilities, be aware that the USAVE and SAVE UNIT utilities store a disc unit as a single tape file. These unit saves are therefore not selectively restorable; efforts to position the tape beyond the start of the save will fail.

PRSTR restores a single subchannel LU, a group of LUs, an entire disc drive unit, or selected files from a tape transport or tape cartridge previously saved by PSAVE. This utility also can be used to read tapes written in SAVE, LSAVE, and USAVE formats. When the verify option is selected, PRSTR spares the destination disc tracks in a prepass over the disc before data is written. (Sparing is not done for 7900 discs.)

Invoke PRSTR with the runstring:

```
[RU,]PRSTR[,input[,destLU[,srceLU[,file#[,opts[,hcpy]]]]]]
```

where:

input - is the LU (or file) from which the parameter inputs are to be read.

PSAVE, PRSTR, PCOPY (Cont'd)

PRSTR

destLU - is the LU of the disc subchannel on which the data is to be restored. If the UN (unit save) option is specified, the LU is a target and may be any LU on the disc. If the selective restore (SE) option is specified, this parameter must be omitted. In all other cases, the parameter is required.

srceLU - is the LU of the tape transport or CS/80 cartridge from which the save file is to be read.

file# - is the integer number of the file to be read. File# - 1 files will be skipped on the tape before the read begins. Default is to the current tape position for tape transports, or file #1 for CS/80 cartridges.

opts - are any of the following two-character ASCII option codes:

VE Turn on data verify option. PRSTR also spares the destination disc tracks in a prepass over the disc before data is written. PSPAR must be loaded into memory for this option.

DE Do not prompt for verification of tape file header. Do not prompt for OK TO CONTINUE? when disc source and destination sizes do not match. (PRSTR will continue with the restore.)

UN Unit restore. This is the default if the tape is a unit save or a from-to save. (Note that from-to saves performed using !DSKUN must use the UN option to restore the save.)

LU LU restore. This is the default if the tape is an LU or MU save.

SE Selective restore from a unit save, or multiple LU restores in one pass. If this option is selected, the destination LU parameter must be omitted; PSAVE will prompt for the file:LU pairs. Not valid for a unit save in pushbutton-restorable format or a unit save in formats other than those created by PSAVE. All LUs must be of the same disc class.

PB Unit save in CS/80 pushbutton-restorable format. PSPAR must be loaded into memory for this option.

hcpy - is the LU of the device on which information about the restore is to be printed. The default is to your log device.

If you enter at least one parameter in the runstring (beyond the input parameter), PRSTR defaults all of the optional parameters and prompts for the remaining required parameters not included in the runstring.

If the SE option is selected, PRSTR prompts with the message

```
ENTER FILE:LU PAIRS
```

and waits for you to enter the file number and destination LU.

PSAVE, PRSTR, PCOPY (Cont'd)

PCOPY

The utility PCOPY allows you to execute a fast disc-to-disc copy operation. The source and destination disc LUs need not be on the same disc unit, but they must have the same track size. (Note, however, that CS/80 tracks are logical tracks, not physical tracks; thus a CS/80 to CS/80 copy is valid regardless of the physical track size, as long as the logical track sizes are identical.)

Invoke PCOPY with the runstring

```
[RU,]PCOPY[,input],srceLU,destLU[,VE[,hcpy]]
```

where:

input - is the LU (or file from which the parameter inputs are to be read. If input is from a file or a non-interactive device, no other parameters may be specified in the runstring. The default is to be the log device.

srceLU - is the LU of the disc subchannel to be copied.

destLU - is the LU of the disc subchannel to which the data is to be copied.

VE - is the verify option. When this option is selected, PCOPY spares the destination subchannel tracks in a prepass over the disc before data is written. The default is to suppress verify. PSPAR must be loaded into memory for this option.

hcpy - is the LU of the device on which the read or verify errors are logged. The default is to the log device.

WRITT, READT

WRITT and READT operate in the following environments only:

RTE-IVB and RTE-6/VM Operating System

* ICD (Integrated Controller Disc) - HP Models 9895 (flexible disc), 7906H, 7920H and 7925H with driver DVA32.

* MAC (Multiple Access Controller Disc) - HP Models 7905, 7906, 7920 and 7925 with driver DVR32.

* CS/80 Discs - HP Models 7908, 7911, 7912 and 7935 with drivers DVM33/DVN33.

* HP Model 7900 Disc with driver DVR31.

* HP Model 9895 Flexible Disc with driver DVR33.

The utilities can be called both under Session Monitor and in a non-session environment. In a non-session environment, you can operate under control of the Multi-Terminal Monitor (MTM) or direct to RTE via the system console.

Run WRITT by entering:

```
[RU,]WRITT[,sdisc[,MT:lu[,IH[,DC[,VE[,"..."]]]]]]
```

where:

sdisc - is the disc cartridge to be saved. This parameter can be either a negative LU number or a positive CRN number. The defaults are defined below.

The following optional parameters are order-independent. They can be specified in any sequence:

MT:lu - is the LU number of the magnetic tape unit on which the cartridge is to be saved. The default is to LU 8. This parameter also may be given using the LU number only (positive or negative), but then must be the second parameter in the runstring.

IH - inhibits tape rewind. The default is to rewind tape before and after each cartridge restoration.

DC - disables the overlay check. Unless disabled by this command, WRITT checks to see if a previously stored cartridge file will be overlaid by this operation.

VE - verify the mag tape; compare the data on tape with that on disc.

"..." - comment to be appended to tape header and displayed by WRITT during the overlays check; 40 characters maximum.

CAUTION

Do not attempt to replace a cartridge file previously saved on the tape as this can corrupt the remaining files on the tape.

WRITT, READT (Cont'd)

Multiple saves to a single tape should be performed in a series of WRITT operations to save the cartridges sequentially on the tape. If you want to add a cartridge save to an existing tape, use the FMGR CN command to position the tape past the last file. Use the IH parameter to inhibit the tape rewind before and after each save. With the rewind inhibited, you must use the CN command (CN,lu,RW) to rewind the tape after the last save operation.

Run READT by entering:

```
RU,READT[,disc[,MT:lu[,type[,SI:nnn[,IH[,VE[,CO]]]]]]]
```

where:

disc - is the disc cartridge to which the saved FMP cartridge is to be restored. This parameter can be either a negative LU number or a positive CRN number. The defaults are defined below.

MT:lu - is the LU of the magnetic tape unit on which the file is stored. The default is to LU 8. This parameter also may be given using the LU number only (positive or negative).

type - is the type of cartridge to be restored: P for private cartridge, G for group cartridge. (System cartridges can only be restored by the System Manager.) If the type specified differs from that in the tape header, the cartridge type given in the command runstring is assigned. The default is to use the cartridge type specified in the tape header. This parameter is meaningless in a non-session environment.

SI:nnn - is the size (specified in tracks) of the disc to which the magnetic tape contents are to be restored. The default is to the first pool cartridge large enough to accept the saved-cartridge file; the entire cartridge is mounted. This parameter also can be given without the SI designator, using only the decimal number of tracks required.

NOTE

The following optional parameters are order-independent and can be specified in any sequence.

IH - inhibit tape rewind. The default is to rewind tape before and after the disc cartridge restoration.

VE - verify the integrity of the data after the restore operation. The VE and CO options are mutually exclusive; only one may be specified.

CO - perform a word-by-word comparison of the tape file and a previously restored cartridge.

SAVER, READR

These utilities are used to save individual files, especially when going from one system to another. They may be used with all disc drives available to RTE-IVA, RTE-IVB and RTE-6/VM.

System Requirements:

READR and SAVER execute only on RTE-IVA, RTE-IVB and RTE-6/VM Operating Systems. Your system configuration must include either:

7970B/E (9 track) magnetic tape, or

264x terminal with Cartridge Tape Units using driver DVR05 or DVA05.

A library called $RSLIB which contains assembler routines is included with the READR/SAVER package. READR requires a minimum of 21 pages of memory. SAVER requires a minimum of 23 pages of memory.

NOTE

It is not recommended to generate READR and SAVER into an RTE system since there will be duplicate subroutine names created. $RSLIB should not be generated into RTE for the same reason. Use the LOADR SE or LI command for $RSLIB.

Documentation:

READR/SAVER Utility Reference Manual, part no. 92068-90016

READR

The READR program reads files from either magnetic tape or minicartridges and restores them to a disc cartridge. You decide which files are to be read and on what disc cartridge they are to be placed. The files can be verified as they are read. You may want to replace the same files on the disc if, for instance, the files on tape are more recent (i.e., they contain software updates).

When the files on tape were saved, the entire file namr was placed in the directory. Unless you specify otherwise, the files will be restored by READR onto the same disc cartridge and with the same security code from which they were saved. READR provides an option to display the directory.

Load READR:

LOADR commands to on-line load READR:

Dialogue		Comment
:RU,LOADR		
/LOADR:	SZ,28	Override program size requirements.
/LOADR:	OP,LB	Specify large background.
/LOADR:	RE,%READR	Load %READR utility.
/LOADR:	SE,$RSLIB	Search the READR/SAVER utility library.
/LOADR:	EN	

NOTE

For RTE-6/VM, you can use OP,EB and SZ,32 to increase READR size.

Run READR by entering:

RU,READR[,option code[,option code...]]

where the option code is any number of the commands listed below in any order. If you are running from a runstring, READR does not give you the opportunity to correct errrors or change options.

SAVER, READR (Cont'd)

READR Commands:

Command	Explanation	Default Values
AL: :	Restore all files	(NO)
CO	Comment Echo	Echo off.
EC	Echo file positioning	Echo on.
LI:lu	List directory, lu is output device	Log LU.
MT,n	magtape or minicartridge LU	LU 8.
OC,n	cartridge reference number override	File's original CRN as saved
OS,n	security code override	File's original SC.
SE,namr	Masked file name restore	Restore selected files.
TR,namr	Transfer to command file	N/A
TT	Select hardcopy mode	CRT mode.
UP	Update files mode	Update off.
VE	Verify	Verify on.
/A	Abort READR	
/E	Exit option setting mode	
??	List all flags and commands	

Documentation:

READR/SAVER Utility Reference Manual, part no. 92068-90016

SAVER

The SAVER program copies disc files onto either magnetic tape or minicartridge. From the file names you supply, it builds a file-name table in memory. You have the option to sort the directory before it is copied to tape. Then each file is copied onto the tape and verified bit by bit unless you bypass the verification.

SAVER rewinds the tape at the beginning and end of the program and will overwrite any information currently on the tape. Therefore be sure you are using a blank tape or that the contents of the tape can be overwritten. SAVER always begins writing on the beginning of the tape; it cannot skip over files to write to the middle of the tape.

Loading SAVER:

If you are using an RTE system with a revision data code less than 2101, you must assemble and relocate the entry point $FREV for use with the SAVER utility. This entry point is required so that SAVER can properly handle extents with Type 1 file access. At revision date code 2101, this entry point was included within RTE File Manager and will not need to be loaded with SAVER. (Note: READR does not need $FREV.)

SAVER, READR (Cont'd)

SAVER

For example, if your RTE File Manager is revision date code 2040, assemble this module:

```
ASMB,R,L
       NAM $FREV,7
       ENT $FREV
$FREV  DEC 2040          <-- Revision code for RTE/FMGR
       END
```

and SAVER will save all files with extents properly.

Dialogue	Comment
:RU,LOADR	
/LOADR SZ,28	Override program size requirements
/LOADR OP,LB	Specify large background.
/LOADR RE,%SAVER	Load SAVER utility.
/LOADR SE,$RSLIB	Search the READR/SAVER utility library.
/LOADR SE,%$FREV	Search for entry point $FREV.
/LOADR EN	

NOTE

OP,EB and SZ,32 can be used in RTE-6/VM for larger file save capabilities.

Run SAVER by entering:

```
:RU,SAVER[,option code[,option code...]]
```

where the option codes is any number of the commands listed below, in any order. If you are running from a runstring, SAVER does not give you the opportunity to correct errors or change options.

SAVER Commands:

Command	Action	Setting
/A or AB	Abort SAVER immediately	
/E or EN	End search (start saving files)	
CO	Show TR files COmments	F
EC	ECho file search CRs	F
ER,lu	Assign ERror LU ##	F 0
LI	LIst files flag	0
MT,lu	Assign Mag Tape LU ##	8
PU	PUrge files flag	F
SE,namr	SElect files via namr mask	
SO,lu	SOrt the directory	F 0
SS	SuSpend SAVER	
SZ	Display tape SiZe	
T6	Save Type 6 files	
TR,namr	TRansfer to command file	
TT	Terminal type if TTY	F
UN,lu	UNselect ## of files	
VE	VErify	
??	Display SAVER commands & options	

```
Sort options:
0=no sort   1=Name,SC,CRN
2=Last5,CRN 3=CRN,Name
4=CRN,Last5 5=Size,CRN,Name
6=CRn,size  7=SC,CRN,Name

(Last5 means to sort chars
 2-6 and then char 1 of
 each name)

NO or NOT in front of any
command negates or resets
the state of the setting.
```

FC

The file backup utility FC provides a means for copying files between disc cartridges and 800/1600 bpi magnetic tape, either disc-to-disc, disc-to-tape, or tape-to-disc (tape-to-tape copying is not supported). The environment and disc drives supported are RTE-IVB (REV 2301 or higher) or RTE-6/VM (and RTE-XL, RTE-A.1, RTE-A). Files being copied may be given a different name, security code, or cartridge by specifying those fields of the destination namr. When copying from disc, file extents are automatically gathered and copied in ascending order following the main extent. As an option, you can eliminate extents and copy all sections of a file to the main extent. Options also can be selected to purge source disc files after copying, to list or suppress the listing of files copied, to replace duplicate files with the last duplicate copied, or to verify the copy. This verification compares FC-written checksums in addition to tape hardware checksums, which are always used.

```
:RU,FC
 FC.nn:<command>
 FC.nn:<command>
       .
       .
       .
 FC.nn:EX
```

where:

.nn in the utility prompt identifies your FMGR session.

COMMAND SUMMARY FUNCTION

Entering ? as the runstring command causes the command summary to be written to the log device, as

```
------ FC commands ------- commands may be abbreviated to 2 chars ------------
COPY,srce,dest,opts,[file1],[file2],[msc]   copy files
DEFAULT , srce , dest , opts                set defaults for COPY command
GROUP / EG  / AG          begin / end / abort GROUP of COPY command
LL , namr                 set list file/device (dash means log device)
DL , srce , [msc] , opts  list tape directory (srce = -tlu or -tlu{namr})
CL , [-tlu] , options     list local cartridge list or tape cartridge list
CLAL                      list global cartridge list (RTE-IVB/6 only)
LH , -tlu , opts          list tape header file
LC , -tlu , opts          list tape comment file
ECHO [, ON/OFF]           turn ON/OFF cmd echo to list device (default ON)
TITLE , title             set tape title (for subsequent COPYs to tape)
CF , comment-file-namr    set comment file (for subsequent COPYs to tape)
TR , namr                 transfer to cmd file/device (dash means log device)
TR                        return from command file/device COPY commands
EXIT                      exit FC abort group of COPY commands
ABORT                     abort FC (same as EX except if copy group active)
SCRATCH , cartridge       set cartridge that FC will use for scratch files
* comment                 command line starting with * treated as comment
HELP [, key [, lu]]       get help, RTE-IVB/6 only (useful for FMGR errors)
? , <command>             list info about particular command (incl. options)
? , <option>              list info about particular option (all commands)
```

If you enter the ? command together with a command or option (as ?,SCRATCH), FC will respond with further information about the selected command/option.

Before running FC on RTE-IVB, ensure that any tape EQTs to be used are set to the unbuffered state using the system EQ command. If this is not done, FC may give unpredictable results since the status from EXEC writes is undefined, and since the System Available Memory (SAM) resource may be severely depleted by the buffering of large EXEC writes. (Refer to the RTE-IVB Terminal User's Reference Manual for details of the EQ command.)

FC (Cont'd)

PERFORMANCE CONSIDERATIONS

The following guidelines are presented as an aid in further increasing the speed of the file copy operation.

1. Specify source cartridges explicitly if multiple cartridges are contained in the cartridge list. For example, if the cartridge list includes cartridges 10, 20 and 30 and you want to copy from cartridge 30, use a COpy command of the form

   ```
   CO,{A::30,B::30,C::30,D::30,E::30},-8
   ```

   In this way, FC will not have to search cartridges 10 and 20 for the files to be copied. You also could use the DEfault command to specify the cartridge, as

   ```
   DE,::30
   CO,{A,B,C,D,E},-8
   ```

   In the latter command form, be aware that sequences of commands cannot be put in the runstring.

2. Keep file extents collected. The speed of the FC COpy operation is increased if the file man and its extents are adjacent on the source cartridge. You can collect extents (make them adjacent) on all files on a cartridge using a COPY command of the form

   ```
   CO,100,,LDF
   ```

   which copies the contents of cartridge 100 to itself (the destination cartridge defaults to the same cartridge as the source). The L option is needed to ensure that extents created are adjacent. The D option is needed so that the new files (with extents collected) can replace the old files. The F option logs the name of each file copied.

JSAVE, JRSTR

Contributor: Software Service Kit

These programs are cataloged in the HP 1000 Software Service Kit (SSK) which is included as part of the SE Subscription Service. The following documentation is included in this handbook for your convenience. Consult the actual SSK for the most current documentation and software. (A customer normally does not have this program unless an SE gives it to him.)

JSAVE

Description:

JSAVE will save a disc cartridge on to a mag tape with a cartridge header and directory of files in the cartridge. JSAVE will work on the following discs: 7900, 7905, 7906, 7920, 7925 (ICD or MAC discs).

Source Files: &JSAVE

Relocatable Files: %JSAVE (includes %JRPLS, %QUOTE, %CMPWD). Revision 2103 or higher.

Load Instructions:

```
:RU,LOADR,,%JSAVE
```

JSAVE requires a size of 14 pages to load.

Run Instructions:

```
           ┌                  ┐
           │ Disc = x,        │
           │ File = x,        │   Parameters may be in any
           │ Inhibit,         │   order separated by
RU,JSAVE,  │ Last trk = x,    │   commas (,)
           │ Mag Tape = x,    │
           │ Repeat = x,      │
           │ Verify,          │
           │ ". . ."          │
           └                  ┘
```

NOTES:

1. Only the first letter of each option is necessary except for quote strings then both quotes are needed to delimit the string.

2. Equals signs(=) can be replaced with colons(:) if desired.

3. 'RU,JSAVE' with no parameters will cause JSAVE to prompt for all answers. (As it did.)

4. 'RU,JSAVE, . . .' with any parameters will cause JSAVE to use defaults for unspecified parameters. A list of JSAVE parameters and their defaults(if any) are described below.

Disc = x	DEFAULT: Ask operator for +CRN or -LU. i.e., NO default either specify in runstring or let JSAVE ask you for it.
File = x	DEFAULT: x = 0 which tells JSAVE to start at current position. Do not rewind tape on entry to program. (This is only true for the 'batch' mode.)
Inhibit RW	DEFAULT: Rewind Mag Tape OFF-LINE when done. Specifying 'I' in the runstring will inhibit this function when JSAVE terminates.

JSAVE, JRSTR (Cont'd)

Last track = x DEFAULT: last track of the subchannel for the given disc LU. (NOTE: This need only be specified if the cartridge mounted was mounted with other than the last track for that subchannel. In addition, if the cartridge is currently mounted and the last track was not specified JSAVE will use the last track as given in the cartridge list, not the physical last track defined by the subchannel.)

Mag Tape = x DEFAULT: x = 8

Repeat = x DEFAULT: x = 1. 'x' specifies the number of times this disc LU will be saved on consecutive files on the tape.

Verify DEFAULT: Verify NOT performed.

" . . . " DEFAULT: Cartridge, label, time, and date put in header; e.g.:

CR 42 LU042 10:39 AM MON., 9 APR., 1979

NOTE

The default is ALWAYS put on the tape. Comments will be appended to the default. This is true for the interactive mode also.

JSAVE will lock the mag tape logical unit. Also, JVRFY is now a subroutine to JSAVE. The program JVRFY is obsolete.

Special Instructions:

JSAVE uses some of the extended instructions of the MX computer. If you need to run JSAVE on a 2100 or earlier machine, a library of MX instructions (simulated for the 2100) is provided in the source file.

Languages: FTN4

Examples:

```
RU,JSAVE,D=47,F=1,V,"SSK DEVELOPMENT"
```

This would save Disc CRN 47, start at file 1, verify, add 'SSK DEVELOPMENT' to the default header and rewind off-line when done.

```
RU,JSAVE,D:47,I
```

This would save Disc CRN 47, start at the current position of the tape, not do a verify, use the default header, and leave the mag tape positioned between the double EOF after the file just created.

JSAVE, JRSTR (Cont'd)

JRSTR

Description: JRSTR will restore a disc cartridge from a mag tape saved by JSAVE.

Source Files: &JRSTR::T1

Relocatable Files: %JRSTR::T1 (includes %JDCMC, %CMPWD)

Load Instructions:

```
:RU,LOADR,,%JRSTR::T1
```

JRSTR requires a size of 13 pages to load.

Run Instructions:

```
:RU,JRSTR
```

JRSTR will prompt with the following questions:

Mag Tape LU: Enter LU of the mag tape drive.

MAG TAPE FILE: Enter the file position that contains the cartridge data to be restored. Entering 0 terminates JRSTR.

Entering a negative value causes JRSTR to display all of the file headers on the tape.

JRSTR positions the tape to the requested file and displays the header. If it is the desired file, type YES; otherwise, type NO.

Disc LU: Enter disc cartridge LU to restore to.

NOTE

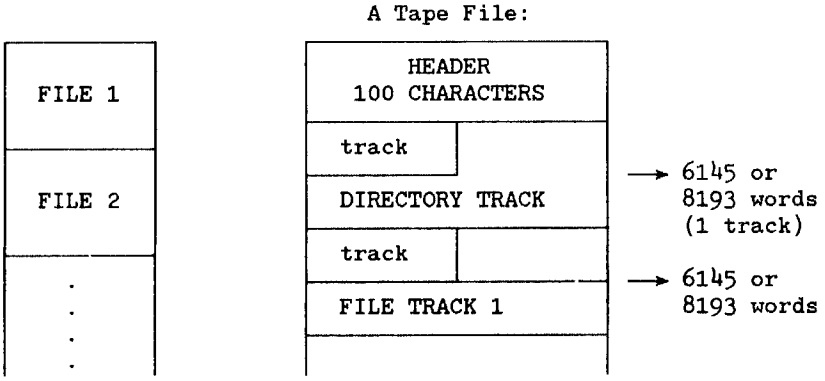
JRSTR will update the cartridge number for RTE-II, III and IV Operating Systems now. If the cartridge number on the JSAVE tape is already mounted, you will be prompted for a new cartridge number.

The following error messages can be returned from the subroutine which does the update:

DCMC ERR	NF	LU not found in cartridge table
	OV	Internal error
	NG	Negative response to CRN prompt
	ZE	Zero response to CRN prompt

Language: FTN4

JRSTR/JSAVE Tape Format:



MFGET

Description:

MFGET will "Get Many Files From a WRITT/JSAVE Tape." It allows you to retrieve any or all files on a WRITT/JSAVE tape. MFGET will not properly handle extended files; i.e., files larger than 16,383 blocks. This program is a Software Service Kit product and it is not normally available to customers.

Scheduling MFGET:

Run MFGET by entering:

```
:RU,MFGET
```

and answer the prompts for the mag tape LU and the file number of the cartridge you previously saved on tape (the first cartridge is 1). MFGET then reads the tape header, prints it, and asks if this is the one. Answer NO to seek to the next cartridge, YES to restore from this cartridge, or EX to stop.

MFGET appends the files from tape to the specified disc cartridge. If you're going to restore lots of files, be sure you've got enough room on the disc.

MFGET reads the tape and stores the directory recorded on the tape on scratch disc tracks. You can add files to a disc with the ADD command, which is usually done after marking some entries so they won't be taken.

This latest version of MFGET handles tapes from cartridges with up to 128 sectors per track, even when the destination disc has a smaller number of sectors per track (as small as 64). MFGET detects that the tape record is longer than the scratch tracks it gets from the current system and allocate an extra set of scratch tracks, dividing the tape record as necessary to fit. It must fit entirely within those two tracks, however, or you will lose data. It can handle the actual tape records from file tracks up to 128 sectors/trk. In actual practice, data is seldom lost.

MFGET commands:

PU,name[,extent]	Permanently removes the file named from the directory (and all extents). If an extent is given, then this extent and all higher-numbered ones are permanently removed from the directory. Default is extent = 0.
RN,oldname,newname	Changes the name of the file to <newname>. When the file is added to the existing file system, it will have the new name (does not change the status of the "don't take" flag, see below).
DE,name[,extent]	Permanently removes all files in the directory from the beginning until, but not including, the file named.
DL[,lu]	Print a directory listing of the current directory on the LU specified. Default is your terminal. Note that the permanently removed entries do not appear.
MA,name or MK,name	Mark the file names (and all extents) as "don't take" (i.e., will not be added to the file system). Note that this is not permanent, because this flag may be cleared (see the use of the minus (-) character below).
CL,name	Clear the "don't take" flag for the file named. Note that in the directory listings, the characters DT appear on the right of each file for which the "don't take" flag is set.

MFGET (Cont'd)

SK,n	Set new sector skipping value. On 7900 discs, the optimum value is 14, which is the value used by the FMP. Unless you know for sure that a different value was used for the cartridge saved on tape, don't use this command!
??	Prints help information for the user.
ADD[,sc[,cr]]	Add all files to the existing file system not excluded by the PU, DE, MA or MK commands. If <sc> is specified, then all files will be added using this security code. Otherwise, the security code of the original file will be used. If <cr> is specified, all files will be added on that disc. Otherwise, they will be added to the first disc found which has enough space. The new file will not have extents, regardless of whether the file on tape did or not. As each file is added, its name, security code, crn and size are printed on the operator console (the attempt to create the file occurs after the name is printed, which is helpful to know if errors are detected).
EX END /E	Exit.

Using the Minus Character (-):

A dash (-) in one or more positions of a file name will match any character in the same position as in the FMGR DL command.

For example:

MA,------	Marks all files "don't take". The flags for individual files can be cleared by name later.
PU,&-----	Purge all files beginning with an ampersand (&). Usually program source files begin with this character, so this command keeps you from getting sources put onto the disc.
DE,&-----	Purges all files up to but not including the first file beginning with ampersand.

EXAMPLES:

1. You have a disc which has source and relocatable files. You wish to add all but a few of the relocatables and none of the sources.

```
:RU,MFGET

 COMMAND?
 PU,&-----      Don't give me any files beginning with &.
 PU,%file1      Get rid of relocatables I don't want.
 PU,%file2              .
 PU,%file3              .
 PU,%fileN              .
 ADD,,-13       Add what's left to my disc LU 13.
 END            Exit.
```

2. You have a disc with only a few files you want to add.

```
:RU,MFGET

 COMMAND?
 MK,------      Mark all files "don't take".
 CL,%file1      Clear the flag for file1, because we want it.
 CL,%file2      Clear the flags for the other files we want also.
 CL,%filen              .
 ADD,LW,YY      Add file2 and filen to CRN YY.  All files will
                have security code LW.
 /E             Exit.
```

WHZAT STATUS UTILITY

Running WHZAT:

Invoke WHZAT, either in session mode or system mode, with the runstring:

```
[RU,]WH[ZAT][,lu[,option]]
```

Options for RTE-6/VM:

AL all scheduled and suspended programs.

SM only scheduled ans suspended state 3 programs having a father-son relationship.

PA all partitions in use.

PL all active programs (added to RTE-6/VM around REV 2213).

NOTE

RTE-III and RTE-IV WHZAT has one option: WHZAT,,1 (the partition list).

Program States:

A program can exist in one of seven states relative to the RTE-6/VM Operating System environment:

0 Dormant - the program is not scheduled to run.

1 Scheduled - the program is in the schedule list.

2 I/O suspended - the system is currently performing an I/O operation requested by the program.

3 General wait - the program has requested services or resources that are temporarily unavailable, or has scheduled a second program, or a device is down.

4 Memory suspended - the program has requested an operation for which sufficient System Available Memory (SAM) is not currently available.

5 Disc suspended - the program has requested the use of more disc space than is currently available.

6 Operator/program suspended - the program is awaiting further operator action or a program EXEC call before it can continue.

WHZAT Output Codes, AI/SM Options:

PRGRM	Program name; ** = father program (precedes name)
T	Program type; E = EMA program
PRIOR	Program priority (0-32767); B = batch
PT	Partition number (1-64); 0 = memory-resident A = assigned to partition
SZ	Page size of program; ** = memory-resident
DO	Dormant (state 0)
SC	Scheduled (state 1)
IO	I/O suspended (state 2)
WT	General wait state (state 3)
ME	Memory suspended (state 4)
DS	Disc suspended (state 5)
OP	Operator suspended (state 6)
PRG CNTR	Program counter, in octal. Value is listed for all programs regardless of state; SWP = program is swapped out
NEXT TIME	Time at which program will next execute; 000000 = program not yet initiated

WHZAT STATUS UTILITY (Cont'd)

WHZAT Output Codes, PA Option:

PTN#	Partition number (1-64); M = Mother C = Subpartition, Chain mode S = Subpartition available R = Reserved
SIZE	Program page size
PAGES	Physical pages where program resides
BG/RT	Program run type; BG = Background RT = Real time
SHR/LBL	Shareable EMA paritition and Label; SH = Shareable ** = Mother with shareable subpartition * = Subpartition of mother
ACT	Number of current users of shareable EMA
L	Partition lock status; L = Locked
PRGRM	Program name

In the output, if a mother partition is currently being used for sharing EMA, the PRGRM entry will show **EMA** as the name of the program occupying the mother partition and subpartitions.

WHZAT Output Codes, PL Option (late RTE-6/VM only *):

NAME	Program name
TY	Program type (see following discussion)
PRIOR	Program priority, 1-32767
LADDR	Low memory address
HADDR	High memory address
LOBP	Low base page
HIBP	High base page
SZ	Program size, in pages
EMA	Extended Memory Area size
MSEG	Memory Segment size, in pages
LBL	Shareable EMA partition label, if used
PTN	Partition number, if assigned to program
TM	Load type; TE = Temporary PE = Permanent = memory-resident
COM	System common type; SC = System common RC = Reverse common NC = No common
LU	Disc LU on which program is stored
S-ID	Session identifier if program loaded under session monitor.

* For RTE-IVA/B and early RTE-6/VM use RU,LOADR,,,,LI.

The status output summary identifies the number of free 33-word program ID segments (long), the number of free 9-word program ID segments (short) available in the system, and the number of 3-word ID extensions available.

!DSKUP

OFF-LINE BACKUP UTILITY FOR 7900, 7905/06/20/25 DISCS USING
THE 13037B/C CONTROLLER -- PROGRAM !DSKUP

STARTING THE OFF-LINE UTILITY

To run the off-line utility (part no. 92067-16304) perform the following steps:

1. With the appropriate loader ROM, load the program !DSKUP from the input device.

2. The utility is preconfigured for mag tape (MT), and consoles using DVR00 as follows:

DEVICE	SELECT CODE (Octal)
console	15
MT	23

   Set the switch register to 0 if you want this configuration. If you want to reconfigure these I/O select codes, set the switch register as follows:

bits 0-5	select code of console
bits 6-15	clear

   Disc select codes are not preconfigured. Disc (and mag tape if switch register is not zero) are configured interactively with the program.

3. Set P-Register to 2.

4. Press PRESET and RUN.

After you perform these steps, the program uses the system console to send messages and receive replies. Typing ?? in response to any prompt causes the utility to print all the valid responses to the question. (The valid responses will also be printed if you enter an invalid reply.) When the utility starts running, it prints a heading "DISC BACKUP UTILITY" and asks which task you want performed. Type SA (for save), RE (for restore), or CO (for copy).

NOTE

If incorrect data is typed when responding to a question (that does not cause the !DSKUP program to issue an error message) and carriage return is pressed, the utility program must be reloaded (i.e., go back to step 1). Once the mag tape is selected, another mag tape may not be specified without reloading. This utility cannot be restarted.

SA - SAVE

NOTE

Do not perform FROM-TO saves unless you can guarantee the data will be restored to an error free disc! Track sparing can never be done with a tape containing FROM-TO data. Also, FROM-TO saves will give an error message when trying to save an activated spare track. The only possible way around this error is to save only the LU portion. This requires an exact description of the LU as stored on the disc.

!DSKUP (Cont.)

SA - SAVE:

For FROM-TO saves you must answer the following questions:

RTE OR DOS DISC? (discs other than 7900, disc for other than DOS enter RT)
Enter RT or DO.

FROM TRACK #? (7900 only)
Enter a number between 0 and 202 specifying where the transfer begins.

FROM CYLINDER #? (discs other than 7900)
Enter appropriate values which will specify where the transfer is to begin.

OF TRACKS?
Indicate the number of tracks to be saved. For 7900 discs it must be between 1 and 203 minus FROM TRACK #. For DOS 7905 it must be between 1 and 200.

PLATTER #? (7900 only)
Indicate which platter is to be saved: 0 for fixed platter or 1 for removable platter.

OF SURFACES? (discs other than 7900)
Type the number of surfaces to be saved.

STARTING HEAD #? (disc other than 7900)
Enter the head number where save begins.

For UNIT saves (the RECOMMENDED method), you must answer the following questions:

RTE OR DOS DISC? (discs other than 7900, disc for other than DOS enter RT)
Enter RT or DO.

WANT TRACK SPARING? (RTE discs other than 7900)
Reply YES or NO. If you reply yes to track sparing, the program needs track map information for each subchannel. You must have the system generation listing (or answer file) to known how the LUs are laid out. NOTE!! all of this is handled automatically with an on-line save. Perform off-line saves only when system cannot run and data must be salvaged.

OF SUBCHNLS TO BE COPIED? (7905 DOS discs only)
Indicate the number of subchannels to be saved (1 through 3). The save operation starts with subchannel 0.

You next indicate whether you want a large buffer and (if there is enough memory) if you want data to be verified. The utility asks for the file number (1 to 8) on the mag tape where you want the data to be recorded. The FILE ID is a 72 character field written into the file's header record.

At this point the actual transfer of data begins. The switch register contains the relative track number being saved. When the transfer (and verification) is done, the utility prints TASK COMPLETED.

When the task has been completed or aborted, the program asks for another task. (You cannot reconfigure mag tape and console select codes.)

!DSKUP (Cont.)

RE - RESTORE

The exact questions depend upon the type of restore and type of disc. If the switch register is not zero, the program asks for the mag tape select code. (Note mag tape select code cannot be changed without reloading.) Reply with an octal value between 10 and 77. For the mag tape file number, type a number from 1 to 8 indicating which file contains the data to be restored. The utility prints the identification information and the tape number (which should be 1) from the files header record. If this is not the tape you want, do not answer YES to the OK? question. Instead, answer NO, mount a new tape, restart the utility by entering GO, and answer the questions again, beginning with MT FILE #?. When you get the right file mounted, the program asks for the destination disc channel number. Input an octal number between 10 and 77. The destination disc drive can be between 0 and 3 for 7900 discs or between 0 and 7 for 7905/06/20/25 discs. (The disc type is read from the header record.)

If the restore is FROM-TO (the type of restore is read from the header record), the program asks these questions.

TO TRACK #? (7900 only)
Enter a number between 0 and 202 specifying where the transfer begins.

TO CYLINDER #? (7905/06/20/25 discs with 13037B/C controller)
Specify where the transfer begins.

PLATTER #? (7900 only)
Indicate which platter is to be restored. 0 for fixed platter or 1 for removable platter.

OF SURFACES? (7905/06/20/ 25 with 13037B/C controller)
Type the number of surfaces to be restored.

STARTING HEAD #? (7905/06/20/25 with 13037B/C controller)
Enter the head number where restore begins.

You can have the data verified by answering VERIFY? with YES.

NOTE

The FROM-TO parameters used to save the original tape ARE NOT in the header. Thus, if it is not recorded on paper somewhere, there is no way to determine how to restore the tape. If the data is restored to the wrong head or wrong number of surfaces, the results are unpredictable. This is why a FROM-TO save is not recommended.

After the dialogue is complete, the data transfer operation begins. The switch register contains the relative track number being restored.

If the data was saved on-line or off-line with track sparing, only the number of the disc, and the verify question are asked. No other information is needed.

If the end-of-tape occurs during the restore, the program prints the message EOT REACHED, MOUNT NEXT TAPE. Mount the next tape (tape number 2) and restart the utility by typing GO followed by a carriage return. (If tape 2 is read to the end, mount tape 3, etc.)

!DSKUP (Cont.)

CO - COPY

The exact questions depend upon the type of copy and the type of disc. The source disc select code must be an octal number between 10 and 77. The source disc driver number is between 0 and 3 for 7900 discs or between 0 and 7 for 7905/06/20/25 discs. The type of copy is FR of FROM-TO and UN for UNIT.

For a FROM-TO copy (to be used only for platter-to-platter copies), you must answer the following questions.

RTE OR DOS DISC (7905/06/20/ 25 with 13037B/C controller)
Enter RT or DO

FROM TRACK#? (7900 only)
Enter a number between 0 and 202 specifying where the transfer begins.

FROM CYLINDER #? (7905/06/20/25 discs with 13037B/C controller)
Enter appropriate values which will specify where the transfer is to begin.

OF TRACKS?
Indicate the number of tracks to be copied. For 7900 discs it must be between 1 and 203 minus FROM TRACK #. For DOS 7905 it must be between 1 and 200.

PLATTER #? (7900 only)
Indicate which platter is to be copied: 0 for fixed platter or 1 for removable platter.

OF SURFACES? (7905/06/20/25 discs with 13037B/C controller)
Type the number of surfaces to be copied.

STARTING HEAD #? (7905/06/20/25 discs with 13037B/C controller)
Enter the head number where copy begins.

For a UNIT copy you must answer these questions:

RTE OR DOS DISC? (7905/06/20/25 discs with 13037B controller)
Enter RT or DO.

WANT TRACK SPARING? (7905/06/20/25 RTE discs with 13037B/C controller)
Reply YES or NO. If you reply yes to track sparing, the program needs track map information for each subchannel. See the sysgen listing (or answer file) for LU layout on disc. Enter four numbers separated by commas for each subchannel to indicate number of tracks, cylinder at which the subchannel begins, head number of the first track in the subchannel, and the number of surfaces the subchannel contains. Enter /E to terminate the subchannel prompts. This must match the system generation track map.

OF SUBCHNLS TO BE COPIED? (7905 DOS discs only)
Indicate the number of subchannels to be copied (1, 2, or 3). The copy operation starts with subchannel 0.

You next indicate whether you want a large buffer (answer yes if you have more than 30K words), and if you want the data to be verified. It is highly recommended that data is always verified.

At this point the actual transfer of data begins. The switch register contains the relative track number being copied. When the transfer (and verification) is done, the utility prints TASK COMPLETED.

When the task has been completed or aborted, the program asks for another task. (You cannot reconfigure the mag tape and console select code.)

!DSKUP (Cont.)

OFF-LINE ERROR MESSAGES

MESSAGE	MEANING AND ACTION
MT NOT READY	The mag tape is either off-line or busy. When it is ready, restart the utility by typing GO.
NO WRITE RING, WRITE ENABLE MT	The write ring is missing from the mag tape during a save operation. Put the write ring on and restart the utility by typing GO.
FILE NOT FOUND	The specified file number is greater than the number of files on the mag tape. Mount another tape, if necessary, and restart the utility by typing GO. Specify the correct file number.
EOT REACHED, MOUNT NEXT TAPE	The end of the mag tape has been detected. Mount the next tape and restart the utility by typing GO.
WARNING-SUBCHNLS ON SOURCE UNIT OVERLAP	7905/06/20/25 discs only. The subchannels defined in the track map table for the source unit overlap. The utility assumes the number of spare tracks for the subchannel is 0. This is usually an operator error. If suspect, stop and reload the utility of check track map validity.
IMPROPERLY DEFINED SUBCHNL	7905/06/20/25 discs only.The specified subchannel is defined such that the starting head number plus the number of surfaces is greater than nine. The utility is aborted.
READY DISC	The disc driver is not ready. Restart the utility by typing GO when the disc is ready.
TURN ON DISC PROTECT	The track is protected and the write protect switch is on. Turn off the disc protect switch and restart the utility.
TURN ON FORMAT SWITCH	The utility is formatting the disc, but the format switch is off. Turn it on and restart the utility. (Format switch allows defective, spare, and protect bits to be set.)
LAST TRACK TOO LARGE	7900 discs only. The number of tracks given in response to FROM TRACK # for FROM-TO save or copy is greater than 202. Re-enter the number of tracks.
BAD TRACK AT loc	Ten tries have been made to read or write on the specified track without success. The location, loc, is printed.
SPARED TO loc*	A bad track has been spared to the indicated track location (loc).
CYLINDER COMPARE ERROR AT loc*	7905/06/20/25 discs only. Ten tries have been made to recalibrate the disc. The program is aborted.

!DSKUP (Cont.)

OFF-LINE ERROR MESSAGES

MESSAGE	MEANING AND ACTION
ILLEGAL SPARE AT loc*	7905/06/20/25 discs only. During a read or write without track sparing, an active spare was found at destination. The source track has no where to go. If this is OK, type YES and the source track is skipped. Otherwise the program aborts.
VERIFY ERROR AT loc*	The verify operation was unsuccessful at specified location. The utility continues.
OUT OF SPARE TRACKS FOR SUBCHNL	7905/06/20/25 discs only. All spare tracks have been used up. The utility is aborted.
UNRECOVERABLE DISC ERROR-EOC OR SEEK CHECK	An end of cylinder or seek check error has occurred because the track map information is incorrect. Also occurred on early versions when copying 7920 discs using FROM-TO copies. Use the most recent version !DSKUP.
WARNING-TRACK AT FOLLOWING LOC WAS NOT SAVED SUCCESSFULLY	Restore only. The track about to be restored was not saved successfully. This was noted on the mag tape so the user could continue anyway. The utility continues.
WARNING-MEM SIZE TOO SMALL FOR VERIFY W/6144 WORD BUF	The memory size is not large enough to hold two 6144 word buffers for a verify. If you want to verify your data, do not request the 6144 word buffer.
I/O ERR PE EQT #2	A parity error occurred on the mag tape. The utility must be reloaded. (Cannot be restarted.)
I/O ERR NR EQT #2	The mag tape drive is not ready. The utility must be reloaded. (Cannot be restarted.)

* The format of the track location (loc) depends on the type of disc. For 7900 discs, the location is printed in the form:

```
TRACK # ttt PLATTER # PP, UNIT# u
```

For 7905/06/20/25 discs the location is printed in the form:

```
SBCHNL# ss, TRACK# tt
CYL# ccc, HEAD# h, UNIT# u
```

The first line is not printed during UNIT transfers without track sparing or FROM-TO transfers (the track map table has not been defined).

!DISK

Off-Line disc backup utility for 7905/0620/25 MAC DISCS using 13037B/C controllers and 7906H/20H/25H/9895 discs using 12821A disc interfaces. Program !DISK.

LOADING THE OFF-LINE UTILITY !DISK

The off-line utility program is a type 1 file and can be stored on mag tape, paper tape, or mini-cartridge. It consists of an RTE-M operating system, and I/O configuration program, and the program DISK.

1. Load the program using the appropriate loader ROM.

2. The utility is preconfigured for a mag tape and DVR05 console as follows:

DEVICE	SELECT CODE (OCTAL)
System Console	14
Mag Tape	16
Time Base Generator	10

   If you want this configuration, set the S-Register to 0. Otherwise you can reconfigure these select codes by setting the S-Register as follows:

   bits 0-5 console select code (DVR05 or DVR00)
   bits 6-11 mag tape select code
   bits 12-15 Time Base Generator select code (RTE-M requirement)

   Select codes for the system console and TBG must be defined by this point. The off-line utility itself does not allow LU 1 (system console) nor the TBG to be reconfigured.

3. Set P-Register to 2.

4. Press PRESET and RUN.

After the above steps have been correctly executed, the system console will be used to send messages and receive replies. The utility now starts by asking you to reconfigure the drivers.

After the utility has been loaded and started, it prints a header (e.g. DISK BACKUP UTILITY REV 2001 790830) and displays the current I/O configuration. The following drivers are preconfigured in the utility:

LU	DRIVER	SELECT CODE
1	DVR00 or DVR00	14 (console)
4	DVA32	13 (12821A ICD Interface Card)
5	DVR32	11 (13037B/C MAC Disc Controller Card)
8	DVR23	16 (Magnetic Tape Interface Card)

DISK asks you to reconfigure the select codes for DVR32 and DVA32:

   ENTER SELECT CODE FOR DVR32, DVA32:

Enter one of the following answers:

1. DVR32 select code and DVA32 select code separated by a comma to change the drivers select codes. A zero value does not change the select code.

2. /E, EN, or EX and carriage RETURN if you do not wish to change these select codes.

!DISK

LOADING THE OFF-LINE UTILITY !DISK

EXAMPLES:

```
21,25   change MAC card to SC21 and the ICD card to SC25.
21,0    the MAC card is at SC21 and the ICD card SC is not changed.
0,25    the MAC card SC is not changed and the ICD card is at SC25.
```

After specifying the select codes, DISK prompts you with:

```
TASK?
```

which you answer with one of the off-line utility tasks.

OFF-LINE UTILITY TASKS

The following is a list of tasks you can perform:

```
IO      List current I/O reconfiguration and ask for reconfiguration.
RE      Restore mag tape file to disc LU or subchannel.
CO      Copy one disc subchannel to another disc subchannel.
RW      Rewind mag tape.
FF[,n]  Forward space mag tape n files, default of n=1.
BF[,n]  Backward space mag tape n files, default of n=1.
```

NOTE

All saves, restores, and copies of the 9895 flexible disc should be done with the on-line utilities. Since the off-line utility does not do formatting of the flexible discs, the off-line utility cannot be used with the 9895.

The table below lists the allowable off-line data transfers.

DESTINATION / SOURCE	7905 7906(H) 7920(H)	7925(H)	9895*	TAPE
7905 7906(H) 7920(H)	CO	N/A	N/A	N/A
7925(H)	N/A	CO	N/A	N/A
9895	N/A	N/A	N/A	N/A
TAPE	RE	RE	N/A	N/A

N/A Not Allowed
* 9895 Flexible Disc is used on-line only.

IDISK (Cont.)

IO - I/O CONFIGURATION

After entering the IO command in response to TASK?, the utility prints the current I/O configuration and asks to be reconfigured.

LU	EQT	S.CHN	S.C.	DRIVER
1	1	1	14	DVR00 or DVR05 CONSOLE
4	4	0	13	DVA32 ICD DISC
5	2	0	11	DVR32 13037B/C MAC DISC
8	7	0	16	DVR23 MAGNETIC TAPE

The utility will automatically reconfigure LU 1 to the appropriate EQT and driver according to the I/O card.

The utility then asks you to reconfigure any of the devices listed:

```
LU,NEW S.C.?
```

If you want to change the configuraiton, enter the LU, followed by the octal select code, separated by a comma.

NOTE

LU 1 (console) cannot be reconfigured by this command. You must set it in the S-Register on boot-up. The program can be restarted by setting the P-Register to 2 and re-setting the S-Register as necessary.

To leave the configuration unchanged or to exit from this task, enter /E, EN, or EX and RETURN.

RE - RESTORE

The RE command restores an LSAVE or UNSAVE tape file to disc. The RE command has the following format:

```
RE,map source,model
```

where:

map source specifies where the track map information is to be found:

DE - Restore the tape file according to the track map information stored in the tape header. The header will be printed but the user cannot OK the header before the restore is performed.

TM - Print the header and track map information and ask the user for a new track map table definiton (see below). You CANNOT use this option with a USAVE tape file, since it must be restored exactly as saved.

If no option is given, the utility will print the tape header and ask if it is OK? to proceed. If YES, the restore will be done according to the track map information in the tape header.

model is the type of disc being restored to. This value is ignored if map source = TM. Enter one of the following values:

A - Restore tape file to a MAC disc according to the tape header.

H - Restore tape file to an ICD disc according to the tape header.

!DISK (Cont.)

RE - RESTORE

To define new track map information (map source = TM), you are given the following message:

```
ENTER MODEL, #TRACKS,1ST CYL,HEAD,#SURF,UNIT,#SPARES FOR SUBCHNL 00?
```

Enter values separated by commas in the same format as the utility message to define the disc subchannels starting with subchannel 00. Terminate the track map input with a /E, EN, or EX. This technique is only used when a new system needs the tracks rearranged for a new LU. Be careful with this option - it must match the operating system's track map or the LU cannot be mounted.

When the map source parameter is defaulted, the utility prints the header and asks to proceed:

```
OK?
```

Enter "YES" to perform the restore.
Enter "NO" to space forward the tape on file. The utility will then print the next header and ask if it is OK? to proceed.
Enter /E, EN, or EX to exit restore and get the TASK? again.

CO - COPY

The CO command allows you to copy one disc subchannel to another disc subchannel according to the information you enter. The format is as follows with no parameters:

```
CO
```

After typing the command, the program will ask you to define the source subchannel and the destination subchannel definition as shown below:

```
ENTER MODEL, #TRKS,1ST CYL,HEAD,#SURF,UNIT,#SPARES FOR SOURCE SUBCH?
```

Enter the appropriate value separated by commas, in the same format as the message.

The program then asks the same question for DESTINATION SUBCHANNEL. Enter /E, EN, or EX to terminate the copy operation and TASK? is asked again.

RE-STARTING THE OFF-LINE UTILITY PROGRAM !DISK

If you mistakenly perform a RESTR or COPY operation to a wrong disc interface select code, the program DISK will be I/O suspended. You may restart the program by typing the following:

```
* OF,DISK     Put the program in a dormant state
* OF,DISK,1   Abort the program
* RU,DISK     Run the program again
```

You are not advised to use the OF,DISK,1 in any other cases, since it could leave the disc partially copied.

!DISK (Cont.)

OFF-LINE ERROR MESSAGES

MESSAGE	MEANING AND ACTION
BAD SPARE AT: TRACK #xxxx	CYL ccc HEAD hhh UNIT/ADDR uuu The spare track is defective, program will ignore this spare track and use the next one in the pool.
BAD TRACK AT: TRACK #xxx	CYL ccc HEAD hhh UNIT/ADDR uuu The track is defective or ten tries have been made to read or write without success. If the track is marked spare and in the source subchannel, this message will also be printed.
DRIVE NOT READY - READY DISC AND ENTER "GO" TO CONTINUE	Ensure that the select code and disc unit no. are correct. If you do not wish to continue, enter /E, EX, or EN to stop and type *RU,DISK to re-start.
FORWARD/BACKWARD N FILES: N = XX	The utility program attempts to forward or backward space N number files. If the tape is at load point, the BF command will have no effect on the tape.
HEAD NO. OUT OF RANGE	The head number specified during a CO command or TM option is out of range for the disc model.
INVALID SEL.CODE	The select code specified for DVA32 or DVR32 is less than 0 or not an octal number.
MT. PARITY ERROR	Parity error detected on the mag tape. Probably caused by positioning the tape in the wrong file.
OUT OF SPARE TRACKS FOR THIS LU	Ensure that you have enough spare tracks in the subchannel. Any bad tracks occurring after this message will not be spared. The utility continues operation. Additional spare tracks will usually require a new system generation. Check for a hardware problem when a lot of spares are needed.
SEEK ERROR	Hardware disc seek error occurs. Program continues operation. Probably caused by restoring or copying to a wrong disc (e.g. 7906 to 7925).
SEL.CODE >77	The select code specified for DVR32 or DVA32 is greater than 77 octal.
TAPE EOF ILLEGAL	Program reaches end of file of mag tape unexpectedly. Program returns to TASK? mode. The tape was improperly saved.
TAPE FORMAT ERROR	Header information in the mag tape is incorrect (wrong tape mounted).
TRACK SIZES NOT EQUAL	Copy or restore a disc with different track size (words per track) is not allowed. Program returns to TASK? mode.
TURN DISC PROTECT SWITCH OFF FOR UNIT/ADDRESS xxx TYPE "GO" TO CONTINUE	Check the disc "READ ONLY" switch. If you do not wish to continue, enter /E, EX, or EN to stop and type *RU,DISK to restart.

!DISK (Cont.)

OFF-LINE ERROR MESSAGES (Cont.)

MESSAGE	MEANING AND ACTION
TURN FORMAT SWITCH OFF FOR UNIT/ADDRESS xxx TYPE "GO" TO CONTINUE	Check the format switch of the disc. If you do not wish to continue, enter /E, EX, or EN to stop and type *RU,DISK to restart.
UNIT # MUST BE FROM 0-7	Ensure that you enter the correct disc unit number.
# OF TRKS MUST BE FROM 1 to xxxx	Ensure the number of tracks for the disc model is correct.

BCKOF

The environment and disc drives supported by BCKOF are the same as for WRITT and READT. The program may be supplied as follows:

A. Three cartridge tapes, where:

1. !BCK01, contains the memory-based (off-line) operating system, reconfigurator, and the startup program BCKOF;

2. !BCK02, contains the off-line utilities FORMT and PSPAR that are scheduled for execution in restore or copy operations where the VErify option has been selected, or in restore operations where the pushbutton option (PB) has been selected;

3. !BCK03, contains the off-line PRSTR, PCOPY, and PSAVE utilities.

   To create another copy of the Off-Line Physical Backup Utilities, enter the command

   ```
   TR,*BCKCT
   ```

   from your RTE-6/VM Primary System and follow the directions given in the system response to the command.

B. One magnetic tape reel that contains all of the files !BCK01, !BCK02, !BCK03, together with a cartridge tape containing !MTLDR.

   If you want to create your own copy of the off-line physical backup utilities on magnetic tape, use the transfer file *BCKMT supplied with the RTE-6/VM Primary System. Mount and load a magnetic tape and then enter the command

   ```
   TR,*BCKMT,<mt>
   ```

   where <mt> is the LU of your magnetic tape device.

   To create your own copy of the cartridge tape !MTLDR, insert a cartridge tape in the left CTU drive of a 264x type terminal (LU 4) and enter the command

   ```
   ST,!MTLDR,4,BA
   ```

   from your RTE-6/VM Primary system. The file !MTLDR will be copied to your cassette.

Loading BCKOF From Cartridge Tape:

Place the cassette labeled !BCK01 in the left CTU of your 264x terminal (LU 4) and load the memory-based operating system as follows:

HALT the computer.

Select and CLEAR the S-Register, then
set bits 15-14 to the CTU Loadr ROM location.
set bits 11-6 to the 264x terminal select code.
set bit 5 (to indicate a slow boot is desired).

Press STORE, PRESET, IBL, then PRESET again.

Press RUN. A HLT 77 should occur (102077 octal displayed).

BCKOF (Cont'd)

Loading BCKOF From Mag Tape:

Procedure One: Loading Utilities WITHOUT a Magnetic Tape Loader ROM.

1. Place a cassette tape containing !MTLDR in the left CTU of your 264x terminal and load !MTLDR into memory as follows:

   HALT the computer.

   Select and CLEAR the S-Register, then
   set bits 15-14 to the location of the Cassette Loader ROM.
   set bits 11-6 to the 264x terminal select code.

   Press STORE, PRESET, IBL, then PRESET again.

   Press RUN. A HLT 77 should occur (102077 octal displayed).

2. Mount and place the Off-Line Backup Utility tape on-line.

3. Load the memory-based operating system as follows:

   Select and CLEAR the P-Register, then
   set bit 1 (the P-Register now contains 2 octal).

   Press STORE.

   Select and CLEAR the S-Register, then
   set bits 11-6 to the select code for the magnetic tape unit.

   Press STORE.

   Press RUN. A HLT 77 should occur (102077 octal displayed).

4. Load the reconfigurator and startup program into memory.

Procedure Two: Loading Utilities Using the Magnetic Tape Loader ROM. (Installed in the processor).

1. Mount and place the Off-Line Backup Utility Tape on-line.

2. Load the memory-based operating system as follows:

   HALT the computer.

   Select and CLEAR the S-Register, then
   set bits 15-14 to the location of the Magnetic Tape Loader ROM
   (12992D or P/Ns 1816-0962 or 12992-80006).
   set bits 11-6 to the magnetic tape unit select code.
   set bit 5 (to indicate a slow boot is desired).
   Press STORE, PRESET, IBL, then PRESET again.
   Press RUN. A HLT 77 should occur (102077 octal displayed).

3. Load the reconfigurator and startup program into memory, as described in the following section.

BCKOF (Cont'd)

RTE-6/VM PBU I/O RECONFIGURATOR

Loading the PBU I/O Reconfigurator:

1. Select and CLEAR the P-Register, then set bit 1.

2. Press STORE.

3. Select and CLEAR the S-Register, then:
   set bit 15 (reconfigure bit).
   set bits 11-6 to select code of the H-Series disc (ICD) to be used, or otherwise to 0.
   set bits 5-0 to the system console select code.

4. Press STORE.

5. Press RUN.

After loading the programs the reconfigurator will automatically start executing with display and input at your system console.

PBU I/O Reconfiguration:

The initial I/O configuration (known to !BCKOF) now must be changed to the system configuration.

The initial !BCKOF configuration is shown below (automatic reconfiguration occurring when you last set the S-Register may have changed this).

```
START RECONFIGURATION
LIST DEVICE LU #?                          *Direct output to your terminal
1
I/O RECONFIGURATION ALREADY PERFORMED
CURRENT SELECT CODE#,NEW SELECT CODE#?
15,15                                      *SYSTEM CONSOLE
                                           *ICD disc if S-Register set
CURRENT I/O CONFIGURATION:

SELECT CODE 11=TBG                         *Time Base Generator card
SELECT CODE 15=EQT  1,TYPE  5              *System Console
SELECT CODE 17=EQT  8,TYPE 23              *Magnetic Tape Unit card #1
SELECT CODE 20=EQT  8,TYPE 23              *Magnetic Tape Unit card #2
SELECT CODE 50=EQT  9,TYPE 31              *7900 Disc card #1
SELECT CODE 51=EQT  9,TYPE 31              *7900 Disc card #2
SELECT CODE 52=EQT  3,TYPE 32              *79xx MAC Disc
SELECT CODE 53=EQT  4,TYPE 32              *79xx ICD Disc
SELECT CODE 54=EQT  5,TYPE 33              *79xx CS/80 discs
SELECT CODE 60=EQT  2,TYPE  0   PRMPT      *Interactive Terminal
SELECT CODE 61=EQT  7,TYPE  0   PRMPT      *Interactive Terminal
SELECT CODE 62=EQT  6,TYPE  5   PRMPT      *Interactive Terminal
I/O RECONFIGURATION? (YE/NO)
YE
```

Reconfigure your system as follows:

NOTE

It is not necessary to reconfigure the select code of your system console as it was done when you last set the S-Register.

BCKOF (Cont'd)

1. Reconfigure the TBG select code if it is not octal 11. In this case, enter:

   11,<sc>

   where <sc> is the TBG select code.

2. Reconfigure the select codes of the MTU if they are not octal 17 and 20. Enter

   17,<sc lc>
   20,<sc hc>

   where <sc lc> is the lower numbered select code of the magnetic tape unit and <sc hc> is the higher numbered select code.

3. If only an ICD disc is to be used, it does not need to be reconfigured. Otherwise, you must reconfigure the appropriate discs:

   <!BCKOF disc sc>,<your disc sc>

   where <!BCKOF disc sc> is the select code of the type of disc (CS/80, MAC, or 7900 disc) to be reconfigured, and <your disc sc> is the select code of the same type of disc that you want to use in the system. Be aware that if you are reconfiguring a 7900 disc unit. The lower numbered select code in the !BCKOF system should be reconfigured to the lower numbered select code in the system.

4. Enter /E to terminate the I/O reconfiguration. The current configuration is then displayed as shown below. When the OK TO PROCEED? prompt appears, review your changes to the original configuraiton. If the changed configuration is correct, enter YE to continue. If the changes are incorrect, enter NO and correct any errors in the configuration (steps 1 through 4 above, as required). When the configuration has been corrected, enter /E to terminate the reconfiguration, and respond YE to the OK TO PROCEED? prompt.

5. Since memory reconfiguration is not necessary, enter NO when the MEM RECONFIGURATION? (YE/NO) prompt is displayed.

6. The operating system will now start its initialization pass and then start executing the startup (and user control) program BCKOF.

A sample system configuration display is shown below.

```
SET TIME
  LU#  EQT#  SUBC#  S.C.   TYPE    DESCRIPTION
   1     1      0     15B     5B    INTERACTIVE TERMINAL
   4     1      1     15B     5B    LEFT C.T.U.
   5     1      2     15B     5B    RIGHT C.T.U.
   8     8      0     17B    17B    MAG TAPE/MASS STORAGE
   9     5      1     11B    33B    CS/80 CARTRIDGE TAPE
  10     2      1     60B     0B    INTERACTIVE TERMINAL
  11     7      0     61B     0B    INTERACTIVE TERMINAL
  12     9      0     50B    31B    7900 DISC
  13     3      0     52B    32B    79XX (MAC) SERIES DISC
  14     4      0     53B    32B    79XX (ICD) SERIES DISC
  15     5      0     11B    33B    79XX (CS/80) SERIES DISC
 Please enter tape-LU for reading 1BCK02: n
```

Your response to the "Please enter tape-LU" prompt above is determined by the tape media on which the Physical Backup Utilities are supplied.

MANUAL PART NO. 5950-3767
Printed in U.S.A. July 1984
E0784

HEWLETT-PACKARD COMPANY
Data Systems Division
11000 Wolfe Road
Cupertino, California 95014