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STUDENT HANDOUT KDA-5024

E4AST30554 054

Don't
Destroy

Technical Training

JSS DATA PROCESSOR AND DISPLAY MAINTENANCE

HMP-1116 LAB EXERCISES

JANUARY 1982



USAF TECHNICAL TRAINING SCHOOL
3390th Technical Training Group
Keesler Air Force Base, Mississippi

Designed For ATC Course Use

DO NOT USE ON THE JOB

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Numerical Listing of Computer Operation Codes

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Instructions

SECTION I

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				1966	MACRO	00000020
				1967 &L	OPTIONS &UNUSED	00000030
				1968	COPY OPTGBLS	00000040
				1969 *		00000010
				1970 *		00000020
				1971 ***	MICRO-PROGRAM FEATURES	00000030
				1972 *		00000040
				1973	GBLA &XFP,&XFP3W	00000050
				1974	GBLA &XDP,&X64SH	00000060
				1975	GBLC &XFST	00000070
				1976	GBLA &XBANK	00000080
				1977	GBLA &XTRIG	00000090
				1978	GBLA &XISAUG1	00000100
				1979	GBLA &XABL	00000110
				1980	GBLC &XPMRPL	00000120
				1981	GBLA &XPRMEM	00000130
				1982	GBLA &COLDRIH	00000135
				1983 *		00000140
				1984 *	IN GENERAL:	00000150
				1985 *	0 = DEFAULT	00000160
				1986 *	1 = OPTION INCLUDED	00000170
				1987 *	-1 = OPTION INCLUDED, BUT INACCESSIBLE	00000180
				1988 *	(THE -1 VALUE IS USEFUL FOR PROVIDING MICROCODE COMMONALITY AMONG	00000190
				1989 *	MACHINES WITH DIFFERENT INSTRUCTION SETS, WHERE ONLY THE DECODE	00000200
				1990 *	ROMS DIFFER.)	00000210
				1991 *		00000220
				1992 *	&XFP =0/1/-1 32-BIT FLOATING POINT	00000230
				1993 *	&XFP3W=0/1/-1 48-BIT FLOATING POINT	00000240
				1994 *		00000250
				1995 *	&XDP =0/1/-1 DOUBLE PRECISION FIXED POINT	00000260
				1996 *	&X64SH=0/1/-1 64-BIT SHIFT INSTRUCTIONS	00000270
				1997 *		00000280
				1998 *	&XFST =NONE 'FST' SIGNAL IGNORED (BECOMES SPURIOUS 'ATH')	00000290
				1999 *	=E3A 'FST' SIGNAL CAUSES E-3A PROGRAM LOAD	00000300
				2000 *	=413 'FST' SIGNAL CAUSES PROJECT-413 PROGRAM LOAD	00000310
				2001 *	=657 'FST' SIGNAL CAUSES PROJECT-657 PROGRAM LOAD	00000320
				2002 *	=SEM 'FST' SIGNAL CAUSES PROJECT SIEMENS PROG. LOAD	00000330
				2003 *	=TGP 'FST' SIGNAL CAUSES PROJECT TGP5G PROG. LOAD	00000340
				2004 *	=RHM 'FST' SIGNAL CAUSES RHM PROGRAM LOAD	00000345
				2005 *		00000350
				2006 *	&XBANK=0/1/-1 INCLUDE BANK SWITCHING INSTNS: EPOR,EPPR	00000360
				2007 *		00000370
				2008 *	&XTRIG=0/1/-1 TRIGONOMETRIC OPERATION OPTION	00000380
				2009 *		00000390
				2010 *	&XISAUG1=0/1/-1 INSTRUCTION SET AUGMENTATION OPTION1	00000400

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
2011						00000410
2012						00000420
2013						00000430
2014						00000440
2015						00000450
2016						00000460
2017						00000470
2018						00000475
2019						00000480
2020						00000490
2021						00000500
2022						00000505
2023						00000510
2024						00000520
2025						00000530
2026						00000540
2027						00000550
2028						00000555
2029						00000560
2030						00000570
2031						00000580
2032						00000590
2033						00000600
2034						00000610
2035						00000620
2036						00000630
2037						00000650
2038						00000660
2039						00000670
2040						00000680
2041						00000690
2042						00000700
2043						00000710
2044						00000720
2045						00000730
2046						00000740
2047						00000750
2048						00000760
2049						00000770
2050						00000780
2051						00000790
2052						00000800
2053						00000810
2054						00000820
2055						00000830

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
2056	&XPHRPL	SETC	'DEV0'		0416 PHRPL	00000240
2057	M					00000250
2058	&ZTRIG	SETA	1		CORDIC CARD IN MACHINE	00000260
2059	&ZEALU	SETA	1		EXTENDED ALU IN MACHINE	00000270
2060		MEND				00000280
2061	M					00000010
2062	M					00000020
2063	***			'BRANCH-AND-COUNT' MACROS		00000030
2064	M					00000040
2065		MACRO				00000050
2066	&L	BCTC	&COND,&ADDR,®			00000060
2067		AIF	('&L' EQ '').NOL			00000070
2068	&L	EQU	M			00000080
2069	.NOL	ANOP				00000090
2070	.M					00000100
2071		MNOTE	M,'IR ®,®'			00000110
2072		IR	®,®			00000120
2073		MNOTE	M,'BCT &COND,&ADDR'			00000130
2074		BCT	&COND,&ADDR			00000140
2075		MEND				00000150
2076	M					00000160
2077	M					00000170
2078	M					00000180
2079		MACRO				00000190
2080	&L	BCFC	&COND,&ADDR,®			00000200
2081		AIF	('&L' EQ '').NOL			00000210
2082	&L	EQU	M			00000220
2083	.NOL	ANOP				00000230
2084	.M					00000240
2085		MNOTE	M,'IR ®,®'			00000250
2086		IR	®,®			00000260
2087		MNOTE	M,'BCF &COND,&ADDR'			00000270
2088		BCF	&COND,&ADDR			00000280
2089		MEND				00000290

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LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT

17 MAY 79

2091				MACRO		00000310
2092				GHOTE &VAL1,&VAL2,&MSG		00000320
2093				AIF ('&VAL1' EQ '&VAL2').OK		00000330
2094				MNOTE 1,&MSG'		00000340
2095	OK			ANOP		00000350
2096				MEMD		00000360

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
2098					MACRO	00000380
2099	&L				CORL &N,&X,&Y,&F,&SP=0,&DEST=	00000390
2100					AIF ('&N' EQ '1').AR	00000400
2101					SR &X,&Y,&F,SP=&SP,DEST=&DEST	00000410
2102					HEXIT	00000420
2103	.AR				AR &X,&Y,&F,SP=&SP,DEST=&DEST	00000430
2104					MEMD	00000440
2105	#					00000450
2106	#					00000460
2107	#					00000470
2108					MACRO	00000480
2109	&L				CORL &N,&X,&Y,&F,&SP=0,&DEST=	00000490
2110					AIF ('&N' EQ '1').ARC	00000500
2111					SRB &X,&Y,&F,SP=&SP,DEST=&DEST	00000510
2112					HEXIT	00000520
2113	.ARC				ARC &X,&Y,&F,SP=&SP,DEST=&DEST	00000530
2114					MEMD	00000540
2115	#					00000550
2116	#					00000560
2117	#					00000570
2118					MACRO	00000580
2119	&LABEL				CORD &X,&Y,&Z,&A,&B,&C,&CL,&CM,&CR, &F1=&F2=&F3=&SP1=SHFT,&SP3=SHFT	00000590
2120					LCLC &L(2),&M(2),&LABELX0,&OPR5	00000600
2121	#					00000610
2122	#				THIS MACRO GENERATES THE BASIC 6-INSTRUCTION CORDIC ITERATION.	00000620
2123	#				X,Y,Z = REGISTERS (IN ORDER OF OPERATION)	00000630
2124	#				A,B,C = OPERATION FLAGS (IN ORDER)	00000640
2125	#				(1=ADD, 2=SUBTRACT)	00000650
2126	#				NOTE: THIS MACRO GENERATES COMMENTS SO THAT "EXPANSION" WILL BE	00000660
2127	#					00000670
2128	&L(1)				SETC 'AR	00000680
2129	&M(1)				SETC 'ARC	00000690
2130	&L(2)				SETC 'SR	00000700
2131	&M(2)				SETC 'SRB	00000710
2132	#					00000720
2133	#					00000730
2134					AIF ('&LABEL' EQ '').NOLABEL	00000740
2135	&LABEL				EQU #	00000750
2136	.NOLABEL				ANOP	00000760
2137	#					00000770
2138	#					00000780
2139					NOTE #,'&L(&A) &X,&CL,C&F1,SP=SPEX,DEST=IINHIB'	00000790
2140					CORL &A,&X,&CL,C&F1,SP=SPEX,DEST=IINHIB	00000800
2141					NOTE #,'&M(&A) &X,&CM,&F1,SP=&SP1 AX; INIT SHIFT'	00000810
						00000820

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
2142	CORN				8A,8X,8CM,8F1,SP=8SP1	00000830
2143	NOTE				8,8L(8B) 8Y,8CR,8F2,SP=8PEX,DEST=INHIB	00000840
2144	CORL				8B,8Y,8CR,8F2,SP=8PEX,DEST=INHIB	00000850
2145	NOTE				8,8M(8B) 8Y,8CR,8F2 8Y	00000860
2146	CORN				8B,8Y,8CR,8F2	00000870
2147	NOTE				8,8L(8C) 8Z,8CL,8F3, BUMP ITERATION	00000880
2148	NOTE				8, SP=8PEX+INCR,DEST=INHIB	00000890
2149	CORL				8C,8Z,8CL,8F3,SP=8PEX+INCR,DEST=INHIB	00000900
2150	NOTE				8,8M(8C) 8Z,8CM,8F3,SP=8SP3 8Z; INIT SHIFT	00000910
2151	CORN				8C,8Z,8CM,8F3,SP=8SP3	00000920
2152	MEHD					00000930

LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT

17 MAY 79

2154				MACRO	00000950
2155	AL			ALIGN AN	00000960
2156	A&SYSNDX	EQU		N-START	00000970
2157	DC			((A&SYSNDX/M+&N-1)/&N*&N+M-A&SYSNDX)X'FF'	00000980
2158				MEMD	00000990

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
2160				MACRO		00001010
2161	&L			DRUM	&DCD,&ADR,&PRIV,&DUP=1,&OPT=1	00001020
2162				LCLA	&I	00001030
2163				LCLC	&DNOX,&DX,&APSO,&APSI,&FORM	00001040
2164	.H					00001050
2165	&DNOX			SETC	'&DCD'.'NOX'	00001060
2166	&DX			SETC	'&DCD'.'X'	00001070
2167				AIF	('&DCD' NE 'RR').A	00001080
2168	&DNOX			SETC	'&BP15'	00001090
2169	&DX			SETC	'&BP15'	00001100
2170	.A			ANOP		00001110
2171	.H					00001120
2172	.H					00001130
2173	&FORM			SETC	'&DCD'(1,2)	00001140
2174	.H					00001150
2175	.H					00001160
2176				AIF	(&OPT LE 0).ILLEG	00001170
2177				AIF	('&ADR' EQ 'ILLEG').ILLEG	00001180
2178	&APSO			SETC	'&ADR'	00001190
2179				AIF	('&PRIV' NE '').ILLEG2	00001200
2180	&APSI			SETC	'&ADR'	00001210
2181				AGO	.C	00001220
2182	.H					00001230
2183	.H					00001240
2184	.ILLEG			ANOP		00001250
2185				AIF	('&FORM' EQ 'RR').ILLEG1A	00001260
2186	&FORM			SETC	'RI'	00001270
2187	.ILLEG1A			ANOP		00001280
2188	&DNOX			SETC	'RINOX'	00001290
2189	&DX			SETC	'RIX'	00001300
2190	&APSO			SETC	'ILLEG'.'&FORM'	00001310
2191	.ILLEG2			ANOP		00001320
2192	&APSI			SETC	'ILLEG'.'&FORM'	00001330
2193	.C			ANOP		00001340
2194	.H					00001350
2195	.H					00001360
2196	&I			SETA	&DUP	00001370
2197	.DUP			DC	AL.4(((&DNOX-&BEGIN)/4),AL.12(((&APSO-&BEGIN)/4),XL6'0'	00001380
2198	.H					00001390
2199				DC	AL.4(((&DX-&BEGIN)/4),AL.12(((&APSI-&BEGIN)/4),XL6'00'	00001400
2200	&I			SETA	&I-1	00001410
2201				AIF	(&I EQ 0).DONE	00001420
2202	.H					00001430
2203				AGO	.DUP	00001440
2204	.DONE			ANOP		00001450

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LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT

17 MAY 79

2205

MEND

00001460

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				2351 *	PHILOSOPHICAL NOTE: IN THE INTEREST OF MICROCODE COMMONALITY, WE	00001580
				2352 *	ALWAYS DO OPERATIONS FOR MOST GENERAL HARDWARE (EG, EXTENDED ALU OR	00001590
				2353 *	CORDIC OPTION). IF OPTIONS ARE NOT INSTALLED, THE EFFECT IS	00001600
				2354 *	ASSUMED TO BE A NOP OR DON'T CARE. (NOTE: "SAVING" CPR ON POWER	00001610
				2355 *	DOWN DESTROYS A MEMORY LOCATION IN LOW MEMORY.) DAS -- 5 DEC 77	00001620
				2356 *		00001630
				2357 *	PROGRAM WIDTH = 9 HEX DIGITS (4 BIT CHIPS)	00001640
				2358 *	POSTPASS PRINTS 'HUGHES PROPRIETARY' ON LISTING	00001650
				2359 *	FILL CHARACTER = 'X'	00001660
000000				2360	PROLOG PWIDTH=9,FILL=X'80000F',ALU=AZALCHIP	00001670
				2361 *BEGIN	CSECT	
				2362 M	EQU SHWIDTH	00001680
	00008			W	EQU 8	
				2363 *		00001690
				2364 ***	<u>INTERNAL REGISTERS</u>	00001700
				2365 *		00001710
				2367	REGEQU ABORTAD,0	
				2368 *ABORTAD	EQU 0	ABORT RETURN ADDRESS (NOT USED) 00001730
	00000			2369	REGEQU TEMPYD,1	
				2370 *TEMPYD	EQU 1	REGD OPERAND FOR HW INSTRUCTIONS 00001740
	00001			2371	REGEQU X00FF,2	
				2372 *X00FF	EQU 2	CONSTANT VALUE X'00FF' 00001750
	00002			2373	REGEQU X0004,3	
				2374 *X0004	EQU 3	CONSTANT VALUE 4 00001760
	00003			2375	REGEQU X0002,4	
				2376 *X0002	EQU 4	CONSTANT VALUE 2 00001770
	00004			2377	REGEQU X8000,5	
				2378 *X8000	EQU 5	CONSTANT VALUE X'8000' 00001780
	00005			2379	REGEQU LOCX,6	
				2380 *LOCX	EQU 6	TEMP FOR LOC 00001790
	00006			2381	REGEQU LOC,7	
				2382 *LOC	EQU 7	LOCATION COUNTER 00001800
	00007			2384 *	(8,9,A,B,C,D,E,F)	RESERVED FOR LOCAL USE 00001820
				2385	REGEQU (SR8,SR9,SRA,SRB,SRC,SRD,SRE,SRF),	00001830
					(8,9,10,11,12,13,14,15)	00001840
	00008			2386 *SR8	EQU 8	
	00009			2387 *SR9	EQU 9	
	0000A			2388 *SRA	EQU 10	
	0000B			2389 *SRB	EQU 11	
	0000C			2390 *SRC	EQU 12	
	0000D			2391 *SRD	EQU 13	
	0000E			2392 *SRE	EQU 14	
	0000F			2393 *SRF	EQU 15	

MICROCODE, IHP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,JSS"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE	STATEMENT	17 MAY 79
				2394		REGEQU (TEMP1,TEMP2),(8,9) (I70 MACRO INSTNS)	00001850
00008				2395+BTMP1	EQU 8		
00009				2396+BTMP2	EQU 9		
				2397		REGEQU (UT,PSWTEMP),(9,11) (AUTO I/O CHANNEL SERVICE)	00001860
00009				2398+BT	EQU 9		
0000B				2399+BPSWTEMP	EQU 11		
				2400		REGEQU (X,Y,THETA,M,NSH), (CORDIC)	00001870
						(8,9,10,11,12)	00001880
0000B				2401+BX	EQU 8		
00009				2402+BY	EQU 9		
0000A				2403+BTHETA	EQU 10		
0000B				2404+BM	EQU 11		
0000C				2405+BNSH	EQU 12		
				2406		REGEQU (S,E,A,S2,E2,A2,Q2,T), (FLOATING POINT: I70 AND 3-WORD)	00001890
						(8,9,10,11,12,13,14,15)	00001900
0000B				2407+BS	EQU 8		
00009				2408+BE	EQU 9		
0000A				2409+BA	EQU 10		
0000B				2410+BS2	EQU 11		
0000C				2411+BE2	EQU 12		
0000D				2412+BA2	EQU 13		
0000E				2413+BQ2	EQU 14		
0000F				2414+BT	EQU 15		
				2415		REGEQU (A3,Q3),(S2,E2) (FLOATING POINT)	00001910
0000R				2416+BA3	EQU BS2		
0000C				2417+BQ3	EQU BE2		
				2418		REGEQU LINK,ABORTAD (CORDIC & MEMORY TEST)	00001920
0000B				2419+BLINK	EQU #ABORTAD		
				2420		REGEQU (HIH,HIL,LOH,LOL,D,ECTR,ALARMSV), (MEMORY TEST)	00001930
						(1,2,3,4,5,6,9)	00001940
00001				2421+BHIH	EQU 1		
00002				2422+BHIL	EQU 2		
00003				2423+BLOH	EQU 3		
00004				2424+BLOL	EQU 4		
00005				2425+BD	EQU 5		
00006				2426+BECTR	EQU 6		
00009				2427+ALARMSV	EQU 9		
				2428 M			00001950
				2429 M			00001960
				2430 M			00001970
				2431 M M		INTERNAL REGISTERS (EXTENDED ALU)	00001980
				2432 M			00001990
				2433		REGEQU CPR,X0004 (CORDIC OPTION)	00002000
00003				2434+BCPR	EQU BX0004		
				2435		REGEQU X0020,X00FF	00002010

MICROCODE, IIMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J55"

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BASIC DEFINITIONS

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LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT 17 MAY 79

00002	2436+BX0020	EQU	0X00FF			00002020
	2437	M				00002030
	2438	M				00002040
	2439	M				00002050
	2440	MM	EXTERNAL REGISTERS			00002060
	2441	M				00002070
	2442		EXTRN CTR,MOR,IR,MAR,PSW,EXT,YSP1,YS,YD,YDP1,FLR,RAR			00002080
	2443		REGEQU (CTR,MOR,IR,MAR,PSW,EXT,YSP1,YS,YD,YDP1,FLR,RAR),			00002090
			(1,2,3,4,5,6,8,9,10,11,14,15)			
00001	2444+BCTR	EQU	1			
00002	2445+BMOR	EQU	2			
00003	2446+BMIR	EQU	3			
00004	2447+BMAR	EQU	4			
00005	2448+BPSW	EQU	5			
00006	2449+BEXT	EQU	6			
00008	2450+YSP1	EQU	8			
00009	2451+YS	EQU	9			
0000A	2452+YD	EQU	10			
0000B	2453+YDP1	EQU	11			
0000E	2454+BFLR	EQU	14			
0000F	2455+BRAR	EQU	15			
	2456	M				00002100
	2457	M				00002110
	2458	MM	EXTERNAL REGISTERS (HARDWARE OPTIONS)			00002120
	2459	M				00002130
	2460		EXTRN CORDM,CORDL,CORDROM,CORDCTL (CORDIC)			00002140
	2461		REGEQU (CORDM,CORDL,CORDROM,CORDCTL),(12,13,7,7)			00002150
0000C	2462+BCORDM	EQU	12			
0000D	2463+BCORDL	EQU	13			
00007	2464+BCORDROM	EQU	7			
00007	2465+BCORDCTL	EQU	7			
	2466	M				00002160
	2467	M				00002170
	2468	MM	MC=... DEFINITIONS			00002180
	2469	M				00002190
00001	2471	MR11	EQU	1	READ INSTN (LOAD MOR & IR)	00002210
00002	2472	MR12	EQU	2	READ 2ND WORD OF INSTN (LOAD MOR	00002220
00003	2473	MRO	EQU	3	READ OPERAND	00002230
00004	2474	MROH	EQU	4		00002240
00005	2475	MW	EQU	5	WRITE	00002250
00006	2476	MWP	EQU	6	WRITE, PRIVILEGED	00002260
00007	2477	MWR	EQU	7		00002270

MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J55"

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BASIC DEFINITIONS

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LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT

17 MAY 79

2479 #

00002290

2480 ### DC=... DEFINITIONS

00002300

2481 #

00002310

00001 2483 PFDC EQU 1

PRIMARY FUNCTION DECODE

00002330

00002 2484 SFDC EQU 2

SECONDARY FUNCTION DECODE

00002340

00003 2485 IFCH EQU 3

*2nd half
execute
Fetch 1st half of instr.*

INSTRUCTION FETCH

00002350

2487 #

00002370

2488 ### INPUT/OUTPUT FLAG DEFINITIONS

00002380

2489 #

00002390

00001 2491 ADRS EQU 1

00002410

00002 2492 CMD EQU 2

00002420

00003 2493 DA EQU 3

00002430

00004 2494 DR EQU 4

00002440

00005 2495 ACK EQU 5

00002450

00006 2496 DACK EQU 6

00002460

00007 2497 SR EQU 7

00002470

00001 2498 SYNC EQU 1

00002480

00002 2499 ESYNC EQU 2

00002490

00003 2500 FSYNC EQU 3

00002500

2502 #

00002520

2503 ### SP=... DEFINITIONS FOR EXTENDED-MAR CONTROL

00002530

2504 #

00002540

00000 2506 NCHG EQU 0#256#256#64

MARA,B := MARA,B (NO CHANGE)

00002560

00000 2507 DBUS EQU 0#256#256#64

:= RDMA,B (INPUT)

00002570

400000 2508 ZERO EQU 1#256#256#64

:= 0 (CLEAR)

00002580

800000 2509 POPR EQU 2#256#256#64

:= QPSW10,11 (OPERAND)

00002590

C00000 2510 PINS EQU 3#256#256#64

:= QPSW08,09 (INSTN)

00002600

*Operand Bank
Instruction Bank*

2512 #

00002620

2513 #

00002630

2514 ### SP=... DEFINITIONS FOR CORDIC CARD

00002640

2515 #

00002650

400000 2516 INCR EQU 1#64#256#256

INCREMENT ITERATION COUNTER

00002660

800000 2517 SHIFT EQU 2#64#256#256

LOAD SHIFT CTR & SHIFT

00002670

MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J55"

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LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT 17 MAY 79

C00000 2518 SHFL EQU 3*64#256#256 LOAD SHIFT CTR & SHIFT LOGICAL 00002680
2519 # 00002690
2520 # 00002700
2521 ### SP=... DEFINITIONS FOR EXTENDED ALU 00002710
2522 # 00002720
2523 # NOTE: 'DEST=INHIB' REQUIRED IN ADDITION TO SOME OF THESE 00002730
100000 2524 DPX EQU 16#256#256 00002740
200000 2525 HTOL EQU 2#DPX 'DEST=INHIB' HIGH HALF TO LOW HALF 00002750
100000 2526 LTOH EQU 1#DPX LOW HALF TO HIGH HALF 00002760
2527 # (NO ARITHMETIC, NO FLAGS)(NO L 00002770
100000 2528 DTPM EQU 1#DPX 'DEST=INHIB' DOUBLE PRECISION COMPARE 00002780
300000 2529 DP EQU 3#DPX DOUBLE PRECISION OPERATION 00002790
300000 2530 SPEX EQU 3#DPX 'DEST=INHIB' SINGLE PRECISION 00002800
2531 # (NO FLAGS ON EXT)=LOW RAM) 00002810
2532 # 00002820
2533 ### MEMORY ADDRESS DEFINITIONS 00002830
2534 # 00002840

00022 2536 PHTR EQU X'22' "REGISTER SAVE POINTER" 00002860
00024 2537 CPSW EQU X'24' CURRENT PSW "SAVE AREA" 00002870
00028 2538 OFPSW EQU X'28' 00002880
00030 2539 OILLPSW EQU X'30' 00002890
00038 2540 OHPSW EQU X'38' OLD PSW "MACHINE MALFUNCTION" 00002900
00040 2541 OIPSW EQU X'40' OLD PSW "EXTERNAL I/O" 00002910
00048 2542 ODPSPW EQU X'48' 00002920
00080 2543 TQPTR EQU X'80' "TERMINATION QUEUE POINTER" 00002930
00082 2544 OCIPSW EQU X'82' OLD PSW "CHANNEL I/O TERMINATION 00002940
0008A 2545 CHOVPTR EQU X'8A' A/OVERFLOWING CCH) 00002950
0008C 2546 CHOVPSPW EQU X'8C' OLD PSW "CHAN QUEUE OFLOW" 00002960
00000 2547 SPTABL EQU X'D0' 00002970

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BASIC MICROPROGRAM ENTRY POINTS

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				2549 #		00002990
				2550 ###	HMP 1116 MICROPROGRAM -- INITIAL PROGRAM ENTRY POINT	00003000
000000	258000DC0			2552 START	B PHRON MICROPROGRAM ENTRY POINT	00003020
000008	FFFFFFFFFFFFFFF			2554	DC (3*W)X'FF'	00003030
				2556 ##	RI FORMAT	00003050
				2557 #		00003060
				2558 #	MAR := A(NEXT INSTRUCTION)	00003070
				2559 #	LOC := A(NEXT INSTRUCTION)	00003080
				2560 #	MOR := A + (X2)	00003090
				2561 #		00003100
000004	C23004000			2562 RINOX	CHD MC=HRI2	00003110
000005	C0B720080			2564	AR LOC,X0002,DC=SFDC	00003120
000030	FFFFFFFFFFFFFFF			2566	DC (2*W)X'FF'	00003130
				2567 #		00003140
000008	C3B904130			2569 RIX	LR TEMP2,YS,MC=HRI2	00003160
000009	62B700020			2571	AI LOC,2	00003170
00000A	C2B9A0040			2573	AR MOR,TEMP2,DC=SFDC	00003180
000058	FFFFFFFFFFFFFFF			2575	DC (W)X'FF'	00003190
				2576 #		00003200
				2578 #		00003220
				2579 ###	RXAD -- 'RX' FORMAT, OPERAND ADDRESS ONLY	00003230
				2580 #		00003240
				2581 #	LOC,MAR := A(OPERAND)	00003250
				2582 #	LOCK := A(NEXT INSTN - 1)	00003260
				2583 #	NO FETCH	00003270
				2584 #		00003280
00000C	D236040E0			2586 RXADNOX	IR LOCK,LOC,MC=HRI2 P0 FETCH 2ND HALF; SET LOCK	00003300
00000D	63B700000			2588	LI LOC,0 P1 "INDEX VALUE" = 0	00003310
00000E	C2B720058			2590	AR LOC,MOR,DC=SFDC,SP=POPR P2 LOC (& MAR) := A(OPERAND)	00003320
000078	FFFFFFFFFFFFFFF			2592	DC (W)X'FF'	00003330
000010	D236040E0			2594 RXADX	IR LOCK,LOC,MC=HRI2 P0 FETCH 2ND HALF; SET LOCK	00003350
000011	83B700130			2596	LR LOC,YS P1 INDEX REG	00003360
000012	C2B720058			2598	AR LOC,MOR,DC=SFDC,SP=POPR P2 LOC (& MAR) := A(OPERAND)	00003370
000098	FFFFFFFFFFFFFFF			2600	DC (W)X'FF'	00003380

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BASIC MICROPROGRAM ENTRY POINTS

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ROM
Address
Reg

9 Digit
Hex

Programmer
A/B

17 MAY 79

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
2602						00003400
2603	MM			RXOP -- 'RX' FORMAT, FETCH OPERAND		00003410
2604						00003420
2605				LOC, MAR := A(OPERAND)		00003430
2606				LOC := A-1(NEXT INSTN)		00003440
2607				OPERAND FETCH BEGUN		00003450
2608						00003460
000014	D236040E0			2610 RXOPNOX IR	LOCK, LOC, MC=MRI2	00003480
000015	63B700000			2612 LI	LOC, 0	00003490
000016	82B700050			2614 AR	LOC, MDR, SP=POPR	00003500
000017	C23026000			2616 CHD	MC=MRO, DC=SFDC	00003510
000018	D236040E0			2619 RXOPX IR	LOCK, LOC, MC=MRI2	00003530
000019	83B700130			2621 LR	LOC, YS	00003540
00001A	82B700050			2623 AR	LOC, MDR, SP=POPR	00003550
00001B	C23026000			2625 CHD	MC=MRO, DC=SFDC	00003560
					Compute SFDC Add using software OP CODE	00003580
				2629 MM RXOM -- 'RX' FORMAT, FETCH OPERAND, AND SETUP MAR=LOC		00003590
				2630		00003600
				2631	OPERAND FETCH BEGUN	00003610
				2632	LOC := A(NEXT INSTN)	00003620
				2633	MAR := A(NEXT INSTN)	00003630
				2634	LOCK := A-1(NEXT INSTN) (REQ'D FOR "ILLEG RX")	00003640
				2635		00003650
00001C	D236040E0			2637 RXHNOX IR	LOCK, LOC, MC=MRI2	00003670
				2639	NOP	00003680
00001D	83B400050			2640 LR	MAR, MDR, SP=POPR	00003690
00001E	C23006000			2642 CHD	MC=MRO	00003700
00001F	D237200CC			2644 IR	LOC, LOC, DC=SFDC, SP=PIHS	00003710
000020	D236040E0			2647 RXHNOX IR	LOCK, LOC, MC=MRI2	00003730
000021	83B700130			2649 LR	LOC, YS	00003740
000022	82B700050			2651 AR	LOC, MDR, SP=POPR	00003750
000023	D237260CC			2653 IR	LOC, LOC, MC=MRO, DC=SFDC, SP=PIHS	00003760
				2655	CHD MC=MRO	00003770
				2656	IR LOC, LOC, DC=SFDC, SP=PIHS	00003780
				2657		00003790
				2659		00003810
				2660 MM RXDP -- 'RX' FORMAT (DOUBLE PRECISION)		00003820
				2661		00003830

Fetch A2 16-31 -> MDR
O -> LOC
MDR -> MAR & LOC
Read Operand Go to SFDC

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				2662	LOC, MAR := A+2(OPERAND) = A(15 WORD)	00003840
				2663	LOCK := A-1(NEXT INSTN)	00003850
				2664		00003860
000024	D236040E0			2665	RXPNOX IR LOCX, LOC, MC=MRI2 P0 FETCH 2ND HALF; SET LOCK	00003870
000025	63B700010			2666	LI LOC, 1 P1 INDEX+1 = 0+1	00003880
				2667	UCT LOC, HDR, AIC=DPB, CIN=1, P2 LOC (MAR) := A+2(OPERAND)	00003890
				2669	SP=POPR, DC=SFDC	00003900
000026	D2B720058				(W)X'FF'	00003910
000138	FFFFFFFFFFFFFFF			2671	DC	00003920
				2672		00003930
000028	D236040E0			2673	RXPX IR LOCX, LOC, MC=MRI2 P0 FETCH 2ND HALF; SET LOCK	00003940
000029	93B700130			2675	IR LOC, YS P1 INDEX+1	00003950
				2677	UCT LOC, HDR, AIC=DPB, CIN=1, P2 LOC (MAR) := A+2(OPERAND)	00003960
					SP=POPR, DC=SFDC	00003970
00002A	D2B720058				(W)X'FF'	00003980
000158	FFFFFFFFFFFFFFF			2679	DC	00003990

2681	IFCH -- COMMON INSTRUCTION FETCH POINT (NO INTERRUPT)	00004000
2682		00004010
2683		00004020
2684	LAST MICRO-INSTN OF PREV INSTN SHOWN BELOW	00004030
2685		00004040

IFCH

00002C	62B70002C			2687	CHD MC=MRI1, DC=IFCH, ST=JMC P0	00004050
				2688	IFETCH AI LOC, 2, SP=PIINS P1 LOC, MAR := A(NEXT HALFWORD)	00004060
				2690	LR TEMPYD, YD, DC=PFDC, P2 YD	00004070
00002D	C3B111550				ST=CLR (CLEAR FOR CLRINT/BREAKPT)	00004080
				2693	INTERRUPT SERVICE -- BREAKPOINT ENABLE	00004100
				2695	BPIFETCH B BREAKPT	00004120
00002E	25B003DA0			2696	GO COMPARE LOC	00004130

1st half instn → MDR+IR
 LOC+2 → LOC+MAR

For Half-Word go to SFDC

Compute Add using Software OPCode

To Pg 19 A 0246

Pg A 024B

INTERRUPT SERVICE

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				2699 #		00004150
				2700 ###	INTERRUPT SERVICE -- ABORT ENTRY POINT	00004160
				2701 #		00004170
00002F	0637000CC			2703 ABORT	DR LOC,LOCX,SP=PINS	00004190
000030	03BEC0070			2705	LR FLR,IR,MOD=EXT0	00004200
000031	25B040330			2707	BCT V,P3HELP	00004210
000032	94B70008C			2709	SR LOC,X0002,SP=PINS	00004220
				2712 #		00004240
				2713 ###	INTERRUPT SERVICE -- NORMAL ENTRY POINT	00004250
				2714 #		00004260
				2715 #	SCRATCH REGISTERS USED	00004270
				2716 #	NONE	00004280
000033	03B800000			2718 P3HELP	LR SR0,EXT	00004300
				2720 #	TEST: FOR "PRIME POWER FAILURE",	00004310
				2721 #	"MACHINE MALFUNCTION", "PANEL	00004320
				2722 #	INTERRUPT", OR PANEL IN	00004330
000034	6E3011F00			2723	NI SR0,X'F0',F,MOD=SWAP	00004340
000035	15B0305D0			2725	BCT GL,HELP	00004350
				2727 #	BIF: "PPF,HALF,CATH,SNGL,FAST"	00004360
000036	03BED00D0			2728	LR FLR,EXT,MOD=EXT1	00004370
				2730 #	ELSE TEST: FOR "INTERLEAVED	00004380
000037	15B0210C0			2731	BCT G,DCR	00004390
				2733 #	DATA CHANNEL" INTERRUPT	00004400
				2734 #	BIF: "DC" TRUE TO "DATA CHANNEL	00004410
				2735 #	REQUEST" INTERRUPT	00004420
				2737 #	ELSE: ASSUME "I/O ATTENTION"	00004430
				2738 ###	INTERRUPT	00004440
				2739 ###	I/O ATTENTION INTERRUPT	00004450
000038	03BED00B0			2740 TEST	LR FLR,PSW,MOD=EXT1	00004470
				2742 #	TEST: "PSW BIT 04" FOR	00004480
				2743 #	"AUTOMATIC I/O SERVICE	00004490
000039	15B000480			2744	BCT C,HSSVC	00004500
				2746 #	INTERRUPT" ENABLED	00004510
00003A	63B480404			2747	LI MAR,OIPSW,SP=ZERO	00004520
				2749 #	BIF: "PSW BIT 04" IS TRUE TO	00004530
				2750 #	"AUTOMATIC I/O SERVICE"	00004540
					ELSE: SET "MAR" TO POINT TO	
					"EXTERNAL" OLD PSW AND DO A	
					"GENERALIZED PSW SWAP"	
				2752 #		00004560
				2753 ###	GENERALIZED PSW SWAP	00004570
				2754 #		00004580

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				2755 #	ASSUMPTIONS	00004590
				2756 #	"MAR" CONTAINS THE ADDRESS OF	00004600
				2757 #	THE "OLD PSW"	00004610
				2758 #	"LOC" CONTAINS THE ADDRESS OF	00004620
				2759 #	THE NEXT INSTRUCTION	00004630
				2760 #	SCRATCH REGISTERS USED:	00004640
				2761 #	LOCK	00004650
00003B	83B2000B0			2763 GENSHP	LR MDR,PSW	00004670
00003C	C2B48C080			2765	AR MAR,X0002,MC=MHP	00004680
00003D	81B780040			2767	LR MDR,LOC	00004690
00003E	C2B48C080			2769	AR MAR,X0002,MC=MHP	00004700
00003F	C2B486080			2771 LPSW	AR MAR,X0002,MC=MRO	00004710
000040	C3B586050			2773	LR PSW,MDR,MC=MRO	00004720
000041	C3B700C5C			2775	LR LOC,MDR,ST=JAM,SP=PIHS	00004730
000042	83BED00B0			2777 TEST1	LR FLR,PSW,MOD=EXT1	00004740
				2779 #	TEST "PSW 06" FOR "CHANNEL TERM	00004750
				2780	INTERRUPT ENABLE"	00004760
000043	15B0206E0			2782 #	BIF: "PSW 06" TRUE TO CHECK FOR	00004770
				2783 #	CHANNEL TERM. INTERRUPT IN	00004780
				2784	QUEUE	00004790
000044	83BEC00B0			2786 TEST2	LR FLR,PSW,MOD=EXT0	00004800
000045	15B080790			2788	BCT C,WAIT	00004810
				2789	INTERRUPT	00004820
000046	81B78008C			2791	P3EXIT LR MAR,LOC,SP=PIHS	00004830
				2792	UPDATE "MAR" TO POINT TO NEXT	00004840
000047	C23033400				INSTRUCTION	00004850
					GO TO: "INSTRUCTION FETCH"	00004860
				2795 #		00004870
				2796 ###	AUTOMATIC I/O SERVICE -- DEVICE INTERROGATION ENTRY POINT	00004880
				2797 #		00004890
				2798 #	SCRATCH REGISTERS USED:	00004900
				2799 #	SR8	00004910
000048	43B800A10			2801 HSSVC	INP SR8,ACK,SYNC	00004920
				2804 #	GET: "DEVICE ADDRESS"	00004930
				2805 ###	AUTOMATIC I/O SERVICE -- "SINT" OR "PANEL INTERRUPT" ENTRY POINT	00004940
				2806 #		00004950
				2807 #		00004960
				2808 #	ASSUMES "00XX" PASSED AS	00004970
				2809 #	PARAMETER VIA "SR8" WHERE	00004980
				2810 #	"XX" = "DEVICE ADDRESS"	00004990
				2811 #	SCRATCH REGISTERS USED:	00005000
					SR8,SR9	00005010
000049	808800100			2813 IOSVC	AQR SR8,SR8	00005030
00004A	633480D04			2815	ARQI MAR,SPTABL,SP=ZERO	00005040
					ACCESS "SERVICE POINTER"	00005050
					FROM "MEMORY ADDRESS" EQUAL TO	00005060

PSR (4:7) → FLR
 AS SP CT PM

PSR (0:3) → FLR

INTERRUPT SERVICE

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Firmware
RAR

17 MAY 79

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
00004B	D4B906120			2017 #	UT,UT,MC=HRO	00005050
				2018 #	UT,UT,MC=HRO	00005060
				2020 #	UT,UT,MC=HRO	00005070
00004C	83B800050			2021 DOIT	LR FLR,MDR	00005080
00004D	83B480054			2023	LR MAR,MDR,SP=ZERO	00005090
00004E	15B013580			2025	BCT L,ISBSVC	00005100
				2027 #	"CHANNEL COMMAND" TO	00005110
00004F	83B2800B0			2028	LR MDR,PSW	00005120
000050	C2B48C080			2030	AR MAR,X0002,MC=HMP	00005130
000051	81B780040			2032	LR MDR,LOC	00005140
000052	C2B48C080			2034	AR MAR,X0002,MC=HMP	00005150
000053	C2B486080			2036	AR MAR,X0002,MC=HRO	00005160
000054	83B580050			2038	LR PSW,MDR	00005170
				2040 #	"LOC"	00005180
				2041 #	NOTE: / NEW "LOC" IS NEXT	00005190
000055	83B700094			2042	LR LOC,MAR,SP=ZERO	00005200
000056	C23032400			2044	CHD MC=HRI1,ST=JMC,DC=IFCH	00005210
				2047 #		00005230
				2048 ###	ILLEGAL OR PRIVILEGED INSTRUCTION INTERRUPT	00005240
				2049 #		00005250
000057	8636000E0			2051 ILLEGRI	DR LOCK,LOC	00005270
000058	8637000C0			2053 ILLEGRI	DR LOC,LOCK	00005280
000059	76B700020			2055 ILLEGRI	SI LOC,2	00005290
00005A	63B480304			2057	LI MAR,OILLPSW,SP=ZERO	00005300
00005B	25B0003B0			2059	B GENSWP	00005310
				2062 #		00005330
				2063 ###	INTERROGATE EXCEPTIONAL CONDITION INTERRUPT TYPE	00005340
				2064 #		00005350
00005C	63B600010			2066 ENTHLP	LI EXT,X'01'	00005370
00005D	83BEC00D0			2068 HELP	LR FLR,EXT,MOD=EXT0	00005380
00005E	15B010C70			2070	BCT L,PHRDIN	00005390
				2072 #	FAILURE" INTERRUPT SERVICE	00005400
00005F	83BED00D0			2073	LR FLR,EXT,MOD=EXT1	00005410
000060	15B087FC0			2075	BCT C,XXFST1	00005420
000061	83BEC00D0			2077 NFST1	LR FLR,EXT,MOD=EXT0	00005430
000062	63B480384			2079	LI MAR,ONPSW,SP=ZERO	00005440
				2081 #	SET "MAR" TO POINT TO "MACHINE	00005450
000063	15B0211F0			2082	BCT G,HIFSWP	00005460
				2084 #	BIF: "HALF" TO "MACHINE	00005470
000064	83BED00D0			2085	LR FLR,EXT,MOD=EXT1	00005480
				2087 #	TEST: FOR "INTERLEAVED DATA	00005490
					CHANNEL REQUEST" OR "EXTERNAL	

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INTERRUPT SERVICE

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				2088	"	I/O" INTERRUPT
00065	823000000			2089	"	
				2091	"	THE FOLLOWING STATEMENT HAS BEEN NO-OP'ED TO INHIBIT 'ATN' INTERRUPTS
				2092	"	AND INTERLEAVED DATA CHANNEL SERVICE WHILE SINGLE STEPPING.
				2093	"	BCT VG,TEST3
				2094	"	"PRIME POWER FAILURE"
00066	83BEC0000			2095	TEST5	LR FLR,EXT,MOD=EXT0
				2097	"	ELSE TEST: FOR "PANEL INTERRUPT"
				2098	"	OR PANEL IN "SINGLE MODE"
00067	15B0C08B0			2099	"	BCT CV,CONSER
				2100	"	BIF: "CATN" OR "SNGL" TO
				2101	"	"CONSOLE SERVICE"
00068	83BEC0000			2102	TEST3	LR FLR,EXT,MOD=EXT0
00069	15B0305E0			2103	"	BCT GL,HELP+H
				2105	"	ELSE BIF: "PPF" OR "HALF" TO
				2106	TEST4	LR FLR,EXT,MOD=EXT1
				2108	"	"INTERROGATE INTERRUPT TYPE"
				2109	"	TEST: FOR "INTERLEAVED DATA
				2111	"	CHANNEL REQUEST"
0006B	15B0210C0			2112	"	BCT G,DCR
				2113	"	BIF: "DC" IS TRUE TO
				2114	"	"INTERLEAVED DATA CHANNEL
				2115	"	REQUEST" SERVICE
0006C	15B040300			2116	TEST4A	BCT V,TEST
				2117	"	BIF: "ATN" TO TEST FOR
				2118	"	"AUTOMATIC I/O SERVICE
				2119	"	INTERRUPT ENABLED"
0006D	25B000440			2120	"	B TEST2
				2121	"	ELSE GO TO: TEST FOR "WAIT"
				2122	"	CONDITION
				2123	"	
				2124	"	2125
				2126	"	2127
				2128	"	2129
				2130	"	2131
				2132	"	2133
				2134	"	2135
				2136	"	2137
				2138	"	2139
				2140	"	2141
				2142	"	2143
				2144	"	2145
				2146	"	2147
				2148	"	2149
				2150	"	2151
				2152	"	2153
				2154	"	2155
				2156	"	2157
				2158	"	2159
				2160	"	2161
				2162	"	2163
				2164	"	2165
				2166	"	2167
				2168	"	2169
				2170	"	2171
				2172	"	2173
				2174	"	2175
				2176	"	2177
				2178	"	2179
				2180	"	2181
				2182	"	2183
				2184	"	2185
				2186	"	2187
				2188	"	2189
				2190	"	2191
				2192	"	2193
				2194	"	2195
				2196	"	2197
				2198	"	2199
				2200	"	2201
				2202	"	2203
				2204	"	2205
				2206	"	2207
				2208	"	2209
				2210	"	2211
				2212	"	2213
				2214	"	2215
				2216	"	2217
				2218	"	2219
				2220	"	2221
				2222	"	2223
				2224	"	2225
				2226	"	2227
				2228	"	2229
				2230	"	2231
				2232	"	2233
				2234	"	2235
				2236	"	2237
				2238	"	2239
				2240	"	2241
				2242	"	2243
				2244	"	2245
				2246	"	2247
				2248	"	2249
				2250	"	2251
				2252	"	2253
				2254	"	2255
				2256	"	2257
				2258	"	2259
				2260	"	2261
				2262	"	2263
				2264	"	2265
				2266	"	2267
				2268	"	2269
				2270	"	2271
				2272	"	2273
				2274	"	2275
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				2280	"	2281
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				2294	"	2295
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				2298	"	2299
				2300	"	2301
				2302	"	2303
				2304	"	2305
				2306	"	2307
				2308	"	2309
				2310	"	2311
				2312	"	2313
				2314	"	2315
				2316	"	2317
				2318	"	2319
				2320	"	2321
				2322	"	2323
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				2326	"	2327
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				2330	"	2331
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				2342	"	2343
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				2348	"	2349
				2350	"	2351
				2352	"	2353
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				2362	"	2363
				2364	"	2365
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				2394	"	2395
				2396	"	2397
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				2400	"	2401
				2402	"	2403
				2404	"	2405
				2406	"	2407
				2408	"	2409
				2410	"	2411
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				2478	"	2479
				2480	"	2481
				2482	"	2483
				2484	"	2485
				2486	"	2487
				2488	"	2489
				2490	"	2491
				2492	"	2493
				2494	"	2495
				2496	"	2497
				2498	"	2499
				2500	"	2501
				2502	"	2503
				2504	"	2505
				2506	"	2507
				2508	"	2509
				2510	"	2511

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				2948 M		00005930
				2949 M M	SIMULATE INTERRUPT (RI)	00005940
				2950 M		00005950
				2951 M		00005960
				2952 M	SCRATCH REGISTERS USED:	00005970
				2953 M	SR0 IS USED TO PASS "DEVICE ADDRESS"	00005980
000076	63B000FF0			2955 SINT	LI SR0,X'FF'	00006000
000077	0E3000050			2957	NR SR0,HDR	00006010
000078	25B000490			2959	B IOSVC	00006020
				2961 M		00006030
				2962 M	EXTRACT "DEVICE ADDRESS" FROM CONTENTS OF "MEMORY"	00006040
					GO TO: "AUTOMATIC I/O SERVICE -- SIMULATE INTERRUPT OR PANEL INTERRUPT ENTRY POINT"	
				2964 M		00006060
				2965 M M	INTERRUPTABLE WAIT	00006070
				2966 M		00006080
				2967 M	SCRATCH REGISTERS USED:	00006090
				2968 M	SR0	00006100
000079	63B600020			2970 WAIT	LI EXT,X'02'	00006120
00007A	83B8100D0			2972 WAITLP	LR SR0,EXT,MOD=SWAP	00006130
00007B	6E3801BE0			2974	NI SR0,X'BE',F	00006140
00007C	25B0307A0			2976	BCF GL,WAITLP	00006150
00007D	63B600010			2978	LI EXT,X'01'	00006160
00007E	25B000330			2980	B PSHELP	00006170

Missing

07F-08B

Console Service Display Entry Point

Panel Idle

Console Service Normal Entry Point

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE	STATEMENT	17 MAY 79
00008C	51B000210			3037	OUT	SR0,ADRS,SYNC	THE PANEL STATUS
00008D	15B040990			3039	BCT	V,CLRMIT	BIF: "NO PANEL" TO "CLEAR WAIT
				3041			BIT IN PSM AND BEGIN
				3042			INSTRUCTION EXECUTION
00008E	43B280E10			3043	INP	MOR,SR,SYNC	TEST: "SINGL MODE"
00008F	83BEC00D0			3045	LR	FLR,EXT,MOD=EXT0	BIF: "SINGL" TO "REGISTER DISPLAY
000090	15B0407F0			3047	BCT	V,DISPLY	EXTRACT "PANEL MODE" FROM
000091	83BEE0050			3049	LR	FLR,MOR,MOD=EXT2	"STATUS BYTE"
				3051			BIF: "STATUS BIT 03" IS TRUE TO
000092	15B010A00			3052	BCT	L,MHSL	"MEMORY WRITE OR ADDRESS"
				3054			BIF: "STATUS BIT 02" IS TRUE TO
000093	15B0209D0			3055	BCT	G,MREAD	"MEMORY READ"
				3057			BIF: "STATUS BIT 01" IS TRUE TO
000094	15B0407F0			3058	BCT	V,DISPLY	"SINGLE OR HALT"
				3060			ELSE: "RUN MODE" TEST " REGISTER
000095	83BE80050			3061	LR	FLR,MOR	SELECT"
				3063			BIF: "ANY REGISTER SELECTED" TO
000096	15B0F0990			3064	BCT	CVGL,CLRMIT	"CLEAR WAIT BIT IN PSM AND
				3066			BEGIN INSTRUCTION EXECUTION"
				3067			ELSE TEST: "PSM BIT 04" FOR
000097	83BED00B0			3068	LR	FLR,PSM,MOD=EXT1	"PANEL INTERRUPT ENABLED"
				3070			BIF: "AUTO-I/O SERVICE ENABLED"
000098	15B080490			3071	BCT	C,IOSVC	TO "AUTOMATIC I/O SERVICE"
				3073			
				3075			00006850
				3076	MMH	CLEAR WAIT BIT IN PSM AND BEGIN INSTRUCTION EXECUTION	00006860
				3077			00006870
000099	8A39000A0			3079	CLRMIT	LROC SR9,X0000	CREATE MASK OF X'7FFF'
00009A	81B78008C			3081	LR	MAR,LOC,SP=PINS	MAR := A(NEXT INSTN)
00009B	CE39820A0			3083	HR	PSM,SR9,MC=MRI1	CLEAR PSM "WAIT"; FETCH INSTR
				3085	CHD	ST=CLR	(CAN'T CLR WHEN PSM=DEST)
				3086	B	IFETCH	DISALLOW INTERRUPT (EXEC
00009C	25B0002C0			3088			AT LEAST ONE INSTN)
							00006890
							00006900
							00006910
							00006920
							00006930
							00006940
				3090			00006960
				3091	MMH	MEMORY READ	00006970
00009D	81B78008C			3093	MREAD	LR MAR,LOC,SP=PINS	ACCESS "MEMORY CONTENTS"
				3095			SPECIFIED BY "LOC"
							00007000

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00009E	C0B706080			3096	AR LOC,X0002,MC=MRO	00007010
00009F	25B000B50			3098	B OUTDIS	00007020
				3101	"	00007040
				3102	*** MEMORY WRITE OR MEMORY ADDRESS	00007050
0000A0	15B020A60			3104	MWSL BCT G,MADR	00007070
				3106	"	00007080
0000A1	81B78008C			3107	MWRITE LR MAR,LOC,SP=PIN3	00007090
0000A2	43B280010			3109	INP MDR,DR,SYNC	00007100
0000A3	43B2A0010			3111	INP MDR,DR,SYNC,MOD=IN3B	00007110
0000A4	C0B70C080			3113	AR LOC,X0002,MC=MHP	00007120
0000A5	25B000B50			3115	B OUTDIS	00007130
				3118	"	00007150
				3119	*** MEMORY ADDRESS	00007160
				3120	"	00007170
0000A6	43B900010			3122	MADR INP SR9,DR,SYNC	00007190
0000A7	6E3900FE0			3124	HI SR9,X'FE'	00007200
0000A8	43B490010			3126	INP MAR,DR,SYNC,MOD=SWAP,SP=DBUS	00007210
0000A9	8EB980080			3128	OR MAR,SR9	00007220
0000AA	63B100040			3130	LI CTR,X'04'	00007230
0000AB	C3B9400D0			3132	LR SR9,EXT,RPT=1	00007240
0000AC	826900120			3134	PLL SR9,SR9	00007250
0000AD	63B400C00			3136	LI SRA,X'C0'	00007260
0000AE	8C3900140			3138	NR SR9,SRA	00007270
0000AF	8A3A00140			3140	LROC SRA,SRA	00007280
0000B0	8E3A000A0			3142	NR PSW,SRA	00007290
0000B1	8EB9800A0			3144	OR PSW,SR9	00007300
0000B2	83B700090			3146	LR LOC,MAR,SP=NCNG	00007310
				3148	"	00007320
				3150	"	00007340
				3151	*** PSW DISPLAY	00007350
				3152	"	00007360
0000D3	83D4800B4			3154	PSWDIS LR MAR,PSW,SP=ZERO	00007380
0000B4	81B780040			3156	LR MDR,LOC	00007390
				3158	"	00007400

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3160 #		00007420
				3161 ###	OUTPUT TO PANEL DISPLAY	00007430
				3162 #		00007440
000085	53B280610			3164 OUTDIS	OUT MDR,DA,SYNC	00007460
000086	53B290610			3166	OUT MDR,DA,SYNC,MOD=SWAP	00007470
000087	53B480610			3168	OUT MAR,DA,SYNC	00007480
000088	53B490610			3170	OUT MAR,DA,SYNC,MOD=SWAP	00007490
000089	25B000830			3172	B IDLE	00007500
					GO TO: "PANEL IDLE"	
				3175 #		00007520
				3176 ###	GENERAL REGISTER DISPLAY	00007530
				3177 #		00007540
00008A	83B970050			3179 REGDIS	LR SR9,MDR,MOD=EXT3	00007560
00008B	80B900120			3181	AR SR9,SR9	00007570
00008C	81B980060			3183	LR IR,SR9	00007580
00008D	83B480134			3185	LR MAR,YS,SP=ZERO	00007590
00008E	93B380070			3187	IR IR,IR	00007600
00008F	83B280130			3189	LR MDR,YS	00007610
0000C0	25B000850			3191	B OUTDIS	00007620
					GO TO: "OUTPUT TO PANEL DISPLAY"	
				3194 #		00007640
				3195 ###	INSTRUCTION DISPLAY	00007650
				3196 #		00007660
0000C1	81B78008C			3198 INSDIS	LR MAR,LOC,SP=PIPS	00007680
0000C2	C2B486080			3200	AR MAR,X0002,MC=MRO	00007690
0000C3	C3B906050			3202	LR SR9,MDR,MC=MRO	00007700
0000C4	81B980084			3204	LR MAR,SR9,SP=ZERO	00007710
0000C5	25B000850			3206	B OUTDIS	00007720
					GO TO: "OUTPUT TO PANEL DISPLAY"	
				3208 #		00007730
				3209 #		00007740
0000C6	823000000			3210	NOP	00007750

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3213	"	00007770
				3214	PRIME POWER FAILURE INTERRUPT -- POWER DOWN	00007780
				3215	"	00007790
				3216	"	00007800
				3217	"	00007810
0000C7	63B480264			3218	PHRDOWN LI MAR,CPSW+2,SP=ZERO	00007820
0000C8	81B780040			3220	LR MDR,LOC	00007830
0000C9	DAB48C080			3222	SR MAR,X0002,MC=MHP	00007840
0000CA	83B280080			3224	LR MDR,PSW	00007850
0000CB	DAB38C080			3226	SR MAR,X0004,MC=MHP	00007860
0000CC	81B380043			3228	LR MDR,CPR,SP=SPEX	00007870
0000CD	C2B48C080			3230	AR MAR,X0002,MC=MHP	00007880
0000CE	C1B4860A0			3232	LR PSW,X0002,MC=MRO	00007890
				3234	"	00007900
0000CF	83B480054			3235	LR MAR,MDR,SP=ZERO	00007910
				3237	"	00007920
0000D0	63B380080			3238	LI IR,0	00007930
				3240	"	00007940
				3241	STORE MULTIPLE (RXAD)	00007950
				3242	G=0 IF STM INSTN	00007960
				3243	G=1 IF POWER DOWN SEQ	00007970
				3244	"	00007980
0000D1	63B800100			3245	STM LI SR8,X'10'	00007990
				3247	"	00008000
0000D2	968860070			3248	ERR SR8,IR,MOD=EXT2,	00008010
0000D3	813080020				AIC=BMDH1,CIN=1,AOC=LDQ	00008020
				3250	LR CTR,Q	00008030
				3252	"	00008040
0000D4	83B200150			3253	STHLP LR MDR,YD	00008050
0000D5	C2B88A060			3255	AR IR,SR8,MC=MHP	00008060
0000D6	82B480080			3257	AR MAR,X0002	00008070
0000D7	15B000040			3259	BCT CTR,STHLP	00008080
				3261	"	00008090
0000D8	25B021320			3262	BCF G,P3EXITX	00008100
				3264	"	00008110
				3265	POWER STOP -- HALT UNTIL MASTER CLEAR BECOMES EFFECTIVE	00008120
				3266	"	00008130
0000D9	25B000090			3267	PSTOP D PSTOP HALT	00008140
				3269	"	00008150
				3270	"	00008160
0000DA	823000000			3271	NOP	00008170
0000DB	823000000			3273	NOP	00008180

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3276	"	00008200
				3277	*** POWER-ON INITIALIZATION SEQUENCE	00008210
				3278	"	00008220
00000C	63B400020			3279	PIWON LI X0002,2 INIT REGISTER CONSTANTS	00008230
00000D	63B510800			3281	LI X8000,X'80',MOD=SWAP	00008240
00000E	63B300040			3283	LI X0004,4	00008250
00000F	63B200FF0			3285	LI X00FF,X'FF'	00008260
0000E0	63B508003			3287	LI X8000,0,SP=SPEX,DEST=INHIB "X8000"=X'80000000'	00008270
0000E1	63B208203			3289	LI X0020,X'20',SP=SPEX,DEST=INHIB	00008280
0000E2	83BEE00D0			3291	LR FLR,EXT,MOD=EXT2 TEST FOR "HTST" OR "PRLD"	00008290
0000E3	15B027FE0			3293	BCT G,XXPRGLD BIF: "PRLD" TO "PROGRAM LOAD"	00008300
0000E4	15B047FF0			3295	BCT V,XXHTST BIF: "HTST" TO "MEMORY TEST"	00008310
				3297	"LSU" CAPABILITY HAS BEEN REMOVED	00008320
				3298	TESTO LI SR8,X'05' TEST FOR "LOADER STORAGE UNIT"	00008330
				3299	OUT SR8,ADRS,SYNC	00008340
				3300	BCF V,ILOAD BIF: "LSU" IN SYSTEM TO "AUTO-BOOTSTRAP LOADER"	00008350
				3301	"	00008360
				3302	"	00008370
				3303	" TEST WHETHER MEMORY IS OPERATIONAL ("COLD" VS "WARM" START)	00008380
0000E5	63BF00AA0			3304	INTENT LI SRF,X'AA'	00008390
0000E6	6EBF10AA0			3306	OI SRF,X'AA',MOD=SWAP	00008400
0000E7	83BEE00D0			3308	LR FLR,EXT,MOD=EXT2	00008410
0000E8	25B010FC0			3310	BCF L,COLDSTRT	00008420
				3312	"	00008430
				3313	" POWER UP(WARM MEMORY): RESTORE PSM,LOC,CPR,REGISTERS	00008440
0000E9	63B480204			3314	LI MAR,X'20',SP=ZERO	00008450
0000EA	C2B386080			3316	AR MAR,X0004,MC=MRO READ M(20) = CPR	00008460
0000EB	83B300053			3318	LR CPR,MOR,SP=SPEX,DEST=INHIB	00008470
0000EC	C2B486080			3320	AR MAR,X0002,MC=MRO READ M(24) = PSM	00008480
0000ED	83B580050			3322	LR PSM,MOR	00008490
0000EE	DAB386C80			3324	SR MAR,X0004,MC=MRO,ST=JAM READ M(26) = LOC	00008500
0000EF	83B800050			3326	LR SR8,MOR SAVE "LOC" WHILE READING POINTER	00008510
0000F0	C23706100			3328	LR LOC,SR8,MC=MRO READ M(22) = REG SAVE PTR	00008520
				3330	CHD MC=MRO	00008530
				3331	LR LOC,SR8	00008540
0000F1	83B480650			3332	BRR MAR,MOR,AIC=D,C=-C MAR := REG SAVE PTR	00008550
				3334	" C := 1 (POWER UP SEQ)	00008560
				3335	"	00008570
				3336	*** LOAD MULTIPLE (RXAD)	00008580
				3337	" C=0 IF LM INSTN	00008590
				3338	" C=1 IF POWER UP SEQ	00008600
				3339	" SCRATCH REGISTERS USED:	00008610
0000F2	63B800100			3340	LM LI SR8,X'10' INITIALIZE "CTR" TO "THOS COMP"	00008620
				3342	" OF "DELTA REGISTER COUNT"	00008630
				3343	BRR SR8,IR,MOD=EXT2, Q := 16-R1 = # REGS	00008640

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0000F3	960060070				AIC=BMDH1,CIN=1,AOC=LDQ	00008650
0000F4	013000020			3345	LR CTR,Q	00008660
				3347	"	00008670
0000F5	9AD000060			3348	SR IR,SRS	00008680
0000F6	C2B000060			3350	LMLOOP AR IR,SRS,MC=MRO	00008690
0000F7	02B400000			3352	AR MAR,X0002	00008700
0000F8	03BA00050			3354	LR YD,MOR	00008710
0000F9	15B000F60			3356	BCT CTR,LMLOOP	00008720
0000FA	25B001320			3358	BCF C,P3EXITX	00008730
0000FB	25B001040			3360	B ADRPHL	00008740
				3362	"	00008750
				3363	" POWER UP(COLD MEMORY): TEST FOR PRESENCE OF MAIN-MEMORY PROM	00008760
				3364	" NOTE: SRF=X'AAAA'	00008770
0000FC	03B103C00			3365	COLDSTRY BLK CLRPTY,TEMPYD	00008780
0000FD	0237000A4			3367	LR LOC,X0000,SP=ZERO	00008790
0000FE	63B200000			3369	LI MDR,0	00008800
0000FF	C3B50C050			3371	LR PSW,MDR,MC=MMP	00008810
000100	C0B706C00			3373	AR LOC,X0002,MC=MRO,ST=JAM	00008820
000101	9ABF09040			3375	CR MDR,SRF,F	00008830
				3377	AIF (A0000000 NE 0).CDRPH1	00008840
000102	15B030030			3378	BCT GL,IDLE	00008850
				3380	AGO .NCDRPH1	00008860
				3381	.NCDRPH1 ANOP	00008880
000103	63B600040			3382	SETHOP LI EXT,4	00008890
				3384	"	00008900
				3385	" MEMORY NOW "OPERATIONAL", SEE WHETHER TO RUN OR COME UP HALTED	00008910
				3386	ADRPHL BIO OUT,X0002,ADRS,SYNC, ADDR PANEL (DEVAD=1)	00008920
000104	55B400210				AIC=BH1	00008930
000105	43B200E10			3388	INP MDR,SR,SYNC	00008940
000106	03DEE0050			3390	LR FLR,MDR,MOD=EXT2	00008950
000107	15B070030			3392	BCT VGL,IDLE	00008960
000108	63B400304			3394	LI MAR,OMPSW,SP=ZERO	00008970
000109	03BEC0080			3396	LR FLR,PSW,MOD=EXT0	00008980
00010A	15B020300			3398	BCT G,GENSWP	00008990
00010B	25B000440			3400	B TEST2	00009000

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
3403	M					00009020
3404	MNM				INTERLEAVED DATA CHANNEL REQUEST	00009030
3405	M					00009040
3406	M				SCRATCH REGISTERS USED:	00009050
3407	M				SRO	00009060
00010C	51B500C10			3409	DCR OUT X0000,DACK,SYNC	00009080
00010D	03BEF00D0			3411	LR FLR,EXT,MOD=EXT3	00009090
00010E	15B021170			3413	BCT G,DCREAD	00009100
				3416	M	00009120
				3417	MNM INTERLEAVED DATA CHANNEL WRITE (OUTPUT)	00009130
				3418	M	00009140
00010F	43B400010			3420	DCRIT INP MAR,DR,SYNC,SP=DBUS	00009160
				3422	M	00009170
000110	C23006000			3423	CHD MC=MRO	00009180
000111	03BEC00D0			3425	LR FLR,EXT,MOD=EXT0	00009190
000112	53B200610			3427	OUT MDR,DA,SYNC	00009200
000113	15B0305E0			3429	BCT GL,HELP,M	00009210
000114	03BED00D0			3431	LR FLR,EXT,MOD=EXT1	00009220
000115	15B0210C0			3433	BCT G,DCR	00009230
000116	25B0006C0			3435	B TEST4A	00009240
				3438	M	00009260
				3439	MNM INTERLEAVED DATA CHANNEL READ (INPUT)	00009270
				3440	M	00009280
000117	43B400010			3442	DCREAD INP MAR,DR,SYNC,SP=DBUS	00009300
				3444	M	00009310
000118	43B200810			3445	INP MDR,DR,SYNC	00009320
000119	C2300C000			3447	CHD MC=MSP	00009330
00011A	03BEC00D0			3449	LR FLR,EXT,MOD=EXT0	00009340
00011B	15B0305E0			3451	BCT GL,HELP,M	00009350
00011C	03BED00D0			3453	LR FLR,EXT,MOD=EXT1	00009360
00011D	15B0210C0			3455	BCT G,DCR	00009370
00011E	25B0006C0			3457	B TEST4A	00009380

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3460	"	00009400
				3461	### MACHINE MALFUNCTION INTERRUPT	00009410
				3462	"	00009420
				3463	SCRATCH REGISTERS USED:	00009430
				3464	SR9	00009440
				3465	THIS ROUTINE ASSUMES THAT "MAR"	00009450
				3466	HAS BEEN INITIALIZED TO POINT	00009460
				3467	TO "MACHINE MALFUNCTION" OLD	00009470
					PSW	
00011F	83B2000B0			3469	MMFSWP LR MDR,PSW PUT: "CURRENT PSW" AND "CURRENT	00009490
000120	C2B48C080			3471	AR MAR,X0002,MC=MMP LOC" INTO "MACHINE MALFUNCTION	00009500
000121	81B780040			3473	LR MDR,LOC OLD PSW	00009510
000122	C2B48C080			3475	AR MAR,X0002,MC=MMP	00009520
000123	C2B487080			3477	AR MAR,X0002,MC=MRO,ST=AMC GET: "CURRENT PSW" AND "CURRENT	00009530
000124	83B800050			3479	LR SR0,MDR LOC" FROM "MACHINE MALFUNCTION	00009540
				3481	"	00009550
000125	8EB0F00A0			3482	BRR PSW,SR0,AIC=DOB,MOD=EXT3 NEW PSW. NOTE: "FLAGS" AND	00009560
				3484	"	00009570
000126	C3B706C5C			3485	LR LOC,MDR,ST=JAM,MC=MRO,SP=PINS NEW "CONDITION CODE"	00009580
000127	25B000420			3487	B TEST1 GO TO: TEST FOR "CHANNEL	00009590
				3489	"	00009600
				3490	TERMINATION INTERRUPT" ENABLED	00009610
				3492	"	00009630

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3494 M		00009650
				3495 M		00009660
				3496 M	THIS SECTION OF CODE EXECUTES THE USER MACRO INSTRUCTIONS	00009670
				3497 M	VIA A SET OF MICRO INSTRUCTIONS. THE OP CODE DETERMINES	00009680
				3498 M	THE TYPE OF INSTRUCTION (I.E. REGISTER TO REGISTER, REGISTER	00009690
				3499 M	TO INDEXED MEMORY, OR REGISTER TO STORAGE), AS WELL AS THE	00009700
				3500 M	STARTING POINT OF THE MICRO CODE RESPONSIBLE FOR THE EXEC-	00009710
				3501 M	UTION OF THE MACRO INSTRUCTION.	00009720
				3503 M		00009740
				3504 M	REGISTERS USED	00009750
				3505 M		00009760
				3507 M	REGEQU TEMP1,6	00009780
				3508 M	REGEQU TEMP2,9	00009790
				3509 M		00009800
				3510 M		00009810
				3513 M		00009840
				3514 M	LOAD IMMEDIATE SHORT (SF)	00009850
				3515 M		00009860
000120 83B871070				3516 L19	LR TEMP1,IR,F,MOD=EXT3	00009870
000129 C1B8B2540				3518	LR YD,TEMP1,ST=JMC,DC=IFCH,MC=MR11	00009880
				3520 M		00009890
				3521 M		00009900
				3522 M	LOAD COMPLEMENT SHORT (SF)	00009910
				3523 M		00009920
00012A 97B871070				3524 LCS	LRTC TEMP1,IR,F,MOD=EXT3	00009930
00012B C1B8B2540				3526	LR YD,TEMP1,ST=JMC,DC=IFCH,MC=MR11	00009940
				3528 M		00009950
				3529 M		00009960
				3530 M	LOAD HALFWORD (RR)	00009970
				3531 M		00009980
00012C 83B801130				3532 LHR	LR TEMP1,YS,F	00009990
00012D C1B8B2540				3534	LR YD,TEMP1,ST=JMC,DC=IFCH,MC=MR11	00010000
				3536 M		00010010
				3537 M		00010020
				3538 M	LOAD HALFWORD & LOAD HALFWORD IMMEDIATE (RXM,RI)	00010030
				3539 M		00010040
00012E 83B801050				3540 LH	LR TEMP1,MOR,F	00010050

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00012F	C1B0B2540			3542	LR YD,TEMP1,ST=JMC,DC=IFCH,MC=HRI1	00010060
				3544	"	00010070
				3545	"	00010080
				3546	MM STORE HALFWORD (RXAD)	00010090
				3547	"	00010100
000130	03B200150			3548	STH LR MDR,YD	00010110
000131	C2300A000			3550	CMD MC=MM	00010120
000132	9237000CC			3552	P3EXITX IR LOC,LOCX,SP=PINS	00010130
000133	C23033400			3554	CMD ST=CLR,DC=IFCH,MC=HRI1	00010140
				3556	"	00010150
				3557	"	00010160
				3558	MM ADD IMMEDIATE SHORT (SF)	00010170
				3559	"	00010180
000134	02B174270			3560	AIS AR TEMPYD,IR,CVF,MOD=EXT3	00010190
000135	C1B1B2540			3562	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00010200
				3564	"	00010210
				3565	"	00010220
				3566	MM ADD HALFWORD TO MEMORY (RXAD)	00010230
				3567	"	00010240
000136	02B104240			3568	AIR AR MDR,TEMPYD,CVF COMPUTE AND STORE SUM	00010250
000137	D2370A0CC			3570	IR LOC,LOCX,MC=MM,SP=PINS	00010260
000138	C23032400			3572	CMD ST=JMC,DC=IFCH,MC=HRI1	00010270
				3574	"	00010280
				3575	"	00010290
				3576	MM ADD W/CARRY HALFWORD (RR)	00010300
				3577	"	00010310
000139	03BE00000			3578	ACHR LR FLR,PSW (RR)	00010320
				3580	" ADD WITHOUT CARRY HALFWORD	00010330
00013A	A2B103330			3581	AHR ARC TEMPYD,Y3,CVF COMPUTE SUM	00010340
00013B	C1B1B2540			3583	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00010350
				3585	"	00010360
				3586	"	00010370
				3587	MM ADD W/CARRY HALFWORD (RXHW)	00010380
				3588	"	00010390
00013C	03BE00000			3589	ACH LR FLR,PSW	00010400
				3591	" ADD WITHOUT CARRY HALFWORD (RXHW,RI)	00010410
00013D	A2B103250			3592	AH ARC TEMPYD,MDR,CVF COMPUTE SUM	00010420
00013E	C1B1B2540			3594	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00010430
				3596	"	00010440
				3597	"	00010450
				3598	MM SUBTRACT IMMEDIATE SHORT (SF)	00010460
				3599	"	00010470
00013F	96B174670			3600	SIS SR TEMPYD,IR,CVF,MOD=EXT3 COMPUTE DIFFERENCE	00010480
000140	C1B1B2540			3602	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00010490
				3604	"	00010500

(TEMPYD)+(MDR) → MDR
Write Memory LOCK → LOC+MAR

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3605 #		00010510
				3606 ##	SUBTRACT HALFWORD M/CARRY & WITHOUT CARRY (RR)	00010520
				3607 #		00010530
000141	83B800B0			3608 SCIR	LR FLR,PSW	00010540
000142	B6B103730			3610 SHR	SRB TEMPYD,YS,CVF COMPUTE DIFFERENCE	00010550
000143	C1B1B2540			3612	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00010560
				3614 #		00010570
				3615 #		00010580
				3616 ##	SUBTRACT HALFWORD M/CARRY & WITHOUT CARRY (RXGM,RI)	00010590
				3617 #		00010600
000144	83B800B0			3618 SCH	LR FLR,PSW	00010610
000145	B6B103650			3620 SH	SRB TEMPYD,MOR,CVF COMPUTE DIFFERENCE	00010620
000146	C1B1B2540			3622	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00010630
				3624 #		00010640
				3625 #		00010650
				3626 ##	COMPARE LOGICAL HALFWORD (RR)	00010660
				3627 #		00010670
000147	96B104730			3628 CLHR	SR TEMPYD,YS,CVF PERFORM COMPARISON,SET FLAGS	00010680
000148	C23032400			3630	CHD ST=JMC,DC=IFCH,MC=HRI1	00010690
				3632 #		00010700
				3633 #		00010710
				3634 ##	COMPARE LOGICAL HALFWORD (RXGM,RI)	00010720
				3635 #		00010730
000149	96B104650			3636 CLH	SR TEMPYD,MOR,CVF PERFORM COMPARISON,SET FLAGS	00010740
00014A	C23032400			3638	CHD ST=JMC,DC=IFCH,MC=HRI1	00010750
				3640 #		00010760
				3641 #		00010770
				3642 ##	COMPARE HALFWORD ALGEBRAIC (RR,RXGM,RI)	00010780
				3643 #		00010790
00014B	83B200130			3644 CHR	LR MOR,YS SECOND OPERAND TO MOR	00010800
00014C	8F3109050			3646 CH	MR TEMPYD,MOR,F,DEST=INHIB CHECK SIGNS	00010810
00014D	15B011500			3648	BCT L,DIFFER BRANCH IF SIGNS DIFFER	00010820
				3650 #	SIGNS ALIKE	00010830
00014E	96B101650			3651	SR TEMPYD,MOR,CF PERFORM COMPARISON,SET FLAGS	00010840
00014F	C23032400			3653	CHD ST=JMC,DC=IFCH,MC=HRI1	00010850
				3655 #	SIGNS DIFFER	00010860
000150	83F802B50			3656 DIFFER	HRR TEMP1,YD,AIC=D, LOAD C,G,L1 USE F=DP TO	00010870
000151	C23032400				AOC=PL3,C=LSH,F=DP INSURE 6 OR 1	00010880
				3658	CHD ST=JMC,DC=IFCH,MC=HRI1	00010890
				3660 #		00010900
				3661 #		00010910
				3662 ##	AND HALFWORD (RR)	00010920
				3663 #		00010930
000152	8E3101130			3664 NHR	NR TEMPYD,YS,F PERFORM AND,SET FLAGS	00010940
000153	C1B1B2540			3666	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00010950

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3668 #		00010960
				3669 #		00010970
				3670 ##	AND HALFWORD (RXHW,RI)	00010980
				3671 #		00010990
000154	0E3101050			3672 NH	NR TEMPYD,MOR,F PERFORM AND,SET FLAGS	00011000
000155	C1B1B2540			3674	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00011010
				3676 #		00011020
				3677 #		00011030
				3678 ##	OR HALFWORD (RR)	00011040
				3679 #		00011050
000156	0E0101130			3680 OHR	OR TEMPYD,YS,F PERFORM OR,SET FLAGS	00011060
000157	C1B1B2540			3682	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00011070
				3684 #		00011080
				3685 #		00011090
				3686 ##	OR HALFWORD (RXHW,RI)	00011100
				3687 #		00011110
000158	0E0101050			3688 OH	OR TEMPYD,MOR,F PERFORM OR,SET FLAGS	00011120
000159	C1B1B2540			3690	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00011130
				3692 #		00011140
				3693 #		00011150
				3694 ##	EXCLUSIVE OR HALFWORD (RR)	00011160
				3695 #		00011170
00015A	0F3101130			3696 XHR	XR TEMPYD,YS,F PERFORM XOR,SET FLAGS	00011180
00015B	C1B1B2540			3698	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00011190
				3700 #		00011200
				3701 #		00011210
				3702 ##	EXCLUSIVE OR HALFWORD (RX,RI)	00011220
				3703 #		00011230
00015C	0F3101050			3704 XH	XR TEMPYD,MOR,F PERFORM XOR,SET FLAGS	00011240
00015D	C1B1B2540			3706	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00011250
				3708 #		00011260
				3709 #		00011270
				3710 ##	TEST HALFWORD IMMEDIATE (RI)	00011280
				3711 #		00011290
00015E	0E3101050			3712 THI	NR TEMPYD,MOR,F	00011300
00015F	C23032400			3714	CHD ST=JMC,DC=IFCH,MC=HRI1	00011310
				3716 #		00011320
				3717 #		00011330
				3718 ##	LOAD BYTE (RR)	00011340
				3719 #		00011350
				3720 LBR	8RR X00FF,YS, LOAD Q WITH BYTE	00011360
					AIC=DNB,	00011370
					AOC=LDQ	00011380
000160	0E0200130					00011390
000161	C130B3540			3722	LR YD,Q,ST=CLR,DC=IFCH,MC=HRI1	00011400
				3724 #		

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3725 #		00011410
				3726 ##	LOAD BYTE (RXOP)	00011420
				3727 #		00011430
000162	838830050			3728 LB	LR TEMP1,MDR,MOD=EXTB TEMP1 := 0.BYTE	00011440
000163	9237000CC			3730	IR LOC,LOCX,SP=PIHS	00011450
000164	C18883540			3732	LR YD,TEMP1,ST=CLR,DC=IFCH,MC=HRI1	00011460
				3734 #		00011470
				3735 #		00011480
				3736 ##	STORE BYTE (RR)	00011490
				3737 #		00011500
000165	8C0100040			3738 STBR	RRR TEMPYD,X00FF,AIC=AHB,AOC=LDQ Q := 0,YD(0..15)	00011510
000166	638910FF0			3740	LI SR9,X'00FF',MOD=SHAP	00011520
000167	8E3900130			3742	NR SR9,Y5 SR9 := Y5(0..7) 0	00011530
				3744 #	NOTE 'A' OPERAND = Y5 = 9 = SR9	00011540
000168	C03983520			3745	BCT Y5,SR9,AIC=APQ, Y5 := Y5(0..7) YD(0..15)	00011550
					ST=CLR,DC=IFCH,MC=HRI1	00011560
				3747 #		00011570
				3748 #		00011580
				3749 ##	STORE BYTE (RXOP)	00011590
				3750 #		00011600
000169	8382A0150			3751 STB	LR MDR,YD,MOD=INSB INSERT BYTE	00011610
00016A	D2370A0CC			3753	IR LOC,LOCX,MC=HH,SP=PIHS	00011620
00016B	C23033400			3755	CMD ST=CLR,DC=IFCH,MC=HRI1	00011630
				3757 #		00011640
				3758 #		00011650
				3759 ##	EXCHANGE BYTE (RR)	00011660
				3760 #		00011670
00016C	838810130			3761 EXBR	LR TEMP1,Y5,MOD=SHAP	00011680
00016D	C18883540			3763	LR YD,TEMP1,ST=CLR,DC=IFCH,MC=HRI1	00011690
				3765 #		00011700
				3766 #		00011710
				3767 ##	COMPARE LOGICAL BYTE (RXOP)	00011720
				3768 #		00011730
00016E	8C3100040			3769 CLB	NR TEMPYD,X00FF ISOLATE BYTE	00011740
00016F	96D131650			3771	SR TEMPYD,MDR,CF,MOD=EXTB PERFORM COMPARISON	00011750
000170	9237000CC			3773	IR LOC,LOCX,SP=PIHS	00011760
000171	C23032400			3775	CMD ST=JMC,DC=IFCH,MC=HRI1	00011770
				3777 #		00011780
				3778 #		00011790
				3779 ##	BRANCH ON TRUE SHORT (SF)	00011800
				3780 #		00011810
000172	8380000B0			3781 BTBS	LR TEMP1,PSH	00011820
000173	8E3861070			3783	NR TEMP1,IR,F,MOD=EXT2 AND OF CC & MASK	00011830
000174	25B021770			3785	BCF 6,BTBSEKIT BIF BRANCH NOT SATISFIED	00011840
				3787 BBACK	RRR LOC,IR,MOD=EXT3,CIN=0, LOC := LOC-1 - D	00011850

MICROCODE, HMP-1116 PLP 1641003 REV. A CCA9 1641603,1641604,1641653 "657,0416,J55"

HUGHES PROPRIETARY

FOR TRAINING
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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000175	06B77007C			3709	ARR AIC=BMDH1,SP=PIN5 LOC,IR,MOD=EXT3,CIN=0, LOC := (LOC-2) - 2ND	00011860 00011870
000176	06B77007C			3791	BTDSEXIT CMD AIC=BMDH1,SP=PIN5	00011880 00011890
000177	C23033400			3793 *	ST=CLR,DC=IFCH,MC=MRI1	00011900 00011910
000178	03B8000B0			3794	BTF5 LR TEMP1,PSW	00011920 00011930
000179	0E0061070			3796	ARR TENP1,IR,MOD=EXT2,F=SP, MASK 'AND'ED WITH CC	00011940 00011950
00017A	25B0217D0			3798	BCF AIC=DHB,AOC=LDQ CLEAR MSB OF Q	00011960 00011970
00017B	08E970070			3800	BFORE ARR G,BTFSEXIT BIF BRANCH NOT SATISFIED	00011980 00011990
00017C	00B70012C			3802	AR AIC=DH1,AOC=PLD TEMP2 := 2*(D-1)	00012000 00012010
00017D	C23033400			3804	BTFSEXIT CMD LOC,TEMP2,SP=PIN5 LOC := (LOC-2) + 2ND	00012020 00012030
				3806 *	ST=CLR,DC=IFCH,MC=MRI1	00012040 00012050
				3807 *		00012060 00012070
				3808 **	BRANCH ON TRUE (RR)	00012080 00012090
				3809 *		00012100 00012110
00017E	03B8000B0			3810	BTCR LR TEMP1,PSW	00012120 00012130
00017F	0E3861070			3812	NR TEMP1,IR,F,MOD=EXT2 AND OF CC & MASK	00012140 00012150
000180	25B021820			3814	BCF G,NRRD BRANCH TO EXIT IF FALSE	00012160 00012170
000181	03B70013C			3816	LR LOC,Y5,SP=PIN5 LOAD NEW ADDRESS INTO LOC	00012180 00012190
000182	C23033400			3818	NRRD CMD ST=CLR,DC=IFCH,MC=MRI1	00012200 00012210
				3820 *		00012220 00012230
				3821 *		00012240 00012250
				3822 **	BRANCH ON TRUE (RI)	00012260 00012270
				3823 *		00012280 00012290
000183	03B8000B0			3824	BTC LR TEMP1,PSW	00012300 00012310
000184	0E3861070			3826	NR TEMP1,IR,F,MOD=EXT2 AND OF CC & MASK	00012320 00012330
000185	25B021870			3828	BCF G,NRxB BRANCH TO EXIT IF FALSE	00012340 00012350
000186	03B70005C			3830	LR LOC,MDR,SP=PIN5 LOAD NEW ADDRESS INTO LOC	00012360 00012370
000187	C23033400			3832	NRxB CMD ST=CLR,DC=IFCH,MC=MRI1	00012380 00012390
				3834 *		00012400 00012410
				3835 *		00012420 00012430
				3836 **	BRANCH ON FALSE SHORT (SF)	00012440 00012450
				3837 *		00012460 00012470
000188	03B8000B0			3838	BFB5 LR TEMP1,PSW	00012480 00012490
000189	0E3861070			3840	NR TEMP1,IR,F,MOD=EXT2 AND OF CC & MASK	00012500 00012510
00018A	25B021750			3842	BCF G,BBACK BRANCH IF CONDITION FALSE	00012520 00012530
00018B	C23033400			3844	CMD ST=CLR,DC=IFCH,MC=MRI1 NEXT INSTRUCTION OTHERWISE	00012540 00012550
				3846 *		00012560 00012570
00018C	03B8000B0			3847	BFB5 LR TEMP1,PSW	00012580 00012590
				3849	ARR TEMP1,IR,MOD=EXT2,F=SP, MASK 'AND'ED WITH CC	00012600 00012610
00018D	0E0061070				AIC=DHB,AOC=LDQ CLEAR MSB OF Q	00012620 00012630
00018E	25B0217B0			3851	BCF G,BFORE BIF BRANCH SATISFIED	00012640 00012650
00018F	C23033400			3853	CMD ST=CLR,DC=IFCH,MC=MRI1	00012660 00012670

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3055 M		00012310
				3056 M		00012320
				3057 M	BRANCH ON FALSE (RR)	00012330
				3058 M		00012340
000190	83B800080			3059 BFCR	LR TEMP1,PSW	00012350
000191	8E3861070			3061	NR TEMP1,IR,F,MOD=EXT2 AND OF CC & MASK	00012360
000192	158021940			3063	BCT 6,BFCNT BRANCH TO EXIT IF TRUE	00012370
000193	83B70013C			3065	LR LOC,YS,SP=PIHS LOAD NEW ADDRESS INTO LOC	00012380
000194	C23033400			3067 BFCNT	CHD ST=CLR,DC=IFCH,MC=HRI1	00012390
				3069 M		00012400
				3070 M		00012410
				3071 M	BRANCH ON FALSE (RI)	00012420
				3072 M		00012430
000195	83B800080			3073 BFC	LR TEMP1,PSW	00012440
000196	8E3861070			3075	NR TEMP1,IR,F,MOD=EXT2 AND OF CC & MASK	00012450
000197	158021990			3077	BCT 6,IRXBB BRANCH TO EXIT IF TRUE	00012460
000198	83B70005C			3079	LR LOC,HDR,SP=PIHS LOAD NEW ADDRESS INTO LOC	00012470
000199	C23033400			3081 IRXBB	CHD ST=C1,DC=IFCH,MC=HRI1	00012480
				3083 M		00012490
				3084 M		00012500
				3085 M	BRANCH ON INDEX (RI)	00012510
				3086 M		00012520
00019A	83B800070			3087 DXLN	LR FLR,IR,MOD=SHAP INSTRUCTION TYPE STORED IN L	00012530
00019B	93B3E0070			3089	IR IR,IR,MOD=EXT2 R1+1	00012540
00019C	82B100130			3091	AR TEMPYD,YS (R1)+(R1+1) TO TEMPYD	00012550
00019D	93B380070			3093	IR IR,IR R2 PLUS 1 TO IR	00012560
00019E	83B800130			3095	LR TEMP1,YS (R1 PLUS 2) TO TEMP1	00012570
00019F	94B480060			3097	SR IR,X0002 R1 TO IR	00012580
0001A0	81B180120			3099	LR YS,TEMPYD UPDATE (R1)	00012590
0001A1	15B011A50			3901	BCT L,XLE BRANCH IF BXLE	00012600
				3903 M	BXN	00012610
0001A2	94B880920			3904	CR TEMP1,TEMPYD,CF TEST: LIMIT-INDEX	00012620
0001A3	15B081A70			3906	BCT C,BRAN BIF C=1 (INDEX>LIMIT) "BRANCH"	00012630
0001A4	C23033400			3908 NOBRAN	CHD ST=CLR,DC=IFCH,MC=HRI1	00012640
				3910 M	BXLE	00012650
0001A5	94B880920			3911 XLE	CR TEMP1,TEMPYD,CF TEST: LIMIT-INDEX	00012660
0001A6	15B081A40			3913	BCT C,NOBRAN BIF C=1 (INDEX>LIMIT) "NO BRANCH"	00012670
0001A7	83B70005C			3915 BRAN	LR LOC,HDR,SP=PIHS LOAD NEW ADDRESS INTO LOC	00012680
0001A8	C23033400			3917	CHD ST=CLR,DC=IFCH,MC=HRI1	00012690
				3919 M		00012700
				3920 M		00012710
				3921 M	BRANCH AND LINK (RR)	00012720
				3922 M		00012730
0001A9	83B280130			3923 BALR	LR HDR,YS SAVE BRANCH ADDR	00012740
				3925 M		00012750

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				3926 M		00012760
				3927 MM	BRANCH AND LINK (RI)	00012770
				3928 M		00012780
0001AA	81B780140			3929 BAL	LR YD,LOC OLD LOC TO (RI)	00012790
0001AB	83B78005C			3931	LR LOC,MDR,SP=PIPS A+(X2) TO NEW LOC	00012800
0001AC	C23033400			3933	CMD ST=CLR,DC=IFCH,MC=HRI1	00012810
				3935 M		00012820
				3936 M		00012830
				3937 MM	SHIFT LEFT LOGICAL (SF,RI)	00012840
				3938 M		00012850
0001AD	83B1F0050			3939 SLHL	LR CTR,MDR,MOD=EXT3 LOAD COUNTER WITH N	00012860
0001AE	C085400A0			3941	AQRR X8000,X8000,RPT=1 CLEAR Q AND REPEAT	00012870
0001AF	826100A20			3943	PLL TEMPYD,TEMPYD,C PERFORM N SHIFTS	00012880
0001B0	81B181140			3945	LR YD,TEMPYD,F RESULTS TO (RI)	00012890
0001B1	C23032400			3947	CMD ST=JMC,DC=IFCH,MC=HRI1	00012900
				3949 M		00012910
				3950 M		00012920
				3951 MM	SHIFT LEFT LOGICAL (RI)	00012930
				3952 M		00012940
0001B2	838000170			3953 SLL	LR Q,YDP1 (RI+1) TO Q	00012950
0001B3	C3B1C0050			3955	LR CTR,MDR,RPT=1 LOAD COUNTER WITH N	00012960
0001B4	826100A20			3957	PLL TEMPYD,TEMPYD,C PERFORM N SHIFTS	00012970
0001B5	813081160			3959	LR YDP1,Q,F LO RESULT TO (RI+1)	00012980
0001B6	81B182140			3961	LRM YD,TEMPYD,F HI RESULT TO (RI)	00012990
0001B7	C23032400			3963	CMD ST=JMC,DC=IFCH,MC=HRI1	00013000
				3965 M		00013010
				3966 M		00013020
				3967 MM	SHIFT RIGHT LOGICAL (SF,RI)	00013030
				3968 M		00013040
0001B8	83B1F0050			3969 SRHL	LR CTR,MDR,MOD=EXT3 LOAD COUNTER WITH N	00013050
0001B9	C38040150			3971	LR Q,YD,RPT=1 (RI) TO Q & REPEAT	00013060
0001BA	94C800F00			3973	PRZ TEMP1,C PERFORM N SHIFTS	00013070
0001BB	813081140			3975	LR YD,Q,F RESULT TO (RI)	00013080
0001BC	C23032400			3977	CMD ST=JMC,DC=IFCH,MC=HRI1	00013090
				3979 M		00013100
				3980 M		00013110
				3981 MM	SHIFT RIGHT LOGICAL	00013120
				3982 M		00013130
0001BD	838000170			3983 SRL	LR Q,YDP1 (RI+1) TO Q	00013140
0001BE	C3B1C0050			3985	LR CTR,MDR,RPT=1 LOAD COUNTER WITH N & REPEAT	00013150
0001BF	824100E20			3987	PRL TEMPYD,TEMPYD,C PERFORM N SHIFTS	00013160
0001C0	813081160			3989	LR YDP1,Q,F LO RESULT TO (RI+1)	00013170
0001C1	81B182140			3991	LRM YD,TEMPYD,F HI RESULT TO (RI)	00013180
0001C2	C23032400			3993	CMD ST=JMC,DC=IFCH,MC=HRI1	00013190
				3995 M		00013200

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				3996	M	
				3997	M	00013210
				3998	MM ROTATE LEFT LOGICAL	00013220
				3999	M (RI)	00013230
0001C3	838000170			4000	RLL LR Q,YDP1 (R1+1) TO Q	00013240
0001C4	C381C0050			4002	LR CTR,MDR,RPT=1 LOAD COUNTER WITH N	00013250
0001C5	826160020			4004	RL TEMPYD,TEMPYD ROTATE	00013260
0001C6	813081160			4006	LR YDP1,Q,F LO RESULT TO (R1+1)	00013270
0001C7	818182140			4008	LRM YD,TEMPYD,F HI RESULT TO (R1)	00013280
0001C8	C23032400			4010	CMD ST=JMC,DC=IFCH,MC=HRI1	00013290
				4012	M	00013300
				4013	M	00013310
				4014	MM ROTATE RIGHT LOGICAL	00013320
				4015	M	00013330
0001C9	838000170			4016	RRL LR Q,YDP1 (R1+1) TO Q	00013340
0001CA	C381C0050			4018	LR CTR,MDR,RPT=1 LOAD COUNTER WITH N	00013350
0001CB	824160020			4020	RR TEMPYD,TEMPYD ROTATE	00013360
0001CC	813081160			4022	LR YDP1,Q,F LO RESULT TO (R1+1)	00013370
0001CD	818181140			4024	LR YD,TEMPYD,F HI RESULT TO (R1)	00013380
0001CE	C23032400			4026	CMD ST=JMC,DC=IFCH,MC=HRI1	00013390
				4028	M	00013400
				4029	M	00013410
				4030	MM SHIFT LEFT HALFWORD ARITHMETIC	00013420
				4031	M (RI)	00013430
0001CF	8381F0050			4032	SLHA LR CTR,MDR,MOD=EXT3 LOAD COUNTER WITH N	00013440
0001D0	630000000			4034	LI Q,0 CLEAR Q	00013450
0001D1	826100A20			4036	PLL TEMPYD,TEMPYD,C PRESIGN SIGN TO C	00013460
0001D2	940840100			4038	CRYS TEMP1 SAVE SIGN IN TEMP1	00013470
0001D3	C185C01C0			4040	LR FLR,X0000,RPT=1 C := 0	00013480
0001D4	826100A20			4042	PLL TEMPYD,TEMPYD,C PERFORM SHIFT	00013490
0001D5	824100020			4044	PRL TEMPYD,TEMPYD COMPENSATE PRESIGN	00013500
0001D6	8CB101100			4046	OR TEMPYD,TEMP1,F INSERT SIGN, SET FLAGS	00013510
0001D7	C1B182540			4048	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00013520
				4050	M	00013530
				4051	M	00013540
				4052	MM SHIFT LEFT ARITHMETIC	00013550
				4053	M (RI)	00013560
0001D8	838000170			4054	SLA LR Q,YDP1 (R1+1) TO Q	00013570
0001D9	826100A20			4056	PLL TEMPYD,TEMPYD,C PRESIGN SIGN TO C	00013580
0001DA	940840700			4058	CRYS TEMP1,C SAVE SIGN IN TEMP1; C:=0	00013590
0001DB	C381C0050			4060	LR CTR,MDR,RPT=1 LOAD COUNTER & REPEAT	00013600
0001DC	826100A20			4062	PLL TEMPYD,TEMPYD,C PERFORM SHIFT	00013610
0001DD	824100020			4064	PRL TEMPYD,TEMPYD COMPENSATE PRESIGN	00013620
0001DE	813081160			4066	LR YDP1,Q,F LO RESULT TO (R1+1)	00013630
0001DF	8CB102100			4068	ORM TEMPYD,TEMP1,F INSERT SIGN SET FLAGS	00013640
						00013650

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0001E0	C1B1B2540			4070	LR YD,TEMPYD,ST=JMC,DC=IFCH,MC=HRI1	00013660
				4072	"	00013670
				4073	"	00013680
				4074	SHR SHIFT RIGHT HALFWORD ARITHMETIC (R1)	00013690
				4075	"	00013700
0001E1	0301F0050			4076	SRA LR CTR,MDR,MOD=EXT3 LOAD CTR WITH N	00013710
0001E2	00B100220			4078	AR TEMPYD,TEMPYD,C SIGN TO C: LSB := 0	00013720
0001E3	C20040020			4080	LR Q,TEMPYD,RPT=1	00013730
0001E4	024140020			4082	PRA TEMPYD,TEMPYD SHIFT & PROPAGATE SIGN	00013740
0001E5	024140E20			4084	PRA TEMPYD,TEMPYD,C	00013750
0001E6	01B101140			4086	LR YD,TEMPYD,F RESULT TO (R1)	00013760
0001E7	C23032400			4088	CHD ST=JMC,DC=IFCH,MC=HRI1	00013770
				4090	"	00013780
				4091	"	00013790
				4092	SHR SHIFT RIGHT ARITHMETIC (R1)	00013800
				4093	"	00013810
0001E8	030000170			4094	SRA LR Q,YDP1 (R1+1) TO Q	00013820
0001E9	026100A20			4096	PLL TEMPYD,TEMPYD,C PRESIFT SIGN TO C	00013830
0001EA	C301C0050			4098	LR CTR,MDR,RPT=1 LOAD COUNTER AND REPEAT	00013840
0001EB	024140020			4100	PRA TEMPYD,TEMPYD SHIFT & PROPAGATE SIGN	00013850
0001EC	024140E20			4102	PRA TEMPYD,TEMPYD,C COMPENSATE PRESIFT, LOAD C	00013860
0001ED	013001160			4104	LR YDP1,Q,F LO RESULT TO (R1+1)	00013870
0001EE	01B102140			4106	LRH YD,TEMPYD,F HI RESULT TO (R1)	00013880
0001EF	C23032400			4108	CHD ST=JMC,DC=IFCH,MC=HRI1	00013890
				4110	"	00013900
				4111	"	00013910
				4112	MUL MULTIPLY HALFWORD (RR,RXHW)	00013920
				4113	"	00013930
0001F0	03B200130			4114	PMR LR MDR,Y3	00013940
0001F1	030001170			4116	PM LR Q,YDP1,F MULTIPLIER TO Q	00013950
0001F2	94CA00F40			4118	PRZ SRA,C	00013960
0001F3	C30040050			4120	LR TEMPI,MDR,RPT=1 MULTIPLICAND TO TEMPI	00013970
0001F4	F5CA20F00			4122	MUL SRA,TEMPI,C PERFORM 16 MULTIPLY STEPS	00013980
0001F5	013000160			4124	LR YDP1,Q LO RESULT TO (R1+1)	00013990
0001F6	15B011F00			4126	BCT L,MULCRT CHECK SIGN OF MULTIPLIER	00014000
				4128	" MULTIPLIER IS POSITIVE: (R1) := SRA	00014010
0001F7	C1BAB3540			4129	LR YD,SRA,ST=CLR,DC=IFCH,MC=HRI1	00014020
				4131	" MULTIPLIER IS NEGATIVE: (R1) := SRA-TEMPI	00014030
				4132	" NOTE: 'A OPERAND' = Y FIELD = YD = 10 = SRA	00014040
				4133	MULCRT BCT YD,TEMPI,AIC=AMBH1,CIN=1, ST=CLR,DC=IFCH,MC=HRI1	00014050
0001F8	D080B3540					00014060
				4135	"	00014070
				4136	"	00014080
				4137	"	00014090
				4138	"	00014100

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				4139 **	MULTIPLY HALFWORD UNSIGNED (RR,RXHM)	00014110
				4140 "		00014120
0001F9	83B280130			4141 MHUR	LR MDR,YS	00014130
0001FA	838000170			4143 MHU	LR Q,YDP1	00014140
0001FB	94C900F20			4145	PRZ TEMP2,C	00014150
0001FC	C3B840050			4147	LR TEMP1,MDR,RPT=1	00014160
0001FD	F5C900F00			4149	UNUL TEMP2,TEMP1,C	00014170
0001FE	813080160			4151	LR YDP1,Q	00014180
0001FF	C1B9B3540			4153	LR YD,TEMP2,ST=CLR,DC=IFCH,MC=MRI1	00014190
				4155 "		00014200
				4156 "		00014210
				4157 **	OUTPUT COMMAND (RR,RXOP)	00014220
				4158 "		00014230
000200	53BA80210			4159 OCR	OUT YD,ADRS,SYNC	00014240
000201	53B980410			4161	OUT YS,CHD,SYNC	00014250
000202	C23032400			4163	CHD ST=JHC,DC=IFCH,MC=MRI1	00014260
000203	53BA80210			4165 OC	OUT YD,ADRS,SYNC	00014270
000204	53B2B0410			4167	OUT MDR,CHD,SYNC,MOD=EXTD	00014280
000205	9237000CC			4169	IR LOC,LOCK,SP=PINS	00014290
000206	C23032400			4171	CHD ST=JHC,DC=IFCH,MC=MRI1	00014300
				4173 "		00014310
				4174 "		00014320
				4175 **	READ DATA (RR)	00014330
				4176 "		00014340
000207	53BA80210			4177 RDR	OUT YD,ADRS,SYNC	00014350
000208	43B980810			4179	INP YS,DR,SYNC	00014360
000209	C23032400			4181	CHD ST=JHC,DC=IFCH,MC=MRI1	00014370
				4183 "		00014380
				4184 "		00014390
				4185 "		00014400
				4186 **	DIVIDE HALFWORD (RR,RXHM)	00014410
				4187 "		00014420
00020A	83B280130			4188 DHR	LR MDR,YS	00014430
00020B	83B801050			4190 DH	LR TEMP1,MDR,F	00014440
00020C	15B012210			4192	BCF L,DRNEG	00014450
00020D	838000170			4194	LR Q,YDP1	00014460
00020E	83B901150			4196	LR TEMP2,YD,F	00014470
00020F	25B012270			4198	BCF L,ENTR1	00014480
000210	978000770			4200	LRTC Q,YDP1,C	00014490
000211	B7B900150			4202	LRTC TEMP2,YD	00014500
				4204 *	DIVIDE WITH DR & DD BEING OPPOSITE SIGN (QUOTIENT NEG)	00014510
000212	94B908700			4205 ENTR2	CR TEMP2,TEMP1,C	00014520
000213	25B002310			4207	BCF C,DIVOVF	00014530
000214	C1B5C01C0			4209	LR FLR,X8000,RPT=1	00014540
000215	E4E920700			4211	DIV TEMP2,TEMP1,C	00014550

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				4213	BRR TEMP2,TEMP1,CIN=DIV, AIC=DIV,C=C, AOC=F, MOD=MD	NO SHIFT ON (N+1)TH ITERATION C := TRUE CARRY TO SHIFT IN #00014560 #00014570 #00014580 #00014590
000216	E4B930300					
000217	826140120			4215	PLA TEMPYD,TEMP2	SHIFT LAST QUOTIENT BIT IN (DONT SHIFT REMAINDER=TEMP2) #00014600 #00014610
000218	15B0821A0			4217 *		
000219	80B900100			4218	BCT C,NOCOMP2	BRANCH IF QUOTIENT BIT EQU. 1 #00014620
00021A	990001000			4220	AR TEMP2,TEMP1	COMPENSATE REMAINDER #00014630
00021B	15B022310			4222 NOCOMP2	LRTC Q,Q,F	2'S COMP QUOTIENT #00014640
00021C	813080160			4224	BCT G,DIVOVF	OVERFLOW IF QT POSITIVE #00014650
00021D	838101150			4226 COMMON	LR YDP1,Q	QUOTIENT TO (R1+1) #00014660
00021E	25B012200			4228	LR TEMPYD,YD,F	CHECK SIGN OF DD #00014670
				4230	BCF L,DDPOS	BRANCH IF DD NOT NEG #00014680
				4232	LRTC YD,TEMP2, ST=CLR,DC=IFCH,MC=MR11	2'S COMP REMAINDER IF DD NEG #00014690
00021F	D9B9B3540					
				4234	DDPOS LR YD,TEMP2, ST=CLR,DC=IFCH,MC=MR11	REMAINDER TO (R1) #00014700 #00014710
000220	C1B9B3540					
				4236 *	NEGATIVE DIVISOR	#00014720
000221	9A3000100			4237	DRNEG LRTC TEMP1,TEMP1	2'S COMPLIMENT DIVISOR #00014730
000222	838000170			4239	LR Q,YDP1	LOAD DIVIDEND #00014740
000223	83B901150			4241	LR TEMP2,YD,F	#00014750
000224	25B012120			4243	BCF L,ENTR2	BRANCH IF DIVIDEND NOT NEG #00014760
000225	97B000770			4245	LRTC Q,YDP1,C	#00014770
000226	B7B900150			4247	LRTC TEMP2,YD	2'S COMPLIMENT DIVIDEND #00014780
				4249 *	DIVIDE WITH DR & DD HAVING LIKE SIGN (QUOTIENT POS)	#00014790
000227	94B900700			4250	ENTR1 CR TEMP2,TEMP1,C	CHECK FOR OVERFLOW #00014800
000228	25B082310			4252	BCF C,DIVOVF	BRANCH IF OVERFLOW #00014810
000229	C1B5C01C0			4254	LR FLR,X8000,RPT=1	#00014820
00022A	E4E920700			4256	DIV TEMP2,TEMP1,C	PERFORM DIVIDE 16 TIMES #00014830
				4258	BRR TEMP2,TEMP1,CIN=DIV, AIC=DIV,C=C, AOC=F, MOD=MD	NO SHIFT ON (N+1)TH ITERATION C := TRUE CARRY TO SHIFT IN #00014840 #00014850 #00014860 #00014870
00022B	E4B930300					
00022C	826140120			4260	PLA TEMPYD,TEMP2	SHIFT LAST QUOTIENT BIT IN (DONT SHIFT REMAINDER=TEMP2) #00014880 #00014890
				4262 *		
00022D	15B0822F0			4263	BCT C,NOCOMP1	BRANCH IF QUOTIENT BIT EQU. 1 #00014900
00022E	80B900100			4265	AR TEMP2,TEMP1	COMPENSATE REMAINDER #00014910
00022F	813101020			4267 NOCOMP1	LR TEMPYD,Q,F	#00014920
000230	25B0121C0			4269	BCF L,COMMON	BRANCH TO EXIT IF QT NOT NEG #00014930
				4271 *	OVERFLOW CONDITION - CHECK PSW03 FOR DIVIDE FAULT ENABLE	#00014940
000231	83BEC00B0			4272	DIVOVF LR FLR,PSW,MOD=EXT0	PSW(03) ENABLES INTERRUPT #00014950
000232	63B400484			4274	LI MAR,X'48',SP=ZERO	#00014960
000233	15B010380			4276	BCT L,GENSWP	#00014970
000234	25B000460			4278	B P3EXIT	#00014980 #00014990
				4280 *		#00015000

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				4281 N		00015010
				4282 NN	ACKNOWLEDGE INTERRUPT (RR)	00015020
				4283 N		00015030
000235	43BA80A10			4284 AIR	INP YD,ACK,SYNC INPUT DEVICE ADDRESS	00015040
000236	53BA80210			4286 SSR	OUT YD,ADRS,SYNC OUTPUT DEVICE ADDRESS	00015050
000237	43B980E10			4288	INP YS,SR,SYNC INPUT STATUS	00015060
000238	83BE80130			4290	LR FLR,YS	00015070
000239	C23032400			4292	CHD ST=JHC,DC=IFCH,MC=MR11	00015080
				4294 N		00015090
				4295 N		00015100
				4296 NN	ACKNOWLEDGE INTERRUPT (RXOP)	00015110
				4297 N		00015120
00023A	43BA80A10			4298 AI	INP YD,ACK,SYNC INPUT DEVICE ADDRESS	00015130
00023B	53BA80210			4300 SS	OUT YD,ADRS,SYNC OUTPUT DEVICE ADDRESS	00015140
00023C	43B2A0E10			4302	INP MDR,SR,SYNC,MOD=INSB INPUT STATUS	00015150
00023D	83BE80050			4304	LR FLR,MDR,MOD=EXTB	00015160
00023E	D2370A0CC			4306	IR LOC,LOCK,MC=HW,SP=PINS	00015170
00023F	C23032400			4308	CHD ST=JHC,DC=IFCH,MC=MR11	00015180
				4310 N		00015190
				4311 N		00015200
				4312 NN	READ DATA (RXOP)	00015210
				4313 N		00015220
000240	53BA80210			4314 RD	OUT YD,ADRS,SYNC OUTPUT DEVICE ADDRESS	00015230
000241	43B2A0E10			4316	INP MDR,DR,SYNC,MOD=INSB INPUT DATA	00015240
000242	D2370A0CC			4318	IR LOC,LOCK,MC=HW,SP=PINS STORE DATA	00015250
000243	C23032400			4320	CHD ST=JHC,DC=IFCH,MC=MR11	00015260
				4322 N		00015270
				4323 N		00015280
				4324 NN	WRITE DATA (RR)	00015290
				4325 N		00015300
000244	53BA80210			4326 MDR	OUT YD,ADRS,SYNC OUTPUT DEVICE ADDRESS	00015310
000245	53B980610			4328	OUT YS,DA,SYNC OUTPUT DATA	00015320
000246	C23032400			4330	CHD ST=JHC,DC=IFCH,MC=MR11	00015330
				4332 N		00015340
				4333 N		00015350
				4334 NN	WRITE DATA (RXOP)	00015360
				4335 N		00015370
000247	53BA80210			4336 MD	OUT YD,ADRS,SYNC OUTPUT DEVICE ADDRESS	00015380
000248	53B2B0610			4338	OUT MDR,DA,SYNC,MOD=EXTB OUTPUT DATA	00015390
000249	9237000CC			4340	IR LOC,LOCK,SP=PINS	00015400
00024A	C23032400			4342	CHD ST=JHC,DC=IFCH,MC=MR11	00015410
				4344 N		00015420
				4345 N		00015430
				4346 NN	READ HALFWORD (RR)	00015440
				4347 N		00015450

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
00024B	53BA00210			4348 RHR	OUT YD,ADRS,SYNC	OUTPUT DEVICE ADDRESS
00024C	63B800010			4350	LI TEMP1,1	
00024D	8E3001000			4352	NR TEMP1,EXT,F	CHECK FOR HALFWORD DEVICE
00024E	15B022530			4354	BCT G,HWD	BRANCH IF HALFWORD DEVICE
00024F	43B010810			4356	INP Q,DR,SYNC,MOD=SWAP	INPUT HI BYTE
000250	43B900810			4358	INP SR9,DR,SYNC	INPUT LO BYTE
				4360	NOTE 'A OPERAND' = YS = 9 = SR9	
000251	803900120			4361	SRP YS,SR9,AIC=APQ	COMBINE BYTES
000252	C23032400			4363	CHD ST=JHC,DC=IFCH,MC=HRI1	(V SET FOR TIMEOUT)
				4365	READ FROM HALFWORD DEVICE	
000253	43B900810			4366 HMDR	INP YS,DR,SYNC	INPUT HALFWORD
000254	C23032400			4368	CHD ST=JHC,DC=IFCH,MC=HRI1	(V SET FOR TIMEOUT)
				4370		
				4371		
				4372	READ HALFWORD	
				4373		
000255	53BA00210			4374 RH	OUT YD,ADRS,SYNC	OUTPUT DEVICE ADDRESS
000256	63B800010			4376	LI TEMP1,1	
000257	8E3001000			4378	NR TEMP1,EXT,F	CHECK FOR HALFWORD DEVICE
000258	15B0225E0			4380	BCT G,HWD	BRANCH IF HALFWORD DEVICE
000259	43B290810			4382	INP HDR,DR,SYNC,MOD=SWAP	INPUT HI BYTE
00025A	43B800010			4384	INP TEMP1,DR,SYNC	INPUT LO BYTE
00025B	8EB880040			4386	OR HDR,TEMP1	COMBINE BYTES
00025C	D2370A0CC			4388	IR LOC,LOCK,MC=HM,SP=PIN5	STORE DATA
00025D	C23032400			4390	CHD ST=JHC,DC=IFCH,MC=HRI1	(V SET FOR TIMEOUT)
				4392	READ FROM HALFWORD DEVICE	
00025E	43B280010			4393 HMD	INP HDR,DR,SYNC	INPUT HALFWORD
00025F	D2370A0CC			4395	IR LOC,LOCK,MC=HM,SP=PIN5	STORE DATA
000260	C23032400			4397	CHD ST=JHC,DC=IFCH,MC=HRI1	(V SET FOR TIMEOUT)
				4399		
				4400		
				4401	WRITE HALFWORD	
				4402		
000261	83B200130			4403 HHR	LR HDR,YS	
000262	53BA00210			4405 WH	OUT YD,ADRS,SYNC	OUTPUT ADDRESS
000263	63B800010			4407	LI TEMP1,1	
000264	8E3001000			4409	NR TEMP1,EXT,F	CHECK FOR HALFWORD DEVICE
000265	15B022670			4411	BCT G,WIRD	BRANCH IF HALFWORD DEVICE
000266	53B290610			4413	OUT HDR,DA,SYNC,MOD=SWAP	OUTPUT HI BYTE
000267	53B280610			4415 HWRD	OUT HDR,DA,SYNC	OUTPUT LO BYTE
000268	C23032400			4417	CHD ST=JHC,DC=IFCH,MC=HRI1	(V SET FOR TIMEOUT)
				4419		
				4420		
				4421	AUTOLOAD	
				4422		

Address → Device
 1 → Temp1 SR8
 Check for this
 Branch or Fall Through
 Input 8-15 and swap to 0-7
 Input 8-15 and swap 8-15
 Route bytes get HW
 actually does an OR
 clock is disabled

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
000269	838900090			4423 AL	LR TEMP2,MAR	17 MAY 79
00026A	63B400704			4425	LI MAR,X'70',SP=ZERO	SAVE END ADDRESS 00015910
00026B	C23006000			4427	CHD MC=MRO	00015920
00026C	53B290210			4429	OUT HDR,ADRS,SYNC,MOD=SWAP	FETCH INPUT DEVICE NUMBER 00015930
00026D	53B280410			4431	OUT HDR,CHD,SYNC	OUTPUT DEVICE ADDRESS 00015940
00026E	63B400804			4433	LI MAR,X'80',SP=ZERO	OUTPUT COMMAND 00015950
				4435	CHECK STATUS AND LOOP IF BUSY	STARTING ADDRESS TO MAR 00015960
00026F	43BE00E10			4436 BUSYAL	INP FLR,SR,SYNC	00015970
000270	15B072800			4438	BCT VGL,ENDAL	INPUT STATUS 00015980
000271	15B0826F0			4440	BCT C,BUSYAL	BRANCH IF STATUS BAD 00015990
000272	43B800010			4442	INP TEMP1,DR,SYNC	LOOP IF ONLY BUSY 00016000
000273	81B881060			4444	LR IR,TEMP1,F	INPUT CHARACTER 00016010
000274	25B0326F0			4446	BCF GL,BUSYAL	SET FLAGS 00016020
				4448	START READING CHARACTERS AS DATA	LOOP IF CHARACTER = ZERO 00016030
000275	C23006000			4449 LOOPAL	CHD MC=MRO	00016040
000276	83B2A0070			4451	LR HDR,IR,MOD=IN3B	00016050
000277	96B909090			4453	CR TEMP2,MAR,F	INSERT DATA BYTE 00016060
000278	D3B48A094			4455	IR MAR,MAR,MC=MW,SP=ZERO	00016070
000279	25B0327F0			4457	BCF GL,EXITAL	RESTORE AND INCREMENT MAR 00016080
00027A	43BE00E10			4459 BUSYAL	INP FLR,SR,SYNC	BRANCH IF FINISHED 00016090
00027B	15B072800			4461	BCT VGL,ENDAL	INPUT STATUS 00016100
00027C	15B0827A0			4463	BCT C,BUSYAL	BRANCH IF STATUS BAD 00016110
00027D	43B300810			4465	INP IR,DR,SYNC	LOOP IF ONLY BUSY 00016120
00027E	25B002750			4467	B LOOPAL	INPUT DATA 00016130
00027F	63BE00000			4469 EXITAL	LI FLR,X'00'	00016140
000280	9237000CC			4471 ENDAL	IR LOC,LOCX,SP=PIN3	00016150
000281	C23032400			4473	CHD ST=JHC,DC=IFCH,MC=MRI1	00016160
				4475		00016170
				4476		00016180
				4477	READ BLOCK / WRITE BLOCK	00016190
				4478	RBR & MBR ENTRANCE	(RR,RXOP) 00016200
000282	83B800130			4479 RBR	LR TEMP1,YS	00016210
000283	93B380070			4481	IR IR,IR	LOAD START ADDRESS 00016220
000284	8636000E0			4483	DR LOCX,LOC	00016230
000285	83B280130			4485	LR HDR,YS	00016240
000286	25B002890			4487	B COMBK	LOAD END ADDRESS 00016250
				4489	RB & MB ENTRANCE	00016260
000287	82B480080			4490 RB	AR MAR,X0002,SP=POPR	00016270
000288	C3B806050			4492	LR TEMP1,HDR,MC=MRO	00016280
000289	81B880080			4494 COMBK	LR MAR,TEMP1,SP=POPR	LOAD START; FETCH END 00016290
00028A	83B800050			4496	LR TEMP1,HDR	00016300
00028B	96B800890			4498	CR TEMP1,MAR,C	END ADDRESS TO TEMP1 00016310
00028C	15B082A10			4500	BCT C,FINISX	00016320
00028D	53BA80210			4502	OUT YO,ADRS,SYNC	BRANCH IF END GREATER THAN START 00016330
00028E	83BED1070			4504	LR FLR,IR,F,MOD=EXT1	OUTPUT DEVICE ADDRESS 00016340
						DETERMINE READ OR WRITE 00016350

LOC	OBJECT CODE	ADDR1	ADDR2	SYMT	SOURCE STATEMENT	17 MAY 79
00028F	1580129A0			4506	BCT L,LOOPR	BRANCH TO READ
				4508	* WRITE BLOCK INSTRUCTION	
000290	C23006000			4509	LOOPW CMD MC=MRO	FETCH HALFWORD
000291	438E80E10			4511	STATWB INP FLR,SR,SYNC	INPUT STATUS
000292	1580F2980			4513	BCT CVGL,TESTW	TEST FOR BUSY OR BAD STATUS
000293	53B2B0610			4515	OUT HDR,DA,SYNC,MOD=EXTB	OUTPUT DATA BYTE
000294	96B809090			4517	CR TEMPI,MAR,F	FINISHED ?
000295	93B480098			4519	IR MAR,MAR,SP=POPR	
000296	158032900			4521	BCT GL,LOOPW	LOOP IF NOT FINISHED
000297	258002A10			4523	B FINISX	BRANCH IF COMPLETED
				4525	* TEST STATUS	
000298	158072A20			4526	TESTW BCT VGL,FINX	STATUS BAD
000299	258002910			4528	B STATWB	ONLY BUSY
				4530	* READ BLOCK INSTRUCTION	
00029A	C23006000			4531	LOOPR CMD MC=MRO	FETCH HALFWORD
00029B	438E80E10			4533	STATRB INP FLR,SR,SYNC	INPUT STATUS
00029C	1580F2A40			4535	BCT CVGL,TESTR	
00029D	4382A0610			4537	INP HDR,DR,SYNC,MOD=INSB	INSERT DATA BYTE
00029E	96B809090			4539	CR TEMPI,MAR,F	FINISHED ?
00029F	03B480A090			4541	IR MAR,MAR,MC=MM	RESTORE HALFWORD
0002A0	1580329A0			4543	BCT GL,LOOPR	LOOP IF NOT FINISHED
0002A1	638E80000			4545	FINISX LI FLR,X'00'	
0002A2	9237000CC			4547	FINX IR LOC,LOCX,SP=PINS	
0002A3	C23032400			4549	CMD ST=JMC,DC=IFCH,MC=MRI1	
				4551	* TEST STATUS	
0002A4	158072A20			4552	TESTR BCT VGL,FINX	STATUS BAD
0002A5	258002980			4554	B STATRB	ONLY BUSY
				4556	*	
				4557	EXCHANGE PROGRAM STATUS (RR)	
				4558	*	
0002A6	83BA800B0			4559	EPSR LR YD,PSW ^{PSR}	STATUS TO (R1)
0002A7	83B580130			4561	LR PSW,Y3	(R2) TO PSW
0002A8	C23000C00			4563	CMD ST=JAM	LOAD CC
0002A9	258000420			4565	Branch TEST1	
				4567	*	
				4568	*	
				4569	SUPERVISOR CALL (RI)	
				4570	*	
0002AA	638480944			4571	SVC LI MAR,X'94',SP=ZERO	
0002AB	C2B48C084			4573	AR MAR,X0002,MC=MMP,SP=ZERO	STORE VALUE 'A*(X2)'
0002AC	83B2800B0			4575	LR HDR,PSW	
0002AD	C2B48C084			4577	AR MAR,X0002,MC=MMP,SP=ZERO	STORE OLD PSW
0002AE	838060070			4579	LR Q,IR,MOD=EXT2	R1 TO Q
0002AF	81B780040			4581	LR HDR,LOC	
0002B0	C2B48C084			4583	AR MAR,X0002,MC=MMP,SP=ZERO	STORE OLD LOC

PSR → (R2) (R3)
 (R2) → PSW
 CVGL → CC
 Restore Status

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
0002B1	94E000100			4505	PLZ TEMP1	17 MAY 79
0002B2	C2B486084			4507	AR MAR,X0002,MC=HRO,SP=ZERO	00016810
0002B3	83B580050			4509	LR PSW,HDR	00016820
0002B4	833080080			4591	AR MAR,Q	00016830
0002B5	C23006400			4593	CHD MC=HRO,ST=JHC	00016840
0002B6	83870005C			4595	LR LOC,HDR,SP=PIN3	00016850
0002B7	C23033400			4597	CHD DC=IFCH,MC=HRI1,ST=CLR	00016860
				4599		00016870
						00016880
				4601		00016900

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
4603	#					00016920
4604	HHH				PROGRAM LOAD INITIALIZATION SEQUENCE	00016930
4605	#					00016940
4606	#				SCRATCH REGISTERS USED:	00016950
4607	#				SR8	00016960
0002B8	03B103C00			4609	PRGLD BLK CLRPTY,TEMPYD INITIALIZE PARITY,"PNTR","CPR"	00016980
0002B9	63B700564			4611	LI LOC,X'50'+6,SP=ZERO M(54) = "BRANCH"	00016990
0002BA	63B280000			4613	LI MDR,X'80' '4300 0080'	00017000
0002BB	04B70C080			4615	SR LOC,X0002,MC=MWP	00017010
0002BC	63B290430			4617	LI MDR,X'43',MOD=SWAP	00017020
0002BD	04B70C080			4619	SR LOC,X0002,MC=MWP	00017030
0002BE	63B280CF0			4621	LI MDR,X'CF' M(50) = "AUTOLOAD"	00017040
0002BF	04B70C080			4623	SR LOC,X0002,MC=MWP 'D500 00CF'	00017050
0002C0	63B290D50			4625	LI MDR,X'D5',MOD=SWAP	00017060
0002C1	C1B58C0A0			4627	LR PSW,X8000,MC=MWP PSW,LOC = "WAIT"	00017070
				4629	# '8000 0050'	00017080
0002C2	63B400780			4630	LI MAR,X'78' SET "MEM X0078" TO "DEVAD/CMD"	00017090
0002C3	55B400210			4632	BIO OUT,X0002,ADRS,SYNC,AIC=BH1 ADDRESS PANEL (DEVAD=1)	00017100
0002C4	43B280010			4634	INP MDR,DR,SYNC	00017110
0002C5	43B2A0010			4636	INP MDR,DR,SYNC,MOD=INSB	00017120
				4638	AIF ('&XPMRPL' NE 'REGPL').NREGPL	00017130
				4639	.NREGPL ANOP	00017170
				4640	AIF ('&XPMRPL' NE 'DEV0').NDEV0	00017180
0002C6	C3B80CC50			4641	LR SR8,MDR,MC=MWP,ST=JAM CC := 0	00017190
0002C7	6E3B19FF0			4643	NI SR8,X'FF',F,DEST=INHIB,MOD=SWAP	00017200
0002C8	25B003530			4645	B XXPLD	00017210
				4647	.NDEV0 ANOP	00017220
				4648	AIF ('&XPMRPL' NE 'FPL733').N733	00017230
				4649	.N733 ANOP	00017270
				4650	AIF ('&XPMRPL' NE 'RIM1').NPMRIM1	00017280
				4651	.NPMRIM1 ANOP	00017320
				4652	ALIGN X'2C9'	00017330
0002C9	01648	4653	A3160	EQU	#-START	

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				4656 #		00017350
				4657 MNN	DIRECT LOAD/STORE FOR EXTENDED MEMORY	00017360
				4658 MNN	JRK -- 22 FEB 77	00017370
				4659 #		00017380
				4660 #		00017390
				4661 #	STH0 -- STORE DIRECT HALFWORD INTO BANK 0 (RXAD)	00017400
				4662 #	STH1 -- STORE DIRECT HALFWORD INTO BANK 1 (RXAD)	00017410
				4663 #	STH2 -- STORE DIRECT HALFWORD INTO BANK 2 (RXAD)	00017420
				4664 #	STH3 -- STORE DIRECT HALFWORD INTO BANK 3 (RXAD)	00017430
				4665 #		00017440
0002C9	63B690040			4666 STH0	LI EXT,4+0,MOD=SWAP QHARA,B := 0,0	00017450
0002CA	83B200150			4668	LR MDR,YD	00017460
0002CB	D2370A0CC			4670	IR LOC,LOCK,MC=FM,SP=PINS	00017470
				4672 #	CHD MC=FM P0	00017480
				4673 #	IR LOC,LOCK,SP=PINS P1	00017490
				4674 #	NOP P2	00017500
0002CC	C23033400			4675	CHD ST=CLR,DC=IFCH,MC=HRI1	00017510
				4677 #		00017520
0002CD	63B690050			4678 STH1	LI EXT,4+1,MOD=SWAP QHARA,B := 0,1	00017530
0002CE	83B200150			4680	LR MDR,YD	00017540
0002CF	D2370A0CC			4682	IR LOC,LOCK,MC=FM,SP=PINS	00017550
				4684 #	CHD MC=FM P0	00017560
				4685 #	IR LOC,LOCK,SP=PINS P1	00017570
				4686 #	NOP P2	00017580
0002D0	C23033400			4687	CHD ST=CLR,DC=IFCH,MC=HRI1	00017590
				4689 #		00017600
0002D1	63B690060			4690 STH2	LI EXT,4+2,MOD=SWAP QHARA,B := 1,0	00017610
0002D2	83B200150			4692	LR MDR,YD	00017620
0002D3	D2370A0CC			4694	IR LOC,LOCK,MC=FM,SP=PINS	00017630
				4696 #	CHD MC=FM P0	00017640
				4697 #	IR LOC,LOCK,SP=PINS P1	00017650
				4698 #	NOP P2	00017660
0002D4	C23033400			4699	CHD ST=CLR,DC=IFCH,MC=HRI1	00017670
				4701 #		00017680
0002D5	63B690070			4702 STH3	LI EXT,4+3,MOD=SWAP QHARA,B := 1,1	00017690
0002D6	83B200150			4704	LR MDR,YD	00017700
0002D7	D2370A0CC			4706	IR LOC,LOCK,MC=FM,SP=PINS	00017710
				4708 #	CHD MC=FM P0	00017720
				4709 #	IR LOC,LOCK,SP=PINS P1	00017730
				4710 #	NOP P2	00017740
0002D8	C23033400			4711	CHD ST=CLR,DC=IFCH,MC=HRI1	00017750
				4713 #		00017760
				4714 #	LH0 -- LOAD DIRECT HALFWORD FROM BANK 0 (RXAD)	00017770
				4715 #	LH1 -- LOAD DIRECT HALFWORD FROM BANK 1 (RXAD)	00017780
				4716 #	LH2 -- LOAD DIRECT HALFWORD FROM BANK 2 (RXAD)	00017790

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				4717	LH3 -- LOAD DIRECT HALFHORD FROM BANK 3 (RXAD)	00017800
				4718	"	00017810
0002D9	63B690040			4719	LH0 LI EXT,4+0,MOD=SWAP QHARA,B := 0,0	00017820
0002DA	D237060CC			4721	IR LOC,LOCX,HC=MRO,SP=PINS	00017830
				4723	CHD HC=MRO P0	00017840
				4724	IR LOC,LOCX,SP=PINS P1	00017850
0002DB	83BA01050			4725	LR YD,MOR,F P2	00017860
0002DC	C23032400			4727	CHD ST=JMC,DC=IFCH,HC=MRI1	00017870
				4729	"	00017880
0002DD	63B690050			4730	LH1 LI EXT,4+1,MOD=SWAP QHARA,B := 0,1	00017890
0002DE	D237060CC			4732	IR LOC,LOCX,HC=MRO,SP=PINS	00017900
				4734	CHD HC=MRO P0	00017910
				4735	IR LOC,LOCX,SP=PINS P1	00017920
0002DF	83BA01050			4736	LR YD,MOR,F P2	00017930
0002E0	C23032400			4738	CHD ST=JMC,DC=IFCH,HC=MRI1	00017940
				4740	"	00017950
0002E1	63B690060			4741	LH2 LI EXT,4+2,MOD=SWAP QHARA,B := 1,0	00017960
0002E2	D237060CC			4743	IR LOC,LOCX,HC=MRO,SP=PINS	00017970
				4745	CHD HC=MRO P0	00017980
				4746	IR LOC,LOCX,SP=PINS P1	00017990
0002E3	83BA01050			4747	LR YD,MOR,F P2	00018000
0002E4	C23032400			4749	CHD ST=JMC,DC=IFCH,HC=MRI1	00018010
				4751	"	00018020
0002E5	63B690070			4752	LH3 LI EXT,4+3,MOD=SWAP QHARA,B := 1,1	00018030
0002E6	D237060CC			4754	IR LOC,LOCX,HC=MRO,SP=PINS	00018040
				4756	CHD HC=MRO P0	00018050
				4757	IR LOC,LOCX,SP=PINS P1	00018060
0002E7	83BA01050			4758	LR YD,MOR,F P2	00018070
0002E8	C23032400			4760	CHD ST=JMC,DC=IFCH,HC=MRI1	00018080

LIST PROCESSING INSTRUCTIONS

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
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4763	#					00018100
4764	NNH				LIST PROCESSING INSTRUCTIONS	00018110
4765	NNH				DAS -- SEPT 29, 75	00018120
4766	#					00018130
4767	#				'ATBL' -- THIS SEGMENT OF MICROCODE IS USED FOR:	00018140
4768	#				ATL INSTRUCTION (RXOP)	00018150
4769	#				ABL INSTRUCTION (RXOP)	00018160
4770	#				AUTOMATIC I/O SERVICE (ADDING ELEMENTS TO CHAN TERMINATION QUEUE)	00018170
4771	#					00018180
4772	#				MAR = A(LIST)	00018190
4773	#				FETCH OF FIRST HALFWORD BEGIN (8:IMAX 8:N)	00018200
4774	#				IR(7) = 0 ADD TO TOP	00018210
4775	#				= 1 ADD TO BOTTOM	00018220
4776	#					00018230
4777	#				IF ATL OR ABL INSTRUCTION:	00018240
4778	#				IR(6) = 0	00018250
4779	#				LOCX = A-1(NEXT INSTRUCTION)	00018260
4780	#				IF AUTOMATIC I/O SERVICE:	00018270
4781	#				IR(6) = 1	00018280
4782	#				LOC = A(NEXT INSTN)	00018290
4783	#				PSW = 0; PSWTEMP = REAL PSW (THIS CODE IS WRITTEN WITH ORDINARY	00018300
4784	#				'WRITES' FOR USER PROTECTION; AUTO IO IS PRIVILEGED, HOWEVER)	00018310
4785	#				Q = A(CCH)-A(OCCH)	00018320
4786	#				SRS = 8:STATUS 8:DEVNO	00018330
4787	#				UT = 1	00018340
4788	#					00018350
4789	#				SCRATCH REGISTERS:	00018360
4790	#				A,T,MAR,MOR	00018370

0002E9	83BA10050	4792	#	MOR = 8:IMAX 8:N		00018390
0002EA	96BA00650	4793	ATBL	LR A,MOR,MOR=SWAP	A := 8:N 8:IMAX	00018400
0002EB	15B082F00	4795		CR A,MOR,C	(8:N 8:IMAX) - (8:IMAX 8:N)	00018410
		4797		BCT C,ADDT0	BIF SPACE AVAILABLE	00018420
		4799	#			00018430
0002EC	83BED0070	4800	#	LIST OVERFLOW -- TEST WHETHER INSTN OR AUTO I/O		00018440
0002ED	15B023B30	4801		LR FLR,IR,MOR=EXT1	TEST IR(6)	00018450
0002EE	63BE80040	4803		BCT G,LISTOV	BIF AUTO I/O TO DO INTERRUPT	00018460
0002EF	25B003030	4805		LI FLR,4	ELSE USER: SET V	00018470
		4807		D COMEX	AND EXIT	00018480
		4809	#			00018490
		4810	#	SPACE IS AVAILABLE		00018500
0002F0	93B280050	4811	ADDT0	IR MOR,MOR	MOR := 8:IMAX 8:N+1	00018510
0002F1	C63F0A080	4813		DR T,X0002,MC=MC	PO UPDATE (IMAX,N)	00018520

MICROCODE, HMP-1116 PLP 1641803 REV. A CCA5 1641603,1641604,1641653 "657,0416,J55"

HUGHES PROPRIETARY

FOR TRAINING
USE ONLY

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0002F2	82B480080			4015	T := 1	00018530
0002F3	8E3F11070			4016	AR MAR,X0002	00018540
				4018	NR T,IR,F,MOD=SHAP	00018550
				4020	G := 0 IF TOP; 1 IF BOTTOM	00018560
0002F4	CEBF86080			4021	OR MAR,T,MC=MRO	00018570
				4023	OR MAR,T	00018580
0002F5	15B023050			4024	BCT G,BOTTOM	00018590
				4026	P2 BIF BOTTOM	00018600
				4027	ADD TO TOP OF LIST; MAR = EVEN = A(CUR TOP)	00018610
0002F6	83BF00050			4028	LR T,MOR	00018620
0002F7	8BB281050			4030	DR MOR,MOR,F,MOD=EXTB	00018630
0002F8	25B012FA0			4032	BCF L,N+2*M	00018640
0002F9	85BA80040			4034	DR MOR,A	00018650
0002FA	83BF20050			4036	LR T,MOR,MOD=INSD	00018660
0002FB	81BF80040			4038	LR MOR,T	00018670
0002FC	83BF30050			4040	LR T,MOR,MOD=EXTB	00018680
				4042	T := 8:0 8:NEW CURTOP	00018690
				4043	UPDATE (CURTOP,NXTBOT); GET A(SLOT)	00018700
				4044	MAR = A(CURTOP,NXTBOT); MOR = NEW (CURTOP,NXTBOT); T = SLOT INDEX	00018710
0002FD	D0BF0A1E0			4045	ADDITXXX BCT T,T,CIN=1,AIC=APB, UPDATE; T := 2*INDEX+1	00018720
0002FE	92BF80080			4047	SRR MAR,T,CIN=1,AIC=DPB	00018730
0002FF	83BE00070			4049	LR FLR,IR,MOD=EXT1	00018740
000300	15B023880			4051	BCT G,AIOADD	00018750
				4053	BIF AUTO I/O TO DO ADD	00018760
				4054	DO USER ADD, END INSTRUCTION	00018770
				4055	ALIST EQU	00018780
000301	83B280150			4056	LR MOR,YD	00018790
000302	C23008400			4058	CHD MC=MN,ST=CLR	00018800
000303	9237000CC			4060	COMEX IR LOC,LOCX,SP=PIN3	00018810
000304	C23032400			4062	CHD DC=IFCH,MC=MRI1,ST=JMC	00018820
				4064	JAM CC & EXIT	00018830
				4065	ADD TO BOTTOM OF LIST; MAR = ODD = A(NEXT BOTTOM)	00018840
000305	83BF30050			4066	BOTTOM LR T,MOR,MOD=EX'1	00018850
000306	84BA001E0			4068	SRR A,T,AIC=BMAH1,CIN=0	00018860
000307	6E3A01FF0			4070	HI A,X'FF',F	00018870
000308	25B0230B0			4072	BCF G,BOTTOM1	00018880
000309	93B280050			4074	IR MOR,MOR	00018890
00030A	25B002FD0			4076	B ADDITXXX	00018900
				4078	JOIN MAIN ROUTINE	00018910
00030B	63D2A0000			4079	BOTTOM1 LI MOR,0,MOD=INSD	00018920
00030C	25B002FD0			4081	B ADDITXXX	00018930
					JOIN MAIN ROUTINE	00018940

LOC	OBJECT CODE	ADDR1	ADDR2	SYMT	SOURCE STATEMENT	17 MAY 79
				4884 #	'RTBL' -- THIS SEGMENT OF MICROCODE IS USED FOR:	00018960
				4885 #	RTL INSTRUCTION (RXOP)	00018970
				4886 #	RBL INSTRUCTION (RXOP)	00018980
				4887 #		00018990
				4888 #	MAR = A(LIST)	00019000
				4889 #	FETCH OF FIRST HALFWORD BEGUN (0:IMAX 0:N)	00019010
				4890 #	IR(7) = 0 REMOVE FROM TOP	00019020
				4891 #	= 1 REMOVE FROM BOTTOM	00019030
				4892 #	LOCKX = A-1(NEXT INSTRUCTION)	00019040
				4893 #		00019050
				4894 #	SCRATCH REGISTERS	00019060
				4895 #	A,T,MAR,MDR,Q	00019070

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
10031E	92BF80080			4942	BRR MAR,T,CIN=1,AIC=DPB	P1 MAR := MAR + 2 + 2*INDEX
10031F	810001200			4944	LR Q,Q,CF	P2 G := 1 IF MORE ELEMENTS
				4946	"	I = 0 OTHERWISE
				4947	IR LOC,LOCX,SP=PINS,	P0 READ ELEMENT
100320	D237060CC				MC=MRO	P1 AND UPDATE LOC
100321	83BA80050			4949	LR YD,MOR	P2 GET ELEMENT
100322	C23032400			4951	CHD MC=MRI1,DC=IFCH,ST=JHC	JAM CC, AND EXIT (NOTE: C=L=0,
				4953	"	G=1 IF NONEMPTY)
				4954	"	(EXIT 'COMEX' V=1 ON UNDERFLOW)
				4955	"	
				4956	" REMOVE FROM TOP, WRAP AROUND	
100323	8E3280040			4957	RTLWRAP NR	MOR := 8:0 8:NXTBOT
100324	258003100			4959	B REMOVXXX	JOIN MAIN ROUTINE
				4961	"	
				4962	" REMOVE FROM BOTTOM OF LIST; MAR = ODD = A(NXT BOT)	
100325	8E3289040			4963	RDL NR	MOR,X00FF,F,DEST=INHIB TEST NXTBOT
100326	2580332A0			4965	BCF GL,RDLWRAP	BIF ZERO TO WRAP AROUND
100327	88B280050			4967	OR MOR,MOR	MOR := 8:CURTOP 8:NXTBOT-1
100328	83BF30050			4969	LR T,MOR,MOD=EXTB	T := INDEX
100329	258003100			4971	B REMOVXXX	JOIN MAIN ROUTINE
				4973	"	
				4974	" REMOVE FROM BOTTOM, WRAP AROUND	
10032A	8EBA80040			4975	RDLWRAP OR	MOR := 8:CURTOP 8:IMAX-1
10032B	83BF30050			4977	LR T,MOR,MOD=EXTB	T := INDEX
10032C	258003100			4979	B REMOVXXX	JOIN MAIN ROUTINE
				4981	"	

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				4983 #		00019660
				4984 ###	MEMORY BANK CONTROL INSTRUCTIONS	00019670
				4985 #		00019680
				4987 #		00019700
				4988 ##	EXCHANGE OPERAND BANK ADDRESS (RR)	00019710
				4989 #		00019720
00032D	83BA800B0			4990 EPOR	LR YD,PSW YD := PSW	00019730
00032E	67B800300			4992	LIOC TEMP1,X'30'	00019740
00032F	8E38800A0			4994	NR PSW,TEMP1 PSW := PSW & X'FFCF'	00019750
000330	6E3100300			4996	NI TEMPYD,X'30'	00019760
000331	8EB1800A0			4998	OR PSW,TEMPYD PSW := NEW PSW (CC UNCHANGED)	00019770
000332	C23033400			5000	CHD ST=CLR,DC=IFCH,MC=HRI1 (CANT 'CLR' WHEN PSW IS DEST)	00019780
				5003 #		00019800
				5004 ##	EXCHANGE PROGRAM ADDRESS (RR)	00019810
				5005 #		00019820
000333	83BA800B0			5006 EPFR	LR YD,PSW YD := PSW	00019830
000334	67B800F00			5008	LIOC TEMP1,X'F0'	00019840
000335	8E38800A0			5010	NR PSW,TEMP1 PSW := PSW & X'FF0F'	00019850
000336	6E3100F00			5012	NI TEMPYD,X'F0'	00019860
000337	8EB1800A0			5014	OR PSW,TEMPYD PSW := NEW PSW (CC UNCHANGED)	00019870
000338	8239000E0			5016	LR TEMP2,LOC	00019880
000339	83B70017C			5018	LR LOC,YDP1,SP=PINS LOC := NEW LOC(USING NEW PINS)	00019890
00033A	C1B9B3560			5020	LR YDP1,TEMP2, YDP1 := PREV LOC	00019900
					ST=CLR,DC=IFCH,MC=HRI1	00019910
				5023	AIF (8XABL EQ 1).NABL1	00019930
				5024 #		00019940
				5025 #	IF AUGMENTED INSTRUCTION SET IS USED THE AUTO BOOTSTRAP	00019950
				5026 #	LOADER IS NOT USED, SO THIS INSTRUCTION IS USED AS A FALL THRU	00019960
				5027 #	FOR ANY ATTEMPTED LOAD	00019970
				5028 #		00019980
00033B	25B000E50			5029 ILOAD	B INTENT FALL THRU NORMALLY	00019990
				5031 .NABL1	ANOP	00020000
				5032	AIF ('8XPS1' NE 'SEM').NSEM	00020010
				5033 .NSEM	ANOP	00020030
				5034	AIF (8XISAUG1 EQ 0).NJOV	00020040

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5036	"	00020460
				5037	" THE FOLLOWING MACRO INSTRUCTIONS HAVE BEEN ADDED TO THE USER	00020470
				5038	" REPERTOIRE. THESE INSTRUCTIONS ARE NOT STANDARD INTERDATA	00020480
				5039	" INSTRUCTIONS.	00020490
				5040	"	00020500
				5041	" SET PSW BITS 0-7	00020510
				5042	"	00020520
00033C	83B800050			5043	SESB LR SR0,MDR (RI)	00020530
00033D	6E3010FF0			5045	NI SR0,X'FF',MOD=SWAP MASK BITS 0-7 FOR SETTING	00020540
00033E	8EB8000A0			5047	OR PSW,SR0 SET BITS IN PSW	00020550
00033F	25B000420			5049	B TEST1 CHECK FOR INTERRUPTS	00020560
				5051	"	00020570
				5052	" RESET PSW BITS 0-7	00020580
				5053	"	00020590
000340	87B800050			5054	RESS LROC SR0,MDR (RI)	00020600
000341	6EB800FF0			5056	OI SR0,X'FF' MASK BITS TO BE RESET	00020610
000342	CE30B34A0			5058	NR PSW,SR0,ST=CLR,DC=IFCH,MC=MR11	00020620
				5060	"	00020630
				5061	" UNCONDITIONAL TWO'S COMPLEMENT	00020640
				5062	"	00020650
000343	97B804650			5063	LCH LRTC SR0,MDR,CVF (RX)	00020660
000344	25B003460			5065	B M+2MH	00020670
000345	97B804730			5067	LCHR LRTC SR0,YS,CVF (RR)	00020680
000346	C1B8B2540			5069	LR YD,SR0,ST=JMC,DC=IFCH,MC=MR11	00020690
				5071	"	00020700
				5072	" NEGATIVE SIGN MAGNITUDE TO TWO'S COMPLEMENT CONVERSION	00020710
				5073	"	00020720
000347	83B801050			5074	LCNH LR SR0,MDR,F (RX)	00020730
000348	25B0034A0			5076	B M+2MH	00020740
000349	83B801130			5078	LCNHR LR SR0,YS,F (RR)	00020750
00034A	25B0134C0			5080	BCF L,M+2MH	00020760
00034B	98B8042A0			5082	BRR SR0,X0000,CIN=1,AIC=AMB1,F=SP,C=C,V=OV	00020770
00034C	C1B8B2540			5084	LR YD,SR0,ST=JMC,DC=IFCH,MC=MR11	00020780
				5086	"	00020790
				5087	" TWO'S COMPLEMENT FOR NEGATIVE NUMBERS (ABSOLUTE VALUE)	00020800
				5088	"	00020810
00034D	83B801050			5089	LAV LR SR0,MDR,F (RX)	00020820
00034E	25B003500			5091	B M+2MH	00020830
00034F	83B801130			5093	LAVR LR SR0,YS,F (RR)	00020840
000350	25B013520			5095	BCF L,M+2MH	00020850
000351	9A3004700			5097	LRTC SR0,SR0,CVF	00020860
000352	C1B8B2540			5099	LR YD,SR0,ST=JMC,DC=IFCH,MC=MR11	00020870
				5101	NJOV ANOP	00020880
				5102	AIF ('&XPMRPL' NE 'DEVO').NDEVO	00020890
				5103	"	00020900

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				5104	# REMAINDER OF 'PROGRAM LOAD INITIALIZATION SEQUENCE'	00020910
				5105	#	00020920
000353	25B039FF0			5106	XXPLD BCF GL,PRPL JUMP TO PROCESSOR PANEL LOAD	00020930
000354	63B680040			5108	LI EXT,4 NORMAL PHP LOAD. SET HOP	00020940
000355	25B000790			5110	B WAIT	00020950
				5112	NODEV0 ANOP	00020960
				5113	AIF (8XABL EQ 0).HABL	00020970
				5114	HABL ANOP	00021350
				5115	ALIGN X'350'	00021360
000356	FFFFFFFFF	01AD0		5116	A3825 EQU #START	

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
5119	*					00021380
5120	***				AUTOMATIC I/O CHANNEL SERVICE	00021390
5121	***				DAS -- SEPT 26, 75	00021400
5122	*					00021410
5124	*				LOCAL REGISTERS	00021430
5125	*				REGEQU IR,3	00021440
5126	*				----- Q	00021450
5127	*				REGEQU SRB,8	00021460
5128	*				REGEQU (A,A2,T),(10,13,15)	00021470
5129	*				REGEQU UT,9	00021480
5130	*				REGEQU PSWTEMP,11	00021490
5132	*				FIELDS OF 'CHANNEL CONTROL BLOCK' (CCB)	00021510
5133	*				DISPLACEMENTS RELATIVE TO CHAIN WORD	00021520
5134	*				'*' = OPTIONAL	00021530
00000	5136	AI0CHAIN	EQU	0	* A(NEXT CCB IN CHAIN)	00021550
00002	5137	AI0DEVNO	EQU	2	0: DEVICE ADRS 0: STATUS	00021560
00004	5138	AI0CCW	EQU	4	CHAINEL COMMAND WORD (CCW)	00021570
00006	5139	AI0START	EQU	6	* BUFFER POINTER OR DMT COUNTER	00021580
00008	5140	AI0END	EQU	8	* A(LAST WORD IN BUFFER)	00021590
0000A	5141	AI0CMD	EQU	10	* OUTPUT COMMAND BYTE	00021600
0000B	5142	AI0TCHAR	EQU	11	* TERMINAL CHARACTER VALUE	00021610
5144	*					00021630
5145	*				CHANNEL SERVICE ENTRY POINT	00021640
5146	*				MAR = A+1(CCW) -- IE, ODD ADDRESS; MARA,B = 0	00021650
5147	*				SRB = 0:0 0:DEVICE ADRS	00021660
5148	*				UT POSSIBLY SET BY PREVIOUS COMMAND 'CHAIN'ING WITH 'CONTINUE'	00021670
000358	C3BF02090	5150	ISBSVC	LR	T,MAR,MC=MRI1	00021690
		5152	BRI	T,AI0CCW+1,AIC=BMDM1,	Q := A(CONTROL BLOCK)	00021700
000359	768F00050				CIN=1,AOC=LDQ	00021710
00035A	838EC0070	5154	LR	FLR,IR,MOD=EXT0	TEST CCB(0..2)	00021720
00035B	15B0E38C0	5156	BCT	CVG,NIO1	BIF INIT,NOP,DMT,NULL	00021730
		5158	*			00021740
		5159	*		READ OR WRITE	00021750
00035C	633480080	5160	SVC1	ARQI	MAR,AI0END	00021760
00035D	DAB486080	5162	SR	MAR,X0002,MC=MRO		00021770
		5164	*	CHD	MC=MRO	00021780
		5165	*	SR	MAR,X0002	00021790
		5166	*			00021800

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5167	INTERROGATE DEVICE STATUS	00021810
00035E	51B000210			5168	OUT SR0,ADR0,SYNC	00021820
00035F	43B020E10			5170	INP SR0,SR,SYNC,MOD=INSD	00021830
				5172		00021840
				5173	NI SR0,X'0F',F,MOD=SWAP, DEST=INHI0	00021850
000360	6E30190F0			5175	BCT G,BSTAT	00021860
000361	15B023C30			5177		00021870
000362	03B0A00050			5178	LR A,MOR	00021880
000363	C23006000			5180	CMO MC=MRO	00021890
000364	03B1F1070			5182	LR CTR,IR,F,MOD=EXT3	00021900
000365	15B023670			5184	BCT G,M+2*W	00021910
000366	63B100100			5186	LI CTR,16	00021920
000367	03B400050			5188	LR MAR,MOR	00021930
000368	03BEC0070			5190	LR FLR,IR,MOD=EXT0	00021940
000369	15B013070			5192	BCT L,WRITE	00021950
				5194		00021960
				5195	READ APPROPRIATE NUMBER OF CHARACTERS	00021970
00036A	C23006000			5196	READ CMO MC=MRO	00021980
00036B	43B2A0010			5198	INP MOR,DR,SYNC,MOD=INSD	00021990
00036C	D3B48C090			5200	IR MAR,MAR,MC=MHP	00022000
				5202	CMO MC=MHP	00022010
				5203	IR MAR,MAR	00022020
00036D	15B0036A0			5204	BCT CTR,READ	00022030
				5206		00022040
				5207	END OF READ OR WRITE OPERATION	00022050
00036E	03BED0070			5208	END1 LR FLR,IR,MOD=EXT1	00022060
00036F	25B0437A0			5210	BCT V,NOTCHAR	00022070
				5212		00022080
				5213	DO TCHAR CHECKING	00022090
000370	0BB400090			5214	DR MAR,MAR	00022100
000371	03BF30050			5216	LR T,MOR,MOD=EXTB	00022110
000372	93B200090			5218	IR MOR,MAR	00022120
000373	633400060			5220	ARQI MAR,AIOTSTART	00022130
000374	C3B00C050			5222	LR A2,MOR,MC=MHP	00022140
000375	6334000B0			5224	ARQI MAR,AIOTCHAR	00022150
000376	C23006000			5226	CMO MC=MRO	00022160
000377	0F3F31050			5228	XR T,MOR,F,MOD=EXTB	00022170
000378	15B0237D0			5230	BCT G,END1A	00022180
000379	25B003A20			5232	B TERM1	00022190
				5234		00022200
				5235	NO TCHAR CHECKING	00022210
00037A	03B200090			5236	NOTCHAR LR MOR,MAR	00022220
00037B	633400060			5238	ARQI MAR,AIOTSTART	00022230
00037C	C3B00C050			5240	LR A2,MOR,MC=MHP	00022240
						00022250

LOC	OBJECT CODE	ADDR1	ADDR2	SYMT	SOURCE STATEMENT	17 MAY 79
				5242 *		00022260
				5243 *	CHECK END OF BUFFER (UNSIGNED COMPARISON)	00022270
00037D	94BA007A0			5244 END1A	CR A,A2,C COMPARE: A(END1)-A(NEXT CHAR)	00022280
00037E	15B003A20			5246	BCT C,TERM1 BIF LAST CHAR IN BUFFER XMITTED	00022290
				5248 *		00022300
				5249 *	GENERAL END OF CHANNEL I/O PROCESSING	00022310
				5250 *	UT = 1 IF ANY ENTRIES MADE IN TERMINATION QUEUE	00022320
00037F	0E39010B0			5251 END3	NR UT,PSW,F TEST UT 'AND'ED WITH PSW06	00022330
				5253 *	IE: (ENTRY MADE) 'AND' (INT ENA)	00022340
000380	25B023030			5254	BCF G,END3A BIF NO INTRPT TO TEST REQUESTS	00022350
000381	63B400824			5256	LI MAR,OCIPSW,SP=ZERO	00022360
000382	25B0003B0			5258	B GENSWP CHANNEL TERMINATION INTRPT	00022370
				5260 *		00022380
000383	03B0F0000			5261 END3A	LR T,EXT TEST CATN,SINGL,PPF,MALF,ATN,DC	00022390
000384	6E3F11F60			5263	NI T,X'F6',F,MOD=SWAP	00022400
000385	15B030330			5265	BCT GL,P3HELP BIF ANY TO SERVICE	00022410
000386	25B000440			5267	B TEST2 ELSE GO CHECK WAIT STATE	00022420
				5269 *		00022430
				5270 *	WRITE APPROPRIATE NUMBER OF CHARACTERS	00022440
000387	C23006000			5271 WRITE	CMD MC=MRO READ WORD IN MEMORY	00022450
000388	53B2B0610			5273	OUT MDR,DA,SYNC,MOD=EXTB SEND BYTE	00022460
000389	93B480090			5275	IR MAR,MAR MAR := A(NEXT CHAR IN BUFFER)	00022470
00038A	15B003870			5277	BCT CTR,WRITE LOOP TO SEND 'CTR' BYTES	00022480
00038B	25B0036E0			5279	B END1 JOIN 'READ' TERMINATION	00022490
				5281 *		00022500
				5282 *	INIT, NOP, DMT, OR NULL	00022510
00038C	15B0437F0			5283 NIO1	BCT V,END3 BIF NOP TO STOP CHANNEL PROCESS	00022520
00038D	25B003960			5285	BCF C,NIO3 INIT? IF NOT, SKIP AHEAD	00022530
				5287 *NIO2	EQU * ELSE DO INIT HERE IN LINE	00022540
00038E	0F3580060			5288	XR IR,X8000 CLEAR INIT BIT	00022550
00038F	633480040			5290	ARQI MAR,AIOCCW	00022560
000390	03B280070			5292	LR MDR,IR	00022570
000391	C2300C000			5294	CMD MC=MHP UPDATE CCM IN CCB	00022580
000392	03BEE0070			5296	LR FLR,IR,MOD=EXT2 TEST CCM(8)	00022590
000393	15B0839D0			5298	BCT C,OC1 BIF OUTPUT COMMAND DESIRED	00022600
000394	03BEC0070			5300	LR FLR,IR,MOD=EXT0 TEST FOR READ OR WRITE	00022610
000395	25B0235C0			5302	BCF G,SVC1 BIF READ+WRITE TO DO SO	00022620
				5304 *		00022630
				5305 *	NOT NOP; NOT INIT (AT LEAST NOT ANY MORE); FLR=IR(0..3)	00022640
000396	15B013A70			5306 NIO3	BCT L,TERM2 BIF NULL TO TERMINATE CCB	00022650
000397	633480060			5308	ARQI MAR,AIOSTART ELSE DHT	00022660
000398	C23006000			5310	CMD MC=MRO READ COUNTER	00022670
000399	00B201050			5312	DR MDR,MDR,F DECREMENT	00022680
00039A	C2300C000			5314	CMD MC=MHP	00022690
00039B	15B0337F0			5316	BCT GL,END3 QUIT IF >0 OR <0	00022700

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00039C	25B003A70			5310	B TERM2	DO TERMINATION WHEN = 0
				5320	#	
				5321	# OUTPUT COMMAND FOR INITIALIZATION	
00039D	6334000A0			5322	OC1 ARQI MAR,AIOCOMD	
00039E	C23006000			5324	CHD MC=MRO	READ COMMAND BYTE
00039F	51B000210			5326	OUT SR0,ADRS,SYNC	NOW HERE THIS: YOUR MISSION,
0003A0	53B2B0410			5328	OUT MDR,CHD,SYNC,MOD=EXTB	SHOULD YOU DECIDE TO ACCEPT IT..
0003A1	25B0037F0			5330	B END3	NO MORE CHANNEL ACTIVITY NOW
				5332	#	
				5333	# CHANNEL TERMINATION -- CHANGE READ/WRITE TO NOP	
0003A2	83BF00070			5334	TERM1 LR T,IR	T := CCM
0003A3	6EDF10400			5336	OI T,X'40',MOD=SWAP	T := CCM + X'4000'
				5338	#	
				5339	# CHANNEL TERMINATION -- UPDATE CCM IN CCB (T=NEW CCM)	
0003A4	81BF80040			5340	TERM4 LR MDR,T	
0003A5	633480040			5342	ARQI MAR,AIOCCW	A(CCW)
0003A6	C1BF8C060			5344	LR IR,T,MC=MHP	UPDATE CCM; IR := UPDATED CCM
				5346	#	
				5347	# CHANNEL TERMINATION -- UPDATE DEVNO/STATUS IN CCB	
0003A7	81B880040			5348	TERM2 LR MDR,SR0	0:STATUS 0:DEVNO
0003A8	83B290050			5350	LR MDR,MDR,MOD=SWAP	0:DEVNO 0:STATUS
0003A9	633480020			5352	ARQI MAR,AIODEVNO	
0003AA	C2300C000			5354	CHD MC=MHP	STORE DEVNO/STATUS
0003AB	83BE00070			5356	LR FLR,IR,MOD=EXT1	TEST CCM(6)
0003AC	25B023BA0			5358	BCF G,TERM3	IF NO QUEUEING,GO TEST CHAINING
				5360	#	
				5361	# CHANNEL TERMINATION -- MAKE ENTRY IN TERMINATION QUEUE	
0003AD	63B400004			5362	LI MAR,TQPTR,SP=ZERO	A(TERM QUEUE PTR)
0003AE	C3B060080			5364	LR PSWTEMP,PSW,MC=MRO	READ PTR; SAVE PSW
0003AF	6EB910020			5366	OI UT,X'02',MOD=SWAP	UT := 1; INDICATES QUEUE ENTRY
				5368	#	MADE FOR 'END3' EXIT
0003B0	83B480050			5369	LR MAR,MDR	MAR := A(QUEUE)
0003B1	CF3B860A0			5371	XR PSW,PSWTEMP,MC=MRO	BEGIN FETCH FOR 'ATBL';
				5373	#	PSW := 0 FOR NONPRIV WRITES
0003B2	25B002E90			5374	B ATBL	GO ADD TO LIST; 'ATBL' WILL
				5376	#	RETURN EITHER TO 'LISTOV'
				5377	#	(IF QUEUE OFLO) OR 'AIOADD'
				5378	#	(TO WRITE A(CCW) INTO QUEUE)
				5379	#	
				5380	# CHAN TERM QUEUE OVERFLOW	
0003B3	63B4800A4			5381	LISTOV LI MAR,CHOVPTR,SP=ZERO	MAR := A(OVERFLOW TERM POINTER)
0003B4	633280040			5383	ARQI MDR,AIOCCW	MDR := A(CCW)
0003B5	C1BB8C0A0			5385	LR PSW,PSWTEMP,MC=MHP	SAVE A(CCW) IN OFLO-TERM-PTR
				5387	#	RESTORE PSW (CC HASNT CHANGED)
0003B6	63B4800C4			5388	LI MAR,CHOVOPSW,SP=ZERO	MAR := A(OLD PSW) FOR 'GENSHP'

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000307	25B000380			5390	B GENSHP	00023160
				5392		00023170
				5393	MAKE ENTRY IN CHAN TERMINATION QUEUE	00023180
				5394	MAR = A(SLOT IN QUEUE)	00023190
000308	633280040			5395	AIOADD ARQI MDR,AIOCCW MDR := A(CCW)	00023200
000309	C18B8C0A0			5397	LR PSW,PSWTEMP,MC=MWP SAVE A(CCW) IN TERM QUEUE	00023210
				5399	RESTORE PSW (CC WASNT CHANGED)	00023220
				5400		00023230
				5401	CHANNEL TERMINATION -- CHECK 'CHAIN' AND 'CONTINUE'	00023240
00030A	838EE0070			5402	TERM3 LR FLR,IR,MOD=EXT2 TEST CCH(10,11)	00023250
00030B	25B0237F0			5404	BCF G,END3 BIF NO CHAIN TO QUIT	00023260
				5406	CHAIN EQU "	00023270
00030C	633480000			5407	ARQI MAR,AIOCHAIN MAR := A(CHAIN WORD)	00023280
00030D	CC3006040			5409	NR S,X00FF,MC=MRO READ CHAIN WORD	00023290
				5411	SRB := 8:0 8:DEVNO	00023300
00030E	808800100			5412	AQRN SRB,SRB	00023310
00030F	633480004			5414	ARQI MAR,SPTABL,SP=ZERO MAR := A(SPTABL) + 2*DEVNO	00023320
000300	C2300C000			5416	CMO MC=MWP PUT CHAIN WORD IN SERVICE TABLE	00023330
000301	15B0104C0			5418	BCT L,DOIT BIF 'CONTINUE' TO CONTINUE	00023340
000302	25B0037F0			5420	B END3 ELSE END OF CHAN PROCESSING	00023350
				5422		00023360
				5423	BAD DEVICE STATUS ON READ OR WRITE	00023370
000303	63BF10FE0			5424	BSTAT LI T,X'FE',MOD=SWAP T := X'FECE'	00023380
000304	6EBF00CF0			5426	OI T,X'CF'	00023390
000305	8E3F00070			5428	NR T,IR CLEAR: HI/LO,CHAIN,CONTINUE	00023400
000306	6EBF10C20			5430	OI T,X'C2',MOD=SWAP SET: INIT,NOP,QUEUE	00023410
000307	25B003A40			5432	B TERM4 THE REST IS TERMINATION	00023420

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5435	AIF ((&COLDMM EQ 0) AND ('&XFST' NE 'RHM') AND ('&XPHRPL' NE 'RHM')) .NCLRRM	00023440
				5436	.NCLRRM ANOP	00023450
				5437	*	00024210
				5438	* CLEAR MEMORY PARITY SUBROUTINE	00024220
				5439	* INITIALIZE REG-SAVE POINTER (IN CASE OF POWER DOWN)	00024230
				5440	* INITIALIZE CORDIC PRECISION REGISTER TO 20	00024240
				5441	* DISABLE MEMORY-PROTECT-CONTROLLER FOR INITIAL POWER UP	00024250
				5442	*	00024260
				5443	* TEMPYD = A-1(RETURN)	00024270
				5444	* SCRATCH: HAR, HDR, PSN, CTR, SR0	00024280
0003C8	63B480224			5445	CLRPTY LI HAR, PNTR, SP=ZERO	00024290
0003C9	63B280500			5447	LI HDR, X'50'	00024300
0003CA	C1B38C020			5449	LR CTR, X0004, MC=MHP	00024310
				5451	LI CPR, 20, INIT 'PNTR'; CTR:=4 MEMORY BANKS	00024320
					SP=SPEX, DEST=INHIB INIT CPR := 20	00024330
0003CB	63B3081C3			5453	LI SR0, X'F9' ADDRESS NPC	00024340
0003CC	63B800F90			5455	LI SR9, X'10' COMMAND = 'DISABLE NPC'	00024350
0003CD	63B900100			5457	OUT SR0, ADPS, SYNC	00024360
0003CE	51B800210			5459	OUT SR9, CHD, SYNC	00024370
0003CF	51B900410			5461	LI PSN, 0 CLEAR BANK; DISABLE PARITY ALARM	00024380
0003D0	63B500000			5463	CLRPTY1 LI HAR, 0, SP=PINS	00024390
0003D1	63B48000C			5465	CLRPTY2 CHD MC=MRO READ	00024400
0003D2	C23006000			5467	CHD MC=MHP WRITE DATA & PARITY	00024410
0003D3	C2300C000			5469	AR HAR, X0002, C BUMP ADDR	00024420
0003D4	82B480280			5471	BCF C, CLRPTY2 BIF MORE IN BANK	00024430
0003D5	25B083D20			5473	LI SR0, X'40'	00024440
0003D6	63B800400			5475	AR PSN, SR0 BUMP 'PINS' BANK	00024450
0003D7	82B0800A0			5477	BCF CTR, CLRPTY1	00024460
0003D8	15B003D10			5479	IR RAR, TEMPYD	00024470
0003D9	91B1801E0			5481	.CLRJOIN ANOP	00024480
						00024490

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5483 #		00024510
				5484 ###	INSTRUCTION FETCH WITH BREAKPOINT ENABLED	00024520
				5485 #		00024530
0003DA	63BF00010			5486 BREAKPT	LI T,1	00024540
0003DB	51BF00210			5488	OUT T,ADRS,SYNC ADDRESS PANEL	00024550
0003DC	43BF00810			5490	INP T,DR,SYNC	00024560
				5492	INP MAR,DR,SYNC,MOD=SWAP, SP=DBUS	00024570
0003DD	43B490810					00024580
0003DE	8EBF80080			5494	OR MAR,T MAR := PANEL SWITCHES	00024590
				5496 #	NOTE: IF SWITCHES ODD, WE WONT BREAK (UNLESS LOC IS ODD)	00024600
0003DF	9AB709080			5497	CR MAR,LOC,F CHECK LOC	00024610
0003E0	15B0302C0			5499	BCT GL,IFETCH BIF NOT EQUAL TO RESUME INSTR	00024620
0003E1	63B180040			5501	LI CTR,4 CHECK 'PINS' FIELD OF PSW	00024630
0003E2	C3BF400B0			5503	LR T,PSW,RPT=1	00024640
0003E3	824F001E0			5505	PRL T,T ALIGN 'PINS' IN T(12,13)	00024650
0003E4	8F3F000D0			5507	XR T,EXT COMPARE EXT(12,13) (IE MARA,B)	00024660
0003E5	6E3F010C0			5509	NI T,X'0C',F	00024670
0003E6	15B0302C0			5511	BCT GL,IFETCH BIF NOT EQUAL	00024680
				5513 #		00024690
				5514 #	BREAKPOINT IS TO BE TAKEN:	00024700
				5515 #	DISPLAY MAR IN 'D1'	00024710
				5516 #	DISPLAY THE INSTN IN 'D2', WITH X'3' IN 5'TH HEX DIGIT	00024720
				5517 #	THEN GO TO PANEL IDLE	00024730
				5518 #		00024740
0003E7	83BF000B0			5519	LR T,PSW SAVE PSW	00024750
0003E8	63B580C00			5521	LI PSW,X'CO' 'PINS' := X'3'	00024760
0003E9	83B48007C			5523	LR MAR,IR,SP=PINS MAR := X'3', INSTN	00024770
0003EA	81BF800A0			5525	LR PSW,T RESTORE PSW; (CC SAME)	00024780
0003EB	53D480610			5527	OUT MAR,DA,SYNC DISPLAY 2	00024790
0003EC	53B490610			5529	OUT MAR,DA,SYNC,MOD=SWAP DISPLAY 2	00024800
0003ED	81B78008C			5531	LR MAR,LOC,SP=PINS	00024810
0003EE	53B480610			5533	OUT MAR,DA,SYNC DISPLAY 1	00024820
0003EF	53B490610			5535	OUT MAR,DA,SYNC,MOD=SWAP DISPLAY 1	00024830
0003F0	25B000830			5537	B IDLE	00024840
0003F1	83BB00050			5539	LR SRB,MDR	00024850
0003F2	6E3B19FF0			5541	NI SRB,X'FF',F,DEST=INHB,MOD=SWAP TEST MSB'S	00024860
				5543	AIF ('&XFST' NE 'SEM').NSEM1	00024870
				5544	.NSEM1 ANOP	00025070
				5545	ALIGN 1024	00025080
0003F3	FFFFFFFFF	01F98		5546,A4485	EQU *-START	
				5548	AIF ('&XFST' NE 'TGP').NTGP	00025090
				5549	.NTGP ANOP	00026840
				5550 #		00026850
				5551 #		00026860
				5552	AIF (&XDP EQ 0).NDP2	00026870

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5554 #		00026890
				5555 ###	DOUBLE PRECISION FIXED-POINT INSTRUCTIONS	00026900
				5556 ###	JRK/DAS -- 20 APR 76	00026910
				5557 #		00026920
				5558 #		00026930
				5559 #		00026940
				5560 #		00026950
				5561 #	LDPR -- LOAD DOUBLE PRECISION (RR)	00026960
				5562 #		00026970
				5563 #	LDP -- LOAD DOUBLE PRECISION (RXDP)	00026980
				5564 #	LOC, MAR= A+2(OPERAND) = A(15 WORD)	00026990
				5565 #	LOCKX = A-1(NEXT INSTN)	00027000
				5566 #		00027010
000400	83B801110			5567 LDPR	LR TEMP1, YSP1, F	00027020
000401	83B902130			5569	LRH TEMP2, YS, F	00027030
000402	81B880160			5571	LR YDP1, TEMP1 (YD+1) := 15 WORD	00027040
				5573	LR YD, TEMP2, (YD) := 15 WORD	00027050
000403	C1B9B2540				ST=JHC, DC=IFCH, MC=HRI1	00027060
				5575 #		00027070
000404	DAB486080			5576 LDP	SR MAR, X0002, MC=HRO, SP=POPR	00027080
				5578 #	CHD MC=HRO P0	00027090
				5579 #	SR MAR, X0002, SP=POPR P1	00027100
000405	83B881050			5580	LR YDP1, HDR, F P2 (YD+1) := 15 WORD	00027110
000406	D237060CC			5582	IR LOC, LOCKX, MC=HRO, SP=PINS	00027120
				5584 #	CHD MC=HRO P0	00027130
				5585 #	IR LOC, LOCKX, SP=PINS P1	00027140
000407	83BA82050			5586	LRH YD, HDR, F P2 (YD) := 15 WORD	00027150
000408	C23032400			5588	CHD ST=JHC, MC=HRI1, DC=IFCH P0	00027160
				5590 #		00027170
				5591 #		00027180
				5592 #	STDP -- STORE DOUBLE PRECISION (RXDP)	00027190
				5593 #	LOC, MAR= A+2(OPERAND) = A(15 WORD)	00027200
				5594 #	LOCKX = A-1(NEXT INSTN)	00027210
				5595 #		00027220
000409	83B280170			5596 STDP	LR HDR, YDP1 --	00027230
00040A	DAB48A080			5598	SR MAR, X0002, MC=HRI1, SP=POPR	00027240
				5600 #	CHD MC=HRI1 P0 STORE 15 WORD	00027250
				5601 #	SR MAR, X0002, SP=POPR P1	00027260
00040B	83B280150			5602	LR HDR, YD P2	00027270
00040C	D2370A0CC			5604	IR LOC, LOCKX, MC=HRI1, SP=PINS	00027280
				5606 #	CHD MC=HRI1 P0 STORE 15 WORD	00027290
				5607 #	IR LOC, LOCKX, SP=PINS P1	00027300
				5608 #	NOP P2	00027310
00040D	C23033400			5609	CHD ST=CLR, DC=IFCH, MC=HRI1 P0	00027320
				5611 #		00027330

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5612 *		00027340
				5613 *	CLDPR -- COMPARE LOGICAL DOUBLE PRECISION (RR)	00027350
				5614 *	TEMPD = (YD)	00027360
				5615 *		00027370
				5616 *	CLDP -- COMPARE LOGICAL DOUBLE PRECISION (RXDP)	00027380
				5617 *	LOC, MAR = A+2(OPERAND) = A(LS WORD)	00027390
				5618 *	LOCKX = A-1(NEXT INSTN)	00027400
				5619 *	TEMPD = (YD)	00027410
				5620 *		00027420
00040E	838800170			5621	CLDPR LR TEMP1, YDP1	00027430
00040F	96B809710			5623	CR TEMP1, YSP1, CF LS COMPARE	00027440
000410	B6B10B730			5625	CRB TEMPD, YS, CVF MS COMPARE	00027450
000411	C23032400			5627	CHD ST=JMC, DC=IFCH, MC=HRI1	00027460
				5629 *		00027470
000412	C38806170			5630	CLDP LR TEMP1, YDP1, MC=HRO P0	00027480
000413	9AB480080			5632	SR MAR, X0002, SP=POPR P1	00027490
000414	96B809650			5634	CR TEMP1, HDR, CF P2 LS COMPARE	00027500
000415	D237060CC			5636	IR LOC, LOCKX, MC=HRO, SP=PINS	00027510
				5638 *	CHD MC=HRO P0	00027520
				5639 *	IR LOC, LOCKX, SP=PINS P1	00027530
000416	B6B10B650			5640	CRB TEMPD, HDR, CVF P2 MS COMPARE	00027540
000417	C23032400			5642	CHD ST=JMC, DC=IFCH, MC=HRI1 P0	00027550
				5644 *		00027560
				5645 *		00027570
				5646 *	CDPR -- COMPARE ALGEBRAIC DOUBLE PRECISION (RR)	00027580
				5647 *	TEMPD = (YD)	00027590
				5648 *		00027600
				5649 *	CDP -- COMPARE ALGEBRAIC DOUBLE PRECISION (RXAD)	00027610
				5650 *	LOC, MAR = A(OPERAND) = A(MS WORD)	00027620
				5651 *	LOCKX = A-1(NEXT INSTN)	00027630
				5652 *	TEMPD = (YD)	00027640
				5653 *		00027650
000418	8F3109130			5654	CDPR XR TEMPD, YS, F, DEST=INHIB CHECK SIGNS	00027660
000419	15B0141F0			5656	BCT L, CDPRDIFF BIF SIGNS DIFFERENT	00027670
				5658 *	SIGNS ALIKE	00027680
00041A	838800170			5659	LR TEMP1, YDP1	00027690
00041B	96B809710			5661	CR TEMP1, YSP1, CF LS COMPARE	00027700
00041C	B6B10B730			5663	CRB TEMPD, YS, CVF MS COMPARE	00027710
00041D	C23032400			5665	CHD ST=JMC, MC=HRI1, DC=IFCH	00027720
				5667 *	SIGNS ALIKE	00027730
00041E	9237000CC			5668	CDPRDIFF IR LOC, LOCKX, SP=PINS	00027740
				5670	CDPRDIFF BRR TEMP1, YD, AIC=D, LOAD C, G, L; USE F=DP	00027750
00041F	83F802B50				AOC=PLS, C=LSH, F=DP TO INSURE 6 OR L.	00027760
000420	C23032400			5672	CHD ST=JMC, MC=HRI1, DC=IFCH	00027770
				5674 *		00027780

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5738 *		00020240
000436	83800170			5739 S0PR	LR TEMP1,YDP1	00020250
000437	968001710			5741	SR TEMP1,YSPI,CF LS DIFFERENCE	00020260
000438	838A00130			5743	LR SRA,YS	00020270
				5745 *	'A OPERAND' = Y FIELD = YD = 10 = SRA	00020280
				5746	RRR YD,TEMPYD,AIC=BHAM1, (YD) := HS DIFFERENCE	00020290
000439	B4B103740				CIN=-C,V=OV,F=DP,C=-C	00020300
				5748	LR YDP1,TEMP1, (YD+1) := LS DIFFERENCE	00020310
00043A	C1B8B2560				ST=JMC,DC=IFCH,MC=MR11	00020320
				5750 *		00020330
00043B	C3B806170			5751 SDP	LR TEMP1,YDP1,MC=HRO P0	00020340
00043C	9AB480000			5753	SR MAR,X0002,SP=POPR P1	00020350
00043D	96B801650			5755	SR TEMP1,MDR,CF P2 LS DIFFERENCE	00020360
00043E	C1B806160			5757	LR YDP1,TEMP1,MC=HRO P0 (YD+1) := LS DIFFERENCE	00020370
00043F	9237000CC			5759	IR LOC,LOCX,SP=PINS P1	00020380
000440	B6B103650			5761	SRB TEMPYD,MDR,CVF P2 HS DIFFERENCE	00020390
				5763	LR YD,TEMPYD, P0 (YD) := HS DIFFERENCE	00020400
000441	C1B102540				ST=JMC,DC=IFCH,MC=MR11	00020410
				5765	AIF (A ZEALU GT 0).DPEALU	00020420
				5766	.DPEALU ANOP	00020430
				5767 *		00020440
				5768 *		00020450
				5769 *	MDPR -- MULTIPLY DOUBLE PRECISION (RR)	00020460
				5770 *		00020470
				5771 *	MDP -- MULTIPLY DOUBLE PRECISION (RXDP)	00020480
				5772 *	LOC,MAR=A+2(OPERAND)	00020490
				5773 *	LOCX =A-1(NEXT INSTN)	00020500
				5774 *		00020510
000442	85B280023			5775 MDPR	DR CTR,X0020,SP=SPEX	00020520
				5777	LR TEMP1,YSPI, SP=SPEX,DEST=INHIB	00020530
000443	83B000113				IR,X0020,SP=SPEX	00020540
000444	82B280063			5779	AR MDR,YS	00020550
000445	83B280130			5781	LR MDPJOIN	00020560
000446	25B0044C0			5783	B	00020570
				5785 *		00020580
				5786 MDP	DR CTR,X0020,SP=SPEX, P0	00020590
000447	C5B286023				MC=HRO	00020600
000448	9AB480080			5788	SR MAR,X0002,SP=POPR P1	00020610
				5790	LR TEMP1,MDR, P2	00020620
000449	83B000053				SP=SPEX,DEST=INHIB	00020630
				5792	AR IR,X0020,SP=SPEX, P0	00020640
00044A	C2B286063				MC=HRO	00020650
00044B	9237000CC			5794	IR LOC,LOCX,SP=PINS P1	00020660
				5796 *		00020670
				5797 MDPJOIN	LR Q,YDP1,	00020680

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00044C	838008173				SP=SPEX,DEST=INHIB	00029380
00044D	838001150			5799	Q,YD,F	00029390
00044E	94C900F23			5801	PRZ TEMP2,C,SP=DP	00029400
00044F	C3B840050			5803	LR TEMP1,HDR,RPT=1	00029410
000450	F5C920F03			5805	MUL TEMP2,TEMP1,C,SP=DP	00029420
000451	15B014580			5807	BCT L,HDPNEG	00029430
				5809	#	00029440
				5810	# MULTIPLIER POSITIVE	00029450
000452	F5C920F03			5811	MUL TEMP2,TEMP1,C,SP=DP	00029460
000453	813080163			5813	LR YDP1,Q,SP=SPEX	00029470
000454	813080140			5815	LR YD,Q	00029480
000455	9AB280063			5817	SR IR,X0020,SP=SPEX	00029490
000456	81B980163			5819	LR YDP1,TEMP2,SP=SPEX	00029500
				5821	LR YD,TEMP2,	00029510
					ST=CLR,DC=IFCH,MC=HRI1	00029520
000457	C1B9B3540			5823	#	00029530
				5824	# MULTIPLIER NEGATIVE	00029540
000458	94C930F03			5825	HDPNEG MULC TEMP2,TEMP1,C,SP=DP	00029550
000459	813080163			5827	LR YDP1,Q,SP=SPEX	00029560
00045A	813080140			5829	LR YD,Q	00029570
00045B	9AB280063			5831	SR IR,X0020,SP=SPEX	00029580
00045C	81B980163			5833	LR YDP1,TEMP2,SP=SPEX	00029590
				5835	LR YD,TEMP2,	00029600
					ST=CLR,DC=IFCH,MC=HRI1	00029610
00045D	C1B9B3540			5837	#	00029620
				5838	#	00029630
				5839	# DDPR -- DIVIDE DOUBLE PRECISION (RR)	00029640
				5840	#	00029650
				5841	# DDP -- DIVIDE DOUBLE PRECISION (RXDP)	00029660
				5842	# LOC,MAR=A+2(OPERAND)	00029670
				5843	# LOCK #A-1(NEXT INSTN)	00029680
				5844	#	00029690
00045E	85B280023			5845	DDPR DR CTR,X0020,SP=SPEX	00029700
				5847	LR TEMP1,YSPI,	00029710
					SP=SPEX,DEST=INHIB	00029720
00045F	83B808113			5849	LR TEMP2,YDP1,	00029730
					SP=SPEX,DEST=INHIB	00029740
000460	83B908173			5851	LR TEMP1,YS,F	00029750
000461	83B801130			5853	B DDPJOIN	00029760
000462	25B004690			5855	#	00029770
				5856	DDP DR CTR,X0020,SP=SPEX,	00029780
					MC=HRO	00029790
000463	C5B286023			5858	SR MAR,X0002,SP=POPR	00029800
000464	9AB480088			5860	LR TEMP1,HDR,	00029810
					SP=SPEX,DEST=INHIB	00029820

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79	
000466	C3B906173			5862	LR TEMP2,YDP1,MC=HRO, SP=SPEX,DEST=INHIB	P0 TEMP2(L) := DIVIDEND(2ND M) (ALSO CLK TEMP2(M);DONT CARE)	00029830 00029840
000467	9237000CC			5864	IR LOC,LOCX,SP=PIN3	P1 LOC := A(NEXT INSTN)	00029850
000468	83B801050			5866	LR TEMP1,MDR,F	P2 TEMP1(M) := DIVISOR(M); FLR	00029860 00029870
000469	15B014830			5868	"		00029880
00046A	83B901150			5869	DDPJ0IN BCT L,DDPDORNEG	BIF DIVISOR NEGATIVE	00029890
00046B	82B280063			5871	LR TEMP2,YD,F	TEMP2(M) := DIVIDEND(M); SET FLR	00029900
				5873	AR IR,X0020,SP=SPEX		00029910
				5875	LR Q,YDP1, SP=SPEX,DEST=INHIB	Q(L) := DIVIDEND(L)	00029920
00046C	838000173						00029930
00046D	838000150			5877	LR Q,YD	Q(M) := DIVIDEND(2ND L)	00029940
00046E	25B0148B0			5879	BCF L,DDP1	BIF DIVIDEND NOT NEG	00029950
00046F	990000603			5881	LRTC Q,Q,C,SP=DP	DIVIDEND NEG:	00029960
000470	BA3900123			5883	LRTC TEMP2,TEMP2,SP=DP	MAKE POSITIVE	00029970
				5885	"		00029980
				5886	" DIVIDE WITH DD,OR OPPOSITE IN SIGN:	QUOTIENT <= 0	00029990
				5887	DDP2 BRR TEMP2,TEMP1,AIC=BMAH1, CIN=1,MOD=MD,AOC=PLD, C=-C,SP=DP	DO DIV STEP (C:= - QUOT BIT)	00030000 00030010
000471	94E930703						00030020
000472	25B002310			5889	BCF C,DIVOVF	OFLO IF C=0 (IE 1ST QUOT BIT=1)	00030030
000473	C23040000			5891	CHD RPT=1		00030040
000474	E4E920703			5893	DIV TEMP2,TEMP1,C,SP=DP	31 MORE ITERATIONS = 32	00030050
				5895	BRR TEMP2,TEMP1,AIC=DIV, CIN=DIV,MOD=MD,AOC=F, C=C,SP=DP	NO SHIFT ON (N+1)TH ITERATION C := TRUE CARRY = QUOTIENT BIT	00030060 00030070
000475	E4B930303						00030080
000476	826140123			5897	PLA TEMPYD,TEMP2,SP=DP	SHIFT IN QUOTIENT BIT	00030090
				5899	"	(DONT SHIFT REMAINDER=TEMP2)	00030100
000477	15B084790			5900	BCT C,DDPCOMPL	BIF QUOTIENT BIT = 1	00030110
000478	80B900103			5902	AR TEMP2,TEMP1,SP=DP	CORRECT "NONRESTORED" REMAINDER	00030120
000479	990001003			5904	DDPCOMPL LRTC Q,Q,F,SP=DP	2'S COMPLEMENT QUOTIENT	00030130
00047A	15B022310			5906	BCT G,DIVOVF	REQUIRE QUOTIENT<=0, ELSE OFLO	00030140
				5908	"		00030150
				5909	" COMMON EXIT		00030160
00047B	813080163			5910	DDPCOM LR YDP1,Q,SP=SPEX	QUOTIENT(L)	00030170
00047C	813080140			5912	LR YD,Q	QUOTIENT(M)	00030180
00047D	9AB280063			5914	SR IR,X0020,SP=SPEX		00030190
00047E	83B101150			5916	LR TEMPYD,YD,F		00030200
00047F	25B014810			5918	BCF L,DDPDPOS	BIF DIVIDEND WAS >= 0	00030210
000480	9A3900123			5920	LRTC TEMP2,TEMP2,SP=DP	MAKE SIGN(REMAINDER)=SIGN(DD)	00030220
000481	81B980140			5922	DDPDPOS LR YD,TEMP2	REMAINDER(M)	00030230
				5924	LR YDP1,TEMP2,SP=SPEX, ST=CLR,DC=IFCH,MC=HRI1	REMAINDER(L)	00030240
000482	C1B9B3563						00030250
				5926	"		00030260
				5927	" NEGATIVE DIVISOR: MAKE DIVISOR >= 0 AND CHECK DIVIDEND		00030270
000483	9A3800103			5928	DDPDORNEG LRTC TEMP1,TEMP1,SP=DP	DIVISOR(M,L)	00030280

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000484	83B901150			5930	LR TEMP2,YD,F	TEMP2(M) := DIVIDEND(M); SET FLR 00030280
000485	82B280063			5932	IR,X0020,SP=SPEX	00030290
				5934	LR Q,YDP1,	Q(L) := DIVIDEND(L) 00030300
000486	838008173				SP=SPEX,DEST=INHIB	00030310
000487	838000150			5936	LR Q,YD	Q(M) := DIVIDEND(2ND L) 00030320
000488	25B014710			5938	BCF L,DDP2	BIF DIVIDEND NOT NEG 00030330
000489	990000603			5940	LRTC Q,Q,C,SP=DP	00030340
00048A	BA3900123			5942	LRTCH TEMP2,TEMP2,SP=DP	00030350
				5944	*	00030360
				5945	* DIVIDE WITH DD,DR HAVING LIKE SIGN: QUOTIENT >= 0	00030370
				5946	DDP1 BRR TEMP2,TEMP1,AIC=BHAM1, DO DIV STEP (C:= - QUOT BIT)	00030380
					CIN=1,MOD=MD,AOC=PLD,	00030390
					C=-C,SP=DP	00030400
00048B	94E930703					
00048C	25B082310			5948	BCF C,DIVOVF	OFLO IF C=0 (IE 1ST QUOT BIT=1) 00030410
00048D	C23040000			5950	CHD RPT=1	00030420
00048E	E4E920703			5952	DIV TEMP2,TEMP1,C,SP=DP	31 MORE ITERATIONS = 32 00030430
				5954	BRR TEMP2,TEMP1,AIC=DIV, NO SHIFT ON (N+1)TH ITERATION	00030440
					CIN=DIV,MOD=MD,AOC=F, C := TRUE CARRY = QUOTIENT BIT	00030450
					C=C,SP=DP	00030460
00048F	E4B930303			5956	PLA TEMPYD,TEMP2,SP=DP	SHIFT IN QUOTIENT BIT 00030470
000490	826140123			5958	*	(DONT SHIFT REMAINDER=TEMP2) 00030480
				5959	BCT C,DDPTST	BIF QUOTIENT BIT = 1 00030490
000491	15B084930			5961	AR TEMP2,TEMP1,SP=DP	CORRECT "NONRESTORED" REMAINDER 00030500
000492	80B900103			5963	DDPTST LR Q,Q,F	00030510
000493	810001000			5965	BCF L,DDPCON	REQUIRE QUOTIENT >= 0, 00030520
000494	25B0147B0			5967	B DIVOVF	ELSE OFLO 00030530
000495	25B002310			5969	NDP2 ANOP	00030540
				5970	AIF (XTRIG EQ 0).NCORD	00030550

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
5972	#					00030570
5973	###				TRIGONOMETRIC OPERATION OPTION	00030580
5974	###				DAS -- 7 MAY 76	00030590
5975	#					00030600
5976					GNOTE &ZEALU,1,'EXTENDED ALU REQUIRED'	00030610
5977					GNOTE &ZTRIG,1,'CORDIC HARDWARE REQUIRED'	00030620
5978	#					00030630
5979	#				REGISTER DEFINITIONS	00030640
5980	#				EXTRN CORDM,CORDL,CORDROM,COROCTL ONLY CORDCTL IS DESTINATION	00030650
5981	#				REGEQU (CORDM,CORDL,CORDROM,COROCTL),(12,13,7,7)	00030660
5982	#				REGEQU X,8	00030670
5983	#				REGEQU (Y,THETA,M,NSH),(9,10,11,12)	00030680
5984	#				REGEQU CPR,X0004	00030690
5985	#					00030700
5986	#				LOCATIONS IN CORDIC CONSTANT ROM	00030710
00000	5987 ROMCIR	EQU	0	THRU 27	DELTA THETA(I), I=0..27	00030720
00020	5988 ROMCIRK	EQU	32		1/K('CIRCULAR') AS S.DDD--DD	00030730
00021	5989 ROMCOSX	EQU	33		1/K('CIRCULAR') AS SO.DD--DD	00030740
00022	5990 ROMHYPK	EQU	34		1/K('HYPERBOLIC') S.DDD--DD	00030750
00081	5991 ROMHYP	EQU	129	THRU 156	DELTA THETA(I), I=1..28	00030760

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				5993	# ECPR -- EXCHANGE CORDIC PRECISION REGISTER (RR)	00030780
				5994	#	00030790
000496	823808063			5995	ECPR LR SR8,CPR,DEST=INHIB,SP=SPEX	00030800
000497	838308133			5997	LR CPR,Y8,DEST=INHIB,SP=SPEX	00030810
000498	6E33081C3			5999	NI CPR,X'1C',DEST=INHIB,SP=SPEX	00030820
000499	6EB308103			6001	OI CPR,X'10',DEST=INHIB,SP=SPEX	00030830
00049A	C1B8B3543			6003	LR YD,SR8,SP=SPEX,ST=CLR,DC=IFCH,MC=HRI1	00030840
				6005	#	00030850
				6006	#	00030860
				6007	# COSR -- LOAD COSINE/SINE (RR)	00030870
				6008	#	00030880
				6009	# COS -- LOAD COSINE/SINE (RXOP)	00030890
				6010	# MAR = A(OPERAND)	00030900
				6011	# LOCK = A-1(NEXT INSTN)	00030910
				6012	# OPERAND FETCH BEGUN	00030920
00049B	C63601CE0			6013	COSR DR LOCK,LOC,ST=SIE INIT LOCK FOR ABORT	00030930
				6015	#	00030940
00049C	83BA00130			6016	LR THETA,Y8 THETA(M)	00030950
00049D	83B280110			6018	LR HDR,YSP1 THETA(L)	00030960
00049E	94B900123			6020	SR Y,Y,SP=DP Y(M,L):=0	00030970
00049F	25B004A30			6022	B COSJOIN	00030980
				6024	#	00030990
0004A0	82B480080			6025	COS AR MAR,X0002,SP=POPR P1	00031000
0004A1	C3BA01C50			6027	LR THETA,HDR,ST=SIE P2 THETA(M)	00031010
				6029	#	00031020
0004A2	D4B906123			6030	SR Y,Y,SP=DP,MC=HRO P0 Y(M,L):=0	00031030
0004A3	63B780210			6032	COSJOIN LI CORDCTL,ROMCOSX P1 ADDR '1/K' IN PROM	00031040
				6034	LR THETA,HDR, P2 THETA(L)	00031050
0004A4	83BA08053				SP=SPEX,DEST=INHIB	00031060
				6036	AI THETA,X'40',F, TEST QUADRANT OF THETA	00031070
0004A5	62BA19400				MOD=SWAP,DEST=INHIB (0,1,2,3)	00031080
0004A6	15B014AA0			6038	BCT L,COS12 BIF 1 OR 2	00031090
				6040	# QUADRANT 0 OR 3	00031100
0004A7	83B8080F3			6041	LR X,CORDROM, X(L):=1/K(CIRCULAR,PRECISION)	00031110
					SP=SPEX,DEST=INHIB	00031120
0004A8	83B8000F0			6043	LR X,CORDROM	00031130
0004A9	25B004AD0			6045	B COS1	00031140
				6047	# QUADRANT 1 OR 2	00031150
0004AA	62BA10800			6048	COS12 AI THETA,X'80',MOD=SWAP THETA := THETA + 180 DEG	00031160
				6050	LRTC X,CORDROM,C, X(L):=-1/K(CIRCULAR,PRECISION)	00031170
					SP=SPEX,DEST=INHIB	00031180
0004AB	97B8086F3			6052	LRTC X,CORDROM X(M):=-1/K(CIRCULAR,PRECISION)	00031190
0004AC	B7B8000F0					00031200
0004AD	81B380023			6054	# DO CIRCULAR CORDIC -- ZERO THETA	00031210
0004AE	63B780000			6055	COS1 LR CTR,CPR,SP=SPEX CTR := 8 ITERATIONS	00031220
				6057	LI CORDCTL,ROMCIR INIT EXTERNAL ITERATION REG	00031220

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE	STATEMENT	17 MAY 79
0004AF	03B005240			6059	BLK	CORDZT, LINK	PERFORM CORDIC -- ZERO THETA
				6061			00031230
				6062	IR	LOC, LOCK, ST=RIE, SP=PINS	00031240
0004B0	0237018CC			6064	LR	YDP1, X, SP=SPEX	00031250
0004B1	01B800163			6066	LR	YD, X	00031260
0004B2	01B800140			6068	BRR	IR, X0002, AIC=DPB, HOD=EXT2	00031270
0004B3	02B4E0060			6070	LR	YSP1, Y, SP=SPEX	00031280
0004B4	01B980103			6072	LR	YS, Y, DC=IFCH, ST=CLR, MC=HRI1	00031290
0004B5	01B9B3520						00031300
							00031310
							00031320

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6075 *	ATHR -- LOAD ARCTANGENT/SQRT OF SUM OF SQUARES (RR)	00031340
				6076 *		00031350
				6077 *	ATH -- LOAD ARCTANGENT/SQRT OF SUM OF SQUARES (RXOP)	00031360
				6078 *	MAR = A(OPERAND)	00031370
				6079 *	LOCK= A-1(NEXT INSTN)	00031380
				6080 *	OPERAND FETCH BEGUN	00031390
				6081 *		00031400
				6082 *		00031410
0004B6	8636800E0			6083	ATHR DR LOCK,LOC INIT LOCK FOR ABORT	00031420
				6085	LR X,YSPI,F, X(L)	00031430
					SP=SPEX,DEST=INHIB	00031440
0004B7	83B809113			6087	LR X,YS,F X(H); FLR := SIGN(X)	00031450
0004B8	83B801130			6089	AR IR,X0002	00031460
0004B9	82B480060			6091	LR Y,YSPI, Y(L)	00031470
					SP=SPEX,DEST=INHIB	00031480
0004BA	83B908113			6093	LR Y,YS Y(H)	00031490
0004BB	83B900130			6095	LR THETA,X,ST=SIE	00031500
0004BC	C23A01000			6097	NR THETA,X0000,SP=DP	00031510
0004BD	8C3A000A3			6099	B ATHJOIN	00031520
0004BE	25B004C90			6101 *		00031530
				6102	ATH AR MAR,X0002 P1	00031540
0004BF	82B480080			6104	LR X,MOR,F P2 X(H); FLR:=SIGN(X)	00031550
0004C0	83B801050			6106	LR THETA,X,MC=MRO P0	00031560
0004C1	C23A06100			6108	AR MAR,X0002 P1	00031570
0004C2	82B480080			6110	LR X,MOR, P2 X(L)	00031580
0004C3	83B808053				SP=SPEX,DEST=INHIB	00031590
				6112	NR THETA,X0000,SP=DP, P0 THETA=X*800000000 IF X<0	00031600
					MC=MRO X*000000000 IF X>=0	00031610
0004C4	CC3A060A3					00031620
0004C5	82B480080			6114	AR MAR,X0002 P1	00031630
0004C6	83B900050			6116	LR Y,MOR P2 Y(H)	00031640
0004C7	C23007C00			6118	CHD MC=MRO,ST=SIE P0, NNN ENABLE ABORT NNN	00031650
				6120 *	NOP P1	00031660
				6121	LR Y,MOR, P2 Y(L)	00031670
0004C8	83B908053				SP=SPEX,DEST=INHIB	00031680
0004C9	25B014CC0			6123	ATHJOIN BCF L,ATH1 BIF X>=0 (X,Y QUAD 0 OR 3)	00031690
0004CA	9A3800103			6125	LRTC X,X,SP=DP ELSE ROTATE X,Y BY 180 DEGREES	00031700
				6127 *		00031710
0004CB	9A3900123			6128	LRTC Y,Y,SP=DP	00031720
0004CC	03B005490			6130	ATH1 BLK CORDNORM,LXNK NORMALIZE X AND Y	00031730
0004CD	15B014D00			6132	BCT L,ATH1 BIF NORMAL CASE	00031740
				6134 *		00031750
				6135 *	L=0, IF C=0 THEN X=Y=0, ELSE X=Y=800000000	00031760
0004CE	25B084E10			6136	BCF C,ATHEXIT THETA=0,Y=0 -- JUST RETURN	00031770
0004CF	25B005070			6138	B CORDOFLO X=Y=800000000, OFLO	00031780
				6140 *		00031790

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6141	M L=1, SEE IF X*ABS(Y) > B6000000 (IE SQRT(2)) -- IF SO, IMMED OFLO	00031790
000400	803B01103			6142	ATNL ARQR M,X,F,SP=DP	00031800
000401	258014040			6144	BCF L,ATND0IT BIF LESS	00031810
000402	76BB19B60			6146	CI M,X*B6*,F,MOD=SHAP	00031820
000403	158025070			6148	BCT G,CORDOFLO IF GREATER OFLO, ELSE CONTINUE	00031830
000404	81B380023			6150	ATND0IT LR CTR,CPR,SP=SPEX CTR := 8 ITERATIONS	00031840
000405	63B780000			6152	LI CORDCTL,RMCIR INIT EXTERNAL ITERATION REG	00031850
000406	038005730			6154	BLK CORDZY,LINK PERFORM ALGORITHM	00031860
				6156	"	00031870
000407	83B8061B3			6157	LR X,CORDL,SP=SPEX,DEST=INHIB	00031880
000408	83B800190			6159	LR X,CORDM	00031890
000409	63B780200			6161	LI CORDCTL,RMCIR ADDR '1/K' IN PROM	00031900
				6163	LR Q,CORDROM,	00031910
00040A	8380080F3				SP=SPEX,DEST=INHIB	00031920
00040B	C380018F0			6165	LR Q,CORDROM,ST=RIE Q(ML) := 1/K(CIRCULAR,PRECISION)	00031930
				6167	"	00031940
00040C	94C900F23			6168	PRZ Y,C,SP=DP INIT MULTIPLY (Y GETS PRODUCT)	00031950
00040D	C5B2C0023			6170	DR CTR,X0020,SP=SPEX,RPT=1 CTR:=31, REPEAT:	00031960
00040E	F5C900F03			6172	UNRL Y,X,C,SP=DP 31 MULTIPLIES, UNSIGNED	00031970
00040F	823901120			6174	LR Y,Y,F	00031980
0004E0	15B015070			6176	BCT L,CORDOFLO BIF RESULT>7FFFFFFF: OFLO	00031990
0004E1	0237010CC			6178	ATHEXIT IR LOC,LOCX,SP=PINS,ST=RIE	00032000
0004E2	01BA00163			6180	LR YDPI,THETA,SP=SPEX (R1+1)	00032010
0004E3	01BA00140			6182	LR YD,THETA (R1)	00032020
0004E4	02B280063			6184	AR IR,X0020,SP=SPEX	00032030
0004E5	C1B981563			6186	LR YDPI,Y,SP=SPEX,ST=CLR (R1+3); COND CODE=0	00032040
				6188	LR YD,Y, (R1+2); JAM COND CODE	00032050
0004E6	C1B9B2540				DC=IFCH,ST=JMC,MC=HRI1	00032060

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6191 *		00032080
				6192 *	SQDSR-- SQUARE ROOT OF THE DIFFERENCE OF SQUARES (RR)	00032090
				6193 *	ASHR -- LOAD ARCSINE OF A RATIO (RR)	00032100
				6194 *		00032110
				6195 *	SQDS -- SQUARE ROOT OF THE DIFFERENCE OF SQUARES (RXOP)	00032120
				6196 *	ASH -- LOAD ARCSINE OF A RATIO (RXOP)	00032130
				6197 *	MAR = A(OPERAND)	00032140
				6198 *	LOCX= A-1(NEXT INSTN)	00032150
				6199 *	OPERAND FETCH BEGUN	00032160
				6200 *		00032170
		02730		6201	SQDSR EQU *	00032180
0004E7	8636000E0			6202	ASHR DR LOCK,LOC	00032190
0004E8	83B801130			6204	LR X,YS,F	00032200
				6206	LR X,YSPI,	00032210
					SP=SPEX,DEST=INHIB	00032220
0004E9	83B800113			6208	AR IR,X0002	00032230
0004EA	82B480060			6210	LR Y,YSPI,	00032240
					SP=SPEX,DEST=INHIB	00032250
0004EB	83B900113			6212	LR HDR,YS	00032260
0004EC	83B200130			6214	B SQDSJOIN	00032270
0004ED	25B004F50			6216 *		00032280
				6217 *		00032290
		02770		6218	SQDS EQU *	00032300
0004EE	82B480080			6219	ASH AR MAR,X0002	00032310
0004EF	83B801050			6221	LR X,HDR,F	00032320
0004F0	C2B386080			6223	AR MAR,X0004,HC=HRO	00032330
				6225 *	CHD HC=HRO	00032340
				6226 *	AR MAR,X0004	00032350
				6227	LR X,HDR,	00032360
					SP=SPEX,DEST=INHIB	00032370
0004F1	83D808053			6229	SR MAR,X0002,HC=HRO	00032380
0004F2	DAB486080			6231 *	CHD HC=HRO	00032390
				6232 *	SR MAR,X0002	00032400
				6233	LR Y,HDR,	00032410
					SP=SPEX,DEST=INHIB	00032420
0004F3	83B900053			6235	CHD HC=HRO	00032430
0004F4	C23006000			6237	SQDSJOIN BCF L,SQDS1	00032440
0004F5	25B014F70			6239	LRTC X,X,SP=DP	00032450
0004F6	9A3800103			6241	SQDS1 LR Y,HDR,ST=SIE	00032460
0004F7	C3B901C50			6243	LR FLR,IR,MOD=EXT1	00032470
0004F8	83BED0070			6245	BCF V,SQDS5SQDS	00032480
0004F9	25B045030			6247 *		00032490
				6248 *	INSTN IS ASH; NORMALIZE X & Y, THEN SAVE SIGNED 'Y' IN TEMPYD;	00032500
				6249 *	Y := ABS(Y); NSH := 0;	00032510
				6250 *	WAIT SCALE OF SQDS(NORMALIZED X,NORMALIZED Y) SAME AS THAT OF	00032520

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6251 *	'NORMALIZED Y'; HENCE NSH := 0	00032530
0004FA	03B005490			6252	BLK CORDNORM, LINK	00032540
0004FB	823100123			6254	LR TEMPYD, Y, SP=DP	00032550
0004FC	813900123			6256	LR Y, Q, SP=DP	00032560
0004FD	63BC00000			6258	LI NSH, 0	00032570
0004FE	15B015050			6260	BCT L, SQ052	00032580
				6262 *		00032590
				6263 *	L=0, IF C=0 THEN X=Y=0, ELSE X=Y=80000000	00032600
0004FF	25B085070			6264	BCF C, CORDOFLO	00032610
000500	63BA10C00			6266	LI THETA, X'CO', MOD=SWAP	00032620
000501	63BA08003			6268	LI THETA, 0, DEST=INHIB, SP=SPEX	00032630
000502	25B005210			6270	B SQ05EXIT	00032640
				6272 *		00032650
				6273 *	INSTN IS SQ05; NORMALIZE X & Y, Y:=ABS(Y); THEN DO CORDIC	00032660
000503	03B005490			6274	SQ05SQ05 BLK CORDNORM, LINK	00032670
000504	813900123			6276	LR Y, Q, SP=DP	00032680
				6278 *		00032690
				6279 *	X, Y NON-NEGATIVE: DO GENERAL SQUARE ROOT OF DIFFERENCE OF SQUARES	00032700
				6280 *	NSH = AMOUNT TO DENORMALIZE	00032710
000505	03B0059A0			6281	SQ052 BLK SQ0, LINK	00032720
000506	25B0350A0			6283	BCF 6L, SQ053	00032730
000507	63BE00040			6285	CORDOFLO LI FLR, 4	00032740
000508	D237018CC			6287	IR LOC, LOCX, SP=PINS, ST=RIE	00032750
000509	C23032400			6289	CHD ST=JHC, DC=IFCH, MC=HRII	00032760
				6291 *		00032770
				6292 *	MULTIPLY X BY 1/K(HYPERBOLIC, PRECISION)	00032780
				6293 *	(NOTE (1/K)>1.0, SO MSB OF MULTIPLIER IS POS AND SIGNIFICANT.)	00032790
00050A	63B780220			6294	SQ053 LI CORDCTL, ROMHYPK	00032800
00050B	823801100			6296	LI X, X, F	00032810
00050C	25B0150E0			6298	BCF L, SQ054	00032820
00050D	94B800103			6300	SR X, X, SP=DP	00032830
				6302	SQ054 LR Q, CORDROM, 1/K(L)	00032840
00050E	83B0080F3				SP=SPEX, DEST=INHIB	00032850
00050F	C380018F0			6304	LR Q, CORDROM, ST=RIE	00032860
000510	94CA00F43			6306	PRZ THETA, C, SP=DP	00032870
000511	C5B2C0023			6308	DR CTR, X0020, SP=SPEX, RPT=1	00032880
000512	F5CA20F03			6310	MUL THETA, X, C, SP=DP	00032890
000513	80BA01103			6312	AR THETA, X, F, SP=DP	00032900
				6314 *		00032910
				6315 *		00032920
000514	25B015160			6316	BCF L, ASHTST	00032930
000515	863A000A3			6318	DR THETA, X0000, SP=DP	00032940
000516	83BE00070			6320	ASHTST LR FLR, IR, MOD=EXT1	00032950
000517	25B045210			6322	BCF V, SQ05EXIT	00032960
				6324 *		00032970

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6325 #		00032980
				6326 #	INSTN IS ASH/ASNR, ANSWER = ARCTAN(Y/X)	00032990
000518	C23801D43			6327	LR X,THETA,SP=DP,ST=SIE X(M,L); ### RE-ENABLE ABORT ###	00033000
000519	823900023			6329	LR Y,TEMPYD,SP=DP Y(M,L)	00033010
00051A	94BA00143			6331	SR THETA,THETA,SP=DP THETA(M,L) := 0	00033020
00051B	824800103			6333	PRL X,X,SP=DP SCALE X AND Y	00033030
00051C	826908820			6335	PLL Y,Y,C,DEST=INHIB TO CONVERGE	00033040
00051D	824940123			6337	PRA Y,Y,SP=DP (X,Y) := (X,Y)/2	00033050
00051E	818380023			6339	ASHDOIT LR CTR,CPR,SP=SPEX CTR := 8 ITERATIONS	00033060
00051F	638780000			6341	LI CORDCTL,ROMCIR INIT EXTERNAL ITERATION COUNT	00033070
000520	038005730			6343	BLK CORDZY,LINK THETA := ARCTAN(Y/X)	00033080
				6345 #		00033090
				6346 #	THETA = ANSWER, NO OVERFLOW	00033100
000521	D237018CC			6347	SQDSEXIT IR LOC,LOCX,SP=PIHS,ST=RIE ### DISABLE ABORT ###	00033110
				6349	LR YDP1,THETA,SP=SPEX, (R1)	00033120
000522	C1BA01563				ST=CLR V FLAG := 0	00033130
				6351	LR YD,THETA, (R1+1)	00033140
000523	C1BAB2540				ST=JHC,DC=IFCH,MC=MR11	00033150

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6354 *		00033170
				6355 ***	'CORDZT' -- GENERAL CORDIC SUBROUTINE: CIRCULAR, ZERO THETA	00033180
				6356 *		00033190
				6357 *	X(M,L), Y(M,L), THETA(M,L) SET.	00033200
				6358 *	THETA IN QUADRANT 0 OR 2.	00033210
				6359 *	CTR = 8 ITERATIONS TO DRIVE LOOP	00033220
				6360 *	CORDCTL = 'ROMCIR'	00033230
				6361 *		00033240
				6362 *		00033250
				6363 *	INITIALIZE OUTBOARD REGISTERS	00033260
000524	81B8081B3			6364 CORDZT	ERR X,CORDL,AIC=B, X(L) -- CORDIC CLOCKS WHEN	00033270
000525	81B800190				SP=SPEX,DEST=INHIB 'CORDL' OR 'CORDH' IS SOURCE	00033280
				6366	ERR X,CORDH,AIC=B X(M)	00033290
				6368	ERR Y,CORDL,AIC=B, Y(L)	00033300
000526	81B9081B3				SP=SPEX,DEST=INHIB	00033310
000527	81B900198			6370	ERR Y,CORDH,AIC=B,SP=SHFT Y(M); CLEAR CORDIC SHIFT	00033320
000528	823A01140			6372	LR THETA,THETA,F	00033330
				6374 *		00033340
				6375 *		00033350
				6376 *	CORDIC LOOP, ODD ITERATIONS(1ST,3RD,...): Y FIRST, THEN X	00033360
				6377 *		00033370
000529	15B015310			6378 CORDZT1	BCT L,CORDZT1L DIF THETA<0	00033380
				6380 *		00033390
				6381 *	THETA>0: ROTATE THETA CW; X,Y CCW (Y FIRST, THEN X)	00033400
				6382	CORD Y,THETA,X,1,2,2,CORDL, Y+, THETA-, X-, FLR:=SIGN(THETA)=	00033410
					CORDH,CORDROM,F2=F	00033420
00052A	82B9083B3			6383+*,AR	Y,CORDL,C,SP=SPEX,DEST=INHIB	
00052B	A2B900198			6385+*,ARC	Y,CORDH,,SP=SHFT Y; INIT SHIFT	
00052C	96BA096F3			6387+*,SR	THETA,CORDROM,CF,SP=SPEX,DEST=INHIB	
00052D	B6BA020F0			6389+*,SRB	THETA,CORDROM,F THETA	
				6391+*,SR	X,CORDL,C, BUMP ITERATION	
00052E	96B8087B7			6392+*,	SP=SPEX+INCR,DEST=INHIB	
00052F	B6B800198			6394+*,SRB	X,CORDH,,SP=SHFT X; INIT SHIFT	
000530	15B005380			6396	BCT CTR,CORDZT2 "LOOP" TO EVEN ITERATION	00033430
				6398 *	IR RAR,LIHK IMPOSSIBLE	00033440
				6399 *		00033450
				6400 *	THETA < 0: ROTATE THETA CCW; X,Y CW (Y FIRST, THEN X)	00033460
				6401 CORDZT1L	CORD Y,THETA,X,2,1,1,CORDL, Y-, THETA+, X+, FLR:=SIGN(THETA)=	00033470
					CORDH,CORDROM,F2=F	00033480
		02988		6402+CORDZT1L	EQU *	
000531	96B9087B3			6403+*,SR	Y,CORDL,C,SP=SPEX,DEST=INHIB	
000532	B6B900198			6405+*,SRB	Y,CORDH,,SP=SHFT Y; INIT SHIFT	
000533	82BA092F3			6407+*,AR	THETA,CORDROM,CF,SP=SPEX,DEST=INHIB	
000534	A2BA020F0			6409+*,ARC	THETA,CORDROM,F THETA	
				6411+*,AR	X,CORDL,C, BUMP ITERATION	

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000535	82B8003B7			6412+H,	SP=SPEX+INCR,DEST=INHIB	
000536	A2B800198			6414+H,ARC	X,CORDH,,SP=SHIFT X; INIT SHIFT	
000537	15B005380			6416	BCT CTR,CORDZT2 "LOOP" TO EVEN ITERATION	00033490
				6418 H	IR RAR,LINK IMPOSSIBLE	00033500
				6419 H		00033510
				6420 H		00033520
				6421 H	CORDIC LOOP, EVEN ITERATIONS(2ND,4TH,...): X FIRST, THEN Y	00033530
				6422 H		00033540
000538	15B015410			6423 CORDZT2 BCT	L,CORDZT2L BIF THETA < 0	00033550
				6425 H		00033560
				6426 H	THETA>=0: ROTATE THETA CW; X,Y CCW (X FIRST, THEN Y)	00033570
				6427	CORD X,THETA,Y,2,2,1,CORDL, X-, THETA-, Y-, FLR:=SIGN(THETA) CORDH,CORDROM,F2=F	00033580
						00033590
000539	96B8007B3			6428+H,SR	X,CORDL,C,SP=SPEX,DEST=INHIB	
00053A	B6B800198			6430+H,SRB	X,CORDH,,SP=SHIFT X; INIT SHIFT	
00053B	96BA096F3			6432+H,SR	THETA,CORDROM,CF,SP=SPEX,DEST=INHIB	
00053C	B6BA020F0			6434+H,SRB	THETA,CORDROM,F THETA	
				6436+H,AR	Y,CORDL,C, BUMP ITERATION	
00053D	82B9003B7			6437+H,	SP=SPEX+INCR,DEST=INHIB	
00053E	A2B900198			6439+H,ARC	Y,CORDH,,SP=SHIFT Y; INIT SHIFT	
00053F	15B005290			6441	BCT CTR,CORDZT1 "LOOP" TO ODD ITERATION	00033600
000540	91B0801E0			6443	IR RAR,LINK END OF LOOP: RETURN	00033610
				6445 H		00033620
				6446 H	THETA < 0: ROTATE THETA CCW; X,Y CW (X FIRST, THEN Y)	00033630
				6447 CORDZT2L CORD	X,THETA,Y,1,1,2,CORDL, X+, THETA+, Y-, FLR:=SIGN(THETA) CORDH,CORDROM,F2=F	00033640
						00033650
		02A08		6448+CORDZT2L EQU	"	
000541	82B8003B3			6449+H,AR	X,CORDL,C,SP=SPEX,DEST=INHIB	
000542	A2B800198			6451+H,ARC	X,CORDH,,SP=SHIFT X; INIT SHIFT	
000543	82BA092F3			6453+H,AR	THETA,CORDROM,CF,SP=SPEX,DEST=INHIB	
000544	A2BA020F0			6455+H,ARC	THETA,CORDROM,F THETA	
				6457+H,SR	Y,CORDL,C, BUMP ITERATION	
000545	96B9007B7			6458+H,	SP=SPEX+INCR,DEST=INHIB	
000546	B6B900198			6460+H,SRB	Y,CORDH,,SP=SHIFT Y; INIT SHIFT	
000547	15B005290			6462	BCT CTR,CORDZT1 "LOOP" TO ODD ITERATION	00033660
000548	91B0801E0			6464	IR RAR,LINK END OF LOOP: RETURN	00033670

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6467		00033690
				6468		00033700
				6469	*** 'CORDNORM' -- NORMALIZE X & Y SO THAT X*ABS(Y) >= 40000000	00033710
				6470		00033720
				6471	CALL	00033730
				6472	0 <= X <= 80000000, Y MAY BE NEGATIVE	00033740
				6473	LINK = RETURN ADDR - 1	00033750
				6474	RETURN	00033760
				6475	X'=X*(2**NSH), Y'=Y*(2**NSH)	00033770
				6476	Q = ABS(Y')	00033780
				6477	NSH = NUMBER OF SHIFTS	00033790
				6478	L=0	00033800
				6479	IF C=0, X=Y=0	00033810
				6480	IF C=1, X=Y=80000000	00033820
				6481	L=1 OTHERWISE	00033830
				6482		00033840
				6483		00033850
				6484	SET V=SIGN(Y), Q=ABS(Y)	00033860
000549	8009060A3			6485	CORDNORM AQRR Y,X8000,V,SP=DP V := 1 IF Y<0	00033870
00054A	820000123			6487	LR Q,Y,SP=DP	00033880
00054B	25B0454D0			6489	BCF V,CZY1	00033890
00054C	9A0000123			6491	LRTC Q,Y,SP=DP Q := ABS(Y)	00033900
				6493		00033910
				6494	SHIFT X & Q LEFT UNTIL (X*Q) >= 40000000; NSH := 8 OF SHIFTS REQ'D	00033920
				6495	(DO THIS BY SHIFTING ONE TOO FAR, AND THEN BACKING UP ONE)	00033930
00054D	63BC00000			6496	CZY1 LI NSH,0 INIT NSH = 0	00033940
00054E	803B01303			6498	ARQR M,X,CF,SP=DP M := X*ABS(Y)	00033950
00054F	25B035720			6500	BCF GL,CORDNORMX BIF X*ABS(Y)=0 (L=0,C LOADED)	00033960
				6502		00033970
				6503	X*ABS(Y) NONZERO	00033980
				6504	IF X*ABS(Y) <= 7FFFFFFF, GO SEE IF NORMALIZATION REQ'D	00033990
				6505	ELSE NORMALIZATION NOT NECESSARY	00034000
000550	15B0156F0			6506	BCT L,CZYNORMD BIF >= 7FFFFFFF, NO NORM REQ'D	00034010
				6508		00034020
				6509	NORMALIZE -- THAT IS, SHIFT X,Y,M LEFT (INCREMENTING NSH ONCE PER	00034030
				6510	SHIFT) UNTIL M >= 40000000.	00034040
				6511	DO THIS BY SHIFTING UNTIL M >= 80000000 AND THEN BACKING OFF BY ONE.	00034050
				6512	(NOTE: AT THIS POINT M <= 7FFFFFFF.)	00034060
000551	826800103			6513	CZYNORM PLL X,X,SP=DP SHIFT X,Y	00034070
000552	80BB00163			6515	AR M,M,SP=DP SHIFT M	00034080
000553	823B01160			6517	LR M,M,F	00034090
000554	15B0355C0			6519	BCT GL,CZYNORM1 BIF M(M) NONZERO	00034100
				6521		00034110
				6522	M(M)=0, SHIFT BY 16	00034120
000555	62BC00100			6523	AI NSH,16 ADD 16 TO COUNT	00034130

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000556	83A000101			6525	RRR X,X,AIC=D,AOC=A,SP=LTON X(M) := X(L)	00034140
				6527	RRR X,X,AIC=D,AOC=A,SP=LTON (TWO CYCLE EXECUTION)	00034150
000557	63B000003			6520	LI X,0,SP=SPEX,DEST=INHIB X(L) := 0	00034160
000558	813000043			6530	LR MDR,Q,SP=SPEX	00034170
000559	830000050			6532	LR Q,MDR Q(M) := Q(L)	00034180
00055A	638000003			6534	LI Q,0,SP=SPEX,DEST=INHIB Q(L) := 0	00034190
00055B	803800103			6536	ARQR M,X,SP=DP RECALCULATE M (IT'S FASTER)	00034200
				6538		00034210
				6539	NOW SEE IF 8 SHIFTS POSSIBLE	00034220
00055C	6E3B19FF0			6540	CZYNORM1 NI M,X'FF',F,MOD=SWAP, CHECK M(00..07)	00034230
00055D	15B035630			6542	BCT GL,CZYNORM2	00034240
				6544		00034250
				6545	M(00..07)=0, SHIFT BY 0	00034260
00055E	62BC00000			6546	AI NSH,0	00034270
00055F	63B180000			6548	LI CTR,0	00034280
000560	C23040000			6550	CHD RPT=1	00034290
000561	826800103			6552	PLL X,X,SP=DP	00034300
000562	803800103			6554	ARQR M,X,SP=DP RECALCULATE M	00034310
				6556		00034320
				6557	NOW SEE IF 4 SHIFTS POSSIBLE	00034330
000563	6E3B19F00			6558	CZYNORM2 NI M,X'F0',F,MOD=SWAP, CHECK M(00..03)	00034340
000564	15B035690			6560	BCT GL,CZYNORM3	00034350
				6562		00034360
				6563	M(00..03)=0, SHIFT BY 4	00034370
000565	62BC00040			6564	AI NSH,4	00034380
000566	C1B3C0020			6566	LR CTR,X0004,RPT=1	00034390
000567	826800103			6568	PLL X,X,SP=DP SHIFT 4 TIMES	00034400
000568	803801103			6570	ARQR M,X,F,SP=DP RECALCULATE M	00034410
				6572		00034420
				6573	0,1,2, OR 3 SHIFTS REMAIN; FLR=SIGN(M)	00034430
000569	15B0156E0			6574	CZYNORM3 BCT L,CZYNORM4	00034440
00056A	826800103			6576	CZYNORM4 PLL X,X,SP=DP	00034450
00056B	80BB01163			6578	AR M,M,F,SP=DP	00034460
				6580	BCFC L,CZYNORM4,NSH	00034470
00056C	923C00180			6581	IR NSH,NSH	00034480
00056D	25B0156A0			6583	BCF L,CZYNORM4	00034490
				6585		00034500
				6586	WE HAVE NOW SUCCEEDED IN OVER-NORMALIZING X & Q -- IE, M(00)=1	00034510
				6587	SO SHIFT BACK ONE BIT	00034520
00056E	824800103			6588	CZYNORM4 PRL X,X,SP=DP	00034530
				6590		00034540
				6591	NORMALIZATION DONE, RESTORE DESIRED SIGN OF Y (V=1 IF Y<0)	00034550
00056F	813900123			6592	CZYNORMD LR Y,Q,SP=DP Y := NORMALIZED Y	00034560

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000570	25B045720			6594	BCF V,CORDNORX	00034570
000571	993900123			6596	LRTC Y,Q,SP=DP	00034580
				6598	Y := NORIALIZED Y	00034590
				6599	EXIT: L=0 IF X=Y=0 OR X=Y=80000000	00034600
000572	91B0801E0			6600	CORDNORX IR RAR, LINK	00034610
				6602		00034620
				6603		00034630
				6604	*** 'CORDZY' -- GENERAL CORDIC SUBROUTINE: CIRCULAR, ZERO Y	00034640
				6605		00034650
				6606	X(M,L), Y(M,L), THETA (M,L) SET	00034660
				6607	X>=0	00034670
				6608	CTR = 8 ITERATIONS TO DRIVE LOOP	00034680
				6609	CORDCTL = 'ROMCIR'	00034690
				6610	RETURN: X=K(CIRCULAR)*SQRT(X**2 + Y**2); THETA=ATAN(Y/X)	00034700
				6611	X MUST BE RETRIEVED FROM CORDL, CORDM; X IS UNSIGNED <=FFFFFFF	00034710
				6612		00034720
				6613	INITIALIZE OUTBOARD REGISTERS	00034730
000573	81B9001B3			6614	CORDZY BRR Y, CORDL, AIC=B, Y(L) -- CORDIC CLOCKS WHEN	00034740
000574	81B901190				SP=SPEX, DEST=INHIB 'CORDL' OR 'CORDM' IS SOURCE	00034750
				6616	BRR Y, CORDM, AIC=B, F=SP Y(M); FLR := SIGN(Y)	00034760
				6618	BRR X, CORDL, AIC=B, X(L)	00034770
000575	81B8001B3				SP=SPEX, DEST=INHIB	00034780
000576	81B800198			6620	BRR X, CORDM, AIC=B, SP=SHFT X(M); CLEAR CORDIC SHIFT	00034790
				6622		00034800
				6623		00034810
				6624	CORDIC LOOP, ODD ITERATIONS(1ST, 3RD, ...): X FIRST, THEN Y	00034820
				6625		00034830
000577	15B0157F0			6626	CORDZY1 BCT L, CORDZY1 BIF Y<0	00034840
				6628		00034850
				6629	Y>=0: ROTATE Y,X CW (X FIRST, THEN Y); ROTATE THETA CCM	00034860
				6630	CORD X, THETA, Y, 1, 1, 2, CORDL, X+, THETA+, Y-, FLR:=SIGN(Y)	00034870
					CORDM, CORDROM, F3=F,	00034880
					SP1=SHFL, SP3=SHFL	00034890
000578	82B8003B3			6631	*, AR X, CORDL, C, SP=SPEX, DEST=INHIB	
000579	A2B80019C			6633	*, ARC X, CORDM, SP=SHFL X; INIT SHIFT	
00057A	82BA002F3			6635	*, AR THETA, CORDROM, C, SP=SPEX, DEST=INHIB	
00057B	A2BA000F0			6637	*, ARC THETA, CORDROM, THETA	
				6639	*, SR Y, CORDL, CF, BUMP ITERATION	
00057C	96B9097B7			6640	*, SP=SPEX+INCR, DEST=INHIB	
00057D	B6B90219C			6642	*, SRB Y, CORDM, F, SP=SHFL Y; INIT SHIFT	
00057E	15B005860			6644	BCT CTR, CORDZY2 "LOOP" TO EVEN ITERATION	00034900
				6646	IR RAR, LINK IMPOSSIBLE	00034910
				6647		00034920
				6648	Y<0: ROTATE Y,X CCM (X FIRST, THEN Y); ROTATE THETA CW	00034930
				6649	CORDZY1L CORD X, THETA, Y, 2, 2, 1, CORDL, X-, THETA-, Y+, FLR:=SIGN(Y)	00034940

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MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603, 1641604, 1641653 "657,0416,J33"

HUGHES PROPRIETARY

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
					CORDM,CORDROM,F3=F, SP1=SHFL,SP3=SHFL	#00034950 00034960
		02BF8		6650	CORDZY1L EQU	
00057F	96B8087B3			6651	+n,SR X,CORDL,C,SP=SPEX,DEST=INHIB	
000580	B6B80019C			6653	+n,SRB X,CORDM,SP=SHFL X; INIT SHIFT	
000581	96BA086F3			6655	+n,SR THETA,CORDROM,C,SP=SPEX,DEST=INHIB	
000582	B6BA000F0			6657	+n,SRB THETA,CORDROM, THETA	
				6659	+n,AR Y,CORDL,CF, BUMP ITERATION	
000583	82B909387			6660	+n, SP=SPEX+INCR,DEST=INHIB	
000584	A2B90219C			6662	+n,ARC Y,CORDM,F,SP=SHFL Y; INIT SHIFT	
000585	15B005860			6664	BCT CTR,CORDZY2 "LOOP" TO EVEN ITERATION	00034970
				6666	n IR RAR,LINK IMPOSSIBLE	00034980
				6667	n	00034990
				6668	n	00035000
				6669	n CORDIC LOOP, EVEN ITERATIONS(2ND,4TH,...): Y FIRST, THEN X	00035010
				6670	n	00035020
000586	15B0158F8			6671	CORDZY2 BCT L,CORDZY2L BIF Y<0	00035030
				6673	n	00035040
				6674	n Y>=0: ROTATE Y,X CCM (Y FIRST, THEN X); ROTATE THETA CCM	00035050
				6675	CORD Y,THETA,X,2,1,1,CORDL, Y-,THETA+,X-,FLR:=SIGN(Y)	#00035060
					CORDM,CORDROM,F1=F, SP3=SHFT,SP1=SHFT	#00035070 00035080
000587	96B9097B3			6676	+n,SR Y,CORDL,CF,SP=SPEX,DEST=INHIB	
000588	B6B902198			6678	+n,SRB Y,CORDM,F,SP=SHFT Y; INIT SHIFT	
000589	82BA082F3			6680	+n,AR THETA,CORDROM,C,SP=SPEX,DEST=INHIB	
00058A	A2BA000F0			6682	+n,ARC THETA,CORDROM, THETA	
				6684	+n,AR X,CORDL,C, BUMP ITERATION	
00058B	82B808387			6685	+n, SP=SPEX+INCR,DEST=INHIB	
00058C	A2B800198			6687	+n,ARC X,CORDM,SP=SHFT X; INIT SHIFT	
00058D	15B005770			6689	BCT CTR,CORDZY1 "LOOP" TO ODD ITERATION	00035090
00058E	25B005960			6691	n B CZYTERN	00035100
				6693	n	00035110
				6694	n Y<0: ROTATE Y,X CCM (Y FIRST, THEN X); ROTATE THETA CCM	00035120
				6695	CORDZY2L CORD Y,THETA,X,1,2,2,CORDL, Y+,THETA-,X-,FLR:=SIGN(Y)	#00035130
					CORDM,CORDROM,F1=F, SP3=SHFT,SP1=SHFT	#00035140 00035150
		02C78		6696	CORDZY2L EQU	
00058F	82B909383			6697	+n,AR Y,CORDL,CF,SP=SPEX,DEST=INHIB	
000590	A2B902198			6699	+n,ARC Y,CORDM,F,SP=SHFT Y; INIT SHIFT	
000591	96BA086F3			6701	+n,SR THETA,CORDROM,C,SP=SPEX,DEST=INHIB	
000592	B6BA000F0			6703	+n,SRB THETA,CORDROM, THETA	
				6705	+n,SR X,CORDL,C, BUMP ITERATION	
000593	96B8087B7			6706	+n, SP=SPEX+INCR,DEST=INHIB	
000594	B6B800198			6708	+n,SRB X,CORDM,SP=SHFT X; INIT SHIFT	
000595	15B005770			6710	BCT CTR,CORDZY1 "LOOP" TO ODD ITERATION	00035160

FOR TRAINING
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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				6712	"	00035170
				6713	" 'Y' IS SHIFTING IN CORDIC SHIFT REG -- IGNORE IT & GET X INTO	00035180
				6714	" THE SHIFT REGISTER FOR DE-NORMALIZATION OF RESULT.	00035190
				6715	" 'NSH' = SHIFT AMOUNT.	00035200
000596	81BC000E0			6716	CZYERM LR CORDCYL,NSH SHIFT AMOUNT	00035210
000597	8380001B0			6718	LR Q,CORDL ADVANCE X TO SHIFT REG	00035220
000598	83800019C			6720	LR Q,CORDM,SP=SHFL ADVANCE X AGAIN, START SHIFT	00035230
000599	D180815E0			6722	CZYEXIT IR RAR,LINK,ST=CLR NORMAL RETURN, V := 0	00035240
				6725	"	00035260
				6726	### 'SQD' -- GENERAL SQUARE-ROOT-OF-DIFFERENCE-OF-SQUARES	00035270
				6727	"	00035280
				6728	" THE FOLLOWING CONDITIONS ARE GUARANTEED:	00035290
				6729	" 0<= X <=800000000	00035300
				6730	" 0<= Y <=800000000	00035310
				6731	" (X+Y) >=400000000	00035320
				6732	" SCRATCH: THETA(ML), M(ML), Q(ML), CTR, CORDIC CARD	00035330
				6733	" NSH = NUMBER OF SHIFTS TO DENORMALIZE RESULT	00035340
				6734	" RETURN:	00035350
				6735	" NORMAL: X(ML) = K(HYPERBOLIC)*SQRT(X**2 - Y**2); GL=ZERO	00035360
				6736	" ERROR : GL=NONZERO (ERROR IF Y>X)	00035370
				6737	"	00035380
				6738	" NOTE: COMMENTS REFERRING TO THE MAGNITUDE OF X AND Y ASSUME THE	00035390
				6739	" REPRESENTATION S.DDDD -- S=SIGN BIT, DDDD=31 FRACTION BITS. THIS IS	00035400
				6740	" FOR COMMENTS ONLY, SINCE ABSOLUTE SCALE OF X AND Y IS IMMATERIAL.	00035410
00059A	8085000A3			6741	SQD AQRR X8000,X8000,SP=DP Q := 0	00035420
00059B	823B00323			6743	LR M,Y,C,SP=DP M := DIVIDEND, C := 0	00035430
00059C	E4EB20703			6745	DIV M,X,C,SP=DP	00035440
00059D	15B085A00			6747	BCT C,SQD1 BIF Y/X=0.XXXX (C=-QUOT BIT)	00035450
				6749	"	00035460
				6750	" Y/X=1.XXXX (IE Y>X): IF Y=X, ANSWER=0; OTHERWISE, ERROR.	00035470
				6751	" IF Y=X, X := ANSWER = 0, FLR:=ZERO	00035480
				6752	" IF Y>X, FLR:=NONZERO	00035490
00059E	94B801123			6753	SR X,Y,F,SP=DP X := X-Y; SET FLR	00035500
00059F	91B0801E0			6755	IR RAR,LINK RETURN	00035510
				6757	"	00035520
				6758	" Y/X=0.XXXX, CONTINUE DIVISION	00035530
0005A0	E4EB20703			6759	SQD1 DIV M,X,C,SP=DP	00035540
0005A1	15B085A40			6761	BCT C,SQDNADJ BIF Y/X=0.0XXX (C=-QUOT BIT)	00035550
0005A2	E4EB20703			6763	DIV M,X,C,SP=DP	00035560
0005A3	25B085A60			6765	BCF C,SQDADJ BIF Y/X=0.11XX (C=-QUOT BIT)	00035570
				6767	"	00035580
				6768	" NO ARGUMENT ADJUSTMENT NECESSARY	00035590
0005A4	820000180			6769	SQDNADJ LR Q,NSH SET Q = DENORMALIZATION COUNT	00035600
0005A5	25B005BE0			6771	B SQDCORD	00035610
				6773	"	00035620

FOR TRAINING
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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				6774	" Y/X = 0.11XX, IE Y/X >= 0.75 -- WE MUST ADJUST ARGUMENTS TO	00035630
				6775	" GET CONVERGENCE.	00035640
				6776	" (NOTE: (X-Y) <= .25)	00035650
				6777	"	00035660
				6778	" FIRST FIND M,E SUCH THAT:	00035670
				6779	" (X-Y) = M * 2**(-2ME); .25 <= M <= 1.00, E >= 1	00035680
				6780	" IF (X-Y) = .25 (IE X=1.0,Y=.75) THEN M=1.00, E=1	00035690
				6781	" ELSE (X-Y) < .25 AND .25 <= M < 1.00 (NOT=1.00), E >= 1	00035700
				6782	" SQD(X,Y) = SQRT(X**2 - Y**2) IS CALCULATED AS FOLLOWS:	00035710
				6783	" SQD(X,Y) = SQD(X+Y*M, X+Y-M)*2**(-E+1)	00035720
				6784	" IN THE CODE WHICH FOLLOWS THE RADIX IS MENTALLY MOVED RIGHT	00035730
				6785	" ONE POINT; THEREFORE AFTER CORDIC ONLY "E" SHIFTS ARE REQUIRED	00035740
0005A6	920000100			6786	SQDADJ IR Q,NSH Q := NSH+E; E := 1	00035750
0005A7	823B00103			6788	LR M,X,SP=DP	00035760
				6790	RRR M,Y,AIC=BMAN1,CIN=1, M := (X-Y)*4 (PHYSICALLY MOVE	00035770
0005A8	94FB00123				AOC=PLS,SP=DP DATA LEFT 1 BIT; MENTALLY MOVE	00035780
				6792	" RADIX POINT RIGHT 1 BIT)	00035790
				6793	" Q(00)=0	00035800
0005A9	823B01160			6794	LR M,M,F	00035810
0005AA	15B035B40			6796	BCT GL,SQDNORM1 BIF M(M) NONZERO	00035820
				6798	"	00035830
0005AB	83AB00161			6799	" M(M)=0: HAVE AT LEAST 14 MORE LEADING 0'S TO SHIFT	00035840
				6800	RRR M,M,AIC=D,AOC=A,SP=LTON M(M):=M(L)	00035850
0005AC	94BB00163			6802	RRR M,M,AIC=D,AOC=A,SP=LTON (TWO CYCLE EXECUTION)	00035860
0005AD	630000000			6803	SR M,M,SP=SPEX,DEST=INHIB M(L):=0	00035870
				6805	AI Q,7+1 E := E+8 (IF NEW M(00,01)=0'S)	00035880
0005AE	6E3B19C00			6807	MI M,X'CO',F,MOD=SWAP, DEST=INHIB	00035890
0005AF	25B035B40			6809	BCF GL,SQDNORM1 BIF M(00,01)=0'S	00035900
				6811	"	00035910
				6812	" M(00,01) NONZERO: SHIFT RIGHT & QUIT NORMALIZING	00035920
0005B0	825B00163			6813	RRR M,M,AIC=A,AOC=PRS,SP=DP	00035930
0005B1	825B00163			6815	RRR M,M,AIC=A,AOC=PRS,SP=DP	00035940
0005B2	850000000			6817	DR Q,Q	00035950
0005B3	25B005BA0			6819	B SQDNORM3 E SHOULD HAVE BEEN BUMPED BY 7	00035960
				6821	"	00035970
				6822	" NORMALIZE M (POSSIBLY ALREADY NORMALIZED OR =1.00)	00035980
				6823	" IE 01.00 OR 00.XX	00035990
0005B4	6E3B19700			6824	SQDNORM1 MI M,X'70',F,MOD=SWAP,DEST=INHIB	00036000
0005B5	15B035BA0			6826	BCT GL,SQDNORM3 BIF ALREADY NORMALIZED OR =1.00	00036010
				6828	"	00036020
				6829	" UNNORMALIZED (LOOP 0..6 TIMES)	00036030
0005B6	80FB00163			6830	SQDNORM2 RRR M,M,AIC=APB,AOC=PLS, M := M*4 (Q(00)=0)	00036040
0005B7	6E3B19300				SP=DP	00036050
				6832	MI M,X'30',F,MOD=SWAP,DEST=INHIB	00036060
						00036070

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0005B8	910000000			6834	BCFC GL,SQDNORM2,Q	00036080
0005B9	25B035B60			6835	IR Q,Q	
				6837	BCF GL,SQDNORM2	
				6839		00036090
				6840	NORMALIZED (E=2 = 8 POSITIONS SHIFTED) -- Q=E	00036100
0005BA	80D800123			6841	SQDNORM3 IRR X,Y,AIC=APB,SP=DP, X:=(X+Y); MOVE RADIX POINT	00036110
					AOC=PRS,MOD=LOG	00036120
				6843		00036130
				6844	NOTE: NORMALIZATION WOULD BE NEEDED HERE TO GUARANTEE	00036140
				6845	(X+Y) >= 08000000; HOWEVER, PRIOR CALL TO CORDNORM HAS	00036150
				6846	ASSURED THAT (X+Y) >= 40000000	00036160
				6847		00036170
				6848	SETUP NEW X AND Y ARGUMENTS FOR CORDIC	00036180
0005BB	823900103			6849	LR Y,X,SP=DP	00036190
0005BC	80B800163			6851	AR X,M,SP=DP	00036200
0005BD	94B900163			6853	SR Y,M,SP=DP	00036210
				6855		00036220
				6856		00036230
				6857	DO (N+1) ITERATIONS OF HYPERBOLIC CORDIC, DRIVING Y TO ZERO.	00036240
				6858	ON (N+1)TH ITERATION WE DONT DO THETA OR Y.	00036250
				6859	(NOTE THAT 'THETA' REGISTER IS DONT-CARE.)	00036260
				6860	V=1 IF ARGUMENTS UNADJUSTED; V=0 IF ARGUMENTS HAD TO BE ADJUSTED.	00036270
0005BE	91B380023			6861	SQDCORD IRR CTR,CPR,SP=SPEX CTR := N+1	00036280
0005BF	63B780810			6863	LI CORDCTL,ROMHYP INIT EXTERNAL ITERATION COUNTER	00036290
				6865		00036300
				6866	INITIALIZE OUTBOARD REGISTERS	00036310
				6867	IRR X,CORDL,AIC=B, X(L) -- CORDIC CLOCKS WHEN	00036320
0005C0	81B8001B3				SP=SPEX,DEST=INHIB 'CORDL' OR 'CORDH' IS SOURCE	00036330
0005C1	81B800190			6869	IRR X,CORDH,AIC=B, X(M)	00036340
				6871	IRR Y,CORDL,AIC=B, Y(L)	00036350
0005C2	81B9001B3				SP=SPEX,DEST=INHIB	00036360
0005C3	81B90119C			6873	IRR Y,CORDH,AIC=B,SP=SHFL, Y(M); INITIAL CORDIC SHIFT	00036370
					F=SP FLR := SIGN(Y)	00036380
				6875		00036390
				6876		00036400
				6877	CORDIC LOOP, ODD ITERATIONS(1ST,3RD,...): Y FIRST, THEN X	00036410
				6878		00036420
0005C4	15B015C00			6879	CORDHY1 BCT L,CORDHY1L BIF Y<1	00036430
				6881		00036440
				6882	Y>=0: ROTATE Y DOWN (Y FIRST, THEN X); ROTATE THETA UP	00036450
				6883	CORD Y,THETA,X,2,1,2,CORDL, Y-,THETA+,X-,FLR:=SIGN(Y)	00036460
					CORDH,CORDROM,F1=F,	00036470
					SP3=SHFT,SP1=SHFT	00036480
0005C5	96B9097B3			6884	IR Y,CORDL,CF,SP=SPEX,DEST=INHIB	
0005C6	86B902198			6886	IR Y,CORDH,F,SP=SHFT Y; INIT SHIFT	

LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT

17 MAY 79

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0005C7 02BA082F3 6880+M,AR THETA,CORDROM,C,SP=SPEX,DEST=INHIB
0005C8 A2BA000F0 6890+M,ARC THETA,CORDROM, THETA
6892+M,SR X,CORDL,C, BUMP ITERATION
0005C9 96B8007B7 6893+M, SP=SPEX+INCR,DEST=INHIB
0005CA B6B800198 6895+M,SRB X,CORDH,,SP=SHFT X; INIT SHIFT
0005CB 15B005050 6897 BCT CTR,CORDHY2 "LOOP" TO EVEN ITERATION
0005CC 25B005E40 6899 B SQDECORD END OF LOOP 00036490
6901 # 00036500
6902 # Y < 0: ROTATE Y UP (Y FIRST, THEN X); ROTATE THETA DOWN 00036510
6903 CORDHY1L CORD Y,THETA,X,1,2,1,CORDL, Y+,THETA-,X+,FLR:=SIGN(Y) 00036520
CORDH,CORDROM,F1=F, 00036530
SP3=SHFT,SP1=SHFT 00036540
00036550
02E60 6904+CORDHY1L EQU #
0005CD 02B9093B3 6905+M,AR Y,CORDL,CF,SP=SPEX,DEST=INHIB
0005CE A2B902198 6907+M,ARC Y,CORDH,F,SP=SHFT Y; INIT SHIFT
0005CF 96BA086F3 6909+M,SR THETA,CORDROM,C,SP=SPEX,DEST=INHIB
0005D0 B6BA000F0 6911+M,SRB THETA,CORDROM, THETA
6913+M,AR X,CORDL,C, BUMP ITERATION
0005D1 02B80083B7 6914+M, SP=SPEX+INCR,DEST=INHIB
0005D2 A2B800198 6916+M,ARC X,CORDH,,SP=SHFT X; INIT SHIFT
0005D3 15B005050 6918 BCT CTR,CORDHY2 "LOOP" TO EVEN ITERATION
0005D4 25B005E40 6920 B SQDECORD END OF LOOP 00036560
6922 # 00036570
6923 # 00036580
6924 # CORDIC LOOP, EVEN ITERATIONS (2ND,4TH,...): X FIRST, THEN Y 00036590
6925 # 00036600
0005D5 15B015DD0 6926 CORDHY2L BCT L,CORDHY2L BIF Y<0 00036610
6928 # 00036620
6929 # Y>=0: ROTATE Y DOWN (X FIRST, THEN Y); ROTATE THETA UP 00036630
6930 CORD X,THETA,Y,2,1,2,CORDL, X-,THETA+,Y-,FLR:=SIGN(Y) 00036640
CORDH,CORDROM,F3=F, 00036650
SP1=SHFL,SP3=SHFL 00036660
00036670
0005D6 96B8007B3 6931+M,SR X,CORDL,C,SP=SPEX,DEST=INHIB
0005D7 B6B80019C 6933+M,SRB X,CORDH,,SP=SHFL X; INIT SHIFT
0005D8 02BA082F3 6935+M,AR THETA,CORDROM,C,SP=SPEX,DEST=INHIB
0005D9 A2BA000F0 6937+M,ARC THETA,CORDROM, THETA
6939+M,SR Y,CORDL,CF, BUMP ITERATION
0005DA 96B9097B7 6940+M, SP=SPEX+INCR,DEST=INHIB
0005DB B6B90219C 6942+M,SRB Y,CORDH,F,SP=SHFL Y; INIT SHIFT
0005DC 15B005C40 6944 BCT CTR,CORDHY1 "LOOP" TO ODD ITERATION 00036680
6946 # B SQDECORD (IMPOSSIBLE) 00036690
6947 # 00036700
6948 # Y < 0: ROTATE Y UP (X FIRST, THEN Y); ROTATE THETA DOWN 00036710
6949 CORDHY2L CORD X,THETA,Y,1,2,1,CORDL, X+,THETA-,Y+,FLR:=SIGN(Y) 00036720
CORDH,CORDROM,F3=F, 00036730

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MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J53"

HUGHES PROPRIETARY

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
					SP1=SHFL,SP3=SHFL	00036740
		02EE8		6950	CORDHY2L EQU	
0005DD	02B8003B3			6951	X,AR X,CORDL,C,SP=SPEX,DEST=INHIB	
0005DE	A2B80019C			6953	X,ARC X,CORDM,,SP=SHFL X; INIT SHIFT	
0005DF	96B8006F3			6955	X,SR THETA,CORDROM,C,SP=SPEX,DEST=INHIB	
0005E0	B6B8000F0			6957	X,SRB THETA,CORDROM, THETA	
				6959	X,AR Y,CORDL,CF, BUMP ITERATION	
0005E1	02B9093B7			6960	X,AR SP=SPEX+INCR,DEST=INHIB	
0005E2	A2B90219C			6962	X,ARC Y,CORDM,F,SP=SHFL Y; INIT SHIFT	
0005E3	15B8005C40			6964	BCT CTR,CORDHY1 "LOOP" TO ODD ITERATION	00036750
				6966	B SQDECORD (IMPOSSIBLE)	00036760
				6967		00036770
				6968	DO LAST ITERATION (X FIRST, THEN FORGET Y AND THETA).	00036780
				6969	(AT THIS POINT Y(I) = 2**(-I) IS NEXT TO COME OUT OF OUTBOARD	00036790
				6970	SHIFTER, AND HAS FINISHED SHIFTING. FLR REFLECTS SIGN OF Y(I).)	00036800
0005E4	15B8015E80			6971	SQDECORD BCT L,SQADD BIF Y<0 TO DO ADD ITEATION	00036810
				6973		00036820
				6974	LAST ITERATION IS SUBTRACT (DO X, FORGET THETA & Y)	00036830
				6975	SR X,CORDL,C, X(L)	00036840
0005E5	96B80087B3				SP=SPEX,DEST=INHIB	00036850
0005E6	B6B8000190			6977	SRB X,CORDM X(M)	00036860
0005E7	25B8005EA0			6979	B SQDTST	00036870
				6981		00036880
				6982	LAST ITERATION IS ADD (DO X, FORGET THETA & Y)	00036890
				6983	SQADD AR X,CORDL,C, X(L)	00036900
0005E8	02B8003B3				SP=SPEX,DEST=INHIB	00036910
0005E9	A2B8000190			6985	ARC X,CORDM X(M)	00036920
				6987		00036930
0005EA	0137801B0			6988	SQDTST BRR CORDCTL,CORDL,ATC=Q ADVANCE X IN CORDIC MECHANISM	00036940
				6990		00036950
0005EB	96B800019C			6991	CR ABORTAD,CORDM,SP=SHFL ADVANCE X IN CORDIC MECHANISM	00036960
				6993		00036970
0005EC	0230000000			6994	NOP WAIT FOR SHIFTS	00036980
0005ED	0230000000			6996	NOP WAIT FOR SHIFTS	00036990
				6998	X,CORDL, X(L)	00037000
0005EE	03B80081B3				DEST=INHIB,SP=SPEX	00037010
0005EF	03B8000190			7000	LR X,CORDM X(M)	00037020
				7002		00037030
				7003	ALL DONE, X=RESULT, GL:=ZERO='NO ERROR'	00037040
0005F0	01B00815E0			7004	IR RAR,LINK,ST=CLR NO ERROR! GL:=ZERO	00037050
				7006	NCORD ANOP	00037060
				7007	ALIGN 512	00037070
0005F1	FFFFFFFFF	02F88		7008	A7101 EQU *-START	
				7010	AIF (X64SH EQ 0).N64SH	00037080

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7012 #		00037100
				7013 ###	64-BIT SHIFT INSTRUCTIONS	00037110
				7014 ###	JRK/DAS -- JULY 9, 1976	00037120
				7015 #		00037130
				7016 #		00037140
				7017	GNOTE &ZEALU,1,'EXTENDED ALU REQUIRED'	00037150
				7018 #		00037160
				7019 #		00037170
				7020 #	SRQL -- SHIFT RIGHT QUADRUPLE LOGICAL (RI)	00037180
				7021 #	SLQL -- SHIFT LEFT QUADRUPLE LOGICAL (RI)	00037190
				7022 #	SRQA -- SHIFT RIGHT QUADRUPLE ARITHMETIC (RI)	00037200
				7023 #	SLQA -- SHIFT LEFT QUADRUPLE ARITHMETIC (RI)	00037210
				7024 #	MOR = SHIFT AMOUNT (0..63)	00037220
				7025 #	MAR = A(NEXT INSTN)	00037230
				7026 #	TEMPYD(M) = (RI)	00037240
				7027 #		00037250
				7028 #		00037260
				7029 #		00037270
				7030 #		00037280
				7031 SRQL	NR MOR,X0020,F, SET G IF COUNT >= 32	00037290
000600	8E3289043				DEST=INHIB,SP=SPEX	00037300
				7033	LR TEMPYD,YDP1, TEMPYD(L) := (RI+1)	00037310
000601	83B108173				SP=SPEX,DEST=INHIB	00037320
000602	82B280063			7035	AR IR,X0020,SP=SPEX	00037330
000603	838000150			7037	LR Q,YD Q(M) := (RI+2)	00037340
				7039	LR Q,YDP1 Q(L) := (RI+3)	00037350
000604	838000173				SP=SPEX,DEST=INHIB	00037360
000605	25B026090			7041	BCF G,SRQL1 BIF SHIFT AMOUNT < 32	00037370
				7043 #		00037380
				7044 #	SHIFT AMOUNT >= 32	00037390
000606	8035002A0			7045	AR X0000,Q,C,DEST=INHIB C := SHIFTED OUT BIT IF SH=32	00037400
000607	820000023			7047	LR Q,TEMPYD,SP=DP Q := TEMPYD	00037410
000608	94B100023			7049	SR TEMPYD,TEMPYD,SP=DP TEMPYD := 0	00037420
				7051 #		00037430
				7052 #	DO SHIFT	00037440
000609	C3B1C0050			7053 SRQL1	LR CTR,MOR,RPT=1 SET COUNTER & REPEAT:	00037450
00060A	824100E23			7055	PRL TEMPYD,TEMPYD,C,SP=DP SHIFT (0..31 TIMES)	00037460
00060B	25B006250			7057	B SH64EXIT GO STORE RESULT & SET FLR/CC	00037470
				7059 #		00037480
				7060 #		00037490
				7061 #		00037500
				7062 SLQL	NR MOR,X0020,F, SET G IF SHIFT AMOUNT >=32	00037510
00060C	8E3289043				SP=SPEX,DEST=INHIB	00037520
				7064	LR TEMPYD,YDP1, (RI+1)	00037530
00060D	83B108173				SP=SPEX,DEST=INHIB	00037540

FOR TRAINING
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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00060E	82B280063			7066	AR IR,X0020,SP=SPEX	00037550
00060F	838000150			7068	LR Q,YD (R1+2)	00037560
				7070	LR Q,YDP1, (R1+3)	00037570
000610	838000173				SP=SPEX,DEST=INHIB	00037580
000611	25B026160			7072	BCF G,SLQL1 BIF SHIFT AMOUNT < 32	00037590
				7074	#	00037600
				7075	# SHIFT AMOUNT >= 32	00037610
				7076	NI TEMPYD,X'01', GET SHIFTED OUT BIT IF SH=32	00037620
000612	6E3108013				SP=SPEX,DEST=INHIB	00037630
				7078	LRTC TEMPYD,TEMPYD,C, C := BORROW(0-BIT) = BIT	00037640
000613	9A3108623				SP=SPEX,DEST=INHIB	00037650
000614	813100023			7080	LR TEMPYD,Q,SP=DP TEMPYD := Q	00037660
000615	8085000A3			7082	AQRR X8000,X8000,SP=DP Q := 0	00037670
				7084	#	00037680
				7085	# DO SHIFT	00037690
000616	C381C0050			7086	SLQL1 LR CTR,MOR,RPT=1 SET COUNTER & REPEAT	00037700
000617	826100A23			7088	PLL TEMPYD,TEMPYD,C,SP=DP SHIFT (0..31 TIMES)	00037710
000618	25B006250			7090	B SH64EXIT GO STORE RESULT & SET FLR/CC	00037720
				7092	#	00037730
				7093	#	00037740
				7094	#	00037750
000619	8E3289043			7095	SRQA NR MOR,X0020,F, SET G IF SHIFT AMOUNT >= 32	00037760
					SP=SPEX,DEST=INHIB	00037770
				7097	LR TEMPYD,YDP1, (R1+1)	00037780
00061A	83B108173				SP=SPEX,DEST=INHIB	00037790
00061B	82B280063			7099	AR IR,X0020,SP=SPEX	00037800
00061C	838000150			7101	LR Q,YD (R1+2)	00037810
				7103	LR Q,YDP1, (R1+3)	00037820
00061D	838000173				SP=SPEX,DEST=INHIB	00037830
00061E	826100A23			7105	PLL TEMPYD,TEMPYD,C,SP=DP C := SIGN BIT	00037840
00061F	25B026220			7107	BCF G,SRQA1 BIF SHIFT AMOUNT < 32	00037850
				7109	#	00037860
000620	820000023			7110	# SHIFT AMOUNT >= 32	00037870
000621	B4B100023			7111	LR Q,TEMPYD,SP=DP Q := TEMPYD	00037880
				7113	SRB TEMPYD,TEMPYD,SP=DP Q := 0-SIGNBIT = 1'S IF SIGN=1	00037890
				7115	# = 0 IF SIGN=0	00037900
				7116	#	00037910
				7117	# DO SHIFT	00037920
000622	C3B1C0050			7118	SRQA1 LR CTR,MOR,RPT=1 SET COUNTER & REPEAT	00037930
000623	824140023			7120	PRA TEMPYD,TEMPYD,SP=DP SHIFT & PROP SIGN (0..31)	00037940
000624	824140E23			7122	PRA TEMPYD,TEMPYD,C,SP=DP COMPENSATE PRE-SHIFT,	00037950
				7124	# C := SHIFT-OUT BIT	00037960
				7125	#	00037970
				7126	#	00037980
				7127	# COMMON EXIT FOR SRQL,SLQL,SRQA: STORE RESULT AND SET FLR/CC	00037990

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000625	810001003		7128	SH64EXIT LR	Q,Q,F,SP=DP	00038000
000626	823102023		7130	LRM	TEMPYD,TEMPYD,F,SP=DP	000380010
000627	813080163		7132	LR	YDP1,Q,SP=SPEX (R1+3)	000380020
000628	813080140		7134	LR	YD,Q (R1+2)	000380030
000629	9AB280063		7136	SR	IR,X0020,SP=SPEX	000380040
00062A	81B180163		7138	LR	YDP1,TEMPYD,SP=SPEX (R1+1)	000380050
			7140	LR	YD,TEMPYD, (R1)	000380060
00062B	C1B1B2540				ST=JMC,DC=IFCH,MC=MR11	000380070
			7142	#		000380080
			7143	#		000380090
			7144	#		000380100
00062C	8E3289043		7145	SLQA NR	MDR,X0020,F, SET 6 IF SHIFT AMOUNT >=32	000380110
					DEST=INIB,SP=SPEX	000380120
			7147	LR	TEMPYD,YDP1, (R1+1)	000380130
00062D	83B108173				SP=SPEX,DEST=INIB	000380140
00062E	82B280063		7149	AR	IR,X0020,SP=SPEX	000380150
00062F	838000150		7151	LR	Q,YD (R1+2)	000380160
			7153	LR	Q,YDP1, (R1+3)	000380170
000630	8380008173				SP=SPEX,DEST=INIB	000380180
000631	826100A23		7155	PLL	TEMPYD,TEMPYD,C,SP=DP GET SIGN BIT	000380190
000632	94D840703		7157	CRYS	TEMP1,C,SP=DP TEMP1:= 1:SIGN,31:0; C:=0	000380200
000633	258026380		7159	BCF	G,SLQA1 BIF SHIFT AMOUNT < 32	000380210
			7161	#		000380220
			7162	#	SHIFT AMOUNT >= 32	000380230
000634	6E3108013		7163	NI	TEMPYD,X'01', GET SHIFTED OUT BIT IF SH=32	000380240
					SP=SPEX,DEST=INIB	000380250
			7165	LRTC	TEMPYD,TEMPYD,C, C := BORROW(C-BIT) = BIT	000380260
000635	9A3108623				SP=SPEX,DEST=INIB	000380270
000636	813100023		7167	LR	TEMPYD,Q,SP=DP TEMPYD := Q	000380280
000637	8085000A3		7169	AQRR	X8000,X8000,SP=DP Q := 0	000380290
			7171	#		000380300
			7172	#	DO SHIFT	000380310
000638	C3B1C0050		7173	SLQA1 LR	CTR,MDR,RPT=1 SET COUNTER & REPEAT:	000380320
000639	826100A23		7175	PLL	TEMPYD,TEMPYD,C,SP=DP SHIFT (0..31 TIMES); C:=BIT	000380330
00063A	824100023		7177	PRL	TEMPYD,TEMPYD,SP=DP COMPENSATE PRE-SHIFT	000380340
00063B	810001003		7179	LR	Q,Q,F,SP=DP FLR	000380350
00063C	8CB102103		7181	ORM	TEMPYD,TEMP1,F,SP=DP RESTORE SIGN; FLR	000380360
00063D	813080163		7183	LR	YDP1,Q,SP=SPEX (R1+3)	000380370
00063E	813080140		7185	LR	YD,Q (R1+2)	000380380
00063F	9AB280063		7187	SR	IR,X0020,SP=SPEX	000380390
000640	81B180163		7189	LR	YDP1,TEMPYD,SP=SPEX (R1+1)	000380400
			7191	LR	YD,TEMPYD, (R1)	000380410
000641	C1B1B2540				ST=JMC,DC=IFCH,MC=MR11	000380420
			7193	.N64SH ANOP		000380430
			7194	#		000380440

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LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT

17 MAY 79

7195					AIF	(&XFP EQ 0).NFP
7196	.NFP				ANOP	
7197					AIF	(&XFP3H EQ 0).NFP3H

00030450
00043090
00043100

MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,JSS"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7199	M	00043120
				7200	MMH 48-BIT FLOATING POINT OPTION	00043130
				7201	MMH DAS -- AUGUST 5, 1976	00043140
				7202	M	00043150
				7203	M	00043160
				7204	M REGISTERS ARE KEPT IN LOW MEMORY	00043170
				7205	M HI(REG I) = I	00043180
				7206	M MIDDLE(REG I) = I*X*10	00043190
				7207	M LO(REG I) = I+FREGBASE	00043200
				7208	M	00043210
000C0				7209	FREGBASE EQU X'C6'	00043220
				7210	GNOTE &ZEALU,1,'EXTENDED ALU REQUIRED'	00043230
				7211	M	00043240
				7212	M	00043250
				7213	M REGISTER DEFINITIONS	00043260
				7214	M	00043270
				7215	M REGEQU (S,E,A,S2,E2,A2,Q2,T),(0,9,10,11,12,13,14,15)	00043280

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7217 *		00043300
				7218 *	STF -- STORE 48-BIT FLOATING (RXAD)	00043310
				7219 *	LOC,MAR = A(OPERAND)	00043320
				7220 *	LOCKX = A-1(NEXT INSTN)	00043330
				7221 *		00043340
000642	83B800090			7222 STF	LR SR0,MAR .. SR0 := A(OPERAND)	00043350
000643	83B760074			7224	LR LOC,IR,MOD=EXT2,SP=ZERO .. LOC,MAR := A(HI REG)	00043360
000644	C1B886088			7226	LR MAR,SR0,SP=POPR,MC=MRO	00043370
				7228 *	CHD MC=MRO P0	00043380
				7229 *	LR MAR,SR0,SP=POPR P1 MAR := A(HI DEST)	00043390
				7230 *	NOP P2	00043400
000645	C2300A000			7231	CHD MC=MRO P0	00043410
000646	62B700104			7233	AI LOC,X'10',SP=ZERO P1 LOC,MAR := A(MIDDLE REG)	00043420
				7235 *	NOP P2	00043430
000647	C23006000			7236	CHD MC=MRO P0	00043440
000648	62B800020			7238	AI SR0,2 P1	00043450
000649	81B880088			7240	LR MAR,SR0,SP=POPR P2 MAR := A(MIDDLE DEST)	00043460
00064A	C2300A000			7242	CHD MC=MRO P0	00043470
				7244	AI LOC,FREGBASE-X'10', SP=ZERO P1 LOC,MAR := A(LO REG)	00043480
00064B	62B700804					00043490
				7246 *	NOP P2	00043500
00064C	C23006000			7247	CHD MC=MRO P0	00043510
00064D	62B800020			7249	AI SR0,2 P1	00043520
00064E	81B880088			7251	LR MAR,SR0,SP=POPR P2 MAR := A(LO DEST)	00043530
00064F	D2370A0CC			7253	IR LOC,LOCKX,SP=PINS,MC=MRO	00043540
				7255 *	CHD MC=MRO P0	00043550
				7256 *	IR LOC,LOCKX,SP=PINS P1	00043560
				7257 *	NOP P2	00043570
000650	C23033400			7258 F3NOJAH	CHD ST=CLR,DC=IFCH,MC=MRO P0	00043580

LOC	OBJECT CODE	ADJR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7261	"	00043600
				7262	" SFR -- SUBTRACT 48-BIT FLOATING (RR)	00043610
				7263	" MAR,LOC = A(NEXT INSTN)	00043620
				7264	"	00043630
				7265	" SF -- SUBTRACT 48-BIT FLOATING (RXAD)	00043640
				7266	" MAR,LOC = A(OPERAND)	00043650
				7267	" LOCX = A-1(NEXT INSTN)	00043660
				7268	"	00043670
000651	8436000E0			7269	SFR DR LOCX,LOC .. SETUP A-1(NEXT INSTN)	00043680
000652	838770074			7271	LR LOC,IR,MOD=EXT3,SP=ZERO .. LOC,MAR = YD = A(HI REGS)	00043690
000653	C238060A0			7273	LR S2,X8000,MC=MRO P0 S2=8000: TOGGLE REGS SIGN	00043700
000654	25B0065A0			7275	B SFRJOIN P1 AND GO ADD	00043710
				7277	"	00043720
000655	C238060A0			7278	SF LR S2,X8000,MC=MRO P0 S2=8000: TOGGLE OPERAND	00043730
000656	25B0067C0			7280	B SFRJOIN P1 AND GO ADD	00043740

LOC	OBJECT CODE	ADDR1	ADDR2	SYMT	SOURCE STATEMENT	17 MAY 79
				7283 *		00043760
				7284 * LFR --	LOAD 48-BIT FLOATING (RR)	00043770
				7285 * CFR --	COMPARE 48-BIT FLOATING (RR)	00043780
				7286 * AFR --	ADD 48-BIT FLOATING (RR)	00043790
				7287 * MFR --	MULTIPLY 48-BIT FLOATING (RR)	00043800
				7288 * DFR --	DIVIDE 3-WORD FLOATING (RR)	00043810
				7289 *		00043820
	032B0			7290 LFR	EQU *	00043830
	032B0			7291 CFR	EQU *	00043840
	032B0			7292 AFR	EQU *	00043850
	032B0			7293 MFR	EQU *	00043860
000657	8636000E0			7294 DFR	DR LOCX,LOC .. SETUP A-1(NEXT INSTN)	00043870
000658	838770074			7296	LR LOC,IR,MOD=EXT3,SP=ZERO .. LOC,MAR = YS = A(HI REGS)	00043880
000659	048B06160			7298	SR S2,S2,MC=MRO P0 S2=0: DONT TOGGLE REGS SIGN	00043890
00065A	62B700100			7300 SFRJOIN	AI LOC,X'10' P1 YS=X'10' = A(MIDDLE REGS)	00043900
00065B	CF3B01C50			7302	XR S2,MOR,ST=5IE P2 S2=REGS(HI)	00043910
				7304 *	*** ENABLE ABORT ***	00043920
				7305	AQRR X8000,X8000,SP=DP, P0 Q(M,L):=0	00043930
00065C	C085060A3				MC=MRO	00043940
00065D	62B700B00			7307	AI LOC,FREGBASE-X'10' P1 YS+FREGBASE = A(LO REGS)	00043950
00065E	83B000050			7309	LR A2,MOR P2 A2(M)=REGS(MIDDLE)	00043960
				7311	BCT E2,S2,AIC=A,AOC=PLS, P0 E2=2*S2 (Q(00)=0)	00043970
00065F	C27C06160				MC=MRO	00043980
000660	83B000070			7313	LR FLR,IR,MOD=EXT1 P1 FLR := OPCODE	00043990
				7315	LR A2,MOR, P2 A2(L)=REGS(LO)	00044000
000661	83B000053				SP=SPEX,DEST=INHIB	00044010
000662	15B076850			7317	BCT VGL,F3HLOAD .. BIF CFR,AFR,SFR,MFR,DFR	00044020
				7319 *	B F3HLOAD .. ELSE LFR	00044030
				7320 *		00044040
				7321 *		00044050
				7322 *	LOAD 48-BIT FLOATING (RR OR RX)	00044060
				7323 *	S2,E2,A2(M,L) = OPERAND	00044070
				7324 *		00044080
000663	838760074			7325 F3LOAD	LR LOC,IR,MOD=EXT2,SP=ZERO LOC := A(HI REGD)	00044090
000664	62B700C00			7327	AI LOC,FREGBASE LOC := A(LO REGD)	00044100
000665	8230041A3			7329	LR A2,A2,VF,SP=DP V := 0	00044110
000666	25B036EC0			7331	BCF GL,F3TRUZRO BIF FRAC ZERO TO GEN TRUE ZERO	00044120
				7333 *	B F3NORM ELSE NORMALIZE	00044130

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7335	NORMALIZE RESULT AND TERMINATE; NEVER COME HERE WITH ZERO	00044150
				7336	S2,E2,A2(ML) = RESULT	00044160
				7337	LOC = A(HI REGD)	00044170
000667	63BE00000			7338	F3NORM LI Q2,0 Q2 IS COUNT FOR NORMALIZATION	00044180
000668	823D011A0			7340	LR A2,A2,F	00044190
000669	15B0366D0			7342	BCT GL,F3NORM1 BIF A2(H) NONZERO	00044200
				7344		00044210
				7345	A2(H)=ZERO, DO 16 BIT SHIFT	00044220
				7346	BRR A2,A2,AIC=D,AOC=A, A2(H) := A2(L)	00044230
00066A	83AD001A1				SP=LTOH	00044240
				7348	BRR " " (2 CYCLE OPERATION)	00044250
00066B	63BD08003			7349	LI A2,0,SP=SPEX,DEST=INHIB A2(L) := 0	00044260
00066C	62BE00100			7351	AI Q2,16 COUNT := 16	00044270
				7353		00044280
				7354	A2(H) NONZERO, CHECK A2(00-07)	00044290
				7355	F3NORM1 HI A2,X'FF',F,MOD=SHAP, DEST=INHIB	00044300
00066D	6E3D19FF0					00044310
00066E	15B036730			7357	BCT GL,F3NORM2 BIF 8 MSB'S NONZERO	00044320
				7359		00044330
				7360	8 MSB'S = 0, SHIFT 8 TIMES	00044340
00066F	62BE00080			7361	AI Q2,8 COUNT = COUNT+8	00044350
000670	63B180070			7363	LI CTR,7	00044360
000671	C0BD401A3			7365	AR A2,A2,SP=DP,RPT=1 SHIFT	00044370
000672	80BD011A3			7367	AR A2,A2,F,SP=DP 8 TIMES	00044380
				7369		00044390
				7370	8 MSB'S NONZERO, NORMALIZE	00044400
000673	15B016770			7371	F3NORM2 BCT L,F3NORM4 BIF NORMALIZED	00044410
000674	80BD011A3			7373	F3NORM3 AR A2,A2,F,SP=DP SHIFT	00044420
				7375	BCFC L,F3NORM3,Q2 AND COUNT	00044430
000675	923E001C0			7376	IR Q2,Q2	
000676	25B016740			7378	BCF L,F3NORM3	
				7380		00044440
				7381	NORMALIZED, BUMP EXP & TERMINATE	00044450
000677	80BE001C0			7382	F3NORM4 AR Q2,Q2 ALIGN INCREMENT WITH EXPONENT	00044460
000678	94BC007C0			7384	SR E2,Q2,C UPDATE EXPONENT; UFLO IF BORROW	00044470
000679	25B086DA0			7386	BCF C,F3END BIF NO UNDERFLOW TO END	00044480
00067A	63BA00390			7388	LI SRA,X'39' CCIU #2 DHA STATUS ADDRESS	00044490

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7391 *		00044510
				7392 * LF	-- LOAD 48-BIT FLOATING (RXAD)	00044520
				7393 * CF	-- COMPARE 48-BIT FLOATING (RXAD)	00044530
				7394 * AF	-- ADD 48-BIT FLOATING (RXAD)	00044540
				7395 * MF	-- MULTIPLY 48-BIT FLOATING (RXAD)	00044550
				7396 * DF	-- DIVIDE 48-BIT FLOATING (RXAD)	00044560
				7397 *	LOC, MAR = A(OPERAND)	00044570
				7398 *	LOCX = A-1(NEXT INSTN)	00044580
	03308			7399 LF	EQU *	00044590
	03308			7400 CF	EQU *	00044600
	03308			7401 AF	EQU *	00044610
	03308			7402 MF	EQU *	00044620
00067B	D4BB06160			7403 DF	SR S2, S2, MC=MRO P0 S2=0: DONT TOGGLE OPD SIGN	00044630
00067C	62B700020			7405 SFJOIN	AI LOC, 2 P1	00044640
00067D	CF3801C50			7407	XR S2, MDR, ST=SIE P2 S2=OPD(HI)	00044650
				7409 *	*** ENABLE ABORT ***	00044660
				7410	AQRX X0000, X0000, SP=DP, P0 Q(M, L) := 0	00044670
00067E	C085060A3				MC=MRO	00044680
00067F	62B700020			7412	AI LOC, 2 P1	00044690
000680	838D00050			7414	LR A2, MDR P2 A2(H) := OPD(MIDDLE)	00044700
				7416	BCT E2, S2, AIC=A, AOC=PLS, P0 E2 := 2 * S2 (Q(00)=0)	00044710
000681	C27C06160				MC=MRO	00044720
000682	838E00070			7418	LR FLR, IR, MOD=EXT1 P1 FLR := OPCODE	00044730
				7420	LR A2, MDR, P2 A2(L) := OPD(LO)	00044740
000683	838D08053				SP=SPEX, DEST=INHIB	00044750
000684	25B076630			7422	BCF VGL, F3LOAD .. BIF 'LF' INSTN	00044760
				7424 *		00044770
				7425 *	COMPARE, ADD, SUBTRACT, MULTIPLY, DIVIDE (RR OR RX)	00044780
				7426 *	S2, E2, A2(M, L) = OPERAND	00044790
				7427 *	FLR = IRI(04..07)	00044800
000685	83B760074			7428 F3HLOAD	LR LOC, IR, MOD=EXT2, SP=ZERO .. LOC, MAR := YD = A(HI REGD)	00044810
000686	C23006000			7430	CMO MC=MRO P0	00044820
000687	62B700100			7432	AI LOC, X*10' P1 YD * X*10' = A(MIDDLE REGD)	00044830
000688	838800050			7434	LR S, MDR P2 S := REGD(HI)	00044840
000689	C23006000			7436	CMO MC=MRO P0	00044850
00068A	62B700B00			7438	AI LOC, FREGBASE-X*10' P1 YD * FREGBASE = A(LO REGD)	00044860
00068B	83BA00050			7440	LR A, MDR P2 A(M) := REGD(MIDDLE)	00044870
				7442	BCT E, S, AIC=A, AOC=PLS, P0 E := 2 * S (Q(00)=0)	00044880
00068C	C27906100				MC=MRO	00044890
				7444 *	NOP P1	00044900
				7445	LR A, MDR, P2 A(L) := REGD(LO)	00044910
					SP=SPEX, DEST=INHIB	00044920
00068D	83BA08053					
00068E	15B0468D0			7447	BCT V, MFD F .. BIF MULTIPLY, DIVIDE	00044930
00068F	15B0269E0			7449	BCT G, AFS F .. BIF ADD, SUBTRACT	00044940
				7451 *	B F3COMP .. ELSE COMPARE	00044950

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7453 #		00044970
				7454 #	48-BIT FLOATING COMPARE	00044980
				7455 #	S, E, A(M,L) = 1ST OPERAND	00044990
				7456 #	S2,E2,A2(M,L)= 2ND OPERAND	00045000
				7457 #		00045010
000690	82680FB00			7458	PLL S,S,CV,DEST=INHIB V1=0, C1=SIGN(REGD)	00045020
000691	803809160			7460	XR S,S2,F,DEST=INHIB	00045030
000692	1580169C0			7462	BCT L,CFDIFF BIF SIGNS DIFFER	00045040
000693	158006980			7464	BCT C,CFNEG SAME: BIF NEGATIVE	00045050
				7466 #		00045060
				7467 #	BOTH NON-NEGATIVE: COMPARE, SET CGL	00045070
000694	94BA017A3			7468	SR A,A2,CF,SP=DP A(M,L) - A2(M,L)	00045080
000695	B4B002760			7470	SRB S,S2,CF S - S2	00045090
				7472	IR LOC,LOCX,SP=PINS, LOC,HAR := A(NEXT INSTN)	00045100
000696	D237018CC				ST=RIE ### DISABLE ABORT ###	00045110
000697	C23032400			7474	CMD ST=JMC,DC=IFCH,HC=HRI1	00045120
				7476 #		00045130
				7477 #	BOTH NEGATIVE: COMPARE, SET CGL	00045140
000698	94B001743			7478	CFNEG SR A2,A,CF,SP=DP A2(M,L) - A(M,L)	00045150
000699	B4B002700			7480	SRB S2,S,CF S2 - S	00045160
				7482	CFDONE IR LOC,LOCX,SP=PINS, LOC,HAR := A(NEXT INSTN)	00045170
00069A	D237018CC				ST=RIE ### DISABLE ABORT ###	00045180
00069B	C23032400			7484	CMD ST=JMC,DC=IFCH,HC=HRI1	00045190
				7486 #		00045200
				7487 #	SIGNS DIFFERENT, L=1, C=SIGN(REGD): SET 6,L (DP) ON REGD MSB'S	00045210
00069C	B2380A100			7488	CFDIFF LRH S,S,F,DEST=INHIB	00045220
00069D	25B0069A0			7490	B CFDONE OTHER EXIT, THIS PATH SHORTER	00045230

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7493 #		00045250
				7494 #	3-WORD FLOATING ADD/SUBTRACT	00045260
				7495 #	S, E, A(M,L) = 1ST OPERAND	00045270
				7496 #	S2,E2,A2(M,L) = 2ND OPERAND	00045280
				7497 #	LOC,MAR=A(HI REGD)	00045290
				7498 #		00045300
				7499 #	WANT ABS(E2,A2) >= ABS(E,A); PREPARE TO SCALE (E,A) TO ALIGN FRAC'S	00045310
				7500 #	IF NOT, SWAP S,E,A AND S2,E2,A2	00045320
				7501 #		00045330
00069E	8D3B09100			7502 AFSF	XR S2,S,F,DEST=INHIB L := 1 IF SIGNS DIFFERENT	00045340
00069F	94BD08741			7504	CR A2,A,C,SP=DPINH	00045350
0006A0	B4BC08720			7506	CRB E2,E,C COMPARE (E2,A2):(E,A)	00045360
0006A1	15B086A90			7508	BCT C,AFSWAP BIF BORROW TO SWAP	00045370
				7510 #		00045380
				7511 #	NO BORROW: 'A' IS THE LESSER OPERAND, SEND IT OUT FOR SCALING	00045390
				7512	GNOTE &ZTRIG,1,'CORDIC HARDWARE REQUIRED'	00045400
				7513	RRR A,CORDL,AIC=B, OUTBOARD SHIFTER := A(L)	00045410
0006A2	81BA0E1B3				SP=SPEX,DEST=INHIB,V=OV V := 0	00045420
0006A3	81BA00190			7515	RRR A,CORDM,AIC=B OUTBOARD SHIFTER := A(M)	00045430
				7517	RRR E,E2,AIC=AHBM1,CIN=1, E := (E2-E)/2 = 8 SHIFTS	00045440
					AOC=PRS,MOD=LOG (1:0, 15: UNSIGNED NUMBER)	00045450
0006A4	98D900180				RRR E,CORDL,AIC=B,AOC=LDQ ADVANCE MECHANISM; Q:=SHIFT AMT	00045460
0006A5	818900180			7519	RRR CORDCTL,CORDM,AIC=Q ADVANCE MECHANISM; SHIFT:=AMT	00045470
0006A6	813780190			7521	LR MDR,E,SP=SHFL MDR := SHIFT AMT; START SHIFT	00045480
0006A7	81B98004C			7523		00045490
0006A8	25B006B20			7525	B AFDOIT	00045500
				7527 #		00045510
				7528 #	BORROW: 'A2' IS LESSER OPERAND, SWAP OPERANDS AND SETUP SCALING	00045520
				7529 AFSWAP	RRR A2,CORDL,AIC=B, OUTBOARD SHIFTER := A2(L)	00045530
					SP=SPEX,DEST=INHIB,V=OV V := 0	00045540
0006A9	81BD0E1B3			7531	RRR A2,CORDM,AIC=B OUTBOARD SHIFTER := A2(M)	00045550
0006AA	81BD00190			7533	RRR E2,E,AIC=AHBM1,CIN=1, E2 := (E-E2)/2 = 8 SHIFTS	00045560
					AOC=PRS,MOD=LOG (1:0, 15: UNSIGNED NUMBER)	00045570
0006AB	98DC00120				RRR E2,CORDL,AIC=B,AOC=LDQ ADVANCE MECHANISM; Q:=SHIFT AMT	00045580
0006AC	818C00180			7535	RRR CORDCTL,CORDM,AIC=Q ADVANCE MECHANISM; SHIFT:=AMT	00045590
0006AD	813780190			7537	LR MDR,E2,SP=SHFL MDR := SHIFT AMT; START SHIFT	00045600
0006AE	81BC8004C			7539		00045610
0006AF	823B00100			7541	LR S2,S S2 := LARGER OPERAND	00045620
0006B0	823C00120			7543	LR E2,E E2 := LARGER OPERAND	00045630
0006B1	823D00143			7545	LR A2,A,SP=DP A2 := LARGER OPERAND	00045640
				7547 #		00045650
				7548 #	DO ADD OR SUBTRACT WITH SCALED OPERAND (SHIFT REQUIRES 2 CYCLES)	00045660
				7549 AFDOIT	SR MDR,X0020,C, COMPARE (SHIFT AMT):32	00045670
					SP=SPEX,DEST=INHIB NO BORROW IF (SHIFT AMT)>=32	00045680
0006B2	9AB288643			7551	BCF C,F3EHD BIF SH>=32: S2,E2,A2; V=0	00045690
0006B3	25B086DA0			7553	BCT L,AFSUB BIF L=1 TO DO SUBTRACT	00045700
0006B4	15B016B90			7555 #		00045710

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				7556	* SIGNS THE SAME: ADD AND GET OUT	00045700
				7557	AR A2,CORDL,CF, A2 := A2 + OPERAND	*00045710
0006B5	02B0093B3				SP=SPEX,DEST=INHIB	00045720
0006B6	A2B002390			7559	ARC A2,CORDM,CF A2 := A2 + OPERAND	00045730
0006B7	15B0B6D60			7561	BCT CGL,F3CRYTST BIF NONZERO TO TEST FOR CARRY	00045740
0006B8	25B006ECO			7563	B F3TRUZRO ELSE GENERATE TRUE ZERO	00045750
				7565	* SIGNS DIFFER: SUBTRACT AND GET OUT	00045760
				7567	AFSUB SR A2,CORDL,CF, A2 := A2 - OPERAND	*00045780
					SP=SPEX,DEST=INHIB	00045790
0006B9	96B0097B3					00045800
0006BA	B6B002790			7569	SRB A2,CORDM,CF A2 := A2 - OPERAND	00045810
0006BB	15B036670			7571	BCT GL,F3INORM BIF NONZERO TO NORMALIZE	00045820
0006BC	25B006ECO			7573	B F3TRUZRO ELSE GENERATE TRUE ZERO	00045830

MICROCODE, HMP-1116 PLP 1641003 REV. A CCAS 1641603,1641604,1641653 "657,0416,JSS"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7576 *		00045840
				7577 *	48-BIT FLOATING MULTIPLY/DIVIDE	00045850
				7578 *	S,E,A(M,L) = 1ST OPERAND	00045860
				7579 *	S2,E2,A2(M,L) = 2ND OPERAND	00045870
				7580 *	LOC,MAR=A(HI REGD)	00045880
				7581 *	FLR = IR(04..07)	00045890
				7582 *		00045900
				7583 MFD	LRTC A2,A2,C,SP=DPINH, DEST=INHIB	00045910
0006BD	9A3D087A1				C := 0 IF 2ND OPD IS ZERO	00045920
0006BE	15B086C20			7585	BCT C,MF1	00045930
0006BF	25B016EC0			7587	BCF L,F3TRUZRO	00045940
0006C0	83BED0070			7589	LR FLR,IR,MOD=EXT1	00045950
0006C1	25B006E40			7591	B F30FAULT	00045960
				7593 *	AND GO CAUSE DIVIDE FAULT	00045970
				7594 MF1	LRTC A,A,C,SP=DPINH, DEST=INHIB	00045980
0006C2	9A3A08741				C := 0 IF 1ST OPD IS ZERO	00045990
0006C3	25B006EC0			7596	BCF C,F3TRUZRO	00046000
				7598 *	BIF 1ST OPD ZERO TO CLEAR RESULT	00046010
				7599 *	SETUP SIGN, EXPONENTS	00046020
0006C4	803B00100			7600	XR S2,S	00046030
0006C5	94B9000A0			7602	SR E,X0000	00046040
0006C6	94BC000A0			7604	SR E2,X0000	00046050
0006C7	15B016F70			7606	BCT L,F30IV	00046060
				7609 *	BIF DIVIDE TO DIVIDE	00046080
				7610 *	48-BIT FLOATING MULTIPLY	00046090
				7611 *	S2 = SIGN(RESULT)	00046100
				7612 *	A(M,L) = FRAC(1ST OPD)	00046110
				7613 *	A2(M,L) = FRAC(2ND OPD)	00046120
				7614 *	LOC,MAR = A(HI REGD)	00046130
				7615 *		00046140
				7616 *		00046150
				7617 *	ADD EXPONENTS	00046160
0006C8	80BC04120			7618	AR E2,E,VF	00046170
0006C9	15B046F00			7620	BCT V,F3WRONG	00046180
				7622 *	PRELIM EXP(RESULT); SET V,G,L	00046190
				7623 *	BIF UFLO OR OFLO (GL SAYS WHICH)	00046200
0006CA	8200001A3			7624	LR Q,A2,SP=DP	00046210
0006CB	94C000FA3			7626	PRZ A2,C,SP=DP	00046220
0006CC	C5D2C0023			7628	DR CTR,X0020,SP=SPEX,RPT=1	00046230
0006CD	F5CD00F43			7630	UNUL A2,A,C,SP=DP	00046240
				7632	RRR A2,A,AIC=MUL,CIN=MUL, AOC=PRD,MOD=LOG,C=C, SP=DP	00046250
0006CE	F5CD00343				31 ITERATIONS	00046260
0006CF	15B086D30			7634	BCT C,F3HEXIT	00046270
				7636 *	BIF ANSWER ALREADY NORMALIZED	00046280
						00046290

LOC	OBJECT CODE	ADDR1	ADDR2	SYMT	SOURCE STATEMENT	
						17 MAY 79
				7637	* NORMALIZE ANSWER (1 BIT IS SUFFICIENT)	
0006D0	76BC06020			7638	SI E2,2,V	00046300
0006D1	15B046F10			7640	BCT V,F3EXPUF	00046310
0006D2	8260001A3			7642	PLL A2,A2,SP=DP	00046320
0006D3	8000082A0			7644	F3MEXIT AR Q,X8000,C,DEST=INHI	00046330
0006D4	80BC000A0			7646	AR E2,X8000	00046340
				7648	* B F3ROUND	00046350
						00046360

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				7650 *		00046380
				7651 *	VARIOUS TERMINATIONS FOR 3-WORD FLOATING POINT	00046390
				7652 *	(MULTIPLY FALLS INTO 'ROUND')	00046400
				7653 *		00046410
				7654 *		00046420
				7655 *	ROUND C INTO ANSWER AND TERMINATE	00046430
				7656 *		00046440
0006D5	A23D003A3			7657	F3ROUND IRC A2,A2,C,SP=DP ADD IN ROUNDING BIT	00046450
				7659 *		00046460
				7660 *	TEST FOR CARRY OUT OF MSB (THIS CAN INDEED HAPPEN AFTER ROUNDING)	00046470
0006D6	25B000DA0			7661	F3CRYST BCF C,F3END BIF NO CARRY-OUT	00046480
0006D7	824D401A3			7663	PRA A2,A2,SP=DP SHIFT	00046490
0006D8	808C00280			7665	AR E2,X0002,C BUMP EXPONENT	00046500
0006D9	15B0006F30			7667	BCT C,F3EXPOF BIF OFLO	00046510
				7669 *		00046520
				7670 *	END OF FLOATING POINT PROCESSING	00046530
				7671 *	S2,E2,A2 = ANSWER	00046540
				7672 *	V=1 IF OFLO/UFLO	00046550
				7673 *	LOC,HAR = A(LO REGD)	00046560
0006DA	026B00B60			7674	F3END PLL S2,S2,C HI WORD :=	00046570
0006DB	824C40180			7676	PRA E2,E2 (SIGN, EXP)	00046580
0006DC	01B081243			7678	F3END1 LR HDR,A2,CF,SP=SPEX .. C:=0; LOAD G,L	00046590
0006DD	C23000000			7680	CMD MC=MWP,ST=RIE P0 *** DISABLE ABORT ***	00046600
0006DE	76B700B00			7682	SI LOC,FREGBASE-X*10 ⁶ P1 LOC := A(MIDDLE REGD)	00046610
0006DF	01B082040			7684	LRM HDR,A2,F P2	00046620
0006E0	C2300C000			7686	CMD MC=MWP P0	00046630
0006E1	76B700100			7688	SI LOC,X*10 ⁶ P1 LOC := A(HI REGD)	00046640
0006E2	81BC82040			7690	LRM HDR,E2,F P2	00046650
0006E3	C2300C000			7692	CMD MC=MWP P0	00046660
0006E4	D237010CC			7694	F3FAULT IR LOC,LOCK,SP=PINS,ST=RIE P1 *** DISABLE ABORT (AGAIN)***	00046670
0006E5	15B046E70			7696	BCT V,F3FAULT P2	00046680
0006E6	C23032400			7698	CMD ST=JMC,DC=IFCH,MC=HRI1 P0	00046690
				7700 *		00046700
				7701 *	FAULT OCCURRED: JAM COND CODE, SEE IF INTERRUPT ENABLED	00046710
0006E7	C23000400			7702	F3FAULT CMD ST=JMC COND CODE OF RESULT	00046720
0006E8	83BE000B0			7704	LR FLR,PSW,MOD=EXT1	00046730
0006E9	25B046500			7706	BCF V,F3NOJAM EXIT IF NPT DISABLED (PSW05)	00046740
0006EA	63B480284			7708	LI HAR,OFFPSW,SP=ZERO	00046750
0006EB	25B0003B0			7710	B GENSHP ELSE TAKE INTERRUPT	00046760
				7712 *		00046770
				7713 *	GENERATE TRUE ZERO RESULT: CLEAR V	00046780
0006EC	63BE00000			7714	F3TRUZERO LI FLR,0 CLEAR V	00046790
				7716 *		00046800
				7717 *	ZERO RESULT IN A2,E2(INCL SIGN)	00046810
0006ED	94BD001A3			7718	F3EXPUZ SR A2,A2,SP=DP	00046820

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48-BIT FLOATING POINT

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
0006EE	63BC00000			7720	LI E2,0	00046830
0006EF	25B006DC0			7722	B F3END1	00046840
				7724	"	00046850
				7725	" EXP OFLO/UFLO: CHECK WHICH (V=1; L=1 IF OFLO, 0 IF UFLO)	00046860
0006F0	15B014F30			7726	F3HROG BCT L,F3EXPOF	00046870
				7728	"	00046880
				7729	" EXP UNDERFLOW: SET V AND GENERATE ZERO	00046890
0006F1	63BE00040			7730	F3EXPUF LI FLR,4	00046900
0006F2	25B006E00			7732	B F3EXPUZ	00046910
				7734	"	00046920
				7735	" EXP OVERFLOW: SET V AND GENERATE MAX EXP,FRACTION (SIGN UNCHANGED)	00046930
0006F3	63BE00040			7736	F3EXPOF LI FLR,4	00046940
0006F4	67BC00010			7738	LI OC E2,1	00046950
0006F5	67BD00003			7740	LI OC A2,0,SP=DP	00046960
0006F6	25B006DA0			7742	B F3END	00046970
				7744	" S2 = SIGN(RESULT)	00046980
				7745	" A(M,L) = FRAC(1ST OPD) E = 2'S COMP EXPONENT(1ST OPD)	00046990
				7746	" A2(M,L) = FRAC(2ND OPD) E2 = 2'S COMP EXPONENT(2ND OPD)	00047000
				7747	" LOC,MAR = A(MI REGD)	00047010
				7748	" Q(M,L)=0	00047020
				7749	"	00047030
				7750	" SUBTRACT EXPONENTS	00047040
				7751	F3DIV BRR E2,E,CIN=1,AIC=AMBH1, E2:=PRELIM EXP; LOAD V,G,L	00047050
0006F7	98BC04120				V=OV,F=SP	00047060
0006F8	15B046F00			7753	BCT V,F3HROG	00047070
0006F9	824A00143			7755	PRL A,A,SP=DP	00047080
0006FA	825D001A3			7757	BRR A2,A2,AIC=A,AOC=PRS,SP=DP ALIGN RADIX WITH DIVIDEND	00047090
				7759	BRR A,A2,AIC=BNH1,CIN=1, 1ST ITERATION: TEST IF QUOT>=1.0	00047100
					AOC=PLD,C=-C,SP=DP,	00047110
					MOD=MD	00047120
0006FB	94EA307A3				C,F3DIV1	00047130
0006FC	25B006FF0			7761	BCF C,F3DIV1	00047140
				7763	"	00047150
				7764	" 1ST QUOT BIT=0: EXP IS CORRECT, NEXT ITERATION IS "1ST"	00047160
0006FD	E4EA207A3			7765	DIV A,A2,C,SP=DP	00047170
0006FE	25B007010			7767	B F3DJOIN	00047180
				7769	"	00047190
				7770	" 1ST QUOT BIT=1: QUOT IS >=1.0, SO BUMP EXPONENT AND USE THE "TEST"	00047200
				7771	" ITERATION AS THE FIRST ITERATION	00047210
0006FF	62BC06020			7772	F3DIV1 AI E2,2,V	00047220
000700	15B046F30			7774	BCT V,F3EXPOF	00047230
				7776	"	00047240
				7777	" DO 31 MORE ITERATIONS, GENERATE ROUNDING BIT, AND QUIT	00047250
000701	C5B2C0023			7778	F3DJOIN DR CTR,X0020,SP=SPEX,RPT=1 CTR:=31	00047260
000702	E4EA207A3			7780	DIV A,A2,C,SP=DP	00047270
				7782	BRR A,A2,AIC=DIV,CIN=DIV, C := ONE MORE QUOTIENT BIT	

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MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J55"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000703	E4EA083A1				AOC=PLD,C=C,	00047280
000704	813D001A3				DEST=INMIB,SP=DPINH	00047290
000705	80BC000A0	7784		LR	A2,Q,P=DP	00047300
000706	25B006050	7786		AR	E2,X0000	00047310
		7788		B	F3ROUND	00047320
		7790	.HFP3H	ANOP		00047330

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
7792	#					00047350
7793	#				MEMORY TEST FUNCTION	00047360
7794	#					00047370
7795	#				THIS FUNCTION IS ONLY ACTIVATED AFTER 'SYSTEM CLEAR'. HENCE	00047380
7796	#				EXTERNAL REGISTERS ARE ZERO AND THE STATE OF THE PANEL IS	00047390
7797	#				'INCREMENT' MODE (IE ADDRESSING PANEL CLEARS COUNTERS).	00047400
7798	#				NOTE -- NO MICROPROGRAM REGISTER CONVENTIONS OBSERVED; YOU SHOULD	00047410
7799	#				'SYSTEM CLEAR' TO REINITIALIZE CONSTANT REGISTERS.	00047420
7801	#				EXTERNAL REGISTERS	00047440
7802	#				EXTRN CTR,HDR,IR,HAR,PSH,EXT,FLR,RAR	00047450
7803	#				REGEQU (CTR,HDR,IR,HAR,PSH,EXT,FLR,RAR)	00047460
7804	#				(1,2,3,4,5,6,14,15)	00047470
7805	#					00047480
7806	#				INTERNAL REGISTERS	00047490
7807	#				REGEQU (A,A2,T),(10,13,15) TEMPORARY	00047500
7808	#				REGEQU (MIN,MIL),(1,2) HIGH ADDRESS BOUND (LAST+1)	00047510
7809	#				REGEQU (LOH,LOL),(3,4) LOW ADDRESS BOUND (FIRST)	00047520
7810	#				REGEQU LINK,0 LINK = ABORTAD (USED IN CORDIC)	00047530
7811	#				REGEQU D,5 EXPECTED DATA	00047540
7812	#				REGEQU ECTR,6	00047550
7813	#				REGEQU X,0 COMMAND BRANCH INDEX	00047560
7814	#				REGEQU ALARHSV,9	00047570
00001		7816	PANADR	EQV 1	PANEL DEVICE ADDRESS	00047590

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MICROCODE, HMP-1116 PLP 1641603 REV. A CCAS 1641603,1641604,1641653 "657,0416,J55"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
				7818 #		00047610
				7819 ###	MEMORY TEST ENTRY POINT:	00047620
				7820 #		00047630
000707	63B600040			7821 MEMTST	LI EXT,4	00047640
				7823 #	TURN ON 'MOP' LAMP	00047650
				7824 #	FIND SIZE OF MEMORY	00047660
				7825 #	LI PSW,0	00047670
				7826 #	LI MAR,0,SP=POPR	00047680
000708	63B200000			7827	LI HIL,0	00047690
000709	63B100040			7829	LI HIL,0	00047700
00070A	63B400000			7831	LI LOL,0	00047710
00070B	63B300040			7833	LI LOH,4	00047720
00070C	63BF10200			7835	LI T,(4096*21)/256,MOD=SWAP	00047730
00070D	63B500AA0			7837	LI D,X'AA'	00047740
00070E	82BF00280			7839 MTSIZE	AR MAR,T,C	00047750
00070F	03B0078E0			7841	BLK MTAOCR,LINK	00047760
000710	25B0171A0			7843	BCF L,MTINIT	00047770
				7845 #	(THEN POPR,MAR=X'40000')	00047780
000711	C23002000			7846	CHD MC=MRIL	00047790
000712	8F3580040			7848	XR MDR,0	00047800
000713	C2300C000			7850	CHD MC=MMP	00047810
000714	C23006000			7852	CHD MC=MRO	00047820
000715	83BA00050			7854	LR A,MDR	00047830
000716	83B280070			7856	LR MDR,IR	00047840
000717	CD3A0C0A0			7858	XR A,D,MC=MMP	00047850
000718	96BA09070			7860	CR A,IR,F	00047860
000719	25B0370E0			7862	BCF GL,MTSIZE	00047870
				7864 #		00047880
				7865 #		00047890
				7866 #	INITIALIZE FOR MEMORY TEST FUNCTION	00047900
				7867 #	POPR,MAR = A+1(LAST WORD IN MEMORY)	00047910
00071A	83B200090			7868	MTINIT LR HIL,MAR	00047920
00071B	83B1600B0			7870	LR HIL,PSW,MOD=EXT2	00047930
				7872 #	LI LOL,0	00047940
00071C	63B300000			7873	LI LOH,0	00047950
00071D	63B510120			7875	LI D,X'12',MOD=SWAP	00047960
00071E	6EB500340			7877	OI D,X'34'	00047970
00071F	63B600000			7879	LI ECTR,0	00047980
000720	63B900000			7881	LI ALARHSV,0	00047990
000721	63BA10200			7883	LI A,X'20',MOD=SWAP	00048000
000722	0EBA000A0			7885	OR PSW,A	00048010
				7887 #		00048020
				7888 #	MAR = HI BOUND (ALSO POPR)	00048030
				7890 #		00048050
				7891 #	DISPLAY 'D' AND WAIT FOR COMMAND	00048060

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000723	01B500040			7892	MTDISP LR HDR,D	00048070
				7894	"	00048080
				7895	" DISPLAY 'HDR' AND WAIT FOR COMMAND	00048090
000724	03B0079E0			7896	MTDISP BLK MTDISPX,LINK	00048100
				7898	"	00048110
				7899	" WAIT FOR COMMAND	00048120
000725	63B600020			7900	MTWAIT LI EXT,2 WAIT-LAMP ON	00048130
000726	03BEC0000			7902	LR FLR,EXT,MOD=EXT0 WAIT FOR CATN	00048140
000727	25B007260			7904	BCF C,H-W	00048150
000728	63B600010			7906	LI EXT,1 WAIT-LAMP OFF	00048160
				7908	"	00048170
				7909	" DECODE COMMAND	00048180
000729	63BF00010			7910	MTSERVE LI T,PANADR	00048190
00072A	51BF00210			7912	OUT T,ADRS,SYNC ADDRESS PANEL & CLEAR CATN	00048200
00072B	43B070E10			7914	INP X,SR,SYNC,MOD=EXT3 STATUS 12..15 = BRANCH INDEX	00048210
				7916	"	00048220
				7917	" EXECUTE ONE ITERATION	00048230
00072C	32B0072D0			7918	MTITERAT BI "H,X INDEXED BRANCH ON 4 LSB'S OF	00048240
				7920	" PANEL STATUS	00048250
				7921	" 0: 'STOP' OR 'XOR DATA DISPLAY'	00048260
00072D	43BEE0E10			7922	INP FLR,SR,SYNC,MOD=EXT2 GET MSB'S OF PANEL STATUS	00048270
00072E	25B0073E0			7924	B HT0 (CONTINUE)	00048280
				7926	"	00048290
				7927	" 2: 'LOAD D, RANDORG'	00048300
00072F	03DA00090			7928	LR A,MAR SAVE MAR	00048310
000730	25B007410			7930	B HT2 (CONTINUE)	00048320
				7932	"	00048330
				7933	" 4: 'LOAD LO BOUND'	00048340
000731	03B007020			7934	BLK MTINMORD,LINK GET DATA FROM SWITCHES	00048350
000732	03B400090			7936	LR LOL,MAR	00048360
000733	0233001E0			7938	LR LOW,T	00048370
000734	25B007240			7940	B MTDISP DISPLAY LO BOUND IN MAR	00048380
				7942	"	00048390
				7943	" 8,9,10,11,12,13,14,15:	00048400
000735	25B007450			7944	B HT8 (CONTINUE)	00048410
000736	25B007490			7946	B HT9 (CONTINUE)	00048420
000737	25B007620			7948	B HT10 (CONTINUE)	00048430
000738	25B007640			7950	B HT11 (CONTINUE)	00048440
000739	25B007670			7952	B HT12 (CONTINUE)	00048450
00073A	25B0076A0			7954	B HT13 (CONTINUE)	00048460
00073B	25B007710			7956	B HT14 (CONTINUE)	00048470
				7958	" HTALARM (CONTINUE)	00048480
				7959	"	00048490
				7960	" 15: 'DISPLAY ALARM-REGISTER AS OF LAST ERROR'	00048500
00073C	01B980040			7961	MTALARM LR HDR,ALARMV DISPLAY IN D2	00048510

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000730	25B007240			7963	B MTDISP	00048520
				7965	"	00048530
				7966	" 0: 'STOP' OR 'XOR DATA DISPLAY' (CONTINUED)	00048540
00073E	25B027240			7967	MT0 BCF G,MTDISP BIF 'STOP' COMMAND	00048550
00073F	0F3580040			7969	XR MDR,D ELSE 'XOR DATA DISPLAY'	00048560
000740	25B007240			7971	B MTDISP	00048570
				7973	"	00048580
				7974	" 2: 'LOAD D' (CONTINUED)	00048590
000741	03B007020			7975	MT2 BLK MTINWORD, LINK GET SWITCH DATA	00048600
000742	03B500090			7977	LR D, MAR	00048610
000743	01BA80000			7979	LR MAR, A, SP=POPR RESTORE MAR	00048620
000744	25B007230			7981	B MTDISPD DISPLAY DATA	00048630
				7983	"	00048640
				7984	" 0: 'LOAD HI BOUND'	00048650
000745	03B007020			7985	MT0 BLK MTINWORD, LINK GET SWITCH DATA	00048660
000746	03B200090			7987	LR HI, MAR	00048670
000747	0231001E0			7989	LR HI, T	00048680
000748	25B007240			7991	B MTDISP DISPLAY BOUND	00048690
				7993	"	00048700
				7994	" 9: 'GALPAT TEST'	00048710
000749	03B0070A0			7995	MT9 BLK MTBUMP, LINK	00048720
00074A	03B007A50			7997	BLK MTRAND, LINK D := RANDOM(D)	00048730
00074B	63BE80000			7999	LI FLR, 0 V := 0	00048740
00074C	01B580040			8001	MTGALP1 LR MDR, D	00048750
00074D	63BA00020			8003	LI A, 2 A := X'0002'	00048760
00074E	63B1800C0			8005	LI CTR, 12 DO 12 BIT POSITIONS	00048770
00074F	C2300C000			8007	CHD MC=MHP P0	00048780
000750	0F3A80000			8009	MTGALP2 XR MAR, A (P1) TOGGLE ADDR BIT	00048790
				8011	LR MDR, D (P2) MDR := TRUE DATA	00048800
000751	CF3A8C000			8012	XR MAR, A, MC=MHP	00048810
				8014	CHD MC=MHP P0 WRITE DATA	00048820
				8015	XR MAR, A P1 MAR := A(TEST LOC)	00048830
000752	CF3A82000			8016	XR MAR, A, MC=MHP P2	00048840
				8018	NOP P0 READ TEST LOC, SAVE IN IR	00048850
				8019	CHD MC=MHP P1 MAR := A(GARBAGE LOC)	00048860
				8020	XR MAR, A P2 MDR := INVERSE DATA	00048870
000753	09B580040			8021	LROC MDR, D	00048880
000754	CF3A8C000			8023	XR MAR, A, MC=MHP	00048890
				8025	CHD MC=MHP P0 WRITE	00048900
				8026	XR MAR, A P1 MAR := A(TEST LOC)	00048910
000755	C0BA06140			8027	AR A, A, MC=MRO	00048920
				8029	NOP P2	00048930
				8030	AR A, A, MC=MRO P0 READ TEST LOC1 BUMP BIT MASK	00048940
000756	9AB589060			8031	CR IR, D, F P1 CHECK FIRST READ	00048950
000757	15B037780			8033	BCT GL, MTGALERR P2 BIF BAD TO REPORT	00048960

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000750	9AB509040			0035	CR HDR,D,F	00048970
000759	15B037790			0037	BCT GL,HTERR	00048980
00075A	03BF000D0			0039	LR T,EXT	00048990
00075B	6E3F11200			0041	NI T,X'20',F,MOD=SHAP	00049000
00075C	15B027790			0043	BCT G,HTERR	00049010
00075D	15B007500			0045	BCT CTR,HTGALP2	00049020
00075E	8A35000A0			0047	LROC D,D	00049030
00075F	15B047750			0049	BCT V,HTENDIT	00049040
000760	63BE00040			0051	LI FLR,4	00049050
000761	25B0074C0			0053	B HTGALP1	00049060
				0055		00049070
				0056	# 10: 'DISPLAY ERROR COUNT'	00049080
000762	81B600040			0057	HT10 LR HDR,ECTR	00049090
000763	25B007240			0059	B HTDISP	00049100
				0061		00049110
				0062	# 11: 'TEST ADDR'	00049120
000764	03B0078A0			0063	HT11 BLK HTBUMP,LINK	00049130
000765	03B500090			0065	LR D,MAR	00049140
000766	25B0076B0			0067	B HT13JOIN	00049150
				0069		00049160
				0070	# 12: 'TEST ADDR BAR'	00049170
000767	03B0078A0			0071	HT12 BLK HTBUMP,LINK	00049180
000768	07B500090			0073	LROC D,MAR	00049190
000769	25B0076B0			0075	B HT13JOIN	00049200
				0077	# 13: 'TEST DATA'	00049210
00076A	03B0078A0			0078	HT13 BLK HTBUMP,LINK	00049220
00076B	C23006000			0080	HT13JOIN CMD MC=MRD	00049230
00076C	9AB509040			0082	CR HDR,D,F	00049240
00076D	15B037790			0084	BCT GL,HTERR	00049250
00076E	03BEC00D0			0086	LR FLR,EXT,MOD=EXT0	00049260
00076F	15B027790			0088	BCT G,HTERR	00049270
000770	25B007730			0090	B HTRESUME	00049280
				0092		00049290
				0093	# 14: 'CLEAR ERROR COUNTER'	00049300
000771	63B600000			0094	HT14 LI ECTR,0	00049310
000772	25B007240			0096	B HTDISP	00049320
				0098		00049330
				0099	# RESUME AFTER ERROR	00049340
000773	01B500040			0100	HTRESUME LR HDR,D	00049350
000774	C2300C000			0102	CMD MC=MHP	00049360
				0104		00049370
				0105	# END OF ITERATION	00049380
000775	03BEC00D0			0106	HTENDIT LR FLR,EXT,MOD=EXT0	00049390
000776	15B007290			0108	BCT C,HTSERVE	00049400
000777	25B0072C0			0110	B HTITERAT	00049410

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				0113 #		00049430
				0114 #	ERROR IN GALPAT	00049440
000778	83B280070			0115	MTGALERR LR MDR,IR GET ERRONEOUS WORD	00049450
				0117 #		00049460
				0118 #	GENERAL ERROR	00049470
000779	9236002C0			0119	MTERR IR ECTR,ECTR,C BUMP COUNTER	00049480
00077A	25B0877C0			0121	BCF C,#+2#W SKIP IF COUNT <= MAX	00049490
00077B	77B600010			0123	LITC ECTR,1 ECTR := MAX (X'FFFF')	00049500
00077C	C23001000			0125	CMO ST=AMC SAVE ALARM REGISTER; CLEAR IT	00049510
00077D	83B9000B0			0127	LR ALARMSV,PSW	00049520
00077E	43BE0E010			0129	INP FLR,SR,SYNC,MOD=EXT2 TEST 'RUN' TO STOP ON ERR	00049530
				0131 #	RUN = -ST08 OR -ST09	00049540
00077F	25B087240			0132	BCF C,MTDISP IF RUN SW SET, STOP ON ERR	00049550
000780	25B047240			0134	BCF V,MTDISP	00049560
000781	25B007730			0136	B MTRESUME	00049570
				0139 #		00049590
				0140 ###	'MTINWORD' -- INPUT 18 BITS FROM PANEL SWITCHES TO MAR (SCRATCH=T)	00049600
				0141 #	ALSO T14,15 = MARA,B	00049610
				0142 #		00049620
000782	43BF00810			0143	MTINWORD INP T,DR,SYNC ASSUME PANEL HAS BEEN ADDRESSED	00049630
				0145	INP MAR,DR,SYNC,MOD=SHAP,	00049640
000783	43B490810				SP=DBUS	00049650
000784	8EBF80080			0147	OR MAR,T MAR := 18 DATA BITS	00049660
000785	83BF000D0			0149	LR T,EXT	00049670
000786	824F001E0			0151	PRL T,T	00049680
000787	824F001E0			0153	PRL T,T	00049690
000788	6E3F00030			0155	NI T,3 T := 2 MS BITS	00049700
000789	91B0801E0			0157	IR RAR,LINK RETURN	00049710
				0160 #		00049730
				0161 ###	'MTDUMP' -- INCREMENT MAR IF 'SNGL' OFF; POSSIBLY WRAP AROUND	00049740
				0162 #	T=SCRATCH	00049750
				0163 #		00049760
00078A	83BEC00D0			0164	MTDUMP LR FLR,EXT,MOD=EXT0 TEST 'SNGL'	00049770
00078B	15B0479D0			0166	BCT V,MTADR2 BIF 'SNGL' TO BYPASS BUMPING	00049780
00078C	63BF00020			0168	LI T,2	00049790
00078D	82BF80280			0170	AR MAR,T,C MAR := MAR+2; LOAD C	00049800
				0172 #	(AND FALL INTO 'MTADRCRY')	00049810
				0173 #		00049820
				0174 ###	'MTADRCRY' -- MAKE SURE MAR < HI BOUND (A = SCRATCH)	00049830
				0175 #	CALL: C=CARRY IN TO MARA,B	00049840
				0176 #	RETN: MARA,B AND POPR REFLECT CARRY	00049850
				0177 #	IF RESULT >= HI BOUND, POPR,MAR := LOW BOUND	00049860
				0178 #	L SET IF RESULT < HI BOUND; CLEARED IF WRAP AROUND	00049870

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00070E	25B007920			0179	MTADRCRY BCF C,MTADR1	00049800
00070F	63BA00100			0181	LI A,X'10'	00049890
000790	82BA000A0			0183	AR PSH,A	00049900
000791	83B400090			0185	LR MAR,MAR,SP=POPR	00049910
000792	83BA600B0			0187	MTADR1 LR A,PSH,MOD=EXT2	00049920
000793	9AB200680			0189	CR MAR,HIL,CF	00049930
000794	B4BA0A020			0191	CRB A,HIL,F	00049940
000795	15B0179D0			0193	BCT L,MTADR2	00049950
000796	823A00060			0195	LR A,LOH	00049960
000797	63B180040			0197	LI CTR,4	00049970
000798	C23040000			0199	CHD RPT=1	00049980
000799	80BA00140			0201	AR A,A	00049990
00079A	6EBA10200			0203	OI A,X'20',MOD=SWAP	00050000
00079B	81BA000A0			0205	LR PSH,A	00050010
00079C	81B4000B0			0207	LR MAR,LOL,SP=POPR	00050020
00079D	91B0801E0			0209	MTADR2 IR MAR,LINK	00050030
				0212	"	00050050
				0213	*** 'MTDISPX' -- DISPLAY MAR,MDR (A SCRATCH)	00050060
				0214	"	00050070
00079E	63BF00010			0215	MTDISPX LI T,PANADR	00050080
00079F	51BF00210			0217	OUT T,ADRS,SYNC	00050090
0007A0	53B200610			0219	OUT MDR,DA,SYNC	00050100
0007A1	53B290610			0221	OUT MDR,DA,SYNC,MOD=SWAP	00050110
0007A2	53B400610			0223	OUT MAR,DA,SYNC	00050120
0007A3	53B490610			0225	OUT MAR,DA,SYNC,MOD=SWAP	00050130
0007A4	91B0801E0			0227	IR MAR,LINK	00050140
				0230	"	00050160
				0231	*** 'NTRAND' -- RANDOM NUMBER GENERATOR (T,A,A2,Q SCRATCH)	00050170
				0232	" CALL: D = I'TH RANDOM NUMBER (16 BITS)	00050180
				0233	" RETN: D = I+1'TH RANDOM NUMBER	00050190
0007A5	63BA10800			0234	NTRAND LI A,X'00',MOD=SWAP	00050200
0007A6	8200000A0			0236	LR Q,D	00050210
0007A7	826A60140			0238	RL A,A	00050220
0007A8	63B100070			0240	LI CTR,7	00050230
0007A9	813F001E0			0242	LR T,Q	00050240
0007AA	C23D40140			0244	LR A2,A,RPT=1	00050250
0007AB	826A00140			0246	PLL A,A	00050260
0007AC	8000003E0			0248	AR Q,T,C	00050270
0007AD	A0BA001A0			0250	ARC A,A2	00050280
0007AE	826A00140			0252	PLL A,A	00050290
0007AF	8000003E0			0254	AR Q,T,C	00050300
0007B0	A0BA001A0			0256	ARC A,A2	00050310
0007B1	824A00140			0258	PRL A,A	00050320

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0007B2	8135000A0			0260	LR D.Q	00050330
0007B3	91B0801E0			0262	IR RAR, LINK	00050340
				0264		00050350
				0265	AIF ('&XFST' NE 'E3A').NE3A	00050360
				0266	ANOP	00051260
				0267	AIF ('&XFST' NE '413').N413	00051270
				0268	ANOP	00051530
				0269	AIF ((&COLDRTM EQ 9) AND ('&XFST' NE 'RHM')) AND ('&XPMRPL' NE 'RHM')).NRHM	00051540
				0270	ANOP	00051550
						00052030

MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J35"

HUGHES PROPRIETARY

TRANSFER VECTOR

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				0272 *		00052850
				0273 *		00052860
				0274 *	THE FOLLOWING TRANSFER VECTOR IS PLACED AT A FIXED LOCATION	00052870
				0275 *	IN UPPER ROM BANK SO THAT LOWER BANKS OF CHIPS ARE COMMON	00052880
				0276 *	AMONG SEVERAL MICRO-CODE CONFIGURATIONS.	00052890
				0277 *		00052900
				0278 *		00052910
				0279	ALIGN 2048	00052920
0007D4	FFFFFFFF	03DA0		0280	A9156 EQU *-START	
004000		03FE0		0282	ORG *-4MH	00052930
				0283	AIF ('&XFST' NE 'NONE').FNONONE	00052940
				0284	.FNONONE AIF ('&XFST' NE 'E3A').FNE3A	00052970
				0285	.FNE3A ANOP	00053000
				0286	AIF ('&XFST' NE '413').FM413	00053010
				0287	.FM413 ANOP	00053040
				0288	AIF ('&XFST' NE '657').FM657	00053050
0007FC	25B008000			0289	XXFST1 B RPL657 4: FST INTERRUPT=P657 LOAD	00053060
0007FD	25B008000			0291	XXFST2 B RPL657 3: FST INTERRUPT=P657 LOAD	00053070
				0293	.FM657 ANOP	00053080
				0294	AIF ('&XFST' NE 'SEM').FNSEM	00053090
				0295	.FNSEM ANOP	00053120
				0296	AIF ('&XFST' NE 'TGP').FNTGP	00053130
				0297	.FNTGP ANOP	00053160
				0298	AIF ('&XFST' NE 'RHM').NRRHMH1	00053170
				0299	.NRRHMH1 ANOP	00053200
0007FE	25B002B00			0300	XXPRGLD B PRGLD 2: PANEL-INVOKED PROG LOAD	00053210
0007FF	25B007070			0302	XXMENTST B MENTST 1: MEMORY TEST	00053220
				0304	ALIGN 2048	00053230
000800		04000		0305	A9173 EQU *-START	
				0307	AIF ('&XFST' NE '657').N657	00053240

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MICROCODE, IMP-1116 PLP 1641603 REV. A CCA5 1641603,1641604,1641653 "657,0416,J35"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				0309 *		00053260
				0310 *		00053270
				0311 *	THIS IS THE ENTRY ROUTINE FOR THE REMOTE PROGRAM LOAD FOR PROJECTS	00053280
				0312 *	657, J55, AND 0416. THIS ROUTINE EXAMINES THE STATUS OF THE DMAB	00053290
				0313 *	TO DETERMINE THE PERIPHERAL THAT IS REQUESTING THE PROGRAM LOAD.	00053300
				0314 *		00053310
				0315 *		00053320
000800	03B103C80			0316 RPL657	BLK CLRPTY,TEMPYD ESTABLISH PARITY	00053330
000801	63B500000			0318	LI PSW,X'00'	00053340
000802	63B6800A0			0320	LI EXT,X'0A'	00053350
000803	63BE00400			0322	LI SRE,X'40'	00053360
000804	51BE00210			0324	OUT SRE,ADRS,SYNC ADDRESS RTC AND ETC	00053370
000805	15B048000			0326	BCT V,RPL6571 NO SYNC CONT. REMOTE PROG. LD.	00053380
000806	63B900440			0328	LI SR9,X'44'	00053390
000807	51B900410			0330	OUT SR9,CMD,SYNC DISABLE INTR. FROM ETC AND RTC	00053400
000808	63B900010			0332 RPL6571	LI SR9,X'01'	00053410
000809	51B900210			0334	OUT SR9,ADRS,SYNC CLEAR FRONT PANEL	00053420
00080A	63B900F90			0336	LI SR9,X'F9'	00053430
00080B	51B900210			0338	OUT SR9,ADRS,SYNC ADDRESS MPC	00053440
00080C	63B900100			0340	LI SR9,X'10'	00053450
00080D	51B900410			0342	OUT SR9,CMD,SYNC DISABLE INTERRUPT	00053460
00080E	C23001000			0344	CMD ST=ANC DISARM MPC	00053470
				0346 *		00053480
				0347 *	REQUEST STATUS FROM DMAB	00053490
				0348 *		00053500
00080F	63B800800			0349	LI SR8,X'88'	00053510
000810	51B800210			0351	OUT SR8,ADRS,SYNC ADDRESS DMAB STATUS REGION	00053520
000811	43BA00E10			0353	INP SRA,SR,SYNC REQUEST STATUS	00053530
000812	63B480004			0355	LI MAR,X'00',SP=ZERO	00053540
000813	81BA80040			0357	LR HDR,SRA	00053550
000814	C2300C000			0359	CMD MC=MHP	00053560
000815	03B108290			0361	BLK DMABINI,TEMPYD INITIALIZE DMAB	00053570
				0363 *		00053580
				0364 *	DETERMINE PROGRAM LOAD REQUESTOR	00053590
				0365 *		00053600
000816	76BA09000			0366	CI SRA,X'00',F	00053610
000817	25B039260			0368	BCF GL,PLCCIU0 JUMP IF CCIU 80 LOAD	00053620
000818	76BA09200			0370	CI SRA,X'20',F	00053630
000819	25B0392C0			0372	BCF GL,PLCCIU1 JUMP IF CCIU 81 LOAD	00053640
00081A	76BA09400			0374	CI SRA,X'40',F	00053650
00081B	25B039300			0376	BCF GL,PLCCIU2 JUMP IF CCIU 82 LOAD	00053660
00081C	51BE00210			0378	OUT SRE,ADRS,SYNC ADDRESS INITIALIZATION REGION	00053670
00081D	63B800040			0380	LI SR8,X'04'	00053680
00081E	51B800410			0382	OUT SR8,CMD,SYNC SEND INIT WORD 1	00053690
00081F	03B1063A0			0384	BLK CHINTR,TEMPYD	00053700

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000820	76BA09600			0306	CI SRA,X'60',F	00053710
000821	25B039810			0308	BCF GL,PLFD	00053720
000822	76BA09800			0390	CI SRA,X'80',F	00053730
000823	25B038490			0392	BCF GL,FPRL	00053740
000824	76BA09A00			0394	CI SRA,X'A0',F	00053750
000825	25B038E00			0396	BCF GL,PLD	00053760
				0398		00053770
				0399	IF THE STATUS VALUES DID NOT MATCH, THEN THERE WAS A BAD DMAB	00053780
				0400	TRANSFER.	00053790
				0401		00053800
000826	63B380010			0402	SRC01 LI IR,X'01'	00053810
000827	81BA00120			0404	LR YS,SRA	00053820
000828	25B000790			0406	B WAIT	00053830
				0408		00053840
				0409	INITIALIZE DMAB PORTS AND USER REGISTERS	00053850
				0410		00053860
000829	63B800770			0411	DMABINI LI SRE,X'77'	00053870
00082A	51B800210			0413	OUT SRE,ADRS,SYNC	00053880
00082B	15B049CB0			0415	BCT V,NOTAV	00053890
00082C	63B900C10			0417	LI SR9,X'C1'	00053900
00082D	51B900410			0419	OUT SR9,CHD,SYNC	00053910
				0421		00053920
				0422	INITIALIZE DMAB PORTS	00053930
				0423		00053940
00082E	63B900000			0424	LI SR9,X'00'	00053950
00082F	51B800210			0426	INIT7 OUT SR8,ADRS,SYNC	00053960
000830	51B900410			0428	OUT SR9,CHD,SYNC	00053970
000831	62B900010			0430	AI SR9,X'01'	00053980
000832	76B909080			0432	CI SR9,X'08',F	00053990
000833	15B0382F0			0434	BCT GL,INIT7	00054000
				0436		00054010
				0437	INITIALIZE USER REGISTERS TO ZERO	00054020
				0438		00054030
000834	63B180080			0439	LI CTR,X'00'	00054040
000835	63B380000			0441	LI IR,0	00054050
000836	63B980000			0443	INIT1 LI YS,0	00054060
000837	93B380070			0445	IR IR,IR	00054070
000838	15B008360			0447	BCT CTR,INIT1	00054080
000839	91B1801E0			0449	IR RAR,TEMPYD	00054090
				0451		00054100
				0452	ENABLE INTERRUPT AND DUMP ANY INTERRUPT PENDING	00054110
				0453		00054120
00083A	63B590400			0454	CHINTR LI PSW,X'40',MOD=SWAP	00054130
00083B	63B8ED00D0			0456	CHINTR1 LR FLR,EXT,MOD=EXT1	00054140
00083C	25B0483F0			0458	BCF V,NOINTR	00054150

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00083D	43B900A10			0460	INP SR9,ACK,SYNC	DUMP INTERRUPT 00054160
00083E	25B0003B0			0462	B CHINTR1	00054170
00083F	63B580000			0464	MOINTR LI PSW,X'00'	DISABLE INTERRUPT 00054180
000840	91B1801E0			0466	IR RAR,TEMPYD	00054190
				0468	"	00054200
				0469	"	00054210
				0470	" THIS SUBROUTINE RESPONDS TO A PMP PROGRAM LOAD SIGNAL WITH DEVICE	00054220
				0471	" ADDRESS OF ZERO, TO REPORT A LOAD REQUEST FROM A MAG TAPE, ASR 733	00054230
				0472	" CASSETTE. IT ALSO RESPONDS TO A REMOTE	00054240
				0473	" PROGRAM LOAD SIGNAL SENT FROM A REMOTE CONSOLE. FLOPPY DISC,	00054250
				0474	" OR DISK PROGRAM LOAD CAPABILITIES HAVE BEEN WRITTEN INTO THE	00054260
				0475	" PROGRAM.	00054270
				0476	"	00054280
				0477	"	00054290
000841	83BF00050			0478	RPL416 LR SRF,MOR	00054300
000842	63B680020			0480	LI EXT,X'02'	SET WAIT LAMP 00054310
000843	63B800080			0482	LI SR0,X'88'	00054320
000844	03B100290			0484	BLK DHABINI,TEMPYD	00054330
000845	51BE00210			0486	OUT SRE,ADRS,SYNC	ADDRESS INITIALIZATION REGION 00054340
000846	63B900040			0488	LI SR9,X'04'	00054350
000847	51B900410			0490	OUT SR9,CHD,SYNC	SEND DHAB INITIALIZATION COMMAND 00054360
000848	25B0004B0			0492	B "3M4	00054370
000849	55B400210			0494	FPRL BIO OUT,X0002,ADRS,SYNC,AIC=BH1	00054380
00084A	43BF00010			0496	INP SRF,DR,SYNC	READ THUMBWHEEL SWITCHES 00054390
00084B	76BF09010			0498	CI SRF,X'01',F	00054400
00084C	25B0385C0			0500	BCF GL,PLMT	JUMP TO MAG TAPE LOAD ROUTINE 00054410
00084D	76BF09020			0502	CI SRF,X'02',F	00054420
00084E	25B0388A0			0504	BCF GL,PLC	JUMP TO CASSETTE LOAD ROUTINE 00054430
00084F	76BF09030			0506	CI SRF,X'03',F	00054440
000850	25B039810			0508	DCF GL,PLFD	JUMP TO FLOPPY LOAD 00054450
000851	76BF09040			0510	CI SRF,X'04',F	00054460
000852	25B038E00			0512	BCF GL,PLD	JUMP TO DISC LOAD 00054470
000853	76BF09050			0514	CI SRF,X'05',F	00054480
000854	25B038E00			0516	BCF GL,PLD	JUMP TO DISC LOAD 00054490
000855	76BF09060			0518	CI SRF,X'06',F	00054500
000856	25B038E40			0520	BCF GL,PLD1	JUMP TO DISC 2 LOAD 00054510
000857	76BF09070			0522	CI SRF,X'07',F	00054520
000858	25B038E40			0524	BCF GL,PLD1	JUMP TO DISC 2 LOAD 00054530
000859	63B380020			0526	LI IR,X'02'	SELECT REG. 2 00054540
00085A	81BF80120			0528	LR YS,SRF	LOAD REG. 2 WITH SRF 00054550
00085B	25B000790			0530	B WAIT	00054560

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				0533	"	00054580
				0534	"	00054590
				0535	" THIS IS A SUBROUTINE SPECIFICALLY DESIGNED TO LOAD THE 1116 WITH A	00054600
				0536	" BOOTSTRAP LOADER FROM A MAG TAPE PERIPHERAL. THERE ARE TWO TAPES	00054610
				0537	" CONNECTED TO EACH CONTROLLER, BUT CONTROLLER DESIGN IS SUCH THAT THE	00054620
				0538	" LOAD TAPE WILL RESPOND TO COMMANDS FOR CONTROLLER TAPE UNIT ZERO.	00054630
				0539	" THE TAPE IS ASSUMED TO BE PRESET TO IT'S LOAD POINT. DATA TRANSFER	00054640
				0540	" IS ACROSS THE I/O MUX BUS.	00054650
				0541	"	00054660
				0542	"	00054670
00085C	63BE00040			0543	PLMT LI SRE,X'04'	00054680
00085D	51BE00210			0545	OUT SRE,ADR9,SYNC	00054690
00085E	15B048610			0547	BCT V,PLMT1	00054700
00085F	43BE00E10			0549	INP FLR,SR,SYNC	00054710
000860	25B018670			0551	BCF L,HTL	00054720
000861	63BE00050			0553	PLMT1 LI SRE,X'05'	00054730
000862	51BE00210			0555	OUT SRE,ADR9,SYNC	00054740
000863	15B049C00			0557	BCT V,NOTAV	00054750
000864	43BE00E10			0559	INP FLR,SR,SYNC	00054760
000865	25B018670			0561	BCF L,HTL	00054770
000866	25B008030			0563	B ENRPAI	00054780
				0565	"	00054790
				0566	" MAG TAPE THAT REQUESTED LOAD IS CLEARED FOR POSSIBLE 7 TRACK. SET	00054800
				0567	" UP FOR 50 SEQUENCE AUTOLOAD. LOOP TO STATUS REQUEST IF IT'S BUSY.	00054810
				0568	"	00054820
000867	15B0885C0			0569	MTL BCT C,PLMT	00054830
000868	63BA00200			0571	LI SRA,X'20'	00054840
000869	51BA00410			0573	OUT SRA,CMD,SYNC	00054850
00086A	63B900A10			0575	RPAL LI SR9,X'A1'	00054860
00086B	51B900410			0577	OUT SR9,CMD,SYNC	00054870
00086C	63B400804			0579	LI MAR,X'00',SP=ZERO	00054880
00086D	630F00FF0			0581	LI SRF,X'FF'	00054890
00086E	43B900E10			0583	RPAL1 INP SR9,SR,SYNC	00054900
00086F	81B9801C0			0585	LR FLR,SR9	00054910
000870	15B0790C0			0587	BCT VGL,PLD5	00054920
000871	15B0886E0			0589	BCT C,RPAL1	00054930
000872	43B800010			0591	INP TEMP1,OR,SYNC	00054940
000873	81B881060			0593	LR IR,TEMP1,F	00054950
000874	25B0386E0			0595	BCF GL,RPAL1	00054960
000875	C23006000			0597	RPAL2 CMD MC=HRO	00054970
000876	8F3F00070			0599	XR SRF,IR	00054980
000877	83B2A0070			0601	LR MOR,IR,M00=INSB	00054990
000878	03B48A094			0603	IR MAR,MAR,MC=MM,SP=ZERO	00055000
000879	43B900E10			0605	RPAL3 INP SR9,SR,SYNC	00055010
00087A	81B9801C0			0607	LR FLR,SR9	00055020

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RENOTE PROGRAM LOAD

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LOC	OBJECT CODE	ADDR1	ADDR2	SYMT	SOURCE STATEMENT	
00007B	15B0590C0			0609	BCT VL,PLD5	JUMP TO ERROR ON BAD TRANSFER
00007C	15B020800			0611	BCT G,EXRPAL	END OF RECORD LOOP OUT
00007D	15B080790			0613	BCT C,RPAL3	LOOP IF BUSY
00007E	43B380810			0615	INP IR,DR,SYNC	INPUT NEXT WORD
00007F	25B0008750			0617	B RPAL2	CONTINUE IN LOOP
000880	76BF09000			0619	EXRPAL CI SRF,X'00',F	LOAD CHECKSUM COMPARE
000881	25B030860			0621	BCF GL,RPAL4	JUMP IF CHECKSUM OK
000882	25B009250			0623	B CHKERR	
000883	63B380050			0625	ENRPAL LI IR,X'05'	SET UP REGISTER 5 FOR
000884	83B9801D0			0627	LR YS,FLR	BAD STATUS
000885	25B000790			0629	B WAIT	
000886	63B70080C			0631	RPAL4 LI LOC,X'80',SP=PINS	SET LOC TO LOCATION 80
000887	63B580000			0633	LI PSW,X'00'	
000888	63B680030			0635	LI EXT,X'03'	SET AND RESET LAMPS
000889	C23032400			0637	CHD ST=JMC,DC=IFCH,MC=MRI1	

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MICROCODE, HMP-1116 PLP 1641603 REV. A CCA5 1641603,1641604,1641653 "657.0416.J55"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00088A	638E00A00			0640 #		00055190
00088B	51BE00210			0641 #		00055200
00088C	15B049C00			0642 #	THIS ROUTINE UNLOADS AN ASR733 CASSETTE INTO MEMORY. THE TRANSFER IS	00055210
00088D	63BC00A90			0643 #	ACROSS THE I/O BUS, THRU A PASLA, IN THE FULL DUPLEX MODE. THE	00055220
00088E	51BC00410			0644 #	CASSETTE IS ASSUMED TO BE PRESET TO IT'S LOAD POINT.	00055230
00088F	63B900640			0645 #		00055240
000890	51B900410			0646 #		00055250
000891	43B280010			0647 PLC	LI SRE,X'A8'	00055260
000892	51BC00210			0649	OUT SRE,ADRS,SYNC ADDRESS READ SIDE OF PASLA	00055270
000893	63B900A00			0651	BCT V,NOTAV GO TO WAIT STATE	00055280
000894	51B900410			0653	LI SRC,X'A9'	00055290
000895	03B108C50			0655	OUT SRC,CHD,SYNC COMMAND ONE TO PUT PASLA IN READ	00055300
000896	63B900100			0657	LI SR9,X'64'	00055310
000897	43BA003A0			0659	OUT SR9,CHD,SYNC ODD PARITY AND 7 DATA BITS	00055320
000898	51B900610			0661	INP HDR,DR,SYNC DUMMY READ	00055330
000899	03B108C50			0663	OUT SRC,ADRS,SYNC ADDRESS PASLA	00055340
00089A	51BA00610			0665	LI SR9,X'AB'	00055350
00089B	03B108C50			0667	OUT SR9,CHD,SYNC COMMAND ONE TO SET PASLA IN	00055360
00089C	63BA00110			0669	BLK PASLAB,TEMPYD WRITE MODE	00055370
00089D	51BA00610			0671	LI SR9,X'10'	00055380
				0673	LI SRA,X'3A'	00055390
				0675	OUT SR9,DA,SYNC SET AUTO DEVICE CONTROL ON	00055400
				0677	BLK PASLAB,TEMPYD SEND 'DLE' AND 'ADC'	00055410
				0679	OUT SRA,DA,SYNC CHARACTER TO PASLA	00055420
				0681	BLK PASLAB,TEMPYD	00055430
				0683	LI SRA,X'11'	00055440
				0685	OUT SRA,DA,SYNC LOAD ADC COMMAND FOR PLAYBACK ON	00055450
				0687 #	/KEYBOARD OFF. BEGIN TRANSFER	00055460
				0688 #	DATA WILL NOW BE LOADED INTO THE CPASLA FROM THE CASSETTE, ONE BYTE	00055470
				0689 #	AT A TIME.	00055480
				0690 #		00055490
00089E	63B490024			0691	LI MAR,X'02',MOD=SWAP,SP=ZERO SET UP ADDRESS AT 200	00055500
00089F	63B900D00			0693	LI SR9,X'D0'	00055510
0008A0	82B980080			0695	AR MAR,SR9	00055520
0008A1	63BF00FF0			0697	LI SRF,X'FF'	00055530
0008A2	62BF20FF0			0699	AI SRF,X'FF',MOD=INSB PRESET CHECKSUM REGISTER	00055540
0008A3	51BE00210			0701	OUT SRE,ADRS,SYNC TO 'FFFF'	00055550
0008A4	03B108D70			0703 PLC1	BLK PLC2,TEMPYD ADDRESS READ SIDE OF PASLA	00055560
0008A5	82B000180			0705	LR SRB,SRC CHECK PASLA IS BUSY	00055570
				0707 #		00055580
				0708 #	BYTE DATA WORD HAS BEEN READ IN REGISTER B. IT MUST BE CHECKED	00055590
				0709 #	FOR END OF LOAD PATTERN.	00055600
				0710 #		00055610
0008A6	63BA00130			0711	LI SRA,X'13'	00055620
0008A7	94BA09180			0713	CR SRA,SRC,F LOAD WITH ASCII 13 COMPARE WORD	00055630
					CHECK IF THIS WORD IS NOT END OF	

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0008A8	25B038C00			8715	BCF GL,PLC3	PROGRAM LOAD
				8717	LR SRB,SRB,MOD=EXT2	
0008A9	83AB60160			8718	*,WARNING - INTERNAL TO INTERNAL WITH MOD	
				8720	*	
				8721	* CHECK THE FIRST DATA WORD FOR X11X----, IF IT HAS THE VALUE	
				8722	* REFORMAT AND READ AND REFORMAT THE NEXT TWO WORDS.	
				8723	*	
0008AA	81B8801C0			8724	LR FLR,SRB	X11X --> FLR
0008AB	25B068A40			8726	BCF VG,PLC1	BIF BITS 182 = 01, 10, 00
0008AC	63B0000F0			8728	PLC5 LI SRD,X'0F'	MASK 4 MSB BITS AND FORMAT THEM:
0008AD	8C3D00180			8730	NR SRD,SRD	000000000000ABCD
0008AE	63B180040			8732	LI CTR,X'04'	LOAD COUNTER WITH 4
0008AF	C2B0401A0			8734	LR Q,SRD,RPT=1	(SRD) TO Q AND INCREMENT COUNTER
0008B0	8240601A0			8736	RR SRD,SRD	ROTATE RIGHT AND POSITION ABCD
0008B1	03B108D70			8738	BLK PLC2,TEMPYD	READ SECOND WORD = 1EFGHIJ
0008B2	63B0E003F0			8740	LI SRE,X'3F'	MASK 6 BITS AND FORMAT THEM:
0008B3	8C3E00180			8742	NR SRE,SRD	0000000000EFGHIJ
				8744	LR SRE,SRE,MOD=SWAP	00EFGHIJ00000000
0008B4	83AE101C0			8745	*,WARNING - INTERNAL TO INTERNAL WITH MOD	
0008B5	824E601C0			8747	RR SRE,SRE	000EFGHIJ00000000
0008B6	824E601C0			8749	RR SRE,SRE	0000EFGHIJ00000000
0008B7	80B0001C0			8751	AR SRD,SRE	ABCDEFGHIJ00000000
0008B8	03B108D70			8753	BLK PLC2,TEMPYD	READ THIRD WORD = IKLMNOP
0008B9	63B0E003F0			8755	LI SRE,X'3F'	MASK 6 BITS AND FORMAT THEM
0008BA	8C3E00180			8757	NR SRE,SRD	0000000000IKLMNOP
0008BB	80B0001C0			8759	AR SRD,SRE	ABCDEFGHIJKLMNOP
0008BC	823E001A0			8761	LR SRE,SRD	
0008BD	03B108D00			8763	BLK PLCPCH,TEMPYD	
0008BE	803900160			8765	XR SR9,SRD	CHECK THE PARITY OF THE
0008BF	6E3901010			8767	NI SR9,X'01',F	DATA AGAINST INDICATOR
0008C0	25B028D00			8769	BCF G,CHKPER	PARITY BIT AND GO TO WAIT
				8771	*	
				8772	* WRITE WORD INTO MEMORY AND THEN GO FETCH ANOTHER ONE.	
				8773	*	
0008C1	803F001A0			8774	XR SRF,SRD	ADD TO CHECKSUM
0008C2	81B080040			8776	LR MDR,SRD	LOAD MDR WITH 16 BIT CHARACTER.
0008C3	C2B48A084			8778	AR MAR,X0002,MC=MN,SP=ZERO	INCREMENT MAR AND WRITE
0008C4	25B008A40			8780	B PLC1	
				8782	*	
				8783	* SUBROUTINE TO CHECK IF WRITE SIDE IS BUSY	
				8784	*	
0008C5	43BE80E10			8785	PASLAB INP FLR,SR,SYNC	
0008C6	15B088C50			8787	BCT C,PASLAB	
0008C7	91D1801E0			8789	IR RAR,TEMPYD	
				8791	*	

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				8792	# PROGRAM HAS BEEN LOADED. BEGIN EXECUTION AT 2D0.	00056070
				8793	#	00056080
0008C8	76BF09000			8794	PLC3 CI SRF,X'00',F SET UP CHECKSUM COMPARE	00056090
0008C9	25B038CB0			8796	BCF GL,PLC4 JUMP IF OK	00056100
0008CA	25B009250			8798	B CHKERR	00056110
0008CB	63B580000			8800	PLC4 LY PSW,X'00' PRESET PSW TO ZERO	00056120
0008CC	63B71002C			8802	LI LOC,X'02',MOD=SWAP,SP=PIHS SET LOCATION COUNTER TO 2D0.	00056130
0008CD	62B700D00			8804	AI LOC,X'00'	00056140
0008CE	63B6800D0			8806	LY EXT,X'0D' RESET AND SET LAMPS	00056150
0008CF	C23033400			8808	CHD ST=CLR,DC=IFCH,MC=HRI1 BEGIN EXECUTION AT LOCATION 2D0.	00056160
				8810	#	00056170
				8811	# SUBROUTINE TO KEEP TRACK OF 16 BITS HALFWORD PARITY	00056180
				8812	#	00056190
0008D9	63B900000			8813	PLCPCH LI SR9,X'00'	00056200
0008D1	63B180100			8815	LI CTR,X'10' LOAD COUNTER WITH 16	00056210
0008D2	8200001C0			8817	LR Q,SRE LOAD Q REGISTER	00056220
0008D3	94CE00FC0			8819	PLCPCH1 PRZ SRE,C COUNT NUMBER OF ONES	00056230
0008D4	A23900120			8821	IRC SR9,SR9 INCREMENT COUNTER,IF C=1	00056240
0008D5	15B008D30			8823	BCT CTR,PLCPCH1	00056250
0008D6	91B1801E0			8825	IR RAR,TEMPD	00056260
				8827	# SUBROUTINE TO READ CASSETTE BYTE FROM PASLA.	00056270
				8828	#	00056280
0008D7	43B900E10			8829	PLC2 INP SR9,SR,SYNC REQUEST STATUS	00056290
0008D8	81B9801C0			8831	LR FLR,SR9	00056300
0008D9	15B0490C0			8833	BCT V,PLD5	00056310
0008DA	15B088D70			8835	BCT C,PLC2 IS DATA READY?	00056320
0008DB	43DC00810			8837	INP SRC,DR,SYNC READ WORD	00056330
0008DC	91B1801E0			8839	IR RAR,TEMPD RETURN	00056340
				8841	#	00056350
				8842	# PARITY CHECK ERROR	00056360
				8843	#	00056370
0008DD	63B380040			8844	CHKPER LI IR,X'04' SELECT REGISTER FIVE	00056380
0008DE	83B980090			8846	LR YS,HAR LOAD 5 WITH MAR	00056390
0008DF	25B000790			8848	B WAIT	00056400
				8851	#	00056420
				8852	#	00056430
				8853	# THIS ROUTINE SERVICES TWO DISKS, WHICH, ALONG WITH THEIR CON-	00056440
				8854	# TROLLERS, ARE LINKED TO THE 1116 THRU TWO CHANNELS OF A CDI. THE	00056450
				8855	# DATA TRANSFER IS DMA. THE DISK IS ASSUMED TO BE SET AT IT'S LOAD	00056460
				8856	# POINT.	00056470
				8857	#	00056480
				8858	#	00056490
0008E0	63BE00990			8859	PLD LI SRE,X'99' LOAD ADDRESS OF FIRST DISK	00056500
0008E1	51BE00210			8861	OUT SRE,ADRS,SYNC ADDRESS DISK	00056510
0008E2	15B048E40			8863	BCT V,PLD1 UNIT NOT AVAILABLE TRY ANOTHER	00056520

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0000E3	25B000E70			0065	B H+4*H	00056530
0000E4	638E009A0			0067	PLD1 LI SRE,X'9A'	00056540
0000E5	51BE00210			0069	OUT SRE,ADRS,SYNC	00056550
0000E6	15B049CB0			0071	BCT V,NOTAV	00056560
0000E7	63B000030			0073	LI SRD,X'03'	00056570
0000E8	51B000410			0075	OUT SRD,CHD,SYNC	00056580
0000E9	43B900E10			0077	INP TEMP2,SR,SYNC	00056590
0000EA	76B909000			0079	CI TEMP2,X'00',F	00056600
0000EB	15B039200			0081	BCT GL,PLD2	00056610
0000EC	63B700D04			0083	LI LOC,X'D0',SP=ZERO	00056620
0000ED	62B710024			0085	AI LOC,X'02',MOD=SWAP,SP=ZERO	00056630
0000EE	63B280000			0087	LI MDR,X'00'	00056640
0000EF	C2B48C004			0089	AR MAR,X0002,MC=MHP,SP=ZERO	00056650
0000F0	63B810010			0091	LI SRB,X'01',MOD=SWAP	00056660
0000F1	62B800600			0093	AI SRB,X'60'	00056670
0000F2	81B880040			0095	LR MDR,SRB	00056680
0000F3	C2B48C004			0097	AR MAR,X0002,MC=MHP,SP=ZERO	00056690
0000F4	63B280040			0099	LI MDR,X'04'	00056700
0000F5	C2B48C004			0901	AR MAR,X0002,MC=MHP,SP=ZERO	00056710
0000F6	63B910200			0903	LI SR9,X'20',MOD=SWAP	00056720
0000F7	62B900000			0905	AI SR9,X'00'	00056730
0000F8	81B980040			0907	LR MDR,SR9	00056740
0000F9	C2300C000			0909	CHD MC=MHP	00056750
0000FA	63BC00060			0911	LI SRC,X'06'	00056760
0000FB	51BC00410			0913	OUT SRC,CHD,SYNC	00056770
0000FC	63BA00010			0915	LI SRA,X'01'	00056780
0000FD	63B800600			0917	LI SRB,X'60'	00056790
0000FE	51BA00610			0919	OUT SRA,DA,SYNC	00056800
0000FF	51BB00610			0921	OUT SRB,DA,SYNC	00056810
				0923		00056820
				0924	" THE CDI WILL NOW PURGE THE 1116 OF THE 4 WORD PACKET AND BEGIN THE	00056830
				0925	" DATA TRANSFER ACROSS DMA. THE CONTROLLER IS NOW POLLED TO FIND OUT	00056840
				0926	" WHEN THE TRANSFER HAS BEEN COMPLETED.	00056850
				0927		00056860
000900	63B590000			0928	LI PSW,X'00',MOD=SWAP	00056870
000901	51B000410			0930	POLD OUT SRD,CHD,SYNC	00056880
000902	43B900E10			0932	INP TEMP2,SR,SYNC	00056890
000903	823C00120			0934	LR SRC,TEMP2	00056900
000904	76B909200			0936	CI TEMP2,X'20',F	00056910
000905	25B0390F0			0938	BCF GL,PLD3	00056920
000906	6E3C00070			0940	NI SRC,X'D7'	00056930
000907	76BC09000			0942	CI SRC,X'00',F	00056940
000908	15B039200			0944	BCT GL,PLD2	00056950
000909	76B909080			0946	CI TEMP2,X'08',F	00056960
00090A	25D039010			0948	BCF GL,POLD	00056970

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00090B	25B009200			8950	B PLD2	00056980
00090C	63B380060			8952	PLD5 LI IR,X'06'	00056990
00090D	81B980120			8954	LR YS,TEMP2	00057000
00090E	25B000790			8956	B WAIT	00057010
00090F	63BF00FF0			8958	PLD3 LI SRF,X'FF'	00057020
000910	62BF20FF0			8960	AI SRF,X'FF',MOD=INSB	00057030
000911	63B700D04			8962	LI LOC,X'00',SP=ZERO	00057040
000912	62B710024			8964	AI LOC,X'02',MOD=SWAP,SP=ZERO	00057050
000913	63B910060			8966	LI TEMP2,X'06',MOD=SWAP	00057060
000914	62B900D00			8968	AI TEMP2,X'00'	00057070
000915	C23006000			8970	PLD4 CHD MC=MRO	00057080
000916	8F3F00050			8972	XR SRF,MOR	00057090
000917	82B480084			8974	AR MAR,X0002,SP=ZERO	00057100
000918	96B909090			8976	CR TEMP2,MAR,F	00057110
000919	15B029150			8978	BCT G,PLD4	00057120
00091A	76BF09000			8980	PLD6 CI SRF,X'00',F	00057130
00091B	15B039200			8982	BCT GL,PLD2	00057140
00091C	63B700004			8984	LI LOC,X'00',SP=ZERO	00057150
00091D	81BE80040			8986	LR MOR,SRE	00057160
00091E	C2300C000			8988	CHD MC=MWP	00057170
00091F	25B008CB0			8990	B PLC4	00057180
				8992	#	00057190
				8993	# THIS ROUTINE IS TO CHECK ADDRESS OF DISK. IF 99 TRY TO LOAD FROM	00057200
				8994	# DISK TWO 9A.	00057210
				8995	#	00057220
000920	76BE09990			8996	PLD2 CI SRE,X'99',F	00057230
000921	25B038E40			8998	BCF GL,PLD1	00057240
000922	76BC09200			9000	CI SRC,X'20',F	00057250
000923	15B0390C0			9002	BCT GL,PLD5	00057260
000924	25B009250			9004	B CHKERR	00057270
				9006	#	00057280
				9007	#	00057290
				9008	# THIS SUBROUTINE IS THE REGISTER DUMP ROUTINE FOR ANY CHECKSUM	00057300
				9009	# ERRORS. ALL ERRORS ARE FOUND IN REGISTER SEVEN.	00057310
				9010	#	00057320
000925	63B380070			9011	CHKERR LI IR,X'07'	00057330
000926	81BF80120			9013	LR YS,SRF	00057340
000927	25B000790			9015	B WAIT	00057350

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				9018 #		00057370
				9019 #		00057380
				9020 #	THIS ROUTINE IS USED FOR ALL CCIU PROGRAM LOADS. THE POINT OF ENTRY	00057390
				9021 #	DEPENDS UPON THE CCIU WHICH REQUESTED THE PROGRAM LOAD. TRANSFER	00057400
				9022 #	OF DATA IS ACROSS DMA.	00057410
				9023 #		00057420
				9024 #		00057430
000920	638E00300			9025 PLCCIU0	LI SRE,X'30'	00057440
000929	638F00320			9027	LI SRF,X'32'	00057450
00092A	638D00330			9029	LI SRD,X'33'	00057460
00092B	25B009330			9031	B LCCIU	00057470
00092C	638E00340			9033 PLCCIU1	LI SRE,X'34'	00057480
00092D	638F00360			9035	LI SRF,X'36'	00057490
00092E	638D00370			9037	LI SRD,X'37'	00057500
00092F	25B009330			9039	B LCCIU	00057510
000930	638E00380			9041 PLCCIU2	LI SRE,X'38'	00057520
000931	638F003A0			9043	LI SRF,X'3A'	00057530
000932	638D003B0			9045	LI SRD,X'3B'	00057540
000933	518E00210			9047 LCCIU	OUT SRE,ADRS,SYNC	00057550
000934	15D049C80			9049	BCT V,NOTAV	00057560
000935	638B00030			9051 LCCIU3	LI SRB,X'03'	00057570
000936	518B00410			9053	OUT SRB,CMD,SYNC	00057580
000937	43B900E10			9055	INP SR9,SR,SYNC	00057590
000938	823B00120			9057	LR SRB,SR9	00057600
				9059	LR SRB,SRB,MOD=EXT2	00057610
000939	83AB60160			9060	#,WARNING - INTERNAL TO INTERNAL WITH MOD	
00093A	818B801C0			9062	LR FLR,SRB	00057620
00093B	15B028030			9064	BCT G,ENRPAI	00057630
00093C	8189801C0			9066	LR FLR,SR9	00057640
00093D	25B089350			9068	BCF C,LCCIU3	00057650
00093E	43B290810			9070	INP MDR,DR,SYNC,MOD=SHAP	00057660
00093F	43B900810			9072	INP TEMP2,DR,SYNC	00057670
000940	8EB980040			9074	OR MDR,TEMP2	00057680
000941	638900770			9076	LI SR9,X'77'	00057690
000942	51B900210			9078	OUT SR9,ADRS,SYNC	00057700
000943	638800040			9080	LI SR8,X'04'	00057710
000944	51B800410			9082	OUT SR8,CMD,SYNC	00057720
000945	03B1083A0			9084	BLK CHINTR,TEMPYD	00057730
000946	63B480024			9086	LI MAR,X'02',SP=ZERO	00057740
000947	C2B48C084			9088	AR MAR,X0002,MC=MIP,SP=ZERO	00057750
000948	63B280010			9090	LI MDR,X'01'	00057760
000949	C2B48C084			9092	AR MAR,X0002,MC=MIP,SP=ZERO	00057770
00094A	63B280070			9094	LI MDR,X'07'	00057780
00094B	C2B48C084			9096	AR MAR,X0002,MC=MIP,SP=ZERO	00057790
00094C	81B8801C0			9098	LR FLR,SRB	00057800

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
00094D	15B049520			9100	BCT V,LCCIU1	00057810
00094E	638B10200			9102	LI SRB,X'20',MOD=SWAP	00057820
00094F	628B00050			9104	AI SRB,X'05'	00057830
000950	818B80040			9106	LR HDR,SRB	00057840
000951	25B009550			9108	B LCCIU2	00057850
000952	638B10600			9110	LCCIU1 LI SRB,X'60',MOD=SWAP	00057860
000953	628B00050			9112	AI SRB,X'05'	00057870
000954	818B80040			9114	LR HDR,SRB	00057880
000955	C2300C000			9116	LCCIU2 CMD MC=MBP	00057890
				9119	"	00057910
				9120	" THE FOUR WORD PACKET IS NOW LOADED INTO MEMORY. IT IS FOUND IN	00057920
				9121	" LOCATIONS 02-08. THE CCIU WILL NOW COME AND FETCH THESE WORDS AND	00057930
				9122	" USE THEM TO OBTAIN THE COMMAND PACKET IN THE 5110.	00057940
				9123	"	00057950
000956	51BF00210			9124	OUT SRF,ADDRS,SYNC	00057960
000957	638B00060			9126	LI SRB,X'06'	00057970
000958	518B00410			9128	OUT SRB,CMD,SYNC	00057980
000959	63B900000			9130	LI SR9,X'00'	00057990
00095A	51B900610			9132	OUT SR9,DA,SYNC	00058000
00095B	638B00010			9134	LI SRB,X'01'	00058010
00095C	51BB00610			9136	OUT SRB,DA,SYNC	00058020
				9138	"	00058030
				9139	" THE DATA TRANSFERS TAKE PLACE ON THE DMA, SO THE PROCESSOR CAN ONLY	00058040
				9140	" POLL THE CCIU FOR A DMA TRANSFER FINISHED SIGNAL	00058050
				9141	"	00058060
00095D	638C00030			9142	LI SRC,X'03'	00058070
00095E	03B1097B0			9144	BLK BIZE,TEMPYD	00058080
00095F	76B909010			9146	CI TEMP2,X'01',F	00058090
000960	15B0390C0			9148	BCT GL,PLD5	00058100
				9150	"	00058110
				9151	" SEND DMA TRANSFER COMMAND TO CCIU TO BEGIN LOADING OF THE 1116.	00058120
				9152	" ALSO, SEND DATA ADDRESS 508 SO THE CCIU KNOWS WHERE THE TRANSFER 4	00058130
				9153	" WORD BLOCK IS, IN THE 1116.	00058140
				9154	"	00058150
000961	518B00410			9155	OUT SRB,CMD,SYNC	00058160
000962	63B900000			9157	LI SR9,X'00'	00058170
000963	51B900610			9159	OUT SR9,DA,SYNC	00058180
000964	63BB00010			9161	LI SRB,X'01'	00058190
000965	51BB00610			9163	OUT SRB,DA,SYNC	00058200
				9165	"	00058210
				9166	" 1116 MUST NOW WAIT FOR DMA TRANSFER TO END. WHEN THIS OCCURS THE	00058220
				9167	" CCIU WILL SEND IT'S STATUS WITH A NOT BUSY. BEGIN EXECUTION AT	00058230
				9168	" LOCATION SPECIFIED IN COMMAND PACKET WORD 6.	00058240
				9169	"	00058250
000966	03B1097B0			9170	BLK BIZE,TEMPYD	00058260

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000967	63B4000E4			9172	LI MAR,X'0E',SP=ZERO	00050270
000968	C23006000			9174	CHD MC=MRO	00050280
000969	83B800050			9176	LR SRB,MOR	00050290
00096A	6E38003F0			9178	NI SRB,X'3F'	00050300
00096B	51B000210			9180	OUT SRD,ADRS,SYNC	00050310
00096C	51B800410			9182	OUT SRB,CHD,SYNC	00050320
00096D	63B800000			9184	LI SRB,X'00'	00050330
00096E	51B800610			9186	OUT SRB,DA,SYNC	00050340
00096F	51B900610			9188	OUT TEMP2,DA,SYNC	00050350
000970	76B900010			9190	CI TEMP2,X'01',F	00050360
000971	25B039740			9192	BCF GL,PLCIUOK	00050370
000972	63B380020			9194	LI IR,X'02'	00050380
000973	81B980120			9196	LR YS,TEMP2	00050390
000974	63B700004			9198	PLCIUOK LI LOC,X'00',SP=ZERO	00050400
				9200	LR SRA,SRA,MOD=SHAP	00050410
000975	83AA10140			9201	M,WARNING - INTERNAL TO INTERNAL WITH MOD	
000976	81BA80040			9203	LR MOR,SRA	00050420
000977	C2300C000			9205	CHD MC=MMP	00050430
000978	63B680000			9207	LI EXT,X'00'	00050440
000979	63B7000A4			9209	LI LOC,X'0A',SP=ZERO	00050450
00097A	25B0003F0			9211	B LPSW	00050460
				9213	M	00050470
				9214	M POLL DEVICE WHEN READY FOR NEXT TRANSFER. DEVICE HAS BEEN ADDRESSED	00050480
				9215	M AND THAT ADDRESS IS IN SRF.	00050490
				9216	M	00050500
00097B	51BC00410			9217	BIZE OUT SRC,CHD,SYNC	00050510
00097C	43B900E10			9219	INP TEMP2,SR,SYNC	00050520
00097D	81B9801C0			9221	LR FLR,TEMP2	00050530
00097E	15B0E9800			9223	BCT CVG,CUIRET	00050540
00097F	25B0197B0			9225	BCF L,BIZE	00050550
000980	91B1801E0			9227	CUIRET IR RAR,TEMPYD	00050560

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				9231	"	00058590
				9232	"	00058600
				9233	" THIS ROUTINE SERVICES THE FLOPPY DISC WHEN IT REQUESTS A PROGRAM LOAD	00058610
				9234	" OF THE 1116. THIS ROUTINE ASSUMES THAT THE FLOPPY DISC IS SET	00058620
				9235	" AT THE LOAD POINT. DATA TRANSFER IS ACROSS THE I/O BUS.	00058630
				9236	" THE ENTRY POINT IS DETERMINED BY THE STATE OF THE PASLA	00058640
				9237	" INTERFACE CONNECTED TO THE FLOPPY DISC.	00058650
				9238	"	00058660
				9239	"	00058670
000981	638E00B80			9240	PLFD LI SRE,X'B8'	00058680
000982	518E00210			9242	OUT SRE,ADRS,SYNC ADDRESS READ SIDE OF PASLA	00058690
000983	15B049CB0			9244	BCT V,NOTAV GO TO WAIT STATE	00058700
000984	638C00A90			9246	LI SRC,X'A9'	00058710
000985	518C00410			9248	OUT SRC,CHD,SYNC PUT PASLA IN READ MODE	00058720
000986	638900740			9250	LI SR9,X'74'	00058730
000987	518900410			9252	OUT SR9,CHD,SYNC ODD PARITY, 0 BIT, 1 STOP BIT	00058740
000988	43B280010			9254	INP MDR,DR,SYNC DUMMY READ	00058750
000989	43B900E10			9256	INP TEMP2,SR,SYNC CHECK FOR DSR ON	00058760
00098A	81B9801C0			9258	LR FLR,TEMP2	00058770
00098B	15B0490C0			9260	BCT V,PLD5	00058780
00098C	638C00B90			9262	LI SRC,X'B9'	00058790
00098D	518C00210			9264	OUT SRC,ADRS,SYNC ADDRESS WRITE SIDE OF PASLA	00058800
00098E	638900AB0			9266	LI SR9,X'AB'	00058810
00098F	518900410			9268	OUT SR9,CHD,SYNC PUT PASLA IN WRITE MODE	00058820
000990	03B108C50			9270	BLK PASLAB,TEMPYD	00058830
000991	63B000030			9272	LI SRD,X'03'	00058840
000992	63B900010			9274	LI SR9,X'01'	00058850
000993	51B000610			9276	OUT SRD,DA,SYNC (03)H ETX CHARACTER	00058860
000994	03B108C50			9278	BLK PASLAB,TEMPYD	00058870
000995	51B900610			9280	OUT SR9,DA,SYNC (01)H SOH CHARACTER	00058880
000996	63B900530			9282	LI SR9,X'53'	00058890
000997	03B108C50			9284	BLK PASLAB,TEMPYD	00058900
000998	51B900610			9286	OUT SR9,DA,SYNC S	00058910
000999	63B900200			9288	LI SR9,X'20'	00058920
00099A	03B108C50			9290	BLK PASLAB,TEMPYD	00058930
00099B	51B900610			9292	OUT SR9,DA,SYNC SPACE	00058940
00099C	63BA005A0			9294	LI SRA,X'5A'	00058950
00099D	03B108C50			9296	BLK PASLAB,TEMPYD	00058960
00099E	51BA00610			9298	OUT SRA,DA,SYNC Z	00058970
00099F	63B900450			9300	LI SR9,X'45'	00058980
0009A0	03B108C50			9302	BLK PASLAB,TEMPYD	00058990
0009A1	51B900610			9304	OUT SR9,DA,SYNC E	00059000
0009A2	03B108C50			9306	BLK PASLAB,TEMPYD	00059010
0009A3	51BA00610			9308	OUT SRA,DA,SYNC Z	00059020
0009A4	03B108C50			9310	BLK PASLAB,TEMPYD	00059030

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
0009A5	63B9003F0			9312	LI SR9,X'3F'	00059040
0009A6	51B900610			9314	OUT SR9,DA,SYNC	00059050
0009A7	03B108C50			9316	BLK PASLAB,TEMPYD	00059060
0009A8	51B900610			9318	OUT SR9,DA,SYNC	00059070
0009A9	03B108C50			9320	BLK PASLAB,TEMPYD	00059080
0009AA	51B900610			9322	OUT SR9,DA,SYNC	00059090
0009AB	03B108C50			9324	BLK PASLAB,TEMPYD	00059100
0009AC	51B000610			9326	OUT SRD,DA,SYNC (03)H ETX CHARACTER	00059110
				9328		00059120
				9329	DATA WILL BE LOADED INTO THE COMPUTER FROM FLOPPY DISK, ONE BYTE	00059130
				9330	AT A TIME.	00059140
				9331		00059150
0009AD	63B700D04			9332	LI LOC,X'D0',SP=ZERO SET UP START ADDRESS	00059160
0009AE	62B710024			9334	AI LOC,X'02',MOD=SWAP,SP=ZERO TO 200	00059170
0009AF	63BA10060			9336	LI SRA,X'06',MOD=SWAP SET UP END ADDRESS	00059180
0009B0	62BA00CE0			9338	AI SRA,X'CE'	00059190
0009B1	63BF00FF0			9340	LI SRF,X'FF'	00059200
0009B2	62BF20FF0			9342	AI SRF,X'FF',MOD=INSB PRESET CHECKSUM REG.	00059210
0009B3	51BE00210			9344	OUT SRE,ADRS,SYNC ADDRESS READ SIDE OF PASLA	00059220
0009B4	03B108D70			9346	PLFD1 BLK PLC2,TEMPYD CHECK PASLA IS BUSY	00059230
0009B5	76BC09010			9348	CI SRC,X'01',F CHECK FOR SOH CHARACTER	00059240
0009B6	15B039B40			9350	BCT GL,PLFD1 IF NOT, KEEP LOOKING	00059250
0009B7	03B108D70			9352	PLFD2 BLK PLC2,TEMPYD	00059260
0009B8	823B00180			9354	LR SRB,SRB HOLD FIRST BYTE IN TEMP. REG.	00059270
0009B9	03B108D70			9356	BLK PLC2,TEMPYD	00059280
				9358	LR SRB,SRB,MOD=SWAP	00059290
0009BA	83AB10160			9359	WARNING - INTERNAL TO INTERNAL WITH MOD	
0009BB	80BB00180			9361	AR SRB,SRB COMBINE 2ND BYTE TO FIRST	00059300
0009BC	8D3F00160			9363	XR SRF,SRB DO XOR TO CHECKSUM	00059310
0009BD	81BB00040			9365	LR HDR,SRB LOAD HDR WITH 16 BIT CHARACTER	00059320
0009BE	C2B48A084			9367	AR MAR,X0002,MC=HM,SP=ZERO INCREMENT MAR AND HIRTE	00059330
0009BF	96BA09090			9369	CR SRA,MAR,F 511 WORDS BEEN READ	00059340
0009C0	15B029B70			9371	BCT G,PLFD2 IF YES, STOP READING	00059350
0009C1	76BF09000			9373	CI SRF,X'00',F HAS CHECKSUM OK	00059360
0009C2	15B039250			9375	BCT GL,CHKERR GO TO ERROR IF BAD TRANS.	00059370
0009C3	03B108D70			9377	BLK PLC2,TEMPYD	00059380
0009C4	94BD09180			9379	CR SRD,SRB,F CHECK FOR ETX CHARACTER	00059390
0009C5	15B039C80			9381	BCT GL,SRB03 IF NO, GO TO WAIT	00059400
0009C6	03B108D70			9383	BLK PLC2,TEMPYD DUMMY READ ETX CHARACTER	00059410
0009C7	25B008CB0			9385	B PLC4 GO TO EXECUTE INST.	00059420
0009C8	63B380030			9387	SRC03 LI IR,X'03' LOAD EXTERNAL REGISTER	00059430
0009C9	81BC00120			9389	LR YS,SRB 3 WITH BAD WORD	00059440
0009CA	25B000790			9391	B WAIT	00059450
				9393		00059460
				9394	UNIT ADDRESSED NOT AVAILABLE. GO TO WAIT.	00059470

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LOC OBJECT CODE ADDR1 ADDR2 STMT SOURCE STATEMENT

17 MAY 79

0009CB 823A001C0		9395	M					00059480
0009CC 25B008260		9396	NOTAV	LR	SRA,SRE	TRANSFER STATUS TO SRA REG.		00059490
		9398		B	SRC01	GO TO IIAIT		00059500
		9400		ALIGN	512			00059510
0009CD FFFFFFFF	04E68	9401	A1025	EQU	M-START			
005000	04FF8	9403		ORG	M-W			00059520
0009FF 25B008410		9404	PRPL	B	RPL416			00059530
		9406	N657	ANOP				00059540

MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J33"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
				9408 N		00059560
				9409 NNN	DECODE ROM SPECIFICATIONS	00059570
				9410 N		00059580
				9412 N		00059600
		001E0		9413 \$BP15	EQU \$BEGIN+15NNNN	00059610
				9414 N		00059620
000A00	105900000			9415	DROM RR,ILLEG	00059630
000A01	205900000			9417+N		
000A02	F1A900000			9419	DROM RR,BALR	00059640
000A03	F1A900000			9421+N		
000A04	F17E00000			9423	DROM RR,BTCR	00059650
000A05	F17E00000			9425+N		
000A06	F19000000			9427	DROM RR,BFCR	00059660
000A07	F19000000			9429+N		
000A08	F15200000			9431	DROM RR,NIR	00059670
000A09	F15200000			9433+N		
000A0A	F14700000			9435	DROM RR,CLHR	00059680
000A0B	F14700000			9437+N		
000A0C	F15600000			9439	DROM RR,CHR	00059690
000A0D	F15600000			9441+N		
000A0E	F15A00000			9443	DROM RR,XHR	00059700
000A0F	F15A00000			9445+N		
000A10	F12C00000			9447	DROM RR,LHR	00059710
000A11	F12C00000			9449+N		
000A12	F14B00000			9451	DROM RR,CHR	00059720
000A13	F14B00000			9453+N		
000A14	F13A00000			9455	DROM RR,AHR	00059730
000A15	F13A00000			9457+N		
000A16	F14200000			9459	DROM RR,SHR	00059740
000A17	F14200000			9461+N		
000A18	F1F000000			9463	DROM RR,MHR	00059750
000A19	F1F000000			9465+N		
000A1A	F20A00000			9467	DROM RR,DHR	00059760
000A1B	F20A00000			9469+N		
000A1C	F13900000			9471	DROM RR,ACHR	00059770
000A1D	F13900000			9473+N		
000A1E	F14100000			9475	DROM RR,SCHR	00059780
000A1F	F14100000			9477+N		
000A20	F34900000			9479	DROM RR,LCNHR,OPT=&XISAUG1	00059790
000A21	F34900000			9481+N		
000A22	F34F00000			9483	DROM RR,LAVR,OPT=&XISAUG1	00059800
000A23	F34F00000			9485+N		
000A24	F34500000			9487	DROM RR,LCHR,OPT=&XISAUG1	00059810
000A25	F34500000			9489+N		

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000A26	105900000			9491	DROM RR,ILLEG,DUP=2	13-14 00059820
000A27	205900000			9493+M		
000A28	105900000			9495+M		
000A29	205900000			9497+M		
000A2A	F40E00000			9499	DROM RR,CLDPR,OPT=&XDP	15 00059830
000A2B	F40E00000			9501+M		
000A2C	105900000			9503	DROM RR,ILLEG,DUP=2	16-17 00059840
000A2D	205900000			9505+M		
000A2E	105900000			9507+M		
000A2F	205900000			9509+M		
000A30	F40000000			9511	DROM RR,LDPR,OPT=&XDP	18 00059850
000A31	F40000000			9513+M		
000A32	F41800000			9515	DROM RR,CDPR,OPT=&XDP	19 00059860
000A33	F41800000			9517+M		
000A34	F42A00000			9519	DROM RR,ADPR,OPT=&XDP	1A 00059870
000A35	F42A00000			9521+M		
000A36	F43600000			9523	DROM RR,SDPR,OPT=&XDP	1B 00059880
000A37	F43600000			9525+M		
000A38	F44200000			9527	DROM RR,MDPR,OPT=&XDP	1C 00059890
000A39	F44200000			9529+M		
000A3A	F45E00000			9531	DROM RR,DDPR,OPT=&XDP	1D 00059900
000A3B	F45E00000			9533+M		
000A3C	105900000			9535	DROM RR,ILLEG,DUP=2	1E-1F 00059910
000A3D	205900000			9537+M		
000A3E	105900000			9539+M		
000A3F	205900000			9541+M		
000A40	F17200000			9543	DROM RR,BTBS	20 00059920
000A41	F17200000			9545+M		
000A42	F17800000			9547	DROM RR,BTFS	21 00059930
000A43	F17800000			9549+M		
000A44	F18800000			9551	DROM RR,BFBS	22 00059940
000A45	F18800000			9553+M		
000A46	F18C00000			9555	DROM RR,BFFS	23 00059950
000A47	F18C00000			9557+M		
000A48	F12800000			9559	DROM RR,LIS	24 00059960
000A49	F12800000			9561+M		
000A4A	F12A00000			9563	DROM RR,LCS	25 00059970
000A4B	F12A00000			9565+M		
000A4C	F13400000			9567	DROM RR,AIS	26 00059980
000A4D	F13400000			9569+M		
000A4E	F13F00000			9571	DROM RR,SIS	27 00059990
000A4F	F13F00000			9573+M		
000A50	105900000			9575	DROM RR,LER,OPT=&XFP	28 00060000
000A51	205900000			9577+M		
000A52	105900000			9579	DROM RR,CER,OPT=&XFP	29 00060010

DECODE ROM SPECIFICATIONS

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
000A53	205900000			9581+M		00060020
000A54	105900000			9583	DROM RR,AER,OPT=AXFP	2A
000A55	205900000			9585+M		00060030
000A56	105900000			9587	DROM RR,SER,OPT=AXFP	2B
000A57	205900000			9589+M		00060040
000A58	105900000			9591	DROM RR,MER,OPT=AXFP	2C
000A59	205900000			9593+M		00060050
000A5A	105900000			9595	DROM RR,DER,OPT=AXFP	2D
000A5B	205900000			9597+M		00060060
000A5C	F32000000			9599	DROM RR,EPOR,OPT=AXBANK	2E
000A5D	F32000000			9601+M		00060070
000A5E	F33300000			9603	DROM RR,EPPR,OPT=AXBANK	2F
000A5F	F33300000			9605+M		00060080
000A60	105900000			9607	DROM RR,ILLEG,DUP=8	30-37
000A61	205900000			9609+M		
000A62	105900000			9611+M		
000A63	205900000			9613+M		
000A64	105900000			9615+M		
000A65	205900000			9617+M		
000A66	105900000			9619+M		
000A67	205900000			9621+M		
000A68	105900000			9623+M		
000A69	205900000			9625+M		
000A6A	105900000			9627+M		
000A6B	205900000			9629+M		
000A6C	105900000			9631+M		
000A6D	205900000			9633+M		
000A6E	105900000			9635+M		
000A6F	205900000			9637+M		00060090
000A70	F65700000			9639	DROM RR,LFR,OPT=AXFP3W	38
000A71	F65700000			9641+M		00060100
000A72	F65700000			9643	DROM RR,CFR,OPT=AXFP3W	39
000A73	F65700000			9645+M		00060110
000A74	F65700000			9647	DROM RR,AFR,OPT=AXFP3W	3A
000A75	F65700000			9649+M		00060120
000A76	F65100000			9651	DROM RR,SFR,OPT=AXFP3W	3B
000A77	F65100000			9653+M		00060130
000A78	F65700000			9655	DROM RR,MFR,OPT=AXFP3W	3C
000A79	F65700000			9657+M		00060140
000A7A	F65700000			9659	DROM RR,DFR,OPT=AXFP3W	3D
000A7B	F65700000			9661+M		00060150
000A7C	105900000			9663	DROM RR,ILLEG,DUP=2	3E-3F
000A7D	205900000			9665+M		
000A7E	105900000			9667+M		
000A7F	205900000			9669+M		

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MICROCODE, MHP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J93"

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DECODE ROM SPECIFICATIONS

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000A80	313000000			9671	DROM RXAD,STH	00060160
000A81	413000000			9673+H		
000A82	11AA00000			9675	DROM RI,BAL	00060170
000A83	21AA00000			9677+H		
000A84	118300000			9679	DROM RI,BTC	00060180
000A85	218300000			9681+H		
000A86	119500000			9683	DROM RI,BFC	00060190
000A87	219500000			9685+H		
000A88	715400000			9687	DROM RXHM,NH	00060200
000A89	815400000			9689+H		
000A8A	714900000			9691	DROM RXHM,CLH	00060210
000A8B	814900000			9693+H		
000A8C	715800000			9695	DROM RXHM,OH	00060220
000A8D	815800000			9697+H		
000A8E	715C00000			9699	DROM RXHM,XH	00060230
000A8F	815C00000			9701+H		
000A90	712E00000			9703	DROM RXHM,LH	00060240
000A91	812E00000			9705+H		
000A92	714C00000			9707	DROM RXHM,CH	00060250
000A93	814C00000			9709+H		
000A94	713D00000			9711	DROM RXHM,AH	00060260
000A95	813D00000			9713+H		
000A96	714500000			9715	DROM RXHM,SH	00060270
000A97	814500000			9717+H		
000A98	71F100000			9719	DROM RXHM,PH	00060280
000A99	81F100000			9721+H		
000A9A	720B00000			9723	DROM RXHM,DH	00060290
000A9B	820B00000			9725+H		
000A9C	713C00000			9727	DROM RXHM,ACH	00060300
000A9D	813C00000			9729+H		
000A9E	714400000			9731	DROM RXHM,SCH	00060310
000A9F	814400000			9733+H		
000AA0	940900000			9735	DROM RXDP,STOP,OPT=RXDP	00060320
000AA1	A40900000			9737+H		
000AA2	734700000			9739	DROM RXHM,LCH,OPT=RXISAUG1	00060330
000AA3	834700000			9741+H		
000AA4	734D00000			9743	DROM RXHM,LAV,OPT=RXISAUG1	00060340
000AA5	834D00000			9745+H		
000AA6	734300000			9747	DROM RXHM,LCH,OPT=RXISAUG1	00060350
000AA7	834300000			9749+H		
000AA8	105700000			9751	DROM RI,ILLEG	00060360
000AA9	205700000			9753+H		
000AAA	941200000			9755	DROM RXDP,CLDP,OPT=RXDP	00060370
000AAB	A41200000			9757+H		
000AAC	105700000			9759	DROM RS,ILLEG,DUP=2	00060380

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DECODE ROM SPECIFICATIONS

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
000AAD	205700000			9761+H		
000AAE	105700000			9763+H		
000AAF	205700000			9765+H		
000AB0	940400000			9767	DROM RXDP,LDP,OPT=1XDP	58 00060390
000AB1	A40400000			9769+H		
000AB2	342100000			9771	DROM RXAD,CDP,OPT=1XDP	59 00060400
000AB3	442100000			9773+H		
000AB4	942F00000			9775	DROM RXDP,ADP,OPT=1XDP	5A 00060410
000AB5	A42F00000			9777+H		
000AB6	943B00000			9779	DROM RXDP,SOP,OPT=1XDP	5B 00060420
000AB7	A43B00000			9781+H		
000AB8	944700000			9783	DROM RXDP,HDP,OPT=1XDP	5C 00060430
000AB9	A44700000			9785+H		
000ABA	946300000			9787	DROM RXDP,DDP,OPT=1XDP	5D 00060440
000ABB	A46300000			9789+H		
000ABC	105700000			9791	DROM RI,ILLEG,DUP=2	5E-5F 00060450
000ABD	205700000			9793+H		
000ABE	105700000			9795+H		
000ABF	205700000			9797+H		
000AC0	105700000			9799	DROM RXAD,STE,OPT=1XFP	60 00060460
000AC1	205700000			9801+H		
000AC2	513600000			9803	DROM RXOP,AHM	61 00060470
000AC3	613600000			9805+H		
000AC4	105700000			9807	DROM RI,ILLEG	62 00060480
000AC5	205700000			9809+H		
000AC6	105700000			9811	DROM RI,ILLEG	63 00060490
000AC7	205700000			9813+H		
000AC8	52E900000			9815	DROM RXOP,ATBL	64 00060500
000AC9	62E900000			9817+H		
000ACA	52E900000			9819	DROM RXOP,ATBL	65 00060510
000ACB	62E900000			9821+H		
000ACC	530000000			9823	DROM RXOP,RTBL	66 00060520
000ACD	630000000			9825+H		
000ACE	530000000			9827	DROM RXOP,RTBL	67 00060530
000ACF	630000000			9829+H		
000AD0	105700000			9831	DROM RXOP,LE,OPT=1XFP	68 00060540
000AD1	205700000			9833+H		
000AD2	105700000			9835	DROM RXOP,CE,OPT=1XFP	69 00060550
000AD3	205700000			9837+H		
000AD4	105700000			9839	DROM RXOP,AE,OPT=1XFP	6A 00060560
000AD5	205700000			9841+H		
000AD6	105700000			9843	DROM RXOP,SE,OPT=1XFP	6B 00060570
000AD7	205700000			9845+H		
000AD8	105700000			9847	DROM RXOP,ME,OPT=1XFP	6C 00060580
000AD9	205700000			9849+H		

MICROCODE, IMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J55"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000ADA	105700000			9851	DROM RXOP,DE,OPT=AXFP 6D	00060590
000ADB	205700000			9853+H		
000ADC	105700000			9855	DROM RI,ILLEG,DUP=2 6E-6F	00060600
000ADD	205700000			9857+H		
000ADE	105700000			9859+H		
000ADF	205700000			9861+H		
000AEO	364200000			9863	DROM RXAD,STF,OPT=AXFP3H 70	00060610
000AE1	464200000			9865+H		
000AE2	105700000			9867	DROM RI,ILLEG,DUP=3 71-73	00060620
000AE3	205700000			9869+H		
000AE4	105700000			9871+H		
000AE5	205700000			9873+H		
000AE6	105700000			9875+H		
000AE7	205700000			9877+H		
000AE8	320900000			9879	DROM RXAD,LH0,OPT=AXBANK 74	00060630
000AE9	420900000			9881+H		
000AEA	320000000			9883	DROM RXAD,LH1,OPT=AXBANK 75	00060640
000AEB	420000000			9885+H		
000AEC	32E100000			9887	DROM RXAD,LH2,OPT=AXBANK 76	00060650
000AED	42E100000			9889+H		
000AEE	32E500000			9891	DROM RXAD,LH3,OPT=AXBANK 77	00060660
000AEF	42E500000			9893+H		
000AF0	367B00000			9895	DROM RXAD,LF,OPT=AXFP3H 78	00060670
000AF1	467B00000			9897+H		
000AF2	367B00000			9899	DROM RXAD,CF,OPT=AXFP3H 79	00060680
000AF3	467B00000			9901+H		
000AF4	367B00000			9903	DROM RXAD,AF,OPT=AXFP3H 7A	00060690
000AF5	467B00000			9905+H		
000AF6	365500000			9907	DROM RXAD,SF,OPT=AXFP3H 7B	00060700
000AF7	465500000			9909+H		
000AF8	367B00000			9911	DROM RXAD,HF,OPT=AXFP3H 7C	00060710
000AF9	467B00000			9913+H		
000AFA	367B00000			9915	DROM RXAD,DF,OPT=AXFP3H 7D	00060720
000AFB	467B00000			9917+H		
000AFC	105700000			9919	DROM RI,ILLEG,DUP=2 7E-7F	00060730
000AFD	205700000			9921+H		
000AFE	105700000			9923+H		
000AFF	205700000			9925+H		
000B00	105900000			9927	DROM RR,ILLEG,DUP=16 80-8F	00060740
000B01	205900000			9929+H		
000B02	105900000			9931+H		
000B03	205900000			9933+H		
000B04	105900000			9935+H		
000B05	205900000			9937+H		
000B06	105900000			9939+H		

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT
000B07	205900000			9941+M	
000B08	105900000			9943+M	
000B09	205900000			9945+M	
000B0A	105900000			9947+M	
000B0B	205900000			9949+M	
000B0C	105900000			9951+M	
000B0D	205900000			9953+M	
000B0E	105900000			9955+M	
000B0F	205900000			9957+M	
000B10	105900000			9959+M	
000B11	205900000			9961+M	
000B12	105900000			9963+M	
000B13	205900000			9965+M	
000B14	105900000			9967+M	
000B15	205900000			9969+M	
000B16	105900000			9971+M	
000B17	205900000			9973+M	
000B18	105900000			9975+M	
000B19	205900000			9977+M	
000B1A	105900000			9979+M	
000B1B	205900000			9981+M	
000B1C	105900000			9983+M	
000B1D	205900000			9985+M	
000B1E	105900000			9987+M	
000B1F	205900000			9989+M	
000B20	F1B800000			9991	DROM RR,SRHL 90 00060750
000B21	F1B800000			9993+M	
000B22	F1B800000			9995	DROM RR,SRHL 91 00060760
000B23	F1B800000			9997+M	
000B24	F16500000			9999	DROM RR,STBR 92 00060770
000B25	F16500000			10001+M	
000B26	F16000000			10003	DROM RR,LBR 93 00060780
000B27	F16000000			10005+M	
000B28	F16C00000			10007	DROM RR,EXBR 94 00060790
000B29	F16C00000			10009+M	
000B2A	F2A600000			10011	DROM RR,EPSR,PRIV 95 00060800
000B2B	F05900000			10013+M	
000B2C	F28200000			10015	DROM RR,RBR,PRIV 96 00060810
000B2D	F05900000			10017+M	
000B2E	F28200000			10019	DROM RR,RBR,PRIV 97 00060820
000B2F	F05900000			10021+M	
000B30	F26100000			10023	DROM RR,WR,PRIV 98 00060830
000B31	F05900000			10025+M	
000B32	F24800000			10027	DROM RR,RHR,PRIV 99 00060840
000B33	F05900000			10029+M	

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000B34	F24400000			10031	DROM RR,MDR,PRIV 9A	00060850
000B35	F05900000			10033+H		
000B36	F20700000			10035	DROM RR,RDR,PRIV 9B	00060860
000B37	F05900000			10037+H		
000B38	F1F900000			10039	DROM RR,MHR 9C	00060870
000B39	F1F900000			10041+H		
000B3A	F23600000			10043	DROM RR,SSR,PRIV 9D	00060880
000B3B	F05900000			10045+H		
000B3C	F20000000			10047	DROM RR,OCR,PRIV 9E	00060890
000B3D	F05900000			10049+H		
000B3E	F23500000			10051	DROM RR,AIR,PRIV 9F	00060900
000B3F	F05900000			10053+H		
000B40	105900000			10055	DROM RR,ILLEG,DUP=16 AD-AF	00060910
000B41	205900000			10057+H		
000B42	105900000			10059+H		
000B43	205900000			10061+H		
000B44	105900000			10063+H		
000B45	205900000			10065+H		
000B46	105900000			10067+H		
000B47	205900000			10069+H		
000B48	105900000			10071+H		
000B49	205900000			10073+H		
000B4A	105900000			10075+H		
000B4B	205900000			10077+H		
000B4C	105900000			10079+H		
000B4D	205900000			10081+H		
000B4E	105900000			10083+H		
000B4F	205900000			10085+H		
000B50	105900000			10087+H		
000B51	205900000			10089+H		
000B52	105900000			10091+H		
000B53	205900000			10093+H		
000B54	105900000			10095+H		
000B55	205900000			10097+H		
000B56	105900000			10099+H		
000B57	205900000			10101+H		
000B58	105900000			10103+H		
000B59	205900000			10105+H		
000B5A	105900000			10107+H		
000B5B	205900000			10109+H		
000B5C	105900000			10111+H		
000B5D	205900000			10113+H		
000B5E	105900000			10115+H		
000B5F	205900000			10117+H		
000B60	F49600000			10119	DROM RR,ECPR,OPT=4XTRIG B0	00060920

LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000B61	F49600000			10121+H		
000B62	F49B00000			10123	DROM RR,COSR,OPT=AXTRIG B1	00060930
000B63	F49B00000			10125+H		
000B64	F4B600000			10127	DROM RR,ATMR,OPT=AXTRIG B2	00060940
000B65	F4B600000			10129+H		
000B66	F4E700000			10131	DROM RR,SQDSR,OPT=AXTRIG B3	00060950
000B67	F4E700000			10133+H		
000B68	F4E700000			10135	DROM RR,ASNR,OPT=AXTRIG B4	00060960
000B69	F4E700000			10137+H		
000B6A	105900000			10139	DROM RR,ILLEG,DUP=11 B5-BF	00060970
000B6B	205900000			10141+H		
000B6C	105900000			10143+H		
000B6D	205900000			10145+H		
000B6E	105900000			10147+H		
000B6F	205900000			10149+H		
000B70	105900000			10151+H		
000B71	205900000			10153+H		
000B72	105900000			10155+H		
000B73	205900000			10157+H		
000B74	105900000			10159+H		
000B75	205900000			10161+H		
000B76	105900000			10163+H		
000B77	205900000			10165+H		
000B78	105900000			10167+H		
000B79	205900000			10169+H		
000B7A	105900000			10171+H		
000B7B	205900000			10173+H		
000B7C	105900000			10175+H		
000B7D	205900000			10177+H		
000B7E	105900000			10179+H		
000B7F	205900000			10181+H		
000B80	119A00000			10183	DROM RI,BXLH C0	00060980
000B81	219A00000			10185+H		
000B82	119A00000			10187	DROM RI,BXLH C1	00060990
000B83	219A00000			10189+H		
000B84	303F00000			10191	DROM RXAD,LPSM,PRIV C2	00061000
000B85	405000000			10193+H		
000B86	115E00000			10195	DROM RI,THI C3	00061010
000B87	215E00000			10197+H		
000B88	115400000			10199	DROM RI,NH C4	00061020
000B89	215400000			10201+H		
000B8A	114900000			10203	DROM RI,CLH C5	00061030
000B8B	214900000			10205+H		
000B8C	115800000			10207	DROM RI,OH C6	00061040
000B8D	215800000			10209+H		

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	
000BBB	605800000			10301+M		
000BBC	520300000			10303	DROM RXOP,OC,PRIV	DE 00061280
000BBD	605800000			10305+M		
000BBE	523A00000			10307	DROM RXOP,AI,PRIV	DF 00061290
000BBF	605800000			10309+M		
000BC0	105700000			10311	DROM RI,ILLEG	E0 00061300
000BC1	205700000			10313+M		
000BC2	12AA00000			10315	DROM RI,SVC	E1 00061310
000BC3	22AA00000			10317+M		
000BC4	107600000			10319	DROM RI,SINT,PRIV	E2 00061320
000BC5	205700000			10321+M		
000BC6	134000000			10323	DROM RI,RESB,PRIV,OPT=AXISAUG1	E3 00061330
000BC7	205700000			10325+M		
000BC8	133C00000			10327	DROM RI,SESB,PRIV,OPT=AXISAUG1	E4 00061340
000BC9	205700000			10329+M		
000BCA	105700000			10331	DROM RI,ILLEG	E5 00061350
000BCB	205700000			10333+M		
000BCC	160000000			10335	DROM RI,SRQL,OPT=AX64SH	E6 00061360
000BCD	260000000			10337+M		
000BCE	160C00000			10339	DROM RI,SLQL,OPT=AX64SH	E7 00061370
000BCF	260C00000			10341+M		
000BD0	161900000			10343	DROM RI,SRQA,OPT=AX64SH	E8 00061380
000BD1	261900000			10345+M		
000BD2	162C00000			10347	DROM RI,SLQA,OPT=AX64SH	E9 00061390
000BD3	262C00000			10349+M		
000BD4	11C900000			10351	DROM RI,RRL	EA 00061400
000BD5	21C900000			10353+M		
000BD6	11C300000			10355	DROM RI,RLL	EB 00061410
000BD7	21C300000			10357+M		
000BD8	11B000000			10359	DROM RI,SRL	EC 00061420
000BD9	21B000000			10361+M		
000BDA	11B200000			10363	DROM RI,SLL	ED 00061430
000BDB	21B200000			10365+M		
000BDC	11E000000			10367	DROM RI,SRA	EE 00061440
000BDD	21E000000			10369+M		
000BDE	11D000000			10371	DROM RI,SLA	EF 00061450
000BDF	21D000000			10373+M		
000BE0	105700000			10375	DROM RI,ILLEG	F0 00061460
000BE1	205700000			10377+M		
000BE2	54A000000			10379	DROM RXOP,COS,OPT=AXTRIG	F1 00061470
000BE3	64A000000			10381+M		
000BE4	54BF00000			10383	DROM RXOP,ATN,OPT=AXTRIG	F2 00061480
000BE5	64BF00000			10385+M		
000BE6	54EE00000			10387	DROM RXOP,SQDS,OPT=AXTRIG	F3 00061490
000BE7	64EE00000			10389+M		

MICROCODE, HMP-1116 PLP 1641603 REV. A CCA3 1641603,1641604,1641653 "657,0416,J53"

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LOC	OBJECT CODE	ADDR1	ADDR2	STMT	SOURCE STATEMENT	17 MAY 79
000BE8	54EE00000			10391	DROM RXOP,ASN,OPT=8XTRIG F4	00061500
000BE9	64EE00000			10393+M		
000BEA	105700000			10395	DROM RI,ILLEG,DUP=3 F5-F7	00061510
000BEB	205700000			10397+M		
000BEC	105700000			10399+M		
000BED	205700000			10401+M		
000BEE	105700000			10403+M		
000BEF	205700000			10405+M		
000BF0	32C900000			10407	DROM RXAD,STH0,OPT=8XBANK F8	00061520
000BF1	42C900000			10409+M		
000BF2	32CD00000			10411	DROM RXAD,STH1,OPT=8XBANK F9	00061530
000BF3	42CD00000			10413+M		
000BF4	32D100000			10415	DROM RXAD,STH2,OPT=8XBANK FA	00061540
000BF5	42D100000			10417+M		
000BF6	32D500000			10419	DROM RXAD,STH3,OPT=8XBANK FB	00061550
000BF7	42D500000			10421+M		
000BF8	105700000			10423	DROM RI,ILLEG,DUP=4 FC-FF	00061560
000BF9	205700000			10425+M		
000BFA	105700000			10427+M		
000BFB	205700000			10429+M		
000BFC	105700000			10431+M		
000BFD	205700000			10433+M		
000BFE	105700000			10435+M		
000BFF	205700000			10437+M		
				10439		00061570
				10441		00061590
				10442		00061600
				10444	EPILOG	00061620
006000				10445+0END1	DS OF	
006000				10446+0END	CSECT	
000C00	00000000			10447+M (2 WORDS) * WIDTH		
000C00	00000000			10449+M WIDTH		
000C01	00000009			10451+M PWIDTH		
000C01	0080000F			10453+M FILL		
				10455	END	00061630

17 MAY 79

[illegible]

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SYMBOL LENGTH,VALUE,DEFN REFERENCES

17 MAY 79

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9960 9962 9962 9964 9964 9966 9966 9968 9968 9970 9970 9972 9972 9974 9974 9976 9976 9978 9978 9980 9980 9982 9982
9984 9984 9986 9986 9988 9988 9990 9990 9992 9992 9994 9994 9996 9996 9998 9998 10000 10000 10002 10002 10004 10004
10006 10006 10008 10008 10010 10010 10012 10012 10014 10014 10016 10016 10018 10018 10020 10020 10022 10022 10024
10024 10026 10026 10028 10028 10030 10030 10032 10032 10034 10034 10036 10036 10038 10038 10040 10040 10042 10042
10044 10044 10046 10046 10048 10048 10050 10050 10052 10052 10054 10054 10056 10056 10058 10058 10060 10060 10062
10062 10064 10064 10066 10066 10068 10068 10070 10070 10072 10072 10074 10074 10076 10076 10078 10078 10080 10080
10082 10082 10084 10084 10086 10086 10088 10088 10090 10090 10092 10092 10094 10094 10096 10096 10098 10098 10100
10100 10102 10102 10104 10104 10106 10106 10108 10108 10110 10110 10112 10112 10114 10114 10116 10116 10118 10118
10120 10120 10122 10122 10124 10124 10126 10126 10128 10128 10130 10130 10132 10132 10134 10134 10136 10136 10138
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10214 10216 10216 10218 10218 10220 10220 10222 10222 10224 10224 10226 10226 10228 10228 10230 10230 10232 10232
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10272 10272 10274 10274 10276 10276 10278 10278 10280 10280 10282 10282 10284 10284 10286 10286 10288 10288 10290
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10310 10310 10312 10312 10314 10314 10316 10316 10318 10318 10320 10320 10322 10322 10324 10324 10326 10326 10328
10328 10330 10330 10332 10332 10334 10334 10336 10336 10338 10338 10340 10340 10342 10342 10344 10344 10346 10346
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10366 10368 10368 10370 10370 10372 10372 10374 10374 10376 10376 10378 10378 10380 10380 10382 10382 10384 10384
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10404 10406 10406 10408 10408 10410 10410 10412 10412 10414 10414 10416 10416 10418 10418 10420 10420 10422 10422
10424 10424 10426 10426 10428 10428 10430 10430 10432 10432 10434 10434 10436 10436 10438 10438 10440
BP15 1,1E0,9413 9420 9422 9424 9426 9428 9430 9432 9434 9436 9438 9440 9442 9444 9446 9448 9450 9452 9454 9456 9458
9460 9462 9464 9466 9468 9470 9472 9474 9476 9478 9480 9482 9484 9486 9488 9490 9500 9502 9512 9514 9516 9518 9520
9522 9524 9526 9528 9530 9532 9534 9544 9546 9548 9550 9552 9554 9556 9558 9560 9562 9564 9566 9568 9570 9572 9574
9600 9602 9604 9606 9640 9642 9644 9646 9648 9650 9652 9654 9656 9658 9660 9662 9992 9994 9996 9998 10000 10002 10004
10006 10008 10010 10012 10014 10016 10018 10020 10022 10024 10026 10028 10030 10032 10034 10036 10038 10040 10042
10044 10046 10048 10050 10052 10054 10120 10122 10124 10126 10128 10130 10132 10134 10136 10138
END 1,6000,10446 END1 4,6000,10445 10448 BA 1,A,2409 4794 4796 4835 4869 4871 4916 4931 4976 5179 5245 7441
7446 7469 7479 7505 7514 7516 7546 7595 7595 7631 7633 7756 7756 7760 7766 7781 7783 7855 7859 7861 7884 7886 7929
7980 8004 8010 8013 8017 8024 8028 8028 8102 8104 8188 8192 8196 8202 8202 8204 8206 8235 8239 8239 8245 8247 8247
8251 8253 8253 8257 8259 8259 ABORTAD 1,0,2368 2419 6992 SALARMSV 1,9,2427 7802 7962 8128
BA2 1,0,2412 5223 5241 5245 7310 7316 7330 7330 7341 7341 7347 7347 7350 7356 7366 7366 7368 7368 7374 7374 7415 7421
7469 7479 7505 7530 7532 7546 7550 7560 7560 7570 7584 7584 7625 7627 7627 7631 7633 7643 7643 7658 7658 7664 7664
7679 7685 7719 7719 7741 7758 7758 7760 7766 7781 7783 7785 7785 8245 8251 8257 BA3 1,B,2416
BCORDCTL 1,7,2465 6033 6050 6153 6162 6295 6342 6717 6864 6989 7522 7538 BCORDL 1,0,2463 6150 6365 6369 6384 6393
6404 6413 6429 6430 6450 6459 6615 6619 6632 6641 6652 6661 6677 6686 6698 6707 6719 6868 6872 6885 6894 6906 6915
6932 6941 6952 6961 6976 6984 6989 6999 7514 7520 7530 7536 7550 7568 BCORDM 1,C,2462 6160 6367 6371 6386 6395
6406 6415 6431 6440 6452 6461 6617 6621 6634 6643 6654 6663 6679 6688 6700 6721 6870 6874 6887 6896 6908 6917
6934 6943 6954 6963 6978 6986 6992 7001 7516 7522 7532 7538 7560 7570 BCORDROM 1,7,2464 6042 6044 6051 6053 6164
6166 6303 6305 6308 6390 6408 6410 6433 6435 6454 6456 6636 6638 6656 6658 6681 6683 6702 6704 6889 6891 6910 6912
6936 6938 6956 6958 BCPR 1,3,2434 3229 3319 5452 5996 5998 6000 6002 6056 6151 6340 6862

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MICROCODE, HMP-1116 PLP 1641003 REV. A CCAS 1641603,1641604,1641653 "657,0416,JSS"

HUGHES PROPRIETARY

CROSS-REFERENCE

17 MAY 79

SYMBOL LENGTH,VALUE,DEFN REFERENCES

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 5057 6056 6151 6171 6309 6340 6549 6567 6862 7054 7087 7119 7174 7364 7629 7779 8006 8198 8241 8440 8733 8816
 OD 1.5,2425 7830 7849 7859 7876 7878 7893 7970 7978 8002 8022 8032 8036 8048 8048 8066 8074 8083 8101 8237 8261 8261
 OE 1.9,2408 7443 7507 7518 7520 7524 7534 7544 7603 7619 7752 SECTR 1.6,2426 7880 8058 8095 8120 8120 8124
 OEXT 1.6,2449 2719 2729 2867 2869 2874 2878 2886 2896 2902 2907 2971 2973 2979 3008 3011 3015 3025 3046 3133 3292
 3309 3303 3412 3426 3432 3450 3454 4353 4379 4410 4667 4679 4691 4703 4720 4731 4742 4753 5109 5262 5508 7822 7901
 7903 7907 8040 8087 8107 8150 8165 8321 8457 8481 8636 8807 9208 OE2 1.C,2411 2417 7312 7385 7417 7507 7518 7534
 7536 7540 7544 7605 7619 7639 7647 7666 7677 7691 7721 7739 7752 7773 7787 OFLR 1.E,2454 2706 2729 2741 2778
 2785 2822 2869 2874 2878 2886 2896 2902 2907 2990 3011 3015 3046 3050 3062 3069 3292 3309 3391 3397 3412 3426 3432
 3450 3454 3579 3590 3609 3619 3888 4041 4210 4255 4273 4291 4305 4437 4460 4470 4505 4512 4534 4546 4802 4806 4850
 4904 5155 5191 5209 5297 5301 5357 5403 6244 6286 6321 7314 7419 7590 7705 7715 7731 7737 7903 7923 8008 8052 8087
 8107 8130 8165 8457 8550 8560 8586 8608 8628 8725 8786 8832 9063 9067 9099 9222 9259
 OHIL 1.1,2421 7830 7871 7990 8192 OHIL 1.2,2422 7828 7869 7988 8190 OIR 1.3,2446 2706 3184 3188 3188 3239
 3249 3256 3344 3349 3351 3517 3525 3561 3601 3784 3788 3790 3797 3801 3813 3827 3841 3850 3862 3876 3888 3890 3890
 3894 3894 3898 4445 4452 4466 4482 4482 4505 4580 4802 4819 4850 4920 5155 5183 5191 5209 5289 5293 5297 5301 5335
 5345 5357 5403 5429 5524 5780 5793 5818 5832 5874 5915 5933 6069 6090 6185 6209 6244 6321 7036 7067 7100 7137 7150
 7188 7225 7272 7297 7314 7326 7419 7429 7590 7857 7861 8032 8116 8403 8442 8446 8446 8527 8594 8600 8602 8616 8626
 8845 8953 9012 9195 9388 OLINK 1.0,2419 6060 6131 6155 6253 6275 6282 6344 6444 6465 6601 6723 6756 7005 7842
 7897 7935 7976 7986 7996 7998 8064 8072 8079 8158 8210 8228 8263 OLOC 1.7,2382 2565 2572 2587 2589 2591 2595 2597
 2599 2611 2613 2615 2620 2622 2624 2638 2645 2648 2650 2652 2654 2666 2668 2670 2674 2676 2678 2689 2704 2710 2768
 2776 2790 2833 2843 2852 2854 2856 3082 3094 3097 3108 3114 3147 3157 3199 3221 3329 3368 3374 3474 3486 3553 3571
 3731 3754 3774 3788 3790 3803 3817 3831 3866 3880 3916 3930 3932 4170 4307 4319 4341 4389 4396 4472 4484 4548 4582
 4596 4612 4616 4620 4624 4671 4683 4695 4707 4722 4733 4744 4755 4861 4948 5017 5019 5498 5532 5583 5605 5637 5669
 5686 5724 5760 5795 5865 6014 6063 6084 6179 6203 6288 6348 7254 7270 7295 7295 7297 7301 7308 7326
 7328 7406 7413 7429 7433 7439 7473 7483 7683 7689 7695 8632 8803 8805 8884 8886 8963 8965 8985 9199 9210 9333 9335
 OLOCX 1.6,2380 2587 2595 2611 2620 2638 2645 2648 2654 2666 2674 2704 2852 2854 3553 3571 3731 3754 3774 4170 4307
 4319 4341 4389 4396 4472 4484 4548 4671 4683 4695 4707 4722 4733 4744 4755 4861 4948 5583 5605 5637 5669 5686 5724
 5760 5795 5865 6014 6063 6084 6179 6203 6288 6348 7254 7270 7295 7295 7297 7301 7308 7326
 OLOL 1.4,2424 7832 7937 8208 OM 1.0,2404 6143 6147 6499 6516 6516 6518 6518 6537 6541 6555 6559 6571 6579 6579
 6744 6746 6760 6764 6789 6791 6795 6795 6801 6801 6804 6804 6808 6814 6814 6816 6816 6825 6831 6831 6833 6852 6854
 OMR 1.4,2447 2641 2748 2766 2770 2772 2790 2816 2824 2831 2835 2837 2843 2858 2880 2928 2932 2937 3082 3094 3108
 3127 3129 3147 3155 3169 3171 3186 3199 3201 3205 3219 3223 3227 3231 3236 3250 3315 3317 3321 3325 3333 3353 3395
 3421 3443 3472 3476 3478 4275 4424 4426 4434 4454 4456 4456 4491 4495 4499 4518 4520 4520 4540 4542 4542 4572 4574
 4578 4584 4588 4592 4631 4817 4822 4848 4914 4923 4943 5151 5161 5163 5189 5201 5201 5215 5219 5221 5225 5237
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 5530 5532 5534 5536 5577 5599 5633 5678 5718 5754 5789 5859 6026 6103 6109 6115 6220 6224 6230 7223 7227 7241 7252
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 8356 8580 8604 8604 8692 8696 8779 8847 8890 8898 8902 8975 8977 9087 9089 9093 9097 9173 9368 9370
 OHDR 1.2,2445 2574 2591 2599 2615 2624 2641 2652 2670 2678 2764 2768 2774 2776 2822 2824 2829 2833 2839 2932 2941
 2950 2990 3044 3050 3062 3110 3112 3157 3165 3167 3180 3190 3203 3221 3225 3229 3236 3254 3319 3323 3327 3333 3355
 3370 3372 3376 3389 3391 3428 3446 3470 3474 3480 3486 3541 3549 3569 3593 3621 3637 3645 3647 3652 3673 3689 3705
 3713 3729 3752 3772 3831 3880 3916 3924 3932 3940 3956 3970 3986 4003 4019 4033 4061 4077 4099 4115 4121 4142 4148
 4168 4189 4191 4303 4305 4317 4339 4383 4387 4394 4404 4414 4416 4430 4432 4452 4486 4493 4497 4516 4538 4576 4582
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 4831 4835 4837 4839 4841 4857 4867 4875 4875 4880 4899 4910 4910 4912 4916 4929 4935 4950 4958 4964 4968 4968 4970

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MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J33"

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CROSS-REFERENCE

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SYMBOL LENGTH,VALUE,DEFN REFERENCES

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 5861 5867 6019 6020 6035 6105 6111 6117 6122 6213 6222 6228 6234 6242 6531 6533 7032 7054 7063 7087 7096 7119 7146
 7174 7303 7310 7316 7408 7415 7421 7435 7441 7446 7524 7540 7550 7679 7685 7691 7849 7855 7857 7893 7962 7970 8002
 8022 8036 8058 8083 8101 8116 8220 8222 8358 8479 8602 8662 8777 8888 8896 8900 8908 8973 8987 9071 9075 9091 9095
 9107 9115 9177 9204 9255 9366 BNSH 1,C,2405 6259 6497 6524 6547 6565 6582 6582 6717 6770 6787
 MPSH 1,5,2440 2741 2764 2774 2778 2785 2829 2839 3069 3084 3143 3145 3155 3225 3233 3323 3372 3397 3470 3483 3579
 3590 3609 3619 3702 3795 3811 3825 3839 3846 3860 3874 4273 4560 4562 4576 4590 4628 4991 4995 4999 5007 5011 5015
 5040 5059 5252 5365 5372 5386 5398 5462 5476 5504 5520 5522 5526 7705 7871 7886 8128 8184 8188 8206 8319 8455 8465
 8634 8801 8929 UPSMTEMP 1,B,2399 5365 5372 5386 5398 8Q2 1,E,2413 7339 7352 7362 7377 7377 7383 7383 7385
 8Q3 1,C,2417 BRAR 1,F,2455 5480 6444 6465 6601 6723 6756 7005 8158 8210 8228 8263 8450 8467 8790 8826 8840 9226
 83 1,8,2407 7435 7443 7459 7459 7461 7471 7481 7489 7489 7503 7542 7601 MSRA 1,A,2388 3137 3139 3141 3141 3143
 4119 4119 4123 4130 5708 5744 7389 8354 8358 8367 8371 8375 8387 8391 8395 8405 8572 8574 8674 8680 8684 8686 8712
 8714 8916 8920 9202 9202 9204 9295 9299 9309 9337 9339 9370 9397 MSRB 1,B,2389 5540 5542 8706 8719 8719 8725 8766
 8892 8894 8896 8918 8922 9052 9054 9058 9061 9061 9063 9099 9103 9105 9107 9111 9113 9115 9135 9137 9162 9164 9185
 9187 9355 9360 9360 9362 9364 9366 MSRC 1,C,2390 8654 8656 8664 8706 8714 8731 8743 8758 8838 8912 8914 8935 8941
 8943 9001 9143 9218 9247 9249 9263 9265 9349 9355 9362 9380 9390 MSRD 1,D,2391 8729 8731 8735 8737 8737 8752 8760
 8762 8775 8777 8874 8876 8931 9030 9038 9046 9181 9273 9277 9327 9380 MSRE 1,E,2392 8323 8325 8379 8412 8414 8467
 8544 8546 8554 8556 8648 8650 8702 8741 8743 8746 8748 8748 8750 8750 8752 8756 8758 8760 8762 8818 8820 8820
 8860 8862 8868 8870 8987 8997 9026 9034 9042 9048 9241 9243 9345 9397 MSRF 1,F,2393 3305 3307 3376 8479 8497 8499
 8503 8507 8511 8515 8519 8523 8529 8582 8600 8620 8698 8708 8775 8795 8959 8961 8973 8981 9014 9028 9036 9044 9125
 9341 9343 9364 9374 MSRE 1,8,2386 2719 2724 2802 2814 2814 2930 2941 2956 2958 2973 2975 3036 3038 3246 3249 3256
 3327 3329 3341 3344 3349 3351 3480 3483 4644 5044 5046 5048 5055 5057 5059 5064 5068 5070 5075 5079 5083 5085
 5090 5094 5098 5098 5100 5169 5171 5174 5327 5349 5410 5413 5413 5454 5458 5474 5476 5996 6004 7223 7227 7239 7241
 7250 7252 8350 8352 8381 8383 8427 8483 9081 9083 9127 9129 9156 9177 9179 9183 MSR9 1,9,2387 3080 3084 3123 3125
 3129 3133 3135 3135 3139 3145 3180 3182 3184 3203 3205 3741 3743 3746 4359 4362 5456 5460 8329 8331 8333 8335
 8337 8339 8341 8343 8418 8420 8425 8429 8431 8433 8461 8489 8491 8576 8578 8584 8586 8606 8608 8658 8660 8666 8668
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 9251 9253 9267 9269 9275 9281 9283 9287 9289 9293 9301 9305 9313 9315 9319 9323 MS2 1,B,2410 2416 7274 7279 7299
 7299 7303 7312 7404 7404 7408 7417 7461 7471 7481 7503 7542 7601 7675 7675 ST 1,F,2414 4014 4819 4822 4829 4837
 4839 4841 4846 4846 4848 4867 4869 4918 4920 4923 4929 4931 4941 4941 4943 4970 4978 5151 5153 5217 5229 5262 5264
 5335 5337 5341 5345 5425 5427 5429 5431 5487 5489 5491 5495 5504 5506 5506 5508 5510 5520 5526 7836 7840 7911 7913
 7939 7990 8040 8042 8144 8148 8150 8152 8152 8154 8154 8156 8169 8171 8216 8218 8243 8243 8249 8255
 BTEMPD 1,1,2370 2691 3366 3561 3563 3569 3582 3584 3593 3595 3601 3603 3611 3613 3621 3623 3629 3637 3647 3652 3665
 3667 3673 3675 3681 3683 3689 3691 3697 3699 3705 3707 3713 3739 3770 3772 3892 3900 3905 3912 3944 3944 3946 3958
 3958 3962 3988 3988 3992 4005 4005 4009 4021 4021 4025 4037 4037 4043 4043 4045 4045 4047 4049 4057 4057 4063 4063
 4065 4065 4069 4071 4079 4079 4081 4083 4083 4085 4085 4087 4097 4097 4101 4101 4103 4103 4107 4216 4229 4261 4268
 4268 4610 4997 4999 5013 5015 5480 5626 5641 5655 5664 5680 5690 5711 5726 5728 5747 5762 5764 5898 5917 5957 6255
 6330 7034 7048 7050 7050 7056 7056 7065 7077 7079 7079 7081 7081 7089 7089 7098 7106 7106 7112 7114 7114 7121 7121
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 8385 8450 8467 8485 8670 8678 8682 8704 8739 8754 8764 8790 8826 8840 9085 9145 9171 9228 9271 9279 9285 9291 9297
 9303 9307 9311 9317 9321 9325 9347 9353 9357 9378 9384 BTEMP1 1,8,2395 3517 3519 3525 3527 3533 3535 3541 3543
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MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J95"

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SYMBOL LENGTH,VALUE,DEFN REFERENCES

17 MAY 79

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 7150 7182 8592 8594 8TEMP2 1,9,2396 2570 2574 3801 3803 4146 4146 4150 4154 4197 4203 4206 4212 4214 4216 4221
 4233 4235 4242 4248 4251 4257 4259 4261 4266 4424 4454 5017 5021 5570 5574 5684 5690 5802 5802 5806 5812 5820 5822
 5826 5834 5836 5850 5863 5872 5884 5884 5888 5894 5896 5898 5903 5921 5921 5923 5925 5931 5943 5943 5947 5953 5955
 5957 5962 8870 8880 8933 8935 8937 8947 8955 8967 8969 8977 9073 9075 9147 9189 9191 9197 9220 9222 9257 9259
 BTHETA 1,A,2403 6017 6020 6035 6037 6049 6096 6098 6107 6113 6181 6183 6267 6269 6307 6307 6311 6313 6319 6328 6332
 6332 6350 6352 6373 6373 6388 6390 6408 6410 6433 6435 6454 6456 6636 6638 6656 6658 6681 6683 6702 6704 6889 6891
 6910 6912 6936 6938 6956 6958 8UT 1,9,2398 2819 2819 5252 5367 8X 1,8,2401 6042 6044 6051 6053 6065 6067 6086
 6088 6096 6105 6107 6111 6126 6126 6143 6158 6160 6173 6205 6207 6222 6228 6240 6240 6297 6297 6301 6301 6311 6313
 6328 6334 6334 6365 6367 6393 6395 6413 6415 6429 6431 6450 6452 6499 6514 6514 6526 6526 6529 6537 6553 6555
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 6103 6109 6115 6209 6220 6230 7666 8495 8779 8890 8898 8902 8975 9089 9093 9097 9368
 8X0004 1,3,2374 2434 3227 3284 3317 3325 5450 6224 6567 8X0020 1,2,2436 3290 5776 5780 5787 5793 5818 5832 5846
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 8X0000 1,5,2378 3080 3282 3288 3368 3410 3942 3942 4041 4210 4255 4628 5083 5289 6098 6113 6319 6486 6742 6742 7046
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 6071 6073 6092 6094 6117 6122 6129 6129 6169 6169 6173 6175 6175 6187 6189 6211 6234 6242 6255 6257 6257 6277 6277
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 6617 6641 6643 6661 6663 6677 6679 6698 6700 6744 6754 6791 6842 6850 6854 6872 6874 6885 6887 6906 6908 6941 6943
 6961 6963 8YD 1,A,2452 2691 3254 3355 3519 3527 3535 3543 3549 3563 3584 3595 3603 3613 3623 3657 3667 3675 3683
 3691 3699 3707 3723 3733 3752 3764 3930 3946 3962 3972 3976 3992 4009 4025 4049 4071 4087 4107 4130 4134 4154 4160
 4166 4178 4197 4203 4229 4233 4235 4242 4248 4285 4287 4299 4301 4315 4327 4337 4349 4375 4406 4503 4560 4669 4681
 4693 4705 4726 4737 4748 4759 4857 4950 4991 5007 5078 5085 5100 5574 5587 5603 5671 5711 5728 5747 5764 5800 5816
 5822 5830 5836 5872 5878 5913 5917 5923 5931 5937 6004 6067 6183 6189 6352 7038 7069 7102 7135 7141 7152 7186 7192
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 5850 5863 5876 5911 5925 5935 6065 6181 6187 6350 7034 7040 7065 7071 7098 7104 7133 7139 7148 7154 7184 7190
 8YS 1,9,2451 2570 2597 2622 2650 2676 3186 3190 3533 3582 3611 3629 3645 3645 3681 3697 3721 3743 3746 3762 3817 3866
 3892 3896 3900 3924 4115 4142 4162 4180 4189 4289 4291 4329 4362 4367 4404 4480 4486 4562 5068 5079 5094 5570 5626
 5655 5664 5708 5744 5782 5852 5998 6017 6073 6088 6094 6205 6213 8405 8444 8529 8628 8847 8955 9014 9197 9390
 8YSP1 1,8,2450 5568 5624 5662 5706 5742 5778 5848 6019 6071 6086 6092 6207 6211 ABORT 2,178,2704
 ACH 2,9E0,3590 9728 9730 ACHR 2,9C8,3579 9472 9474 ACK 1,5,2495 2802 4285 4299 8461
 ADDITXXX 2,17E0,4846 4877 4882 ADDTO 2,1780,4812 4798 ADP 2,2170,5716 9776 9778
 ADPR 2,2150,5704 9520 9522 ADPRHL 2,820,3387 3361 ADPS 1,1,2491 3038 3387 4160 4166 4178 4287 4301 4315 4327
 4337 4349 4375 4406 4430 4503 4633 5169 5327 5458 5489 7913 8218 8325 8335 8339 8352 8379 8414 8427 8487 8495 8546
 8556 8650 8664 8702 8862 8870 9048 9079 9125 9181 9243 9265 9345 AF 1,3308,7401 9904 9906
 AFDOIT 2,3590,7550 7526 AFR 1,3288,7292 9640 9650 AFSF 2,34F0,7503 7450 AFSUB 2,35C0,7568 7554
 AFSHAP 2,3548,7530 7509 AII 2,9E0,3593 9712 9714 10224 10226 AIH 2,9B0,3569 9804 9806
 AIH 2,900,3582 9456 9458 AI 2,1100,4299 10308 AIOADD 2,10C0,5396 4852 AIOCCW 1,4,5138 5153 5291 5343 5384
 5396 AIOCHAIN 1,0,5136 5408 AIOCOMD 1,A,5141 5323 AIODEVNO 1,2,5137 5353

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MICROCODE, IIMP-1116 PLP 1641803 REV. A CCA3 1641603,1641604,1641653 "657,0416,J55"

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SYMBOL LENGTH,VALUE,DEFN REFERENCES

17 MAY 79

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 AIR 2,11A0,4205 10052 AIS 2,9A0,3561 9568 9570 AL 2,13A0,4424 10260 ASN 2,2770,6220 10392 10394
 ASINDOIT 2,28F0,6340 ASNR 2,2730,6203 10136 10138 ASNTST 2,2880,6321 6317 ATBL 2,1740,4794 5375 9016 9018
 9020 9022 ATN 2,25F0,6103 10384 10386 ATINDOIT 2,26A0,6151 6145 ATHEXIT 2,2700,6179 6137
 ATHJOIN 2,2640,6124 6100 ATHL 2,2600,6143 6133 ATNR 2,2580,6004 10120 10130
 ATHI 2,2660,6131 6124 A1025 1,4E60,9401 9402 9402 A3160 1,1640,4653 4654 4654
 A3025 1,1A80,5116 5117 5117 A4485 1,1F90,5546 5547 5547 A7101 1,2F80,7008 7009 7009
 A9156 1,3DA0,8280 8281 8281 A9173 1,4000,8305 8306 8306 BAL 2,050,3930 9676 9678
 BALR 2,040,3924 9420 9422 BBACK 2,BA0,3788 3843 BFB3 2,040,3839 9552 9554 BFC 2,CA0,3874 9604 9606
 BFCNT 2,CA0,3868 3864 BFCR 2,000,3860 9420 9430 BFF3 2,060,3848 9556 9558
 BFORE 2,000,3801 3852 BIZE 2,4B00,9218 9145 9171 9226 BOTTOM 2,1020,4067 4825
 BOTTOM1 2,1050,4080 4873 BPIFETCH 2,170,2697 BRAN 2,030,3916 3907 BREAKPT 2,1ED0,5487 2697
 BSTAT 2,1E10,5425 5176 BSYAL 2,1300,4460 4464 BTBS 2,090,3782 9544 9546
 BTBSEXIT 2,080,3792 3786 BTC 2,010,3825 9600 9602 BYCR 2,0F0,3011 9424 9426
 BTFS 2,0C0,3795 9548 9550 BTFSEXIT 2,0E0,3005 3799 BUSYAL 2,1370,4437 4441 4447
 BXIH 2,000,3088 10104 10186 10188 10190 CDP 2,2100,5676 9772 9774 CDPDIFF 2,20F0,5669 5602
 CDPR 2,20C0,5655 9516 9518 CDPDIFF 2,20F0,5671 5657 CF 1,3300,7400 9900 9902
 CDFIFF 2,34E0,7409 7463 CDFONE 2,34D0,7403 7491 CFNEG 2,34C0,7479 7465 CFR 1,32B0,7291 9644 9646
 CH 2,060,3647 9708 9710 10220 10222 CHINTR 2,4100,8455 8385 9085 CHINTRI 2,4100,8457 8463
 CHKERR 2,4920,9012 8624 8799 9005 9376 CHKPER 2,46E0,8845 8770 CHOVOPSW 1,0C,2546 5389
 CHOVPTIR 1,0A,2545 5382 CHR 2,450,3645 9452 9454 CIUREY 2,4C00,9228 9224 CLB 2,070,3770 10264 10266
 CLDP 2,2090,5631 9756 9758 CLDPR 2,2070,5622 9500 9502 CLH 2,440,3637 9692 9694 10204 10206
 CLIR 2,430,3629 9436 9430 CLRPTY 2,1E40,5446 3366 4610 8317 CLRPTY1 2,1E00,5464 5478
 CLRPTY2 2,1E90,5466 5472 CLRMIT 2,4C0,3080 3027 3040 3065 CMD 1,2,2492 4162 4168 4432 5329 5460 8331 8343
 8383 8420 8429 8491 8574 8578 8656 8660 8668 8876 8914 8931 9054 9083 9129 9156 9183 9218 9249 9253 9269
 COLDSTRT 2,7E0,3366 3311 COMBK 2,1440,4495 4480 CONEX 2,1010,4861 4808 4906
 COMMON 2,10E0,4227 4270 CONSER 2,450,3036 2899 COROCTL 1,0,2460 CORDHY1 2,2E20,6880 6945 6965
 CORDHY1L 1,2E60,6904 6880 CORDHY2 2,2EA0,6927 6898 6919 CORDHY2L 1,2EE0,6950 6927
 CORDL 1,0,2460 CORDH 1,0,2460 CORDHORM 2,2A40,6486 6131 6253 6275 CORDHORK 2,2B90,6601 6501 6595
 CORDOFL0 2,2030,6286 6139 6149 6177 6265 CORDROM 1,0,2460 CORDZT 2,2920,6365 6060
 CORDZT1 2,2940,6379 6442 6463 CORDZT1L 1,2980,6402 6379 CORDZT2 2,29C0,6424 6397 6417
 CORDZT2L 1,2A00,6448 6424 CORDZY 2,2B90,6615 6155 6344 CORDZY1 2,2BB0,6627 6690 6711
 CORDZY1L 1,2BF0,6650 6627 CORDZY2 2,2C30,6672 6645 6665 CORDZY2L 1,2C70,6696 6672
 COS 2,2500,6026 10300 10382 COSJOIN 2,2510,6033 6023 COSR 2,2400,6014 10124 10126
 COS1 2,2560,6056 6046 COS12 2,2550,6049 6039 CPSW 1,24,2537 3219 CTR 1,0,2442
 CZYEXIT 2,2CC0,6723 CZYHORM 2,2A80,6514 CZYNORMD 2,2B70,6593 6507 CZYNORML 2,2B50,6577 6584
 CZYNORM1 2,2AE0,6541 6520 CZYNORM2 2,2B10,6559 6543 CZYNORM3 2,2B40,6575 6561
 CZYNORM4 2,2B70,6589 6575 CZYTERM 2,2CB0,6717 6692 CZY1 2,2A60,6497 6490 DA 1,3,2493 3165 3167 3169 3171
 3420 4329 4339 4414 4416 4516 5274 5520 5530 5534 5536 8220 8222 8224 8226 8676 8680 8686 8920 8922 9133 9137 9160
 9164 9187 9189 9277 9281 9287 9293 9299 9305 9309 9315 9319 9323 9327 DACK 1,6,2496 3410
 DBUS 1,0,2507 3127 3421 3443 5493 8146 DCR 2,060,3410 2732 2910 3434 3456 DCREAD 2,080,3443 3414
 DCIRIT 2,070,3421 DDP 2,2310,5857 9788 9790 DDPCOM 2,23D0,5911 5966 DDPCOMPL 2,23C0,5905 5901
 DDPDDPOS 2,2400,5923 5919 DDPDRNEG 2,2410,5929 5870 DDPJOIN 2,2340,5870 5854
 DDPDS 2,1100,4235 4231 DDP2 2,22F0,5846 9532 9534 DDPST 2,2498,5964 5960
 DDP1 2,2450,5947 5880 DDP2 2,2380,5888 5939 DF 2,33D0,7404 9916 9918 DFR 2,32B0,7295 9660 9662

17 MAY 79

SYMBOL	LENGTH,VALUE,DEFN	REFERENCES
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DMADINI 2,4148,8412 8362 8405	DOIT 2,260,2822 5419	DP 1,300000,2529 5802 5806 5812 5826 5882 5884 5888 5894
5096 5898 5903 5905 5921 5929 5941 5943 5947 5953 5955 5957 5962 6021 6031 6098 6113 6126 6129 6143 6169 6173 6240		
6255 6257 6277 6301 6307 6311 6313 6319 6328 6330 6332 6334 6338 6436 6488 6492 6499 6514 6516 6537 6553 6555 6569		
6571 6577 6579 6589 6593 6597 6742 6744 6746 6754 6760 6764 6789 6791 6814 6816 6831 6842 6850 6852 6854 7048 7050		
7056 7081 7083 7089 7106 7112 7114 7121 7123 7129 7131 7156 7158 7168 7170 7176 7178 7180 7182 7306 7330 7366 7368		
7374 7411 7469 7479 7546 7625 7627 7631 7633 7643 7658 7664 7719 7741 7756 7758 7760 7766 7781 7785		
DPINH 1,100000,2528 7505 7584 7595 7783	DPX 1,100000,2524 2525 2526 2528 2529 2530	
DR 1,4,2494 3110 3112 3123 3127 3421 3443 3446 4180 4317 4357	DRNEG 2,1108,4238 4193	
5491 5493 8144 8146 8497 8592 8616 8662 8838 9071 9073 9255	END1 2,1870,5209 5280	
ECPR 2,2480,5996 10120 10122	ENDAL 2,1400,4472 4439 4462	END3A 2,1C10,5262 5255
EIND1A 2,18E8,5245 5231	EIND3 2,18F8,5252 5284 5317 5331 5405 5421	
ENRPA 2,4418,8626 8564 9065	ENTHLP 2,2E0,2867 3018	ENTRI 2,1138,4251 4199
ENTR2 2,1090,4206 4244	EPOR 2,1968,4991 9600 9602	EPPR 2,1998,5007 9604 9606
EPSR 2,1530,4560 10012	ESYNC 1,2,2499	EXBR 2,860,3762 10088 10010
EXRPA 2,4400,8620 8612	EXT 1,0,2442	FINISX 2,1508,4546 4501 4524
FLR 1,0,2442	FPRL 2,4248,8495 8393	FREGBASE 1,0,7209 7245 7308 7328 7439 7683
FSYNC 1,3,2500	F3CRYST 2,3680,7662 7562	F3DFault 2,3720,7695 7592
F3DIV1 2,37F8,7773 7762	F3DJOIN 2,3808,7779 7768	F3END 2,36D8,7675 7387 7552 7662 7743
F3EIND1 2,36E0,7679 7723	F3EXPOF 2,3798,7737 7668 7727 7775	F3EXPUF 2,3788,7731 7641
F3EXPUZ 2,3768,7719 7733	F3FAULT 2,3730,7703 7697	F3LOAD 2,3318,7326 7423
F3EXIT 2,3698,7645 7635	F3HLOAD 2,3428,7429 7318	F3HJAM 2,3280,7259 7707
F3HORM 2,3338,7339 7572	F3HORM1 2,3368,7356 7343	F3HORM2 2,3398,7372 7358
F3HORM3 2,33A8,7374 7379	F3HORM4 2,3388,7383 7372	F3ROUND 2,36A8,7658 7789
F3TRUZRO 2,3760,7715 7332 7564 7574 7588 7597	F3WRONG 2,3780,7727 7621 7754	GENSWP 2,1D8,2764 2860 2943 3399
4277 5259 5391 7711	HELP 2,2E0,2869 2726 2904 3430 3452	HSSVC 2,240,2802 2745
HTOL 1,200000,2525	HWD 2,12F0,4394 4381	HMDR 2,1298,4367 4355
IDLE1 1,420,3009 3022	IFCH 1,3,2485 2793 2845 3519 3527 3535 3543 3555 3563 3573 3584 3595 3603 3613 3623 3631	
3639 3654 3659 3667 3675 3683 3691 3699 3707 3715 3723 3733 3746 3756 3764 3776 3792 3805 3819 3833 3845 3854 3868		
3882 3909 3918 3934 3948 3964 3978 3994 4011 4027 4049 4071 4089 4109 4130 4134 4154 4164 4172 4182 4233 4235 4293		
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5021 5059 5070 5085 5100 5574 5589 5610 5628 5643 5666 5673 5692 5713 5728 5749 5764 5822 5836 5925 6004 6073 6189		
6290 6352 7141 7192 7259 7475 7485 7699 8638 8809	IFETCH 2,160,2689 3087 5500 5512	
ILLEGRI 2,288,2852 9752 9754 9760 9762 9764 9766 9792 9794 9796 9798 9800 9802 9808 9810 9812 9814 9832 9834 9836		
9838 9840 9842 9844 9846 9848 9850 9852 9854 9856 9858 9860 9862 9868 9870 9872 9874 9876 9878 9880 9882 9884 9886 9888 9890 9892 9894 9896 9898 9899 9900 9902 9904 9906 9908 9910 9912 9914 9916 9918 9920 9922 9924 9926		
10312 10314 10322 10326 10330 10332 10334 10376 10378 10396 10398 10400 10402 10404 10406 10424 10426 10428 10430		
10432 10434 10436 10438	ILLEGRR 2,2C8,2856 9416 9418 9492 9494 9496 9498 9504 9506 9508 9510 9536 9538 9540 9542	
9576 9578 9580 9582 9584 9586 9588 9590 9592 9594 9596 9598 9608 9610 9612 9614 9616 9618 9620 9622 9624 9626 9628		
9630 9632 9634 9636 9638 9644 9646 9648 9670 9928 9930 9932 9934 9936 9938 9940 9942 9944 9946 9948 9950 9952 9954		
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10178 10180 10182	ILLEGRR 2,2C0,2854 10194 10270 10274 10278 10282 10286 10290 10294 10302 10306 10310	

MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,J55"

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SYMBOL LENGTH,VALUE,DEFN REFERENCES

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 IOSVC 2,240,2814 2960 3072 IR 1,0,2442 ISBSVC 2,1AC0,5151 2026 LAV 2,1A60,5090 9744 9746
 LAVR 2,1A78,5094 9404 9406 LB 2,810,3729 10260 10262 LBR 2,800,3721 10004 10006
 LCCIU 2,4998,9048 9032 9040 LCCIU1 2,4A90,9111 9101 LCCIU2 2,4AA0,9117 9109
 LCCIU3 2,49A0,9052 9069 LCH 2,1A18,5064 9748 9750 LCHR 2,1A28,5068 9408 9490
 LCINI 2,1A38,5075 9740 9742 LCNIR 2,1A48,5079 9400 9402 LCS 2,950,3525 9564 9566
 LDP 2,2020,5577 9768 9770 LDPR 2,2000,5568 9512 9514 LF 1,3308,7399 9896 9898
 LFR 1,3288,7290 9640 9642 LH 2,970,3541 9704 9706 10216 10218 LHR 2,960,3533 9448 9450
 LHO 2,16C0,4720 9800 9802 LHI 2,16E0,4731 9804 9806 LHM 2,1708,4742 9808 9890
 LHS 2,1728,4753 9892 9894 LIS 2,940,3517 9560 9562 LISTOV 2,1098,5302 4804 LN 2,790,3341 10252 10254
 LINLOOP 2,780,3351 3357 LOOPAL 2,13A8,4450 4468 LOOPR 2,14D0,4532 4507 4544
 LOOPW 2,1400,4510 4522 LPSW 2,1F8,2772 9212 10192 LYOH 1,100000,2526 6526 6801 7347
 MADR 2,530,3123 3105 MAR 1,0,2442 MDP 2,2238,5787 9784 9786 MDPJOIN 2,2260,5798 5784
 MDPNEG 2,22C0,5826 5808 MDPFR 2,2210,5776 9528 9530 MDR 1,0,2442 MEHTST 2,3838,7822 8303
 MF 1,3308,7402 9912 9914 MFDF 2,35E8,7584 7448 MFR 1,32B8,7293 9656 9658 MF1 2,3610,7595 7586
 MH 2,580,4117 9720 9722 MHR 2,580,4115 9464 9466 MHU 2,580,4144 10296 10298
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 7274 7279 7299 7306 7312 7404 7411 7417 7431 7437 7443 7853 8028 8081 8598 8971 9175
 MROI 1,4,2474 MTADCRY 2,3C70,8180 7842 MTADR1 2,3C90,8180 8180 MTADR2 2,3CE8,8210 8167 8194
 MTALARM 2,39E8,7962 MTBUMP 2,3C50,8165 7996 8064 8072 8079 MTDISP 2,3920,7897 7941 7964 7968 7972 7992 8060
 8097 8133 8135 MTDISPD 2,3910,7893 7982 MTDISPX 2,3CF0,8216 7897 MTENDIT 2,38A8,8107 8050
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 MTGALP2 2,3A80,8010 8046 MTINIT 2,38D0,7869 7844 MTINWORD 2,3C10,8144 7935 7976 7986
 MTITERAT 2,3960,7919 8111 MTL 2,4338,8570 8552 8562 MTRAND 2,3028,8235 7998
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 MT12 2,3838,8072 7953 MT13 2,3850,8079 7955 MT13JOIN 2,3858,8081 8068 8076
 MT14 2,3888,8095 7957 MT2 2,3A08,7976 7931 MTO 2,3A28,7986 7945 MT9 2,3A48,7996 7947
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 MWR 1,7,2477 MWRITE 2,508,3108 MWSL 2,500,3105 3053 MCHG 1,0,2506 3147
 HFST1 2,308,2878 HFST2 2,430,3015 NH 2,AA0,3673 9680 9690 10200 10202 NHIR 2,490,3665 9432 9434
 NIO1 2,1C60,5284 5157 NIO3 2,1C80,5307 5286 NOBRAM 2,820,3909 3914 NOCOMPI 2,1178,4268 4264

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SYMBOL LENGTH,VALUE,DEFN REFERENCES

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NOTCHAR 2,1800,5237 5211 NRRB 2,C10,3019 3015 NRXB 2,C38,3033 3029 NRXB 2,CC8,3082 3078
OC 2,1010,4166 10304 OCIPSW 1,82,2544 2937 5257 OCR 2,1000,4160 10048 OC1 2,1CE8,5323 5299
ODPSW 1,40,2542 OFFSW 1,28,2538 7709 OH 2,AC0,3689 9696 9698 10208 10210 OHR 2,AB0,3681 9440 9442
OILLPSW 1,30,2539 2858 OIPSW 1,40,2541 2748 OHPSW 1,38,2540 2880 3395 OUTDIS 2,5A8,3165 3099 3116 3192
3207 PANADR 1,1,7016 7911 8216 PASLAB 2,4628,8786 8670 8678 8682 8788 9271 9279 9285 9291 9297 9303 9307 9311
9317 9321 9325 PFDC 1,1,2403 2691 PINS 1,C00000,2510 2645 2654 2669 2704 2710 2776 2790 3082 3094 3108 3199
3486 3553 3571 3731 3754 3774 3788 3790 3803 3817 3831 3866 3880 3916 3932 4170 4307 4319 4341 4389 4396 4472 4548
4596 4671 4683 4695 4707 4722 4733 4744 4755 4861 4948 5019 5464 5524 5532 5583 5605 5637 5669 5686 5724 5760 5795
5865 6063 6179 6208 6340 7254 7473 7483 7695 8632 8803 PLC 2,4450,8648 8505
PLCCIU0 2,4940,9026 8369 PLCCIU1 2,4960,9034 8373 PLCCIU2 2,4980,9042 8377
PLCIUOK 2,48A0,9199 9193 PLCPCN 2,4680,8814 8764 PLCPCN1 2,4698,8820 8824
PLC1 2,4520,8704 8727 8781 PLC2 2,4688,8830 8704 8739 8754 8836 9347 9353 9357 9378 9384
PLC3 2,4640,8795 8716 PLC4 2,4658,8801 8797 8991 9386 PLC5 2,4560,8729 PLD 2,4700,8860 8397 8513 8517
PLD1 2,4720,8868 8521 8525 8864 8999 PLD2 2,4900,8997 8882 8945 8951 8983 PLD3 2,4878,8959 8939
PLD4 2,48A8,8971 8979 PLD5 2,4860,8953 8588 8610 8834 9003 9149 9261 PLD6 2,48D8,8981
PLFD 2,4C08,9241 8389 8509 PLFD1 2,4DA8,9347 9351 PLFD2 2,4DB8,9353 9372 PLMT 2,42E8,8544 8501 8578
PLMT1 2,4308,8554 8548 PNTR 1,22,2536 5446 POLD 2,4808,8931 8949 POPR 1,800000,2509 2591 2599 2615 2624
2641 2652 2670 2678 4491 4495 4520 5577 5599 5633 5678 5718 5754 5789 5859 6026 7227 7241 7252 7980 8186 8208
PRGLD 2,15C0,4610 8301 PRPL 2,4FF8,9405 5107 PSTOP 2,6C8,3268 3268 PSW 1,0,2442
PSHDIS 2,598,3155 2996 PSHDRN 2,638,3219 2871 PSHRN 2,6E0,3280 2553 PJEXIT 2,230,2790 4279
PJEXITX 2,990,3553 3263 3359 PJHELP 2,198,2719 2708 2981 5266 RAR 1,0,2442 RB 2,1430,4491 10272 10276
RBL 2,1928,4964 4925 RBLWRAP 2,1950,4976 4966 RBR 2,1410,4480 10016 10020 RD 2,1200,4315 10292
RDR 2,1038,4178 10036 READ 2,1B50,5197 5205 REGDIS 2,500,3180 2993 REMOVOK 2,18E8,4941 4960 4972 4980
RESB 2,1A00,5055 10324 RH 2,12A8,4375 10284 RHR 2,1258,4349 10028 RINOX 2,20,2563 9416 9492 9496 9504
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9760 9764 9792 9796 9800 9808 9812 9832 9836 9840 9844 9848 9852 9856 9860 9868 9872 9876 9920 9924 9928 9932 9936
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RIX 2,40,2578 9418 9494 9498 9506 9510 9538 9542 9578 9582 9586 9590 9594 9598 9610 9614 9618 9622 9626 9630 9634
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10246 10314 10318 10322 10326 10330 10334 10338 10342 10346 10350 10354 10358 10362 10366 10370 10374 10378 10398
10402 10406 10426 10430 10434 10438 RLL 2,E18,4001 10356 10358 ROMCIR 1,0,5987 6058 6153 6342
ROMCIRK 1,20,5988 6162 ROMCOSX 1,21,5989 6033 ROMHYP 1,81,5991 6864 ROMHYPK 1,22,5990 6295
RPAL 2,4350,8576 RPAL1 2,4370,8584 8590 8596 RPAL2 2,43A8,8598 8618 RPAL3 2,43C8,8606 8614
RPAL4 2,4430,8632 8622 RPL416 2,4208,8479 9405 RPL657 2,4000,8317 8290 8292
RPL6571 2,4040,8333 8327 RRL 2,E48,4017 10352 10354 RTBL 2,1868,4899 9824 9826 9828 9830
RTBL1 2,1888,4910 4901 RTLWRAP 2,1918,4958 4933 RXADINOX 2,60,2587 9672 9772 9864 9880 9884 9888 9892 9896
9900 9904 9908 9912 9916 10192 10248 10252 10268 10284 10408 10412 10416 10420 RXADX 2,80,2595 9674 9774 9866
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SYMBOL LENGTH,VALUE,DEFN REFERENCES

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 RXHNDX 2,100,2630 9688 9692 9696 9700 9704 9708 9712 9716 9720 9724 9728 9732 9740 9744 9748 10280 10296
 RXHNDX 2,100,2640 9690 9694 9698 9702 9706 9710 9714 9718 9722 9726 9730 9734 9742 9746 9750 10282 10298
 RXOPHDX 2,100,2611 9804 9816 9820 9824 9828 10256 10260 10264 10272 10276 10288 10292 10300 10304 10308 10380 10384
 10388 10392 RXOPX 2,100,2620 9806 9818 9822 9826 9830 10258 10262 10266 10274 10278 10290 10294 10302 10306 10310
 10382 10386 10390 10394 SCH 2,100,2619 9732 9734 SCHR 2,100,2609 9476 9478
 SDP 2,2108,5752 9780 9782 SDRP 2,2180,5740 9524 9526 SESB 2,1908,5044 10328
 SETHOP 2,018,3383 SF 2,32A8,7279 9908 9910 SFDC 1,2,2404 2565 2574 2591 2599 2617 2626 2645 2654 2670 2678
 SFJOIN 2,33E0,7406 7201 SFR 2,3288,7270 9652 9654 SFRJOIN 2,3200,7301 7276 SH 2,100,3621 9716 9718 10228
 10238 SHFL 1,000000,2518 6634 6643 6654 6663 6721 6874 6934 6943 6954 6963 6992 7524 7540
 SHFT 1,000000,2517 6371 6386 6395 6406 6415 6431 6440 6452 6461 6621 6679 6688 6700 6709 6887 6896 6908 6917
 SHR 2,100,3611 9460 9462 SH64EXIT 2,3128,7129 7058 7091 SINT 2,380,2956 10320
 SIS 2,9F8,3601 9572 9574 SLA 2,100,4055 10372 10374 SLHA 2,100,4033 10244 10246
 SLHL 2,068,3940 10236 10238 SLL 2,090,3954 10364 10366 SLQA 2,3160,7146 10348 10350
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 5848 5850 5857 5861 5863 5874 5876 5911 5915 5925 5933 5935 5996 5998 6000 6002 6004 6035 6042 6051 6056 6065 6071
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 7166 7184 7188 7190 7316 7350 7421 7446 7514 7530 7550 7558 7568 7629 7679 7779 SPTABL 1,00,2547 2616 5415
 SQD 2,2000,6742 6282 SQDADD 2,2F40,6984 6972 SQDADJ 2,2030,6787 6766 SQDCORD 2,20F0,6062 6772
 SQDECORD 2,2F20,6972 6900 6921 SQDNADJ 2,2020,6770 6762 SQDNORM1 2,2DA0,6025 6797 6810
 SQDNORM2 2,2DB0,6831 6838 SQDNORM3 2,2DD0,6842 6820 6827 SQDS 1,2770,6218 10388 10390
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 SQDS4 2,2870,6303 6299 SQDTST 2,2F58,6989 6980 SQD1 2,2D00,6760 6748 SR 1,7,2497 3044 3389 4289 4303 4437
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 SRHL 2,0C0,3970 9992 9994 9996 9998 10232 10234 SRL 2,0E8,3984 10360 10362 SRQA 2,30C8,7096 10344 10346
 SRQA1 2,3110,7119 7108 SRQL 2,3008,7032 10336 10338 SRQL1 2,3048,7054 7042 SS 2,1108,4301 10300
 SSR 2,1180,4287 10044 STARY 2,0,2553 4653 5116 5546 7008 8200 8305 9401 STATRB 2,1408,4534 4555
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 STH3 2,16A8,4703 10420 10422 STH 2,688,3246 10248 10250 STHLP 2,6A0,3254 3260
 SVC 2,1550,4572 10316 10318 SVC1 2,1A00,5161 5303 SYNC 1,1,2498 2802 3038 3044 3110 3112 3123 3127 3165 3167
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SYMBOL LENGTH,VALUE,DEFN REFERENCES

9309 9315 9319 9323 9327 9345 TERM1 2.1010,5335 5233 5247 TERM2 2.1038,5349 5307 5319
TERM3 2.1000,5403 5359 TERM4 2.1020,5341 5433 TEST 2.1C0,2741 2914 TESTR 2.1520,4553 4536
TESTH 2.14C0,4527 4514 TEST1 2.210,2770 3488 4566 5050 TEST2 2.220,2785 2918 2946 3401 5268
TEST3 2.340,2902 TEST4 2.350,2907 TEST4A 2.360,2914 3436 3458 TEST5 2.330,2896
THI 2.AF0,3713 10196 10198 TQPTR 1.80,2543 2928 5363 USREBL 2.370,2928 2701 W 1.8,2362 2554 2566 2575
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9908 9910 9910 9912 9912 9914 9914 9916 9916 9918 9918 9920 9920 9922 9922 9924 9924 9926 9926 9928 9928 9930 9930
9932 9932 9934 9934 9936 9936 9938 9938 9940 9940 9942 9942 9944 9944 9946 9946 9948 9948 9950 9950 9952 9952 9954
9954 9956 9956 9958 9958 9960 9960 9962 9962 9964 9964 9966 9966 9968 9968 9970 9970 9972 9972 9974 9974 9976 9976
9978 9978 9980 9980 9982 9982 9984 9984 9986 9986 9988 9988 9990 9990 9992 9992 9994 9994 9996 9996 9998 9998 10000
10000 10002 10002 10004 10004 10006 10006 10008 10008 10010 10010 10012 10012 10014 10014 10016 10016 10018 10018
10020 10020 10022 10022 10024 10024 10026 10026 10028 10028 10030 10030 10032 10032 10034 10034 10036 10036 10038
10038 10040 10040 10042 10042 10044 10044 10046 10046 10048 10048 10050 10050 10052 10052 10054 10054 10056 10056
10058 10058 10060 10060 10062 10062 10064 10064 10066 10066 10068 10068 10070 10070 10072 10072 10074 10074 10076
10076 10078 10078 10080 10080 10082 10082 10084 10084 10086 10086 10088 10088 10090 10090 10092 10092 10094 10094
10096 10096 10098 10098 10100 10100 10102 10102 10104 10104 10106 10106 10108 10108 10110 10110 10112 10112 10114
10114 10116 10116 10118 10118 10120 10120 10122 10122 10124 10124 10126 10126 10128 10128 10130 10130 10132 10132
10134 10134 10136 10136 10138 10138 10140 10140 10142 10142 10144 10144 10146 10146 10148 10148 10150 10150 10152
10152 10154 10154 10156 10156 10158 10158 10160 10160 10162 10162 10164 10164 10166 10166 10168 10168 10170 10170
10172 10172 10174 10174 10176 10176 10178 10178 10180 10180 10182 10182 10184 10184 10186 10186 10188 10188 10190
10190 10192 10192 10194 10194 10196 10196 10198 10198 10200 10200 10202 10202 10204 10204 10206 10206 10208 10208
10210 10210 10212 10212 10214 10214 10216 10216 10218 10218 10220 10220 10222 10222 10224 10224 10226 10226 10228
10228 10230 10230 10232 10232 10234 10234 10236 10236 10238 10238 10240 10240 10242 10242 10244 10244 10246 10246

MICROCODE, HMP-1116 PLP 1641803 REV. A CCAS 1641603,1641604,1641653 "657,0416,JSS"

HUGHES PROPRIETARY

FOR TRAINING
USE ONLY

SYMBOL LENGTH,VALUE,DEFN REFERENCES

17 MAY 79

10248 10248 10250 10250 10252 10252 10254 10254 10256 10256 10258 10258 10260 10260 10262 10262 10264 10264 10266
10266 10268 10268 10270 10270 10272 10272 10274 10274 10276 10276 10278 10278 10280 10280 10282 10282 10284 10284
10286 10286 10288 10288 10290 10290 10292 10292 10294 10294 10296 10296 10298 10298 10300 10300 10302 10302 10304
10304 10304 10306 10306 10308 10308 10310 10310 10312 10312 10314 10314 10316 10316 10318 10318 10320 10320 10322 10322
10324 10324 10326 10326 10328 10328 10330 10330 10332 10332 10334 10334 10336 10336 10338 10338 10340 10340 10342
10342 10344 10344 10346 10346 10348 10348 10350 10350 10352 10352 10354 10354 10356 10356 10358 10358 10360 10360
10362 10362 10364 10364 10366 10366 10368 10368 10370 10370 10372 10372 10374 10374 10376 10376 10378 10378 10380
10380 10382 10382 10384 10384 10386 10386 10388 10388 10390 10390 10392 10392 10394 10394 10396 10396 10398 10398
10400 10400 10402 10402 10404 10404 10406 10406 10408 10408 10410 10410 10412 10412 10414 10414 10416 10416 10418
10418 10420 10420 10422 10422 10424 10424 10426 10426 10428 10428 10430 10430 10432 10432 10434 10434 10436 10436
10438 10438 WAIT 2,3C8,2971 2787 5111 8407 8531 8630 8849 8957 9016 9392 WAITLP 2,3D0,2973 2977
WD 2,1238,4337 10288 WDR 2,1220,4327 10032 WH 2,1310,4406 10280 WHR 2,1308,4404 10024
WIRD 2,1338,4416 4412 WRITE 2,1C38,5272 5193 5278 XH 2,AE0,3705 9700 9702 10212 10214
XMR 2,AD0,3697 9444 9446 XLE 2,D28,3912 3902 XXFST1 2,3FE0,8290 2876 XXFST2 2,3FE8,8292 3013
XXHEMTST 2,3FF8,8303 3296 XXPLD 2,1A98,5107 4646 XXPRGLD 2,3FF0,8301 3294 YD 1,0,2442
YDPI 1,0,2442 YS 1,0,2442 YSPI 1,0,2442 ZERO 1,400000,2508 2748 2816 2824 2843 2850 2880 2928 2932 2937
3155 3186 3205 3219 3236 3315 3368 3395 4275 4426 4434 4456 4572 4574 4578 4584 4588 4612 5257 5363 5382 5389 5415
5446 7225 7234 7245 7272 7297 7326 7429 7709 8356 8500 8604 8692 8779 8884 8886 8890 8898 8902 8963 8965 8975 8985
9087 9089 9093 9097 9173 9199 9210 9333 9335 9368

NO STATEMENTS FLAGGED IN THIS ASSEMBLY

136 SYSLIB SOURCE RECORDS, 8278 SYSIN SOURCE RECORDS
449 SYSGO OUTPUT RECORDS, 12443 SYSPRINT OUTPUT RECORDS

