

UNIVERSAL ASSEMBLER VERSION 3.1 FEBRUARY 29, 1980 (IN-HOUSE)

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COMMAND LINE WAS: SNAP3 PROC14.PROD,,,PROC144:GBQPLX

INCLUSION A: PROCINC/TXT:DR0
 INCLUSION B: PROC14/LIB:DR0.PMACMIC
 INCLUSION C: PROC14/LIB:DR0.GMACROZ
 INCLUSION D: PROC14/LIB:DR0.PROCEQUS
 INCLUSION E: PROC14/LIB:DR0.BDEF1800
 INCLUSION F: PROC14/LIB:DR0.MDEF1800
 INCLUSION G: PROC14/LIB:DR0.PORTEQUS
 INCLUSION H: PROC14/LIB:DR0.PORTASGN
 INCLUSION I: PROC14/LIB:DR0.PROCP4

D 20.A CAPIVS EQU 0 INVERTED DISPLAY SCREEN VERSION **NEW**

*** ERRORS: D

PROGRAM NAME: PROD

PROGRAM ADDRESS BLOCKS:	010000	/ABSOLUTE/	SIZE=000000	(ABS)
	167400	/SYSIVR/	SIZE=000400	(ABS)
	170000	/SYSROM/	SIZE=000047	(ABS)
	002000	/PRODL/	SIZE=002000	(ABS)
	000000	/PRODP/	SIZE=004000	(REL)

EXTERNAL DEFINITIONS:

FETCHRW	002000	FETCHW	002003	FETCH	002005	FETCHI	002007
FETCHS	002011	SRVDO	002640	CALLCC	002025	NOJ	002446
CALL	002031	MEMPF\$	002221	PCMOD	002076	PSHSTO	002053
PUSH	002110	PUSHI	002116	EIROJ	002142	JUMP	002453

PAGE 2 PROC14/LIB:DR0.PROD

MICRO-PROCESSOR EMULATION SUPPORT CODE - HJS -
 SATURDAY, AUGUST 7, 1982 -- 3:45:42 PM

07AUG82 15:52

RETURN	002152	RETCC	002147	RETS	002206	POPST0	002155
POP	002212	STKS	002301	SYSRETO	002374	SIR0	002421
SIRX	002431	JUMPCC	002443	LD6	002474	LD7	002504
L7S	002522	LDS	002533	AP4	002536	AP7	002545
APS	002560	SRVRPT	002631	SRVNXT	002636	SRVRTW	002652
AC\$DO	003400	DL\$DO	003000	LODCF	003253	BEEP	003326
CLICK	003342	INFO	003633				

EXTERNAL REFERENCES (UNDEFINED SYMBOLS):

SCROMLI SCRAMI RIN16 SYSRETI IVIOL\$ COMMR COMMT SCRAM SCLST SCROM

UNUSED LABELS:

AMLINT ACCFCN ACCSTP

- 1. *
- 2. . 2.14.I HJS 80 APR 2 ADD INVERTED (RASTER) SCREEN CAPABILITIES
- 3. . 2.14.F HJS 80 JAN 16 START MODIFICATIONS FOR IMA-VERSION
- 4. *
- 5. . 2.13 HJS 79 FEB 12 VERSION 13 RELEASE
- 6. . 2.13.B HJS 79 FEB 7 ENABLE COMM ON 3800 PROCESSORS
- 7. . 2.13.A HJS 79 JAN 22 FIX REGS BUG TO ALLOW ACCESS TO PROTECTED STACK
- 8. *
- 9. . 2.12.C HJS 78 OCT 12 CORRECT MEMORY FAULTS SO PC MATCHES 6600 PC
- 10. . 2.12.A HJS 78 SEP 05 REFORMAT, RE-COMMENT, AND FIX STACK FOR ACCESS
- 11. . 12 SET VERSION NUMBERS TO MATCH ? FROM DEBUG
- 12. *
- 13. . 2.9.L HJS 78 JUL 18 FIX ANOTHER HONEYWELL BUG
- 14. . 2.9.K HJS 78 JUN 16 FIX BUG INTRODUCED IN HONEYWELL CODE (TZ TO FZ)
- 15. . 2.9.K HJS 78 APR 23 SPLIT PROC, MAKE RELOCATABLE, CHANGE APF, ADD AML
- 16. . 2.9.J HJS 78 MAR 20 RESTRUCTURE INTERRUPT SEQUENCE & MINOR MODS
- 17. . 2.9.I HJS 78 FEB 27 CORRECT 9.H FOR FAULT CLEANUP
- 18. . 2.9.H HJS 78 FEB 16 EVERYBODY MEMPF'S, KEYBOARD SCAN, & SIR CHANGE
- 19. . 2.9.G HJS 78 FEB 3 CORRECT TIMING, COMMENTS, & ADD POR TIMEOUT
- 20. . 2.9.F HJS 78 JAN 11 FIXING MIN/MOUT TIMINGS
- 21. . 2.9.E HJS 78 JAN 4 TESTING REPEATED KEYIN CONTROLS
- 22. . 2.9.D HJS 77 DEC 21 CORRECT STL INSTRUCTION
- 23. . 2.9.C HJS 77 DEC 13 BACK OFF FROM KBD RPT & RE-DO STL FOR TIMING
- 24. . 2.9.B HJS 77 NOV 20 INCLUDE TIMINGS AS CALCULATED & FIX MINOR BUGS
- 25. . 2.9.A HJS 77 NOV 14 CHANGE KEYBOARD CODE TO AID REPEATED KEY CONTROL
- 26. *
- 27. . 2.8.B HJS 77 SEP 22 MTI CHANGE SO LENGTH IS 2 BYTE NUMBER
- 28. . 2.8.A HJS 77 SEP 19 MTI CHANGE TO ALLOW MFRPT ON ANY INTERRUPT
- 29. *
- 30. . 2.7. HJS 77 SEP 7 MINOR BUG-FIX AND OPTIMIZATION FOR RELEASE
- 31. *
- 32. . 2.H.B HJS 77 AUG 31 MTI SPECIAL VERSION
- 33. *
- 34. . 2.5.C HJS 77 AUG 16 UPDATE COMMENTS ON THE CODE
- 35. . 2.5.B HJS 77 JULY 13 CORRECTED NAMES FOR COM REGISTERS
- 36. . 2.5.A HJS 77 JULY 12 UP TO NEXT NEW VERSION NUMBER
- 37. *
- 38. . 2.4.B HJS 77 JULY 12 FIXED ILLEGAL MAR CHANGE IN REGL RETURN TO FETCH
- 39. . FIXED FILE TO CONFORM TO VRP FORMAT (A LITTLE)
- 40. . 2.4.A HJS 77 JULY 7 INITIAL PRE-RELEASE OF THE MICRO-CODE

DATAPOINT CONFIDENTIAL INFORMATION - SEE PAGE 1

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MICRO-PROCESSOR EMULATION SUPPORT CODE - HJS -
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41.
42.

*
INC PROCINC

14.A
15.A
16.A

* TYPE	SNAPOPT	X	
	EQU	4	DEFINE VERSION OF MACHINE TO BE ASSEMBLED
	INC	PROC14.PORTASGN	PORT ASSIGNMENT DISPLAY

3.H
 4.H
 5.H
 6.H
 7.H
 8.H
 9.H
 10.H
 11.H
 12.H
 13.H
 14.H
 15.H
 16.H
 17.H
 18.H
 19.H
 20.H
 21.H
 22.H
 23.H
 24.H
 25.H
 26.H
 27.H
 28.H
 29.H
 30.H
 31.H
 32.H
 33.H
 34.H
 35.H
 36.H
 37.H
 38.H
 39.H
 40.H
 41.H
 42.H
 43.H
 44.H
 45.H
 46.H
 47.H
 48.H
 49.H
 50.H
 51.H

```

*
.PORT
. SUB 0 1 2 3 4 5 6 7
. 0 0 LIREG LIMP BASW MODW STW LUF LUCF
. 0 I MODIN INBUS MIFIN SDLCIN ACUIN
. 0 0 IIMP DIMP COMF CHUF IMAR DMAR
. 10 I
. 1 0 OTBUS MDW LSPKR SDLCOT ACUOT SDLCMD MIFADR MIFDAT
. 0 I SRVREQ STATUS IDCODL IDCODH UCFLG MDR STEK
. 1 0 MIFSTB MIFIAK MIFSTB2 SINS SIOD CSRF CSTF SOTS
. 10 I
. 2 0 LDCH LDMAP SKCH SDLM KBSC RDLM CMPF SMR
. 0 I KBDD SNID
. 3 0 URFO
. I
. 4 0 URO (MR2XXL)
. I MARIL
. 5 0 URO (MR2XXH)
. I MARIH
. 6 0 MAROL (XX2MRL)
. I URI
. 7 0 MAROH (XX2MRH)
. I URI
.
. USER IO PORTS 4-7
. REGS 0 URA URB URC URD URE URH URL URX
. 10 PCH PCL SPH SPL PSW I35 I02 IMP
*
.SUBBITS 0 1 2 3 4 5 6 7
.
.SRVREQ: SCPMEM SCMBUS SCSDLOR SCSDLCT SCDSPNL SCONMS SCHUMS
.
.STATUS: STUSCF STIODR STPFIN STPFOU STKBKC STKBNS STKBRDY STBOTLN
.
.MODW: SWINTE SWBASD SWUSER SWSTDT SWRPT SWALBT
.
.STEK: STLA STLW STLSP
.
    
```

MICRO-PROCESSOR EMULATION SUPPORT CODE - HJS - 07AUG82 15:52
. THE PORT ASSIGNMENTS, ORGANIZED BY PORT - SUBPORT NUMBER IN IN/OUT PAIRS

52.H
53.H
54.H
55.H
56.H
57.H
58.H
59.H
60.H
61.H
62.H
63.H
64.H
65.H
66.H
17.A
1.I 000002
2.I 000014
3.I
4.I 000004
5.I
6.I
7.I
8.I
9.I
10.I
11.I

```

*
. JUMP INPUT CONDITION CODES ARE:
.
.SELECT    0      1      2      3      4      5      6      7
.
           CARRY  ZERO   MEMRDY  PARITY  IMPZERO  IMPODD  BUSRDY  TRUE
.
*
. DOUBLY NAMED (SUB)PORTS ARE:
.
           URO    <>  MR2XXL
.
           URO    <>  MR2XXH
.
           MAROL  <>  XX2MRL
.
           MAROH  <>  XX2MRH
.
           INC    PROC14.PROCP4      INDIRECT TO PARAMETER FILE
VER        EQU    2                  1800 - INFO INSTRUCTION PROCESSOR NUMBER
REV        EQU    014                INFO INST. MICRO-CODE REVISION NUMBER
.
TYPE       EQU    4                  =0 FOR 1800 PROCESSOR (DISK, ICA)
.
.                                           =1 FOR 1871 PROCESSOR (DISK, ICA, APF/AML)
.                                           =2 FOR 3800 PROCESSOR (ICA)
.                                           =3 FOR 3802 PROCESSOR (RIM)
.                                           =4 FOR 38MP PROCESSOR (IMA)
*
           SNAPOPT X
*

```

14.I		*		
15.I		. CONDITION CODES		
16.I		.		
17.I	020002	MO	EQU F6+2	MEMORY READY
18.I	020003	MP	EQU F6+3	MEMORY FAILURE (OF ANY SORT!)
19.I	020004	IZ	EQU F6+4	IMPLICIT REGISTER ZERO
20.I	020005	IO	EQU F6+5	IMPLICIT REGISTER ODD
21.I	020006	BR	EQU F6+6	BUS READY (MICRO-BUS ONLY)
22.I		*		
23.I		. REGISTER ALLOCATION		
24.I		.		
25.I	010002	Q	EQU F5+02	NOBODY SHOULD DO WRITE'S TO Q
26.I		.		
27.I	010000	PDLNP	EQU F5+0	DISPLAY LINE POINTER
28.I	010001	KBSCNT	EQU F5+01	KEYBOARD SCAN COUNTER
29.I	010002	SCANSV	EQU F5+02	KEYBOARD SAVED SCAN NUMBER, REPEATED AI
30.I		*		
31.I		. DISKETTE CONTROL REGISTERS		
32.I		.		
33.I	010003	MADR	EQU F5+03	DISKETTE DEVICE ADDRESS
34.I	010004	MBITS	EQU F5+04	DISKETTE I/O CONTROL, FUNCTION & STATUS
35.I	010005	MBSTAT	EQU F5+05	DISKETTE STATE CONTROL LINK REGISTER
36.I	010006	MCRCH	EQU F5+06	DISKETTE CRC GENERATOR STORAGE REG.
37.I	010007	MCRCL	EQU F5+07	DISKETTE CRC GENERATOR STORAGE REG.
38.I	010010	MDSKS	EQU F5+010	DISKETTE HEADER READ SECTOR NUMBER
39.I	010011	MDSKT	EQU F5+011	DISKETTE HEADER READ TRACK NUMBER
40.I	010012	MTRAK	EQU F5+012	DISKETTE USER DESIRED TRACK NUMBER
41.I	010013	MSECT	EQU F5+013	DISKETTE USER DESIRED SECTOR NUMBER
42.I		.		* APF VERSION ABOVE 2 BYTES IN MEMORY *
43.I		*		
44.I		. HONEYWELL-APF DMA CHANNEL CONTROL REGISTERS		
45.I		.		
46.I	010013	APFRP	EQU F5+013	APF RECEIVER POINTER LSB
47.I	010014	APFRK	EQU F5+014	APF RECEIVER COUNTER LSB
48.I	010015	APFTP	EQU F5+015	APF TRANSMITTER POINTER LSB
49.I	010016	APFTK	EQU F5+016	APF TRANSMITTER COUNTER LSB
50.I		*		
51.I		. AUDIO CHANNEL CONTROL REGISTER		
52.I		.		
53.I	010015	ACD	EQU F5+015	AUDIO CHANNEL ATTEN/VALUE
54.I	010016	ACPL	EQU F5+016	
55.I	010017	ACPH	EQU F5+017	AUDIO CHANNEL CONTROL & MSB POINTER
56.I	010017	ACCTL	EQU ACPH	APF - AUDIO CHANNEL 1 BYTE CONTROL
57.I		.		(ACPH & ACCTL SHOULD BE SAME REG.)

58.I
 59.I
 60.I
 61.I 030000
 62.I 030001
 63.I 030002
 64.I 030001
 65.I 030002
 66.I
 67.I
 68.I
 69.I 030003
 70.I 030004
 71.I 030005
 72.I 030006
 73.I 030007
 74.I 030010
 75.I 030011
 76.I 030012
 77.I 030013
 78.I 030014
 79.I 030015
 80.I 030016
 81.I 030017
 82.I
 83.I
 84.I
 85.I
 86.I 010013
 87.I 030003
 88.I 030004
 89.I 030005
 90.I 030006
 91.I 030007
 92.I 030010
 93.I 010014
 94.I 030012
 95.I 030013
 96.I 030014
 97.I 030015
 98.I 030016
 99.I 030017

*
 . TEMPORARIES - AVAILABLE IN ANY ROUTINE, LOST BETWEEN ROUTINES
 .
 LINK EQU F5+F6+00 SUBROUTINE CALL AND RETURN LINKAGE REGS
 TEMP1 EQU F5+F6+01 PROCESSOR EMULATION TEMPORARIES
 TEMP2 EQU F5+F6+02
 TEMPH EQU TEMP1 H & L ONLY FOR DOUBLE H/L MACROS
 TEMPL EQU TEMP2
 *
 . COMMUNICATIONS CHANNEL CONTROL REGISTERS
 .
 RSTAT EQU F5+F6+03 COM RECEIVER STATUS
 RPNTR EQU F5+F6+04 COM RECEIVER MEMORY POINTER
 RDATA EQU F5+F6+05 COM RECEIVER DATA
 RCRCH EQU F5+F6+06 COM RECEIVER CRC GENERATOR STORAGE AREA
 RCRCL EQU F5+F6+07 COM RECEIVER CRC GENERATOR STORAGE AREA
 UXPNTR EQU F5+F6+010 USER TRANSMIT BUFFER POINTER
 COMMODE EQU F5+F6+011 COMMUNICATION MODE CONTROL REGISTER
 URPNTR EQU F5+F6+012 USER RECEIVE BUFFER POINTER
 XSTAT EQU F5+F6+013 COM TRANSMITTER STATUS
 XPNTR EQU F5+F6+014 COM TRANSMITTER MEMORY POINTER
 XDATA EQU F5+F6+015 COM TRANSMITTER DATA
 XCRCH EQU F5+F6+016 COM TRANSMITTER CRC GENERATOR STORAGE
 XCRCL EQU F5+F6+017 COM TRANSMITTER CRC GENERATOR STORAGE
 *
 . INTERNAL MULTI-PORT ADAPTER CONTROL REGISTER
 .
 .COMMODE EQU F5+F6+011!!! COMMUNICATIONS MODE
 TRNFCN EQU F5+013 TX CONTROL LINE SHADOW
 TRNCHN EQU F5+F6+03 TRANSMITTING CHANNEL NUMBER
 TRNDTA EQU F5+F6+04 TRANSMITTING CHANNEL DATA
 TRNCTL EQU F5+F6+05 TRANSMITTING CHANNEL CONTROL
 TRNSEL EQU F5+F6+06 TRANSMITTING CHANNEL SELECTION
 RCVCTL EQU F5+F6+07 RECEIVER CONTROL REGISTER
 RCH0C EQU F5+F6+010
 RCH0D EQU F5+014 SWAP OUT WITH COMMODE
 RCH1C EQU F5+F6+012
 RCH1D EQU F5+F6+013
 RCH2C EQU F5+F6+014 RECEIVER CHANNEL & DATA REGISTERS
 RCH2D EQU F5+F6+015
 RCH3C EQU F5+F6+016
 RCH3D EQU F5+F6+017

```

100.I
101.I
102.I
103.I
104.I
105.I
106.I
107.I
108.I
109.I
110.I
111.I
112.I
113.I
114.I
115.I 000000
116.I 000002
117.I 000000
118.I 000000
119.I 000000
120.I 000000
121.I 000100
122.I 000000
123.I
124.I
125.I 000102
126.I
127.I
128.I
129.I 000000
130.I 002000
131.I 004000
132.I 006000
133.I 007000
134.I
135.I 000000
18.A 000111
19.A
D 20.A 000000
21.A
    
```

```

*
. CAPABILITY BITS:
. THESE BITS DEFINE THE VERSION OF THE 1800/3800 PROCESSOR THAT THIS IS FOR
.
. XX XXX XXX
. 0 --- MICRO I/O BUS AVAILABLE
. 1 ---- 1500 SINGLE DENSITY DISKETTE DRIVE AVAILABLE
. 2 ----- 1800 SINGLE/DOUBLE DISKETTE DRIVE AVAILABLE
. 3 ----- APF SPECIAL MICRO-BUS INTERFACE AVAILABLE
. 4 ----- INTERNAL MULTIPOINT ADAPTER AVAILABLE
. 5 ----- INBOARD RIM AVAILABLE
. 6 ----- 5500 I/O BUS AVAILIABLE
. 7 ----- COMMUNICATIONS INTERFACE AVAILABLE (ASYNCR, BISYNCR, & SDLC)
.
. *PROCESSOR*
CAPMICK EQU 0<0 YES YES
CAPIMA EQU 1<1 YES YES
CAPBLUE EQU 0<2 YES YES
CAPAPF EQU 0<3 YES
CAPDMP10 EQU 0<4 YES
CAPRIM EQU 0<5 YES
CAP5510 EQU 1<6 YES YES YES YES
CAPCOM EQU 0<7 YES YES YES
. *TYPE*
0 1 2 3 4
.
CAPABILI EQU CAPCOM+CAP5510+CAPRIM+CAPDMP10+CAPAPF+CAPBLUE+CAPIMA+CAPMICK
*
. LOCATION OF THE CODE IN ROMS IS A FOLLOWS (MSB & LSB OF COURSE)
.
PROC EQU 00<9 EMULATION SUPPORT CODE IN ROMS 0 & 1
PROD EQU 02<9 EMULATION SUPPORT CODE IN ROMS 2 & 3
FLEX EQU 04<9 MICRO-BUS CODE IN ROMS 4 & 5
CDOX EQU 06<9 COMM TRANSMIT CODE IN ROM 6
CDOR EQU 07<9 COMM RECEIVE CODE IN ROM 7
.
CAPIVS EQU 0
PRE EQU '1' RELEASE LEVEL (FINAL IS BINARY ZERO)
*
CAPIVS EQU 0
*
INVERTED DISPLAY SCREEN VERSION **NEW**
0 = NORMAL, 1 = INVERTED (PURE RASTER!)
    
```

43.		*			
44.	002000	PRODL	ORG	PROD	LOGICAL SPACE DEFINED IN PLACE
45.	000000	PRODP	ORG	0	PHYSICAL SPACE RELOCATABLE
46.	002000	PRODL	USE	PRODL	USE THEM BOTH
47.	000000		USE	PRODP	PUT THE CODE IN PHYSICAL SPACE
48.	002000L	PRODP	LOC	PRODL,2	WITH ADDRESSES IN LOGICAL SPACE

51.					
52.					
53.				*	. GET NEXT INSTRUCTION IN SEQUENCE AND GO TO IT
54.					. UNLESS SERVICE REQUEST INTERFERES (RETURNS TO SRVEND SO CODE CAN NEVER
55.					. BE LOCKED OUT!)
56.	002000L	11000100	11111111	FETCHRW:	MWAIT ,IGNORE ENTRY IF WRITE OPERATIONS & TEMPORARY MODW
57.				. 2.95~3.15	
58.	002001L	00110001	11011100	LDPP	MODW,PSWI RESTORE CORRECT PROTECTION BEFORE FETCH
	002002L	00110111	00000100		
59.				. BRA	FETCH SAVE 2 WORDS & 100 NS
60.					
61.	002003L	11000100	11111100	FETCHW:	MWAIT ,MEMPF2 ENTRY IF WRITE OPERATIONS LAST
	002004L	11000111	01101111		
62.				. 2.55~2.75	
63.	002005L	00110001	11001001	FETCH:	DLDX PC2MR ENTRY IF MAR MUST BE LOADED (NORMAL)
	002006L	00110001	11101000		
64.				. 2.35~2.55	
65.	002007L	00110111	00001100	FETCHI:	STB IMAR,SMR ENTRY IF PC IN MAR NEED ONLY UPDATE
	002010L	00110111	01000111		
66.				. 2.05~2.25	
67.	002011L	00110001	10001001	FETCHS:	DLDX MR2PC ENTRY FOR JUMP OR CALL (P.C. OK)
	002012L	00110001	10101000		
68.				. 1.75	
69.	002013L	01010001	00000000	LDPI	LIMP,0 IMPLICIT REGISTER ZERO
	002014L	00110111	00000001		
70.	002015L	00110001	00110000	TSTPT	FI,SRVREQ SERVICE REQUEST?
71.	002016L	11010010	01011111	BRA	SRVDO,FZ YES, DO IT & SAVE MAR ETC. FOR RETURN
72.					
73.	002017L			SRVEND	SERVICE RE-ENTRY, IMP, MAR & PC ALL OK?
74.	002017L	11000100	11110000	FETLIMP	MWAIT ,MEMPF2 ERROR IF MEMORY FAULT
	002020L	11000111	01101111		
75.	002021L	00110001	00110110	LDPP	LIREG,MDR LOAD INSTRUCTION REGISTER
	002022L	00110111	00000000		
76.	002023L	00111001	00110100	SRVID	BRPX IDCOD GO TO THE ROUTINE
	002024L	10101111	00110011		

79.								
80.	002025L							
81.								
82.								
83.								
84.								
85.								
86.								
87.								
88.								
89.								
90.								
91.								
92.								
93.								
94.	002025L	11001000	10011100		BRA	USERET,F@,IZ		USER RETURN, NOT A CALL!
95.	002026L	00110001	00110001		ISTIP	,STUSCF,STATUS		IS USER CC CORRECT?
	002027L	01000101	00000001					
96.	002030L	11010011	11011001		BRA	NOJ,TZ		NO, DO NOJ NOT A RETURN
97.								
98.	002031L							
99.								
100.								
101.								
102.								
103.	002031L	00110111	00001100		STB	IMAR,SMR		GET THE ADDRESS TO CALL
	002032L	00110111	01000111					
104.	002033L	01010001	00001001		LDPI	LIMP,PCL		PC TO BE PUSHED ONTO THE STACK
	002034L	00110111	00000001					
105.	002035L	11000100	11100010		MWAIT	,MEMPF\$		
	002036L	11000111	01101110					
106.	002037L	00110001	00110110		LDTP	MDR		
107.	002040L	00110111	00001100		STB	IMAR,SMR		
	002041L	00110111	01000111					
108.	002042L	01101111	11110010		LDRT	TEMPL		SAVE LSB
109.	002043L	11000100	11011100		MWAIT	,MEMPF\$		
	002044L	11000111	01101110					
110.	002045L	00110001	00110110		LDRP	TEMPH,MDR		SAVE MSB
	002046L	01101111	11110001					
111.	002047L	00110111	00001100		STB	IMAR		POINT MAR TO THE NEXT INSTRUCTION
112.	002050L	00110001	10001001		DLDX	MR2PC		SO PUSHED P.C. IS CORRECT
	002051L	00110001	10101000					
113.	002052L	01010001	11000001		BAL	,PCMOD		

114.					
115.	002053L	01101111	10110000	PSHST0:	BAS LINK,CC IN-PAGE ENTRY TO PUSH
116.	002054L			PSHSTK	OFF-PAGE ENTRY (LINK RETURN PRE-LOADED)
117.				. 2.90	+ 0.20 INTO MEMORY WAIT MUST HAVE CARRY CLEAR TO USE THIS ENTRY
118.					
119.				.	NOTE: CAN NOT PARITY CHECK IN HERE OR LOST FOREVER WITH
120.				.	MEMPF\$ & SYS CALL & PUSH !!!
121.					
122.	002054L	00110001	11011100	DOPIP	MODW,ND,-1-SWUSER,PSWI ALLOW STACK IN ACCESS PROTECTED MEM
	002055L	01010101	11111011		
	002056L	00110111	00000100		
123.	002057L	00110001	11011011	DOTIP	,SB,2,SPIL UPDATE THE SP
	002060L	01010100	00000010		
124.	002061L	01010011	01000000	DOPI	SPOL,OR,0100 MAKE SURE EVEN & WRAP AROUND (MOD 32/64)
	002062L	00110111	10001011		
125.	002063L	00110111	11000000	LDPT	MAROL SAVE UPDATED LSB
126.	002064L	00110001	11101010	LDX	SP2MRH POINT TO MEMORY STACK
127.	002065L	00110001	11011111	LDPP	MDW,IMPI STORE LSB THERE
	002066L	00110111	00100001		
128.	002067L	00110111	00001001	STB	DIMP
129.	002070L	00110001	11011111	LDTP	IMPI PRE-LOAD MSB DATA TO WRITE
130.	002071L	11000100	11000110	MWAIT	,MEMPF\$ *** LET THE CALLER WORRY ABOUT IT ***
	002072L	11000111	11000010		
131.	002073L	00110111	00001100	STB	IMAR NOW POINT & DO THE MSB TO FINISH OFF
132.	002074L	00110111	00100001	LDPT	MDW
133.	002075L	11101111	00000000	MEMPF\$	BRK LINK
134.				.	*** NOTE ROUTINE CALLING PSHSTK OR PSHST0 MUST HAVE MWAIT ,ADDR ***
135.				.	*** AND MUST RESTORE MODW FROM THE PSW ***
136.				*	
137.	002076L			PCMOD:	RETURN FROM PSHSTK AND SET NEW PC
138.				.	2.15~2.35 (WITH MWAIT WITHOUT FETCHS)
139.					
140.	002076L	11000100	11000001	MWAIT	,MEMPF\$
	002077L	11000111	01101110		
141.	002100L	00110001	11011100	LDPP	MODW,PSWI RESTORE CORRECT MODE
	002101L	00110111	00000100		
142.	002102L	01110001	11110010	DLDP	MARO,TEMP,,SMR LOAD UP SAVED P.C.
	002103L	00110111	11000000		
	002104L	01110001	11110001		
	002105L	00110111	11100000		
	002106L	00110111	01000111		
143.	002107L	11001111	11110110	BRA	FETCHS GO TO ADDRESS AT MACRO LEVEL

144.					
145.	002110L				
146.					
147.					
148.					
149.					
150.					
151.					
152.					
153.	002110L	01010001	11111111	BRS	PSHSTK,F@,IZ,FETCHRW,CC REG PAIR SPECIFIED!
	002111L	01101111	10110000		
	002112L	11001000	11010011		
154.	002113L	01010001	00000110	LDPI	LIMP,URL DEFAULT
	002114L	00110111	00000001		
155.	002115L	11001111	11010011	BRA	PSHSTK
156.					
157.	002116L				
158.					
159.					
160.					
161.	002116L	00110111	00001100	STB	IMAR,SMR GET THE IMMEDIATE VALUE
	002117L	00110111	01000111		
162.	002120L	01010001	00001111	LDPI	LIMP,IMPL AND HIDING PLACE
	002121L	00110111	00000001		
163.	002122L	11000100	10101101	MWAIT	,MEMPF\$
	002123L	11000111	01101110		
164.	002124L	00110001	00110110	LDTP	MDR
165.	002125L	00110111	00001100	STB	IMAR,SMR
	002126L	00110111	01000111		
166.	002127L	00110111	10001111	LDPT	IMPO,DIMP GOT LSB, POINT TO MSB
	002130L	00110111	00001001		
167.	002131L	00110001	10001001	DLDX	MR2PC SAVE THE UPDATED P.C.
	002132L	00110001	10101000		
168.	002133L	11000100	10100100	MWAIT	,MEMPF\$
	002134L	11000111	01101110		
169.	002135L	00110001	00110110	LDPP	IMPO,MDR,IIMP GOT MSB, POINT CORRECTLY FOR PUSH
	002136L	00110111	10001111		
	002137L	00110111	00001000		
170.	002140L	01010001	11111111	BRC	PSHSTO,,FETCHRW RETURN FROM PUSH TO FETCH WAIT
	002141L	11001111	11010100		

*

PUSH:

. (070) PUSH HL PUSHED ONTO THE STACK
 . 4.45~4.65 (SP-1 | SP-2) <- HL; SP <- SP - 2
 . (062 070) PUSH BC
 . (174 070) PUSH DE
 . (022 070) PUSH XA
 . 4.10~4.30 (SP-1 | SP-2) <- HL; SP <- SP - 2

*

PUSHI:

. (051) PUSH.LSB.MSB PUSH CONSTANT (ADDRESS?) ONTO STACK
 . 7.35~7.75 (SP-1 | SP-2) <- NN; SP <- SP - 2

173.				*			
174.	002142L			EIROJ:			
175.				. 7.20	(062 050)	EUR	ENABLE INTERRUPTS & USER &
176.				.			PC <- (SP+1 | SP); SP <- SP + 2
177.				. 5.20	(111 050)	EJMP.LSB.MSB	ENABLE INTERRUPTS & PC <- NN
178.							
179.	002142L	11011011	11010100			BRA	JUMP,T@,IO
180.				*			
181.	002143L			USERET			
182.				. 7.20	(062 050)	EUR	ENABLE INTERRUPTS & USER &
183.				.			PC <- (SP+1 | SP); SP <- SP + 2
184.				. 5.60	(111 102)	UR	USER RETURN
185.							
186.	002143L	00110001	11011100			DOPIP	PSWO,OR,SWUSER,PSWI SET USER MODE
	002144L	01010011	00000100				
	002145L	00110111	10001100				
187.				.		STB	MODW
188.	002146L	11001111	10010101			BRA	RETURN
189.				*			
190.	002147L			RETCC:			
191.				.	(	0C3)	RET
192.				. 5.70	(0.45	NOT TAKEN)	CONDITIONAL RETURN
193.				.	(	003)	RFC
194.				.	(	013)	RFZ
195.				.	(	023)	RFS
196.				.	(	033)	RFP
197.				.	(	043)	RTC
198.				.	(	053)	RTZ
199.				.	(	063)	RTS
200.				.	(	073)	RTP
201.							
202.	002147L	00110001	00110001			TSTIP	,STUSCF,STATUS
	002150L	01000101	00000001				
203.	002151L	11000011	11111000			BRA	FETCHI,TZ
204.				*			
205.	002152L			RETURN:			
206.				. 5.35	(	007)	RET
207.				.			UNCONDITIONAL RETURN
208.							PC <- (SP+1 | SP); SP <- SP + 2
209.	002152L	01010001	00001001			LDPI	LIMP,PCL
	002153L	00110111	00000001				POP STACK INTO PROGRAMME COUNTER
210.	002154L	01010001	01111001			BAL	,RETS
							RETURN FROM POP TO SPECIAL STARTUP

211.						
212.	002155L	01101111	10110000	* POPST0:	BAS LINK,CC	IN-PAGE CALL
213.	002156L			POPSTK		POP THE STACK TO IMP AND IMP-1
214.				. 4.15		CARRY MUST BE CLEAR TO USE THIS ENTRY
215.						
216.	002156L	00110001	110.11100		DOPIP MODW,ND,-1-SWUSER,PSWI	ALLOW ACCESS TO PROTECTED MEMORY
	002157L	01010101	11111011			
	002160L	00110111	00000100			
217.	002161L	00110001	11101010		LDX SP2MRH	POINT INTO THE STACK AREA
218.	002162L	00110001	11001011		LDX SP2MRL,SMR	(SAVE 150 N.SEC BY INVERTING ORDER)
	002163L	00110111	01000111			
219.	002164L	01010101	10111111		DOTI ,ND,-1-0100	TURN OFF WRAP-AROUND BIT
220.	002165L	01010010	00000010		DOTI ,AC,2	SKIP TO NEXT ENTRY TO POP
221.				.		NOTE: (STKS) ASSUMES FALSE CARRY
222.				.		GENERATED HERE (TO SAVE WORD)
223.	002166L	010100.11	01000000		DOPI SPOL,OR,0100	SET BIT ON TO FINISH WRAP-AROUND
	002167L	00110111	10001011			
224.	002170L	11000100	10000111		MWAIT ,MEMPFs	
	002171L	11000111	01101110			
225.	002172L	00110001	00110110		LDTP MDR	
226.	002173L	00110111	00001100		STB IMAR,SMR	GET MSB DATA
	002174L	00110111	01000111			
227.	002175L	00110111	10001111		LDPT IMPO	SAVE LSB DATA
228.	002176L	00110111	00001001		STB DIMP	
229.	002177L	11000100	10000000		MWAIT ,IGNORE	PUT MEMPFs AFTER LDPP, BETTER STACK!
230.	002200L	00110001	110.11100		LDPP MODW,PSWI	
	002201L	00110111	00000100			
231.	002202L	00110001	00110110		LDPP IMPO,MDR	SAVE MSB DATA
	002203L	00110.111	10001111			
232.	002204L	11100000	00000000		BRR LINK,F@,MP	
233.	002205L	11001111	01101110		BRA MEMPFs	** SAVE 100 NS **
234.				*		
235.	002206L			RETS:		
236.				. 0.65		
237.						
238.	002206L	00110001	11001001		DLDX PC2MR,,SMR	LOAD THE MAR FROM P.C. VALUE (NO IMAR)
	002207L	00110001	11101000			
	002210L	00110111	01000111			
239.	002211L	11001111	11110110		BRA FETCHS	
240.				*		
241.	002212L			POP:		
242.				. 5.05	(060) POP	HL IS POPPED FROM STACK
243.				. 4.65	(062 060) POP	BC
244.				. 4.65	(174 060) POP	DE
245.				. 4.65	(022 060) POP	XA
246.				.		RP <- (SP+1 I SP); SP <- SP + 2
247.						
248.	002212L	01010001	11111010		BRS POPSTK,F@,IZ,FETCH,CC	IMP POINTS TO REG-PAIR ALREADY
	002213L	01101111	10110000			
	002214L	11001000	10010001			
249.	002215L	01010001	00000110		LDPI LIMP,URL	DEFAULT USES HL
	002216L	00110111	00000001			

250. 002217L .11001111 10010001

BRA POPSTK

253.				*		
254.	002220L	01011001	11111011	MEMPF2	BPGX	\$ IF FROM WRONG EVEN/ODD PAGE PAIR
255.	002221L			MEMPF\$:		
256.				. *****		
257.				. P.C. UPPED TO NEXT INST. WHEN GET MEMPF, WILL ALWAYS ASSUME IT CORRECT		
258.				. HOPING TO POINT TO THE NEXT INSTRUCTION.		
259.				. *****		
260.						
261.	002221L	00110001	00110111		LDRP	TEMP1,STEK,CC GET AND SAVE STATUS WORD
	002222L	01101111	10110001			
262.				.	STB	CMPF CLEAR THE FAULT (NOT NECESSARY)
263.				.		(THE NEXT READ/WRITE DOES IT)
264.	002223L	00110001	11011100		DOPIP	MODW,ND,-1-SWUSER,PSWI ENABLE MEMORY ACCESSING
	002224L	01010101	11111011			
	002225L	00110111	00000100			
265.	002226L	01010001	00001111		LDPI	LIMP,IMPL USING HIDDEN REGS AND PSHSTK
	002227L	00110111	00000001			
266.	002230L	00110001	10001111		DLDX	MR2IM,DIMP SAVE THE MAR ON THE STACK
	002231L	00110111	00001001			
	002232L	00110001	10101111			
267.	002233L	01010101	11000000		DOTI	,ND,0300
268.	002234L	01000000	10000000		TSTIT	XR,0200 HIGH BIT ON, NEXT BIT OFF?
269.	002235L	11000010	01010111		BRA	MEMNBAS,FZ NO, IN ANOTHER 16K CHUNK
270.	002236L	01010001	10101011		DLDP	MAR0,SEBRLS,,SMR IN BASED AREA, GET BASE REG VALUE
	002237L	00110111	11000000			
	002240L	01010001	11101111			
	002241L	00110111	11100000			
	002242L	00110111	01000111			
271.	002243L	00110001	11011111		LDP	IMPI SO ADDRESS MATCHES 5500 VALUE
272.	002244L	11000100	01011011		MWAIT	,MEMPQ !!! HELP !!!
	002245L	11000111	01010100			
273.	002246L	00110010	00110110		DOPP	IMPO,AC,MDR ADD IN BASING
	002247L	00110111	10001111			
274.	002250L	00110111	00001000	MEMNBAS	STB	IIMP POINT TO LSB TO SAVE
275.	002251L	01010001	01010100		BRC	PSHSTO PUSH MAR VALUE ON THE STACK
	002252L	11001111	11010100			
276.	002253L	01010001	00000110	MEMPQ	LDTI	SRSYSMF ASSUME THE WORST, GOT ANOTHER FAULT
277.	002254L	11000100	01010011		MWAIT	,MEMPX !!! HELP !!!
	002255L	11000111	01001001			
278.	002256L	01110001	11110001		TSTIR	,STLSP,TEMP1 SP: SECTOR TABLE PARITY FAULT
	002257L	01000101	10000000			
279.	002260L	11000010	01000111		BRA	MEMPS,FZ
280.	002261L	01000101	01000000		TSTIT	,STLW WV: WRITE VIOLATION FAULT
281.	002262L	11000010	01000010		BRA	MEMPW,FZ
282.	002263L	01000101	00000001		TSTIT	,STLA AV: ACCESS VIOLATION FAULT
283.	002264L	11000010	01000101		BRA	MEMPA,FZ
284.	002265L	01010001	00010010		LDTI	SRMEMPE
285.	>002266L	01011001	11111111	MEMPX	BRAX	SCROMLI MP: MEMORY PARITY FAULT
	>002267L	11001111	11111111			THESE ERRORS GO TO ROM VECTORS!
286.						
287.	002270L	01010001	00011011	MEMPS	LDTI	SRSTPE SECTOR, ROM VECTOR
288.	002271L	11001111	01001001		BRA	MEMPX

289.							
290.	002272L	01010001	00011000	MEMPA	LDRI	TEMPL,SVAVIOL	ACCESS, RAM VECTOR
	002273L	01101111	11110010				
291.	002274L	11001111	01000000		BRA	MEMPR	
292.							
293.	002275L	01010001	00010010	MEMPW	LDRI	TEMPL,SVWVIOL	WRITE, RAM VECTOR
	002276L	01101111	11110010				
294.	>002277L	01011001	11111111	MEMPR	BRAX	SCRAMI	
	>002300L	11001111	11111111				

. STACK LOAD, STORE AND MOVE (MOVE WITH SYSTEM SAVE AREA)

```

297.
298. 002301L
299.
300.
301.
302.
303.
304.
305.
306.
307.
308.
309.
310.
311.
312.
313.
314.
315. 002301L 11001000 00100101
316. 002302L 01010001 00001111
    002303L 00110111 00000001
317. 002304L 01010001 00111001
    002305L 11001111 10010010
318. 002306L 00110001 11000110
    002307L 00110001 11100101
    002310L 00110111 00001000
319. 002311L 00110001 11011111
    002312L 00110111 00100001
320. 002313L 00110001 11010110
    002314L 01010010 00000010
    002315L 00110111 10000110
    002316L 00110001 11010101
    002317L 00110110 10000101
321. 002320L 00110111 00001001
322. 002321L 00110001 11011111
323. 002322L 11000100 00101101
    002323L 11000111 01101110
324. 002324L 00110111 00001100
325. 002325L 00110111 00100001
326. 002326L 01010001 00000000
    002327L 00110111 00000001
327. >002330L 01011001 11111111
    >002331L 11001111 11111111

```

*

STKS:

. (065) STKS SAVE STACK CONTENTS

. -0.30 + C * 9.50 (HL+1 | HL) <- (SP+1 | SP)

. HL <- HL + 2; SP <- SP + 2

. C <- C - 1; UNTIL = 0 (16)

. (111 065) STKL LOAD STACK CONTENTS

. -0.30 + C * 10.40~10.80 (SP-1 | SP-2) <- (HL-1 | HL)

. HL <- HL - 2; SP <- SP - 2

. C <- C - 1; UNTIL = 0 (16)

. 2.80 (022 065) SYSM TO XA, MOVE SYSTEM SAVE AREA

. 2.80 (062 065) SYSM TO BC

. 2.80 (174 065) SYSM TO DE (SWAP WITH REG PAIR)

. 2.80 (176 065) SYSM TO HL

. SP-1 | SP <-> RP

BRA STKL,F@,IZ LOAD THE STACK (OR MOVE IT)

LDPI LIMP,IMPL POINT TO HIDDEN REGISTERS

BRC POPST0 GET THE TOP STACK ENTRY (M. POINTER)

DLDX HL2MR.,IIMP POINT TO MEMORY AND CORRECT IMP

LDPP MDW,IMPI STORE THE LSB

DADDP URO+UR,URI+UR,2 UPDATE THE HL POINTER (POPST DOES CC)

STB DIMP GET THE MSB

LDTP IMPI

MWAIT ,MEMPFS

STB IMAR STORE THE MSB

LDPT MDW

LDPI LIMP,0 RESET IMP FOR STKS OP-CODE

BRAX RIN16 DO REPEATED INSTRUCTION

358.
359. 002374L
360. >002374L 01011001 11111111
>002375L 11001111 11111111
361.
362. 002376L 11111111 11111111
002377L 11111111 11111111

*
SYSRET0: BRAX SYSRET1 OFF PAGE JUMP FOR SYSRETURN CODE

TABPAGE PRODL

363.					
364.	002400L				
365.					
366.					
367.					
368.					
369.					
370.					
371.					
372.					
373.					
374.					
375.					
376.					
377.					
378.					
379.	002400L	00110001	11011100	TSTIP	,SWUSER,PSWI NOT ALLOWED IF IN USER MODE
	002401L	01000101	00000100		
380.	002402L	11010010	11011110	BRA	IVIOL2,FZ
381.	002403L	00110001	11011111	DOTIP	,ND,-2,IMPI LOW BIT MUST BE OFF
	002404L	01010101	11111110		
382.	002405L	01010011	01000000	DOPI	MAROL,OR,0100 BIT 6 MUST BE ON
	002406L	00110111	11000000		
383.	002407L	00110111	00001001	STB	DIMP
384.	002410L	00110001	11101111	LDX	IM2MRH SAVE NEW REG PAIR
385.	002411L	00110001	11011010	LDPP	IMPO,SPIH,IIMP MOVE STACK TO REG PAIR
	002412L	00110111	10001111		
	002413L	00110111	00001000		
386.	002414L	00110001	11011011	LDPP	IMPO,SPIL
	002415L	00110111	10001111		
387.	002416L	00110001	10001011	LDX	MR2XXL+SPL MOVE SAVED NEW STACK POINTER
388.	002417L	00110001	10101010	LDX	MR2XXH+SPH
389.	002420L	11001111	11111010	BRA	FETCH
390.				IFC	CAPAPF

+

SYSM

. 2.80 (022 065) SYSM XA
 . 2.80 (062 065) SYSM BC
 . 2.80 (174 065) SYSM DE
 . 2.80 (176 065) SYSM HL

MOVE SYSTEM AREA

(SWAP POINTER WITH REGISTER PAIR)

SP-1 I SP <-> RP

<8-MSB> <X1PPPPPO>

WHERE: 8-MSB IS CORRECT MSB
 X IS 128 BYTE BOUNDARY
 P P P P P IS STACK POINTER
 1 IS FORCED ONE AND
 0 IS FORCED ZERO FOR
 CORRECT OPERATION

393.								
394.	002421L							
395.								
396.								
397.	002421L	00110111	00001100	STB	IMAR,SMR		START TO GET THE OP-CODE	
	002422L	00110111	01000111					
398.	002423L	11011000	11011110	BRA	IVIOL2,F@,IZ		MULTIPLE IMPLICIT IN A ROW IS ERROR	
399.	002424L	01010001	00010000	LDPI	LIMP,IMP8			
	002425L	00110111	00000001					
400.	002426L	00110001	10001001	DLDX	MR2PC			
	002427L	00110001	10101000					
401.	002430L	11001111	11110000	BRA	FETLIMP			
402.								
403.	002431L							
404.								
405.								
406.								
407.								
408.								
409.								
410.								
411.								
412.	002431L	00110111	00001100	STB	IMAR,SMR		START TO GET REAL OP-CODE	
	002432L	00110111	01000111					
413.	002433L	11011000	11011110	BRA	IVIOL2,F@,IZ		MULTIPLE IMPLICIT IN A ROW IS ERROR	
414.	002434L	01010101	00000111	DOPI	LIMP,ND,7			
	002435L	00110111	00000001					
415.	002436L	00110001	10001001	DLDX	MR2PC			
	002437L	00110001	10101000					
416.	002440L	11001111	11110000	BRA	FETLIMP			
417.				XIF				
418.								
419.	>002441L	01011001	11111111	IVIOL2	BRAX	IVIOL\$		
	>002442L	11001111	11111111					

*

SIR0:

. 2.10 (022) XA SELECT XA REGISTER PAIR

*

SIRX:

. 2.10 (111) B SELECT B OR IMP ODD
 . (062) C SELECT C OR BC OR IMP EVEN
 . (113) D SELECT D
 . (174) E SELECT E OR DE
 . (115) H SELECT H
 . (176) L SELECT L OR HL
 . (117) X SELECT X

422.						
423.	002443L					
424.						
425.						
426.						
427.						
428.						
429.						
430.						
431.						
432.						
433.						
434.						
435.	002443L	00110001	00110001	ISTIP	,STUSCF,STATUS	TEST CC
	002444L	01000101	00000001			
436.	002445L	11010010	11010100	BRA	JUMP,FZ	YES, IT'S MET, DO THE JUMP
437.						
438.	002446L					
439.						
440.						
441.	002446L	00110111	00001100	STB	IMAR,IMAR	
	002447L	00110111	00001100			
442.	002450L	00110111	00001100	STB	IMAR,SMR	A LITTLE FASTER IN COMPETITION WITH DMA
	002451L	00110111	01000111			
443.	002452L	11001111	11110110	BRA	FETCHS	
444.						
445.	002453L					
446.						
447.						
448.						
449.	002453L	00110111	00001100	STB	IMAR,SMR	GET THE LSB
	002454L	00110111	01000111			
450.	002455L	11001110	11111111	MWAIT	NOOP,MEMPF2	
	002456L	11010100	11010001			
	002457L	11000111	01101111			
451.	002460L	00110001	00110110	LDTP	MDR	
452.	002461L	00110111	00001100	STB	IMAR,SMR	GET THE MSB
	002462L	00110111	01000111			
453.	002463L	01101111	11110001	LDRT	TEMP1	
454.	002464L	11010100	11001011	MWAIT	,MEMPF2	
	002465L	11000111	01101111			
455.	002466L	00110001	00110110	LDPP	MAROH,MDR	GOT THE MSB
	002467L	00110111	11100000			
456.	002470L	01110001	11110001	LDPR	MAROL,TEMP1,SMR	AND SAVED LSB
	002471L	00110111	11000000			
	002472L	00110111	01000111			
457.	002473L	11001111	11110110	BRA	FETCHS	GO TO IT!

*

JUMPC:

.	(	100)	JCC.LSB.MSB	CONDITIONAL JUMP
.	4.30	(1.15	NOT TAKEN)	PC <- NN
.	(	100)	JFC.LSB.MSB	FALSE CARRY
.	(	110)	JFZ.LSB.MSB	FALSE ZERO (.NE.)
.	(	120)	JFS.LSB.MSB	FALSE SIGN (.GE.)
.	(	130)	JFP.LSB.MSB	FALSE PARITY (EVEN)
.	(	140)	JTC.LSB.MSB	TRUE CARRY
.	(	150)	JTZ.LSB.MSB	TRUE ZERO (.EQ.)
.	(	160)	JTS.LSB.MSB	TRUE SIGN (.LT.)
.	(	170)	JTP.LSB.MSB	TRUE PARITY (ODD)

*

NOJ:

.	0.80	(045)	NOJ.LSB.MSB	3 BYTE NO-OP
---	------	---	------	-------------	--------------

*

JUMP:

.	3.85	(	104)	JMP.LSB.MSB	UNCONDITIONAL JUMP
.					PC <- NN

460.								
461.	002474L							
462.								
463.								
464.								
465.								
466.								
467.								
468.								
469.								
470.								
471.								
472.								
473.	002474L	00110111	00001100		STB	IMAR,SMR		POINT TO THE DATA
	002475L	00110111	01000111					
474.	002476L	11001110	11111111		MWAIT	NOOP, MEMPF2		
	002477L	11010100	11000000					
	002500L	11000111	01101111					
475.	002501L	00110001	00110110		LDPP	I350,MDR		GET THE DATA
	002502L	00110111	10001101					
476.	002503L	11001111	11111000		BRA	FETCHI		AND RETURN
477.								
478.	002504L							
479.								
480.								
481.								
482.								
483.								
484.								
485.	002504L	11011000	10111000		BRA	LD7I,F@,IZ		SPECIFIED IMP?
486.	002505L	01010001	00000110		LDPI	LIMP,URL		NO, THEN USE HL AS REG PAIR
	002506L	00110111	00000001					
487.	002507L	00110001	11001111		LD7I	DLDX	IM2MR,DIMP,SMR	POINT AND START MEMORY READ
	002510L	00110111	00001001					
	002511L	00110001	11101111					
	002512L	00110111	01000111					
488.	002513L	11001110	11111111		MWAIT	NOOP,s+1		PUT IN STANDARD 200 NS DELAY FROM READY
	002514L	11010100	10110011					
	002515L	11010111	10110001					
489.	002516L	00110001	00110110		LDPP	I350,MDR		GET THE DATA FIRST, THEN
	002517L	00110111	10001101					
490.	002520L	11000110	11111010		BRA	FETCH,F@,MP		NO FAULT AFTER READ, THEN DONE
491.	002521L	11001111	01101111		BRA	MEMPF2		ELSE, GO TO FAULT ROUTINE

492.									
493.	002522L								
494.									
495.									
496.									
497.									
498.									
499.									
500.									
501.	002522L	11011000	10101010		BRA	L7SI,F@,IZ		ALMOST EXACTLY LIKE LD7	
502.	002523L	01010001	00000110		LDPI	LIMP,URL			
	002524L	00110111	00000001						
503.	002525L	00110001	11001111	L7SI	DLDX	IM2MR,DIMP			
	002526L	00110111	00001001						
	002527L	00110001	11101111						
504.	002530L	00110001	11011110		LDPP	MDW,I02I		WRITE REGISTER IN MEMORY	
	002531L	00110111	00100001						
505.	002532L	11001111	11111100		BRA	FETCHW			
506.									
507.	002533L								
508.									
509.									
510.									
511.	002533L	00110001	11011110		LDPP	I350,I02I		SAVE SOURCE REGISTER IN DESTINATION	
	002534L	00110111	10001101						
512.	002535L	11001111	11111000		BRA	FETCHI		AND DONE!	

*

L7S:

. (37S) LMR STORE A BYTE IN MEMORY
 (HL) <- S
 . 1.90~2.10 USE REG PAIR BC
 (062 37S) LMR USE REG PAIR DE
 (174 37S) LMR USE REG PAIR XA
 (022 37S) LMR (RP) <- S
 . 1.75~1.95

*

LDS:

. 0.50 (3DS) LRR LOAD SOURCE REGISTER INTO ANOTHER REG
 D <- S

515.				*		
516.	002536L			AP4:		
517.				. 3.15	(0P4)	OP.VVV ALUOP ON IMMEDIATE VALUE
518.				.	(IMP 0P4)	OP.VVV ALUOP IS OTHER THAN TO A-REG.
519.				. +.45	IF 'AC' OR 'SB'	R <- R OP N
520.				.	(004)	AD.VVV ADD IMMEDIATE VALUE TO A-REG
521.				.	(IMP 004)	AD.VVV ADD IMMEDIATE VALUE TO IMP-REG
522.				.	(014)	AC.VVV ADD WITH CARRY IMM. TO A-REG
523.				.	(IMP 014)	AC.VVV ADD WITH CARRY IMM. TO IMP-REG
524.				.	(024)	SU.VVV SUB IMMEDIATE VALUE FROM A-REG
525.				.	(IMP 024)	SU.VVV SUB IMMEDIATE VALUE FROM IMP-REG
526.				.	(034)	SB.VVV SUB WITH CARRY IMM. FROM A-REG
527.				.	(IMP 034)	SB.VVV SUB WITH CARRY IMM. FROM IMP-REG
528.				.	(044)	ND.VVV AND IMMEDIATE VALUE TO A-REG
529.				.	(IMP 044)	ND.VVV AND IMMEDIATE VALUE TO IMP-REG
530.				.	(054)	XR.VVV XOR IMMEDIATE VALUE TO A-REG
531.				.	(IMP 054)	XR.VVV XOR IMMEDIATE VALUE TO IMP-REG
532.				.	(064)	OR.VVV IOR IMMEDIATE VALUE TO A-REG
533.				.	(IMP 064)	OR.VVV IOR IMMEDIATE VALUE TO IMP-REG
534.				.	(074)	CP.VVV SUB IMM. VALUE FROM A-REG TO SET FLAGS
535.				.	(IMP 074)	CP.VVV SUB IMM. VALUE FROM IMP-REG TO SET FLAG
536.						
537.	002536L	00110111	00001100		STB	IMAR,SMR GET FOLLOWING IMMEDIATE DATA
	002537L	00110111	01000111			
538.	002540L	01101111	11110010		LDRT	TEMP2 SAVE ALU OP-CODE
539.	002541L	11010100	10011110		MWAIT	,MEMPF2
	002542L	11000111	01101111			
540.	002543L	00110001	00110110		LDTP	MDR THE DATA IS IN T
541.	002544L	11011111	10001101		BRA	ALUOP
542.				*		
543.	002545L			AP7:		
544.				. 3.70	(2P7)	OPM ALUOP WITH MEMORY DATA
545.				.	(IMP 2P7)	OPM DEST. OTHER THAN A-REG
546.				. +.45	IF 'AC' OR 'SB'	R <- R OP (HL)
547.						
548.	002545L	01101111	11110010		LDRT	TEMP2 SAVE ALU OP-CODE
549.	002546L	00110001	11000110		DLDX	HL2MR,,SMR GET THE DATA
	002547L	00110001	11100101			
	002550L	00110111	01000111			
550.	002551L	11001110	11111111		MWAIT	NOOP,MEMPF2
	002552L	11010100	10010101			
	002553L	11000111	01101111			
551.	002554L	00110001	11001001		DLDX	PC2MR SO ALUOP CAN USE FETCHI RETURN
	002555L	00110001	11101000			
552.	002556L	00110001	00110110		LDTP	MDR THE DATA
553.	002557L	11011111	10001101		BRA	ALUOP AND GO WORK WITH IT

```

554.
555. 002560L
556.
557.
558.
559.
560. 002560L 01101111 11110010
561. 002561L 00110001 11011110
562.
563.
564. 002562L
565.
566.
567.
568. 002562L 01101111 11110001
569. 002563L 01110001 11110010
570. 002564L 00010111 10010010
571. 002565L 01010101 00011100
572. 002566L 01010010 01101010
573. 002567L 01101111 10110000
574. 002570L 11101111 00000000
575.
576.
577.
578.
579.
580. 002571L 00110001 11011111
    002572L 01110100 00110001
    002573L 00110111 00000110
581. 002574L 11001111 11111000
582.
583.
584.
585. 002575L 00110001 11011111
    002576L 01110011 10110001
    002577L 00110111 01101111
586. 002600L 11001111 11111000
587.
588.
589.
590. 002601L 00110001 11011111
    002602L 01110000 10110001
    002603L 00110111 01101111
591. 002604L 11001111 11111000
592.
593.
594.
595. 002605L 00110001 11011111
    002606L 01110101 10110001
    002607L 00110111 01101111
596. 002610L 11001111 11111000
597.
    
```

+

APS:

. 1.65 (2PS) OPR ALUOP WITH SOURCE REGISTER
 . (IMP 2PS) OPR DEST. OTHER THAN A-REG
 . +.45 IF 'AC' OR 'SB' R <- R OP S

LDRT TEMP2 SAVE ALU OP-CODE
 LDTP I02I SELECT SOURCE REG.
 BRA ALUOP

ALUOP

. 1.40
 . +.45 IF 'AC' OR 'SB'

LDRT TEMP1 SAVE SOURCE REG.
 LDTR TEMP2 GET OPCODE
 SHIFT SR,CC GET ALUOP IN BITS 4-2
 DOTI ,ND,034 SELECT 3 BITS
 DOTA ,AC,ALUXQT OFFSET TO THE EXEC TABLE
 BAS LINK,CC CLEAR CARRY AND
 BRK LINK GO TO CORRECT ROUTINE

*
 . THE TABLE STARTS HERE AND IS BACKWARDS

(A7S) CP 2'S COMPLEMENT SUBTRACT TO SET FLAGS

DOPRP LUF,SB,TEMP1,IMPI,CO

BRA FETCHI

(A6S) OR LOGICAL INCLUSIVE OR

DOPRP IMPFO,OR,TEMP1,IMPI,CC

BRA FETCHI

(A5S) XR LOGICAL EXCLUSIVE OR

DOPRP IMPFO,XR,TEMP1,IMPI,CC

BRA FETCHI

(A4S) ND LOGICAL AND

DOPRP IMPFO,ND,TEMP1,IMPI,CC

BRA FETCHI

598.				. (A3S) SB	2'S COMPLEMENT SUBTRACT WITH CARRY
599.					
600.	002611L	00110001	00110101	LDRP	TEMP2,UCFLG
	002612L	01101111	11110010		
601.	002613L	01110010	00110010	DOTR	,AC,TEMP2,,CO SET THE CARRY
602.	002614L	11001110	11111111	NOOP	
603.					
604.				. (A2S) SU	2'S COMPLEMENT SUBTRACT
605.					
606.	002615L	00110001	11011111	DOPRP	IMPFO,SB,TEMP1,IMPI
	002616L	01110100	11110001		
	002617L	00110111	01101111		
607.	002620L	11001111	11111000	BRA	FETCHI
608.					
609.				. (A1S) AC	2'S COMPLEMENT ADD WITH CARRY
610.					
611.	002621L	00110001	00110101	LDRP	TEMP2,UCFLG
	002622L	01101111	11110010		
612.	002623L	01110010	00110010	DOTR	,AC,TEMP2,,CO SET THE CARRY
613.	002624L	11001110	11111111	NOOP	
614.					
615.				. (A0S) AD	2'S COMPLEMENT ADD
616.					
617.	002625L	00110001	11011111	ALUXQT DOPRP	IMPFO,AC,TEMP1,IMPI
	002626L	01110010	11110001		
	002627L	00110111	01101111		
618.	002630L	11001111	11111000	BRA	FETCHI

621.
 622. 002631L
 623.
 624. 002631L 00110001 11011100
 002632L 01010011 00100000
 002633L 00110111 10001100
 625. 002634L 11010100 01100011
 002635L 11000111 01101111
 626.
 627. 002636L
 628.
 629.
 630.
 631.
 632. 002636L 00110001 00110000
 633. 002637L 11010011 01010101
 634.
 635. 002640L
 636.
 637.
 638.
 639.
 640.
 641.
 642.
 643.
 644.
 645.
 646.
 647. 002640L 01000101 00010000
 648. 002641L 11010010 00000000
 649.
 652.
 653. 002642L 01000101 00001000
 654. 002643L 11010010 01000110
 655.
 656. 002644L 01000101 00000100
 657. 002645L 11010010 01001011
 658.
 659. 002646L 01000101 00100000
 660. 002647L 11010010 00101110
 661.
 664.
 665. 002650L 01000101 01000000
 666. 002651L 11010010 00111110

*
 SRVRPT: REPEATED SERVICE REQUESTS
 DOPIP PSWO,OR,SWRPT,PSWI SET REPEAT FLAG
 MWAIT ,MEMPF2
 SRVNXT:
 . FOLLOWING TIMING ASSUMED OR CORRECTED TILL THIS POINT REACHED
 . (NOT INCLUDING OFF-PAGE ROUTINES)
 ISTTP FI,SRVREQ RELOAD SERVICE REQUEST FLAGS
 BRA SRVRTW,TZ (SPEEDUP, REALLY NO MORE INTERRUPTS)
 *
 SRVDO: SERVICE LOOP - PRIORITY SEQUENCE
 . *****
 . NOTICE:: ALL SERVICE ROUTINES THAT USE THE MAR MUST FIRST HAVE A
 . MWAIT , \$+1 SO THAT THE MEMORY BUS IS NOT OVERRUN.
 . ALSO, THE MODE-WORD SWUSER MODE BIT MAY NEED TO BE TURNED OFF
 . TO ALLOW ACCESS TO PROTECTED MEMORY
 . *****
 . NOTE: P.C. POINTS TO START OF INSTRUCTION BEING EXECUTED (REPEATED)
 . OR TO INST. THAT WAS TO BE EXECUTED (FETCH)
 . NOT INCLUDING THE IMP-SPEC.
 . *****
 TSTIT ,SCDSPNL
 BRA DLDO,FZ DISPLAY-KEYBOARD SERVICE
 IFC CAPIMA NON-IMA
 XIF
 TSTIT ,SCSDLCT
 BRA COMTDO,FZ COMM TRANSMIT
 IFS CAPIMA IMA
 TSTIT ,SCSDLCR
 BRA COMRDO,FZ COMM RECEIVE
 XIF
 TSTIT ,SCONMS
 BRA OMDO,FZ ONE MILLI-SECOND INT
 IFS CAPMICR
 XIF
 TSTIT ,SCHUMS
 BRA HUMDO,FZ HUNDRED MICRO-SEC INT

667.					
668.	002652L				
669.					
670.	002652L	11010100	01010101	MWAIT	,MEMPF2 FOR TRAILING MDW'S
	002653L	11000111	01101111		
671.	002654L	00110001	11011100	LDPP	MODW,PSWI RESTORE CORRECT MODE (IF CHANGED)
	002655L	00110111	00000100		
672.	002656L	01000101	00100000	TSTIT	,SWRPT REPEATED INSTRUCTION?
673.	002657L	11000010	11101100	BRA	SRVID,FZ YES, DO IT ONLY
674.					WARNING! SOME REPEATED CODE IN FUTURE
675.					MAY NEED MAR TO MATCH THE PC
676.	002660L	00110001	11001001	DLDX	PC2MR,,SMR NO, CODE AS AT FETCH WITHOUT SERVICE
	002661L	00110001	11101000		
	002662L	00110111	01000111		
677.	002663L	11001111	11110000	BRA	SRVEND GO TO FETCH-EXECUTE

678.								
679.								
680.	002664L							INTERRUPT ROUTINES TO DO COMMUNICATION RECEIVE
681.								
682.	002664L	00110111	00101101	STB	CSRFB			CLEAR INTERRUPT
683.	002665L	01110001	11001001	TSTRF	FI,COMMODE			COMM IN USE?
684.	002666L	11010011	01100001	BRA	SRVNXT,TZ			NO!
685.	>002667L	01011001	11111111	BRAX	COMMR			YES, COMMUNICATIONS RECEIVE
	>002670L	11001111	11111111					
686.								
687.	002671L							COMMUNICATIONS TRANSMIT
688.								
689.				IFC	CAPIMA			
695.				XIF				
696.				IFS	CAPIMA			
697.	002671L	01110001	11110011	LDPR	ACUOT,TRNCHN			OUTPUT NEXT DATA AS SOON AS POSSIBLE
	002672L	00110111	00100100					
698.	002673L	00110111	00100011	STB	SDLCOT			TURN OFF THE COMM INTERRUPT
699.								** EYE PATTERN SDLCOT VS ACUOT BIT 0 **
700.								***** NOTE: SDLCOT & ACUOT BIT 0 WILL MATCH (EXCEPT INVERSED & 1 BIT DELAY)
701.	>002674L	01011001	11111111	BPGX	COMMT			
702.	002675L	01110001	11001001	TSTRF	FI,COMMODE			COMM IN USE?
703.	>002676L	11000010	11111111	BRA	COMMT,FZ			YES, COMMUNICATIONS TRANSMIT
704.				XIF				
705.	002677L	01011001	11111010	BRAX	SRVNXT			
	002700L	11011111	01100001					
706.								
707.	002701L							HUNDRED-MICRO-SECOND INTERRUPT (AUDIO)
708.								
709.	002701L	00110111	00001011	STB	CHUF			CLEAR INTERRUPT
710.				IFC	CAPAPF			
711.	002702L	00010001	11111111	LDTR	ACPH			IS THE CHANNEL OFF (ZERO)
712.	002703L	11010011	01100001	BRA	SRVNXT,TZ			YES, DO NOTHING
713.	002704L	11010100	00111011	MWAIT	,MEMPF2			WAIT ON WASTED I-FETCH
	002705L	11000111	01101111					
714.	002706L	00110111	11100000	LDPT	MAROH			LOAD MSB OF CHANNEL COMMAND ADDRESS
715.	002707L	00110001	11011100	DOPIP	MODW,ND,-1-SWUSER,PSWI			ALLOW PRIV'D ACCESS
	002710L	01010101	11111011					
	002711L	00110111	00000100					
716.	002712L	00010001	11111110	LDPR	MAROL,ACPL,SMR			GET NEXT COMMAND (LOAD LSB OF ADDRESS)
	002713L	00110111	11000000					
	002714L	00110111	01000111					
717.	002715L	00010001	11111101	LDPR	LSPKR,ACD			PUT OUT THIS TIME-SLOT'S D/A VALUE
	002716L	00110111	00100010					
718.	002717L	01011001	11111000	BRAX	ACSDO			GO DO AUDIBLE CHANNEL COMMAND
	002720L	11011111	11111111					(MWAIT DELAY OF ONE TIMED IN ACCSDO)
719.								
720.				XIF				
721.				IFS	CAPAPF			
735.				XIF				

736.					
737.					
747.					
748.					
758.					
759.					
760.					
764.					
765.					
766.					
786.					
787.					
812.					
813.					
814.	002721L				
815.					
816.					
817.					
818.					
819.	002721L	00110111	00001010		
820.	002722L	01010001	00100100		
	002723L	01101111	11110010		
821.					
822.	002724L				
823.	002724L	11010100	00101011		
	002725L	11000111	01101111		
824.	>002726L	01011001	11111111		
825.	002727L	00110001	11011100		
	002730L	01000101	00100000		
826.	>002731L	11000011	11111111		
827.	>002732L	11001111	11111111		
828.					
829.					
830.					
831.					
832.					
833.					
834.					
835.					
836.	002733L	11111111	11111111		
	002734L	11111111	11111111		
	002735L	11111111	11111111		
	002736L	11111111	11111111		
	002737L	11111111	11111111		
	002740L	11111111	11111111		
	002741L	11111111	11111111		
	002742L	11111111	11111111		
	002743L	11111111	11111111		
	002744L	11111111	11111111		
	002745L	11111111	11111111		
	002746L	11111111	11111111		
	002747L	11111111	11111111		

*		IFS	CAPMICR	
		XIF		
		IFS	CAPMICR	
		XIF		
		IFS	CAPMICR-CAPAPF	(MICRO-BUS, NON-APF)
		XIF		
		IFS	CAPMICR	
		XIF		
		IFS	CAPMICR	
		XIF		
*				
	OMDO			ONE MILLISECOND INTERRUPT CONTROL
				. SHOULD BE LAST INTERRUPT IN CHAIN BECAUSE DOESN'T RETURN AS OTHERS DO
				. THROUGH SRVRET (GOES OFF ON ITS OWN)
		STB	COMF	CLEAR FLAG
		LDRI	TEMPL,SVONEMS	LOAD INTERRUPT VECTOR ADDRESS
				(\$+1 OR SRV. RTN. FAULT GENERATES MEMPF)
	AMLINT			
		MWAIT	,MEMPF2	WAIT FOR UNUSED INST. FETCH TO COMPLETE
		BPGX	SCRAM	
		ISTIP	,SWRPT,PSWI	WAS REPEATED INSTRUCTION?
		BRA	SCRAM,TZ	NO, THE P.C. CORRECT (IMP - UNKNOWN)
		BRA	SCLST	YES, BACK UP P.C. TO IMP-SPEC.
				. IF I-FETCH ENTRY PC POINTING TO NEXT INSTRUCTION TO EXECUTE SO CORRECT
				. IMP IS ZERO BY WAY FETCH CODE WRITTEN
				. IF NON-I-FETCH (REPEATED) PC POINTING TO INSTRUCTION BEING REPEATED
				. IF IMP ZERO PC IS CORRECT, POINTING TO INST. TO CONTINUE
				. IF IMP NON-ZERO MUST BACK UP PC TO RE-DO IMP SPEC CODE WHEN MACRO-RETURNS
				. COULD SIMPLIFY, IF IMP-NON-ZERO MUST BACKUP BECAUSE IS IMP-SPEC REPEATED
*		PAD	-(\$+1)	

```

002750L 11111111 11111111
002751L 11111111 11111111
002752L 11111111 11111111
002753L 11111111 11111111
002754L 11111111 11111111
002755L 11111111 11111111
002756L 11111111 11111111
002757L 11111111 11111111
002760L 11111111 11111111
002761L 11111111 11111111
002762L 11111111 11111111
002763L 11111111 11111111
002764L 11111111 11111111
002765L 11111111 11111111
002766L 11111111 11111111
002767L 11111111 11111111
002770L 11111111 11111111
002771L 11111111 11111111
002772L 11111111 11111111
002773L 11111111 11111111
002774L 11111111 11111111
002775L 11111111 11111111
002776L 11111111 11111111
002777L 01011001 11111001

```

837.
838.
839.
840.

```

DLDO      BPGX      DL$DO
.
          TABPAGE  PRODL

```

DISPLAY - KEYBOARD
FALL THROUGH FROM LAST WORD OF PAGE

843.						
844.	003000L					
845.						
846.	003000L	01010001	11110111	BAL	LINK,DLNL	SET UP RETURN FROM KEY SERVICE
	003001L	01101111	11110000			
847.	003002L	11000100	11111101	MWAIT	,MEMPFDL	WAIT ON WAISTED IFETCH
	003003L	11000111	11001111			
848.	003004L	00110001	11011100	DOPIP	MODW,ND,-1-SWUSER,PSWI	DISABLE USER MODE FOR READ/WRTES
	003005L	01010101	11111011			
	003006L	00110111	00000100			
849.	003007L	11001111	11001101	BRA	KBD\$DO	GO DO FIRST KEYBOARD SERVICE
850.						
851.	003010L	00110001	00110001	DLNL	TSTIP	AC,STBOTLN,STATUS SET CARRY IF BOTTOM LINE STATUS
	003011L	01000010	10000000			
852.	003012L	00010001	11110000	LDTR	PDLNP	
853.	003013L	11000000	11100111	BRA	DLNXT,FC	NOT YET
854.						
855.	003014L	11000100	11110011	MWAIT	,MEMPFDL	WAIT ON KBD STATUS BIT WRITE
	003015L	11000111	11001111			
856.	003016L	01010001	01101011	LDPI	MAROL,SELFREQ,SMR	GET FREQ COUNTER, SAME PAGE AS KBD STUF
	003017L	00110111	11000000			
	003020L	00110111	01000111			
857.	003021L	01010001	00000000	TCLR		SET T-REG ZERO (NOTE: CARRY IS TRUE!!)
858.	003022L	11000100	11101101	MWAIT	,MEMPFDL	
	003023L	11000111	11001111			
859.	003024L	00110010	00110110	DOPP	MDW,AC,MDR	ADD ONE AND RESTORE IT
	003025L	00110111	00100001			
860.				IFS	CAPAPF	
865.				XIF		
866.				IFC	CAPAPF	
867.	003026L	00010111	10110010	CCLR		
868.				XIF		
869.				IFS	CAPIVS	
875.				XIF		
876.				IFC	CAPIVS	
877.	003027L	01010001	10011100	LDTI	SEDLBOT	POINT TO BOTTOM LINE FOR SCAN
878.						
879.	003030L	11000100	11100111	DLNXT	MWAIT	,MEMPFDL
	003031L	11000111	11001111			
880.	003032L	00110111	11000000	LDPT	MAROL,SMR	SET LSB OF ADDRESS AND READ ADDRESS LSB
	003033L	00110111	01000111			
881.	003034L	01010100	00000010	DORI	PDLNP,SB,2	SUBTRACT 2 FROM LIST POINTER
	003035L	00000111	11110000			
882.				XIF		
883.	003036L	11000100	11100001	MWAIT	,MEMPFDL	** E0 VECTOR FAULT NEEDED HERE **
	003037L	11000111	11001111			
884.						** AND IN ALL OTHER SERVICE ROUTINES **
885.	003040L	00110001	00110110	LDTP	MDR	GET LSB OF DATA POINTER
886.	003041L	00110111	00001100	STB	IMAR,SMR	GET MSB ALSO
	003042L	00110111	01000111			
887.	003043L	01101111	11110001	LDRT	TEMPI	HOLD LSB FOR THE MOMENT
888.	003044L	01010001	11010001	BAL	LINK,DLNLR	SET UP RETURN ADDRESS (VERY EARLY!)

889.	003045L	01101111	11110000			
	003046L	11000100	11011001	MWAIT	,MEMPFDL	
	003047L	11000111	11001111			
890.	003050L	00110001	00110110	LDPP	MAROH,MDR	GET MSB POINTER
	003051L	00110111	11100000			
891.	003052L	01110001	11110001	LDPR	MAROL,TEMP1,LDMAP	AND LSB, AND STROBE TO LOAD THE DMA PNT
	003053L	00110111	11000000			
	003054L	00110111	01000001			
892.	003055L	11001111	11001101	BRA	KBD\$DO	GO DO THE SECOND KEYBOARD SCAN
893.				*		
894.	003056L	01011001	11111010	DLNLR	BRAX	SRVNXT
	003057L	11011111	01100001			
895.						
896.	003060L	00110111	01000001	MEMPFDL	STB	LDMAP
897.	003061L	11011111	01010000	BRA	MEMPF3	CLEAR INTERRUPT ON ANY MEMORY FAULT

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898.
899. 003062L
900.
901.
902.
903.
904.
905.
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912.
913.
914.
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916.
917.
918.
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920.
921.
922. 003062L 01010001 01101001          DLDPI    MAR0,SEKBS1      MIDDLE OF 3 BYTES THAT WILL WORK WITH
      003063L 00110111 11000000
      003064L 01010001 11101111
      003065L 00110111 11100000
923. 003066L 00110001 00110001          KBDWAIT  TSTIP      ,STKBRDY,STATUS
      003067L 01000101 01000000
924. 003070L 11000011 11001001          BRA      KBDWAIT,TZ      (LOOPS ONCE ON SECOND SERVICE, MAYBE)
925.
926. 003071L 00010001 10110001          TSTIR    SB,16,KBSCNT,CC (NOT READY TILL 5.3 MICRO-S FROM KBSC)
      003072L 01000100 00010000          IS IT FUNCTION KEY (OR THAT GROUP?)
927. 003073L 11000000 10100001          BRA      KBKEY,FC        NO, REGULAR KEY
928.
929. 003074L 00010010 00110001          DOTR     ,AC,KBSCNT,,CO  DOUBLE THE NUMBER FOR JUMP TABLE
930. 003075L 01010010 10100001          DOTA     ,AC,KBTBL      MAKE IT A BACKWARDS TABLE OFFSET
931. 003076L 01101111 11110001          BAS      TEMPI          PUSH
932. 003077L 11101111 00000001          BRR      TEMPI          RETURN
933.
934.
935. 003100L 01010001 00000010          LDTI     SEKBDKY        17 KEYBOARD KEY
936. 003101L 11001111 10000010          BRA      KBKS1
937. 003102L 01010001 00000001          LDTI     SEDSPKY        16 DISPLAY KEY
938. 003103L 11001111 10000010          BRA      KBKS1
939. 003104L 01010001 00000010          LDTI     SEFUNC2        15 F2 KEY
940. 003105L 11001111 10000011          BRA      KBKS2
941. 003106L 01010001 00001000          LDTI     SEFUNC4        14 F4 KEY
942. 003107L 11001111 10000011          BRA      KBKS2
943. 003110L 01010001 10000000          LDTI     SEINTKY        13 INTERRUPT KEY
944. 003111L 11001111 01110110          BRA      KBREINT
    
```

```

+
KBD$DO
. * * * 5.60 * * * NEW KEY JUST WENT DOWN
.      2.95 THE KEY IS UP AND WAS NOT LAST TO GO DOWN
.      4.85 REPEATED KEY UP
.      4.65 REPEATED KEY DOWN
.      + 0.70 IF <SPACE>, <CANCEL>, <.>, <BACKSPACE>
. OR + 0.50 IF <ENTER>

. * * * 4.20 * * * KBKS1 STATUS BIT (UP OR DOWN)
. OR 4.35 KBKS2 STATUS BIT
. OR 4.35 KBREINT STATUS BIT DOWN
. OR 5.50 KBREINT STATUS BIT UP
. OR 5.50 RESTART - IMP ZERO TO SCROM
. OR 5.85 RESTART - NON-RPT'D INST. TO SCROM
. OR 6.70 RESTART - RPT'D & IMP NON-ZERO TO SCROM
    
```

- . SCAN THE KEYBOARD BY:
- . 1) WAIT FOR THE LAST SCAN TO COMPLETE
- . 2) IF SPECIAL KEY, DO IT'S TYPE OF SERVICE (SET OR CLEAR STATUS BIT)
- . 3) IF NEW CLOSURE GET KEYCODE, SAVE IT, AND SAVE THE SCAN NUMBER
- . 4) IF NOT THE SAME KEY AS SPECIFIED BY LAST SCAN NUMBER THEN DONE
- . 5) IF SAME, AND STILL DOWN, SET STATUS BIT ELSE, CLEAR IT

968.				+				
969.	003137L	01101111	11110001	KBREG	LDRT	TEMP1		
970.	003140L	00110001	00110001		TSTIP	,STKBKC,STATUS	NEW CLOSURE?	
	003141L	01000101	00010000					
971.	003142L	11000010	10010111		BRA	KBGET,FZ	YES, DO IT	
972.	003143L	00010001	11110001		TSTRR	XR,SCANSV,KBSCNT	SAME AS THE LAST KEY?	
	003144L	00010000	11000010					
973.	003145L	11000010	10001001		BRA	KBDON,FZ	NO, FINISHED	
974.	003146L	01010001	00001000		LDTI	SEKBDWN	YES, SAME KEY	
975.	003147L	11001111	10000010		BRA	KBKS1	CONTINUOUSLY SET THE BIT IF STILL DOWN	
976.				.			CLEAR BIT CONTINUOUSLY IF UP	
977.				.			IF GOES DOWN AGAIN GET NEW CLOSURE	
978.				.			RATHER THAN REPEATED CLOSURE!	
979.								
980.	003150L	00110111	00001100	KBGET	STB	IMAR	KEYBOARD CHARACTER SAVE AREA	
981.	003151L	00110001	01010000		LDPP	MDW,KBDD	OUTPUT THE DATA	
	003152L	00110111	00100001					
982.	003153L	00010001	11110001		LDRR	SCANSV,KBSCNT	SAVE THE SCAN NUMBER (FOR REPEATS)	
	003154L	00000111	11110010					
983.	003155L	11000100	10010010		MWAIT	,MEMPFDL		
	003156L	11000111	11001111					
984.	003157L	00110111	00001101		STB	DMAR,SMR	POINT BACK TO SEKBS1	
	003160L	00110111	01000111					
985.	003161L	01110001	11110001	KBCLS	LDTR	TEMP1	GET BIT TO SET	
986.	003162L	11000100	10001101		MWAIT	,MEMPFDL		
	003163L	11000111	11001111					
987.	003164L	00110011	00110110		DOPP	MDW,OR,MDR	SET IT	
	003165L	00110111	00100001					
988.	003166L	00010001	11110001	KBDON	DOTRR	,IT,Q,KBSCNT,CI	POINT TO THE NEXT SCAN ENTRY (CLEAR)	
	003167L	00010110	01110010					
989.	003170L	01010101	00111111		DOPI	KBSC,ND,077	KEEPING THE NUMBER IN RANGE (CARRY ALSO	
	003171L	00110111	01000100					
990.	003172L	00000111	11110001		LDRT	KBSCNT,CC	(5.3 MICRO-SEC TIME TILL READY FROM NOW	
991.	003173L	11101111	00000000		BRR	LINK	AND RETURN FROM KEY SERVICE ON ERROR TO	
992.				*				
993.	003174L	00110111	00001101	KBKS2	STB	DMAR	POINT TO SEKBS2	
994.								
995.	003175L	00110111	01000111	KBKS1	STB	SMR	GET THE STATUS BYTE	
996.	003176L	01101111	11110001		LDRT	TEMP1	SAVE THE STATUS BITS	
997.	003177L	00110001	00110001		TSTIP	,STKBNS,STATUS	KEY CLOSED?	
	003200L	01000101	00100000					
998.	003201L	11000010	10001110		BRA	KBCLS,FZ	YES	
999.								
1000.	003202L	01110001	11110001	KBOPN	DOTIR	,XR,0377,TEMP1	NO, OPEN, TURN THE BIT OFF	
	003203L	01010000	11111111					
1001.	003204L	11000100	01111011		MWAIT	,MEMPFDL		
	003205L	11000111	11001111					
1002.	003206L	00110101	00110110		DOPP	MDW,ND,MDR	BY ANDING IT OUT	
	003207L	00110111	00100001					
1003.	003210L	11001111	10001001		BRA	KBDON		

1004.							
1005.	003211L	01101111	11110001	KBREINT	LDRT	TEMP1	SAVE THE BIT
1006.	003212L	00110111	00001101		STB	DMAR,SMR	IN SEKBKS2
	003213L	00110111	01000111				
1007.	003214L	00110001	00110001		ISTIP	,STKBKC+STKBNS,	STATUS NEW CLOSURE OR STILL CLOSED?
	003215L	01000101	00110000				
1008.	003216L	11000010	10001110		BRA	KBCLS,FZ	YES, ITS DOWN, SO SET IT!
1009.							
1010.	003217L	01010001	10100000		LDTI	SEINTKY+SERSTKY	
1011.	003220L	11000100	01101111		MWAIT	,MEMPFDL	IT IS UP! SEE IF BOTH KEYS WERE DOWN
	003221L	11000111	11001111				
1012.	003222L	00110101	00110110		DOTP	,ND,MDR	SELECT RESTART AND INTERRUPT KEYS
1013.	003223L	01000000	10100000		ITIT	XR,SEINTKY+SERSTKY	WERE BOTH SET?
1014.	003224L	11000010	01111101		BRA	KBOPN,FZ	NO, ONLY ONE
1015.	003225L	00110001	00110110		DOPRP	MDW,XR,TEMP1,MDR	YES, TURN THE BIT OFF & DO A RESTART
	003226L	01110000	11110001				
	003227L	00110111	00100001				
1016.	003230L	01010001	00000001		DOPRI	KBSC,AC,KBSCNT,1,CO	FINISH LIKE REGULAR, BUT INLINE
	003231L	00010010	00110001				
	003232L	00110111	01000100				
1017.	003233L	00000111	11110001		LDRT	KBSCNT	ONLY KEYBOARD INVOLVED (INLINE SRVRTW)
1018.							
1019.							
1020.							
1021.							
1022.							
1023.							
1024.							
1025.							
1026.							
1027.							
1028.							
1029.							
1030.							
1031.	003234L	01010001	00000011		LDRI	TEMPL,SRRSTRT	SET RESTART ADDRESS
	003235L	01101111	11110010				
1032.	003236L	11000100	01100001		MWAIT	,MEMPFDL	
	003237L	11000111	11001111				
1033.	>003240L	01011001	11111111		BRAX	SCROM,T@,IZ	IMP ZERO, POINTING TO INSTRUCTION
	>003241L	11001001	11111111				
1034.	003242L	00110001	11011100		TSTIP	,SWRPT,PSWI	IS IT REPEATED?
	003243L	01000101	00100000				
1035.	>003244L	11000011	11111111		BRA	SCROM,TZ	NO, THEN P.C. POINTS TO INSTRUCTION
1036.	003245L	00110001	11001001		DLDX	PC2MR,,DMAR	YES, THEN BACK THE PC UP
	003246L	00110001	11101000				
	003247L	00110111	00001101				
1037.	003250L	00110001	10001001		DLDX	MR2PC	BEFORE DOING THE RESTART
	003251L	00110001	10101000				
1038.	>003252L	11001111	11111111		BRA	SCROM	

*
 *** NOTE: MAY WANT TO CHANGE OR ADD CODE TO STOP COMMUNICATIONS IN PROGRESS! *
 . (WILL DO IT IN MACRO-LEVEL CODE)

. SPECIAL SERVICE REQUESTED INSTRUCTION LEVEL SYSTEM CALL INTERRUPT
 . THE P.C. MUST BE BACKED UP IF IMP NON-ZERO, TO THE IMP SPEC.
 . ELSE IT IS POINTING TO THE INSTRUCTION TO EXECUTE NEXT
 . OR BEING EXECUTED IF REPEATED.
 . NOTE: THE PRESENT WAY CODE WORKS IF NOT REPEATED (OR NOT STARTED YET)
 . THEN IMP MUST BE ZERO BECAUSE CAN'T INTERRUPT BETWEEN IMP. SPEC & OPCODE
 . BUT CODE BELOW WILL WORK ANYWAY (TOO GENERALIZED)
 . I.E. IF IMP-NON-ZERO MUST BE REPEATED THEREFORE MUST BACK IT UP.

```

1041.
1042. 003253L
1043.
1044.
1045.
1046.
1047.
1048. 003253L 00110001 11011100          ISTIP      ,SWUSER,PSWI
      003254L 01000101 00000100
1049. 003255L 11010010 01010011          BRA        IVIOL3,FZ
1050. 003256L 00110001 11010000          DOTIP      ,ND,0177,URI+URA ONLY 7 BITS OF DATA!
      003257L 01010101 01111111
1051. 003260L 00110111 01000011          STB        SDLM          PUT IT IN LOAD FONT MODE
1052. 003261L 00010111 10110010          CCLR
1053.
1054. 003262L 01010100 00001010          LDCFP      DOTI        ,SB,10          COUNT IN STEPS OF TEN
1055. 003263L 11000001 00101101          BRA        LDCFNL,TC      IF AT END, DO FINAL STUFF
1056.
1057. 003264L 00110111 01000010          LDCFLP     RPT          5          THERE ARE TEN STROBES IN THE SPEEDUP
      003265L 00110111 01000010          STB        SKCH,SKCH
1057. 003266L 00110111 01000010          STB        SKCH,SKCH
      003267L 00110111 01000010
1057. 003270L 00110111 01000010          STB        SKCH,SKCH
      003271L 00110111 01000010
1057. 003272L 00110111 01000010          STB        SKCH,SKCH
      003273L 00110111 01000010
1057. 003274L 00110111 01000010          STB        SKCH,SKCH
      003275L 00110111 01000010
1058. 003276L 11000010 01001101          BRA        LDCFP,FZ      DONE AND DONE WELL (I HOPE)
1059. . QUESTION, IF ROOM, DO IN 16'S AND JUMP ENTRY WITH IMP COUNTING GROUPS LEFT
1060. 003277L 01010001 00000111          LDPI       LIMP,7        SET UP FOR 7 ROWS PER FONT
      003300L 00110111 00000001
1061.
1062. 003301L 00110001 11100101          IFC        CAPIVS
      LDX        HL2MRH          INIT MARH TO FONT STRING
1063.
1064.
1068.
1069. 003302L 00110001 11000110          LDCFLD     LDX        HL2MRL,SMR      NOW CAN FINALLY START ACTUAL FONT LOAD
      003303L 00110111 01000111
1070. 003304L 00110111 00001001          STB        DIMP          LOADING MARL >400 nS AFTER LDCH
1071. 003305L 11000100 00111010          MWAIT      ,MEMPCF       IF ERROR, RESET LOAD MODE
      003306L 11010111 01010001
1072.
1073. 003307L 00110111 00001100          IFC        CAPIVS
      STB        IMAR
1074.
1075.
1077.
1078. 003310L 00110001 10000110          IFS        CAPIVS
      LDX        MR2XXL+URL      UPDATE HL THE FASTEST WAY
1079. 003311L 00110001 00110110          XIF
      LDPP       MAROL,MDR,LDCH  GET THE CHARACTER OUT AND LOAD THE FONT
      003312L 00110111 11000000
      003313L 00110111 01000000
1080. 003314L 11001111 00110010          BRA        $+1          200 nSEC. DELAY ADDED FOR LDCH (400 nS)
    
```

1081.	003315L	11001000	00111101	BRA	LDCFLD,F@,IZ	LOOP TILL ALL SEVEN ROWS DONE
1082.	003316L	00110001	10100101	LDX	MR2XXH+URH	GET NEW HL CAUSE L UPDATED
1083.	003317L	00110111	01000101	STB	RDLM	RESET LOAD MODE (>400 nS AFTER LDCH)
1084.	003320L	01011001	11111011	BRAX	FETCH	
	003321L	11001111	11111010			
1085.						
1086.	003322L			LDCFNL		
1087.						. FOR THE FINAL STEP ONLY GO PARTIALLY THROUGH THE LOOP
1088.						. T >=0=10 STEPS, -1=9 STEPS, -2=8 STEPS, ... -9=1 STEP
1089.						. SKIPS 0 STEPS, 1 STEP 2 STEPS, ... 9 STEPS
1090.						
1091.	003322L	01010010	01001010	DOTA	,AC,LDCFLP+1	ADDS ADDRESS TO NEGATIVE VALUE (CRY SET
1092.	003323L	01101111	10110000	BAS	LINK,CC	MOVES FORWARD FROM LDCFSK (1 TO 9 STEPS
1093.	003324L	01010001	00000000	TCLR		MARK ENDED
1094.	003325L	11101111	00000000	BRR	LINK	DO AS MANY STEPS AS NEEDED
1095.						
1096.				IFC	CAPAPF	

```

1099.
1100. 00 3326L
1101.
1102.
1103.
1104.
1105. 00 3326L 00 110001 110 111100
      00 3327L 01 000101 00000100
1106. 00 3330L 11010010 01010011
1107. 00 3331L 00010001 11001111
1108. 00 3332L 11000010 00011111
1109. 00 3333L 11001000 00001011
1110. 00 3334L 01010001 01001000
      00 3335L 00000111 11111110
      00 3336L 01010001 11101111
      00 3337L 00000111 11111111
1111. 00 3340L 01011001 11111011
      00 3341L 11001111 11111000
1112.
1113. 00 3342L
1114.
1115.
1116.
1117.
1118.
1119.
1120. 00 3342L 00 110001 110 111100
      00 3343L 01 000101 00000100
1121. 00 3344L 11010010 01010011
1122. 00 3345L 00010001 11001111
1123. 00 3346L 11001000 00010010
1124. 00 3347L 11000010 00000110
1125. 00 3350L 01010001 01001110
      00 3351L 00000111 11111110
      00 3352L 01010001 11101111
      00 3353L 00000111 11111111
1126. 00 3354L 11001111 00000110
1127.
1128. 00 3355L 11001010 00001011
1129. 00 3356L 11000010 00000110
1130. 00 3357L 01010001 00010111
      00 3360L 00000111 11111110
      00 3361L 01010001 11110000
      00 3362L 00000111 11111111
1131. 00 3363L 11001111 00000110
    
```

```

*
BEEP:
. 1.35 ( 151) EX BEEP          START AUDIBLE BEEP IF QUIET
. 1.70 (IMP 151) PACO         START AUDIBLE CHANNEL IF QUIET
. 0.95 IF IN PROGRESS

      TSTIP    ,SWUSER,PSWI    ONLY IF PRIV'D

      BRA      IVIOL3,FZ
      TSTRT    FI,ACPH          STILL MAKING LAST SOUND?
      BRA      FTCHB,FZ         THEN STILL DO IT
      BRA      ACNOYZ,F@,IZ    (IMP 151)
      DLDRI    ACP,SVBEEP      (151) START MAKING NEW SOUNDS

FTCHB  BRAX  FETCHI

*
CLICK:
. 1.55 ( 153) EX CLICK        START AUDIBLE CLICK IF QUIET
. 1.05 IF IN PROGRESS
. 1.80 (IEV 153) PACOO        START AUDIBLE CHANNEL ALWAYS
. 1.75 (IOD 153) CLICKR      DO CLICK FROM ROM
. 1.25 IF IN PROGRESS

      TSTIP    ,SWUSER,PSWI    ONLY IF PRIV'D

      BRA      IVIOL3,FZ
      TSTRT    FI,ACPH          SET FZ IF STILL MAKING LAST SOUND
      BRA      ACLIKR,F@,IZ    (IEV 153 / IOD 153 - ROM CLICK)
      BRA      FTCHC,FZ         CONTINUE IF SOUNDING
      DLDRI    ACP,SVCLIK      START MAKING NEW SOUNDS

      BRA      FTCHC

ACLIKR  BRA      ACNOYZ,F@,IO    (IEV 153)
      BRA      FTCHC,FZ         STILL MAKING LAST SOUND?
      DLDRI    ACP,SRCLICKR    (IOD 153 - DO ROM CLICK)

      BRA      FTCHC
    
```

1132.
1133. 003364L
1134.
1135.
1136.
1137.
1138. 003364L 00110001 11011111
003365L 00000111 11111110
1139. 003366L 00110111 00001001
1140. 003367L 00110001 11011111
003370L 00000111 11111111
1141. 003371L 01011001 11111011
003372L 11001111 11111000
1142.
1143. 003373L 11111111 11111111
003374L 11111111 11111111
003375L 11111111 11111111
003376L 11111111 11111111
003377L 11111111 11111111

*
ACNOYZ
. 1.70 (IMP 151) PACO START AUDIBLE CHANNEL IF QUIET
. 0.95 IF IN PROGRESS
. 1.80 (IEV 153) PAC00 START AUDIBLE CHANNEL ALWAYS
LDRP ACPL,IMPI
STB DIMP
LDRP ACPH,IMPI
FTCHC BRAX FETCHI
.
TABPAGE PRODL

```

1146.
1147. 003400L
1148.
1149.
1150.
1151.
1152.
1153.
1154.
1155.
1156.
1157.
1158.
1159.
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1169.
1170.
1171.
1172.
1173.
1174.
1175.
1176.
1177.
1178.
1179.
1180.
1181. 003400L 11010100 11111111
1182. 003401L 11010111 01101001
1183. 003402L 00110001 00110110
1184. 003403L 01101111 11110001
1185. 003404L 00110111 00001100
1186. 003405L 01000101 11000000
1187. 003406L 11010011 01110011
1188. 003407L 00110111 01000111
1189. 003410L 00010111 10010010
1189. 003411L 00010111 10010010
1189. 003412L 00010111 10010010
1190. 003413L 01010101 00000111
1191. 003414L 01010010 11101001
1191. 003415L 01101111 11110000
1192. 003416L 11101111 00000000
    
```

*
 AC\$DO:
 . COMMAND FORMAT
 . 2.30 00 DDD DDD VALUE
 . 01 DDD DDD NOT USED (TAKEN AS 10 CASE)
 . 11 DDD DDD NOT USED (TAKEN AS 10 CASE)
 . 10 CCC NNN CONTROL COMMAND WHERE
 . NNN IS LOOP COUNTER NUMBER OR ATTENUATION VALUE (2 BITS ONLY)
 . 6.55 CCC IS 000 STOP (SET EXTER. INFO FLAG TO ZERO)
 . 6.40 001 JUMP TO LSB, MSB
 . 8.95 -.4 IF ZERO 010 INCR. LOOP COUNTER & SKIP + LSB IF NON-ZERO
 . 9.00 -.45 IF ZERO 011 DECR. LOOP COUNTER & SKIP - LSB IF NON-ZERO
 . 7.35 100 LOAD LOOP COUNTER FROM LSB
 . 4.55 101 LOAD ATTENUATION FROM NNN
 . 7.15 110 SET EXTERNAL INFO. FLAG
 . 6.75 111 UNUSED (PRESENTLY LIKE STOP)
 . + 0.80 IF VALUE FOLLOWS
 . *** TIMINGS INCORRECT DUE TO ADDITION OF JUMP TZ AT ACCNXW ***
 . *** NOTE: THERE IS ROOM FOR SPEEDUP CHANGES ***
 . NOTE! LSB (NNN & MSB) ARE BYTES FOLLOWING THE COMMAND
 . USES ACPH & ACPL FOR CHANNEL COMMAND POINTER
 . IF ACPH = 0 THEN CHANNEL IS OFF
 . ACD FOR AUDIO CHANNEL DATA IN THE FORM
 . TT VVVVVV
 . TT IS THE ATTENUATION VALUE
 . VVVVVV IS 64 LEVEL DAC
 . TEMP1 TO HOLD COMMAND WORD
 . TEMP2 TO HOLD FOLLOWING LSB VALUE
 . LINK FOR MULTI-DIRECTIONAL BRANCH
 MWAIT ,MEMPFAC (DELAYS ONCE)
 LDRP TEMP1,MDR GET THE COMMAND AND POINT TO NEXT ONE
 STB IMAR
 TSTIT ,0300 WAS IT A SIMPLE VALUE?
 BRA ACCAUD,TZ YES, GO DO IT!
 ACCFCN STB SMR ODD'S ARE, I'LL NEED THAT NEXT BYTE
 RPT 3
 SHIFT SR GET COMMAND # IN LS BITS
 SHIFT SR GET COMMAND # IN LS BITS
 SHIFT SR GET COMMAND # IN LS BITS
 DOTI ,ND,7 ONLY 3 BITS
 DORA LINK,AC,ACCTBL BACKWARDS TABLE
 BRR LINK GO SELECT FUNCTION

1193.					
1194.	003417L	11011111	01101001	BRA	ACCKIL 7 N/A (LIKE STOP BUT RAM NOT ZEROED)
1195.	003420L	11011111	11100011	BRA	ACCFLG 6 SET INFO FLAG
1196.	003421L	11011111	11010011	BRA	ACCATT 5 SET ATTENUATION
1197.	003422L	11011111	11000111	BRA	ACCLDC 4 LOAD COUNTER
1198.	003423L	11011111	10101010	BRA	ACCDISK 3 DECR. & SKIP (BACKWARDS)
1199.	003424L	11011111	10101010	BRA	ACCDISK 2 DECR. & SKIP (FORWARDS)
1200.	003425L	11011111	10110101	BRA	ACCJMP 1 JUMP TO ADDRESS
1201.	003426L			ACCTBL	
1202.				*	
1203.				*	
1204.	003426L	01010001	00000000	ACCSTP	LDRI ACPH,0 TURN THE BEAST OFF
	003427L	00000111	11111111		
1205.	003430L	01101111	11110010	LDRT	TEMP2 AND MARK IT
1206.	003431L	11010100	11100110	MWAIT	,MEMPFAC (DIDN'T NEED THAT DATA)
	003432L	11010111	01101001		
1207.	003433L	11011111	11011010	BRA	ACCSFG USING STOP FLAG
1208.				*	
1209.	003434L	11010100	11100011	ACCFLG	MWAIT ,MEMPFAC
	003435L	11010111	01101001		
1210.	003436L	00110001	00110110	LDRP	TEMP2,MDR GET THE FLAG BYTE
	003437L	01101111	11110010		
1211.	003440L	00110111	00001100	STB	IMAR
1212.	003441L	00110001	10010000	DLDRP	ACP,MARI UPDATE THE POINTER
	003442L	00000111	11111110		
	003443L	00110001	10110000		
	003444L	00000111	11111111		
1213.	003445L	01010001	01011111	ACCSFG	DLDPi MAR0,SEACFLG
	003446L	00110111	11000000		
	003447L	01010001	11101111		
	003450L	00110111	11100000		
1214.	003451L	01110001	11110010	LDPR	MDW,TEMP2 SAVE THE NEW FLAG
	003452L	00110111	00100001		
1215.	003453L	11011111	10000100	BRA	ACCNXH
1216.				*	
1217.				* . NOTE: SETTING ATTEN. FORCES D/A TO MIDPOINT IF NEXT NOT AUDIO	
1218.	003454L	00110001	10010000	ACCATT	DLDRP ACP,MARI SAVE UPDATED POINTER
	003455L	00000111	11111110		
	003456L	00110001	10110000		
	003457L	00000111	11111111		
1219.	003460L	01110001	11110001	LDTR	TEMP1
1220.				RPT	3 NEW VALUE TO BITS 7 & 6
1221.	003461L	00010111	10010010	SHIFT	SR THROUGH THE LINK!
1221.	003462L	00010111	10010010	SHIFT	SR THROUGH THE LINK!
1221.	003463L	00010111	10010010	SHIFT	SR THROUGH THE LINK!
1222.	003464L	01010101	11000000	DOTI	,ND,0300 SAVE ONLY 2 BITS
1223.	003465L	01010011	00100000	DORI	ACD,OR,040 OR '040' TO FORCE D/A TO MIDDLE!
	003466L	00000111	11111101		
1224.	003467L	11011111	01111011	BRA	ACCNXM AND DONE

1225.					
1226.	003470L	11010100	11000111	* ACCLDC	MWAIT ,MEMPFAC
	003471L	11010111	01101001		
1227.	003472L	00110001	00110110	LDRP	TEMP2,MDR GET VALUE
	003473L	01101111	11110010		
1228.	003474L	00110111	00001100	STB	IMAR
1229.	003475L	00110001	10010000	DLDRP	ACP,MARI SAVE UPDATED C.C.P.
	003476L	00000111	11111110		
	003477L	00110001	10110000		
	003500L	00000111	11111111		
1230.	003501L	01110001	10110001	DOTIR	,ND,7,TEMP1,CC GET LOOP COUNT
	003502L	01010101	00000111		
1231.	003503L	01010010	01100000	DOPI	MAROL,AC,SEACCNT
	003504L	00110111	11000000		
1232.	003505L	01010001	11101111	LDPI	MAROH,SEACCNT>8
	003506L	00110111	11100000		
1233.	003507L	01110001	11110010	LDPR	MDW,TEMP2 SAVE NEW VALUE
	003510L	00110111	00100001		
1234.	003511L	11011111	10000100	BRA	ACCNXH AND DONE
1235.					
1236.	003512L	11010100	10110101	* ACCJMP	MWAIT ,MEMPFAC
	003513L	11010111	01101001		
1237.	003514L	00110001	00110110	LDTP	MDR GET LSB
1238.	003515L	00110111	00001100	STB	IMAR,SMR POINT TO THE NEXT
	003516L	00110111	01000111		
1239.	003517L	00000111	11111110	LDRT	ACPL SET THE LSB
1240.	003520L	11010100	10101111	MWAIT	,MEMPFAC
	003521L	11010111	01101001		
1241.	003522L	00110001	00110110	LDRP	ACPH,MDR GET NEW MSB
	003523L	00000111	11111111		
1242.	003524L	11011111	10000011	BRA	ACCNXT AND DONE
1243.					
1244.	003525L	11010100	10101010	* ACCDSK	MWAIT ,MEMPFAC
	003526L	11010111	01101001		
1245.	003527L	00110001	00110110	LDRP	TEMP2,MDR GET SKIP VALUE
	003530L	01101111	11110010		
1246.	003531L	00110111	00001100	STB	IMAR
1247.	003532L	00110001	10010000	DLDRP	ACP,MARI SAVE UPDATED C.C.P.
	003533L	00000111	11111110		
	003534L	00110001	10110000		
	003535L	00000111	11111111		
1248.	003536L	01110001	10110001	DOTIR	,ND,7,TEMP1,CC GET LOOP COUNT #
	003537L	01010101	00000111		
1249.	003540L	01010010	01100000	DOPI	MAROL,AC,SEACCNT
	003541L	00110111	11000000		
1250.	003542L	01010001	11101111	LDPI	MAROH,SEACCNT>8,SMR
	003543L	00110111	11100000		
	003544L	00110111	01000111		
1251.	003545L	00010111	10110010	CCLR	
1252.	003546L	11010100	10011001	MWAIT	,MEMPFAC
	003547L	11010111	01101001		
1253.	003550L	00110001	00110110	DOPIP	MDW,SB,1,MDR DECR & SAVE THE VALUE

	003551L	01010100	00000001			
	003552L	00110111	00100001			
1254.	003553L	11010011	10000100	BRA	ACCNXH,TZ	DO NO MORE IF ZERO
1255.	003554L	01110001	11110001	ISTIR	,010,TEMP1	FORWARD OR BACKWARD JUMP?
	003555L	01000101	00001000			
1256.	003556L	11010010	10001010	BRA	ACCDSB,FZ	BACKWARD IF BIT SET
1257.	003557L	00010001	11111110	DORRR	ACPL,AC,TEMP2,ACPL,C0	FORWARD WE GO!
	003560L	01110010	00110010			
	003561L	00000111	11111110			
1258.	003562L	00010001	11111111	INCR	ACPH,ACPH,CF	ACROSS PAGES
	003563L	00000110	11111111			
1259.	003564L	11011111	10000011	BRA	ACCNXT	
1260.						
1261.	003565L	00010001	11111110	ACCDSB	DORRR	ACPL,SB,TEMP2,ACPL,C0
	003566L	01110100	00110010			BACKWARD WE GO!
	003567L	00000111	11111110			
1262.	003570L	00010001	11111111	DORIR	ACPH,SB,0,ACPH	ACROSS PAGES
	003571L	01010100	00000000			
	003572L	00000111	11111111			
1263.				BRA	ACCNXT	
1264.						
1265.						TRY HIDE VALUE IN COMMANDS TIME LOT
1266.	003573L	00010001	11111111	ACCNXH	LDTR	ACPH
1267.	003574L	11010011	01101011	ACCNXT	BRA	ACCEND,TZ
1268.	003575L	11010100	10000010		MWAIT	,MEMPFAC
	003576L	11010111	01101001			STOP AUDIO IF REACH PAGE ZERO
1269.	003577L	00110111	11100000	LDPT	MAR0H	LOAD MAR FOR NEXT CONTROL BYTE
1270.	003600L	00010001	11111110	LDPR	MAR0L,ACPL,SMR	GET THE NEXT COMMAND (CAN OPTIMIZE)
	003601L	00110111	11000000			
	003602L	00110111	01000111			
1271.	003603L	11001110	11111111	NOOP		
1272.	003604L	11010100	01111011	ACCNXM	MWAIT	,MEMPFAC
	003605L	11010111	01101001			
1273.	003606L	00110111	00001100	STB	IMAR	POINT POINTER TO NEXT CH. COMMAND
1274.	003607L	00110001	00110110	LDRP	TEMP1,MDR	
	003610L	01101111	11110001			
1275.	003611L	01011001	11111010	BPGX	SRVNXT	
1276.	003612L	01000101	11000000	TSTIT	,0300	IS IT AUDIO CODE?
1277.	003613L	11010010	01100001	BRA	SRVNXT,FZ	NO, THIS WAS WAISTED.
1278.						
1279.	003614L	00010001	11111101	ACCAUD	DOTIR	,ND,0300,ACD
	003615L	01010101	11000000			GET THE OLD ATTENUATION
1280.	003616L	01110011	11110001	DORR	ACD,OR,TEMP1	COMBINE BOTH FOR THE NEXT ONE
	003617L	00000111	11111101			
1281.	003620L	00110001	10010000	DLDRP	ACP,MARI	SAVE THE UPDATED P.C.
	003621L	00000111	11111110			
	003622L	00110001	10110000			
	003623L	00000111	11111111			
1282.	003624L	01011001	11111010	ACCEND	BRAX	SRVNXT
	003625L	11011111	01100001			AND RETURN

1283.				*	
1284.	003626L			ACCKIL	STOP AUDIO CHANNEL & SEE IF FAULT
1285.	003626L	01010001	00000000	MEMPFAC	CLEAR THE AUDIO CHANNEL
		003627L	00000111		
1286.	003630L	11010100	01100111	MWAIT	DO FAULT IF WAS ONE
		003631L	11010111		
1287.	003632L	11011111	01101011	BRA	
1288.				XIF	
1289.				IFS	CAPAPF
1643.				XIF	
1644.				IFC	CAPMICR

1647.									
1648.	003633L								
1649.									
1650.									
1651.									
1652.									
1653.									
1654.									
1655.									
1656.									
1657.									
1658.									
1659.	003633L	11011001	01010101		BRA	INFNO,T@,IZ			
1660.	003634L	00110111	00001001		STB	DIMP		CHECK IF ITS 1 (111)	
1661.	003635L	01010001	00000010		LDTI	VER		(ASSUME SO)	
1662.	003636L	11011000	010.11101		BRA	INFEXT,F@,IZ		NO SEE IF 2 OR ABOVE	
1663.	003637L	00110111	10000000		LDPT	URO+URA			
1664.	003640L	01010001	00001100		LDTI	REV		SET PROCESSOR VERSION AND REVISION LEVE	
1665.	003641L	11011111	010.10110		BRA	INFEND			
1666.									
1667.	003642L	00110111	00001001	INFEXT	STB	DIMP		CHECK IF ITS 2 (062)	
1668.	003643L	01010001	00000000		LDPI	URO+URC,0			
	003644L	00110111	10000010						
1669.	003645L	00110111	10000011		LDPT	URO+URD		SET CDE = 0 IN ANY CASE	
1670.	003646L	00110111	10000100		LDPT	URO+URE			
1671.	003647L	11011000	01010110		BRA	INFEND,F@,IZ		WAS IT 062 OR OTHER?	
1672.	003650L	01010001	01000010		LDTI	CAPABILI		YES, 062 SET CAPABILITIES	
1673.	003651L	00110111	10000001	INFEND	LDPT	URO+URB		SET B-REGISTER	
1674.	003652L	01011001	11111011	INFNO	BRAX	FETCHI		AND DONE	
	003653L	11001111	11111000						
1675.					XIF				
1676.									
1677.									
1678.	>003654L	01011001	11111111	*	IVIOL3	BRAX	IVIOL\$		
	>003655L	11001111	11111111						
1679.									
1680.	003656L	00110111	01000101	MEMPF3	STB	RDLM		SPECIAL FOR LDCF, OUT OF LOAD MODE	
1681.	003657L	01011001	11111011	MEMPF3	BRAX	MEMPF\$			
	003660L	11001111	0110.1110						
1682.									
1683.	003661L	11111111	111.11111		TABPAGE	PRODL			
	003662L	11111111	11111111						
	003663L	111.11111	111.11111						
	003664L	11111111	11111111						
	003665L	11111111	111.11111						
	003666L	11111111	11111111						
	003667L	111.11111	111.11111						
	003670L	11111111	11111111						
	003671L	11111111	11111111						
	003672L	11111111	11111111						
	003673L	111.11111	111.11111						
	003674L	11111111	11111111						

003675L 11111111 11111111
003676L 11111111 11111111
003677L 11111111 11111111
003700L 11111111 11111111
003701L 11111111 11111111
003702L 11111111 11111111
003703L 11111111 11111111
003704L 11111111 11111111
003705L 11111111 11111111
003706L 11111111 11111111
003707L 11111111 11111111
003710L 11111111 11111111
003711L 11111111 11111111
003712L 11111111 11111111
003713L 11111111 11111111
003714L 11111111 11111111
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003716L 11111111 11111111
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003730L 11111111 11111111
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003757L 11111111 11111111
003760L 11111111 11111111

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003761L 11111111 11111111
003762L 11111111 11111111
003763L 11111111 11111111
003764L 11111111 11111111
003765L 11111111 11111111
003766L 11111111 11111111
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003773L 11111111 11111111
003774L 11111111 11111111
003775L 11111111 11111111
003776L 11111111 11111111
003777L 11111111 11111111

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1684. 002000
1685. 002000
1686. 002000
1687.

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PRODLN  EQU  $-PRODP
        USE  PRODL
        SKIP PRODLN
        END

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*** ERRORS: D

	AC	220	273	320	572	601	612	617	851	859	929	930	1016
		1091	1191	1231	1249	1257							
003400	AC\$DO	*1147	718										
003454	ACCATI	*1218	1196										
003614	ACCAUD	*1279	1185										
003565	ACCDSB	*1261	1256										
003525	ACCDSK	*1244	1198	1199									
003624	ACCEND	*1282	1267	1287									
003407	ACCFCN	*1187											
003434	ACCFLG	*1209	1195										
003512	ACCJMP	*1236	1200										
003626	ACCKIL	*1284	1194										
003470	ACCLDC	*1226	1197										
003573	ACCNXH	*1266	1215	1234	1254								
003604	ACCNXM	*1272	1224										
003574	ACCNXT	*1267	1242	1259									
003445	ACCSFG	*1213	1207										
003426	ACCSTP	*1204											
003426	ACCTBL	*1201	1191										
010017	ACCTL	*56:I											
010015	ACD	*53:I	717	1223	1279	1280							
003355	ACLIKR	*1128	1123										
003364	ACNOYZ	*1133	1109	1128									
010017	ACPH	*55:I	56:I	711	1107	1110	1122	1125	1130	1140	1204	1212	1218
		1229	1241	1247	1258	1262	1266	1281	1285				
010016	ACPL	*54:I	716	1110	1125	1130	1138	1212	1218	1229	1239	1247	1257
		1261	1270	1281									
	ACUOT	697											
002562	ALUOP	*564	541	553									
002625	ALUXQT	*617	572										
002724	AMLINT	*822											
002536	AP4	*516											
002545	AP7	*543											
010014	APFRK	*47:I											
010013	APFRP	*46:I											
010016	APFTK	*49:I											
010015	APFTP	*48:I											
002560	APS	*555											
003326	BEEP	*1100											
020006	BR	*21:I											
	CO	580	601	612	929	1016	1257	1261					
	CI	988											
002031	CALL	*98											
002025	CALLCC	*80											
000100	CAP55IO	*121:I	125:I										
000102	CAPABILI	*125:I	1672										
000000	CAPAPF	*118:I	125:I	390	710	721	760	860	866	1096	1289		
000000	CAPBLUE	*117:I	125:I										
000000	CAPCOM	*122:I	125:I										
000000	CAPDMPIO	*119:I	125:I										
000002	CAPIMA	*116:I	125:I	649	655	689	696						
000000	CAPIVS	*135:I	*20:A	869	876	1061	1064	1072	1075				

000000	CAPMICR	*115:I	.125:I	661	737	748	760	766	787	1644			
000000	CAPRIM	*120:I	.125:I										
	CC	115	153	212	248	261	344	570	573	585	590	595	867
		926	1052	1092	1189	1221	1230	1248	1251				
007000	CDOR	*133:I											
006000	CDOX	*132:I											
	CF	.108	110	142	278	290	293	453	456	538	548	560	568
		569	600	606	611	617	683	697	702	711	716	717	820
		846	852	881	887	888	891	931	969	972	982	985	988
		990	996	1000	1005	1015	1017	1031	1107	1110	1122	1125	1130
		1138	1140	1182	1191	1204	1205	1210	1212	1214	1218	1219	1223
		1227	1229	1233	1239	1241	1245	1247	1255	1257	1258	1261	1262
		1266	1270	1274	1279	1280	1281	1285					
	CHUF	709											
003342	CLICK	*1113											
	COMF	819											
030011	COMMODE	*75:I	683	702									
	COMMR	685											
	COMMT	701	703										
002664	COMRDO	*680	657										
002671	COMTDO	*687	654										
	CSRF	682											
	DIMP	.128	166	228	266	321	383	487	503	1070	1139	1660	1667
003000	DL\$DO	*844	837										
002777	DLDO	*837	648										
003010	DLNL	*851	846										
003056	DLNLR	*894	888										
003030	DLNXT	*879	853										
	DMAR	348	984	993	1006	1036							
002142	EIROJ	*174											
002005	FETCH	*63	248	389	490	1084							
002007	FETCHI	*65	203	476	512	581	586	591	596	607	618	1111	1141
		1674											
002000	FETCHRW	*56	153	170									
002011	FETCHS	*67	143	239	443	457							
002003	FETCHW	*61	505										
002017	FETLIMP	*74	401	416									
004000	FLEX	*131:I											
003340	FTCHB	*1111	1108										
003371	FTCHC	*1141	1124	1126	1129	1131							
	HL2MRH	318	342	549	1062								
	HL2MRL	318	342	549	1069								
002701	HUMDO	*707	666										
	I02I	504	511	561									
	I350	475	489	511									
	IDCODH	76											
	IDCODL	76											
	IIMP	169	274	318	349	385							
	IM2MRH	384	487	503									
	IM2MRL	487	503										
	IMAR	65	103	107	111	131	161	165	226	324	397	412	441
		442	449	452	473	537	886	980	1073	1183	1211	1228	1238

		1246	1273											
	IMP8	399												
	IMPFO	585	590	595	606	617								
	IMPH	343												
	IMPI	127	129	271	319	322	381	580	585	590	595	606	617	
		1138	1140											
	IMPL	162	265	316										
	IMPO	166	169	227	231	273	349	352	385	386				
003651	INFEND	*1673	1665	1671										
003642	INFEXT	*1667	1662											
003652	INFNO	*1674	1659											
003633	INFO	*1648												
020005	IO	*20:I	179	341	1128									
	IT	320	988	1258										
	ITW	683	702	972	1107	1122								
	IVIOL\$	419	1678											
002441	IVIOL2	*419	380	398	413									
003654	IVIOL3	*1678	1049	1106	1121									
020004	IZ	*19:I	94	153	248	315	398	413	485	501	1033	1081	1109	
		1123	1659	1662	1671									
002453	JUMP	*445	179	436										
002443	JUMPC	*423												
003161	KBCLS	*985	998	1008										
003062	KBD\$DO	*899	849	892										
	KBDD	981												
003166	KBDON	*988	973	1003										
003066	KBDWAIT	*923	924											
003150	KBGET	*980	971											
003136	KBKEY	*966	927											
003175	KBKS1	*995	936	938	975									
003174	KBKS2	*993	940	942	946	948	954	956						
003202	KBOPN	*1000	1014											
003137	KBREG	*969	950	952	960	962	964							
003211	KBREINT	*1005	944	958										
	KBSC	989	1016											
010001	KBSCNT	*28:I	926	929	972	982	988	990	1016	1017				
003136	KBTL	*965	930											
002522	L7S	*493												
002525	L7SI	*503	501											
002474	LD6	*461												
002504	LD7	*478												
002507	LD7I	*487	485											
003302	LDCFLD	*1069	1081											
003264	LDCFLP	*1056	1091											
003322	LDCFNL	*1086	1055											
003262	LDCFPT	*1054	1058											
	LDCH	1079												
	LDMAP	891	896											
002533	LDS	*507												
	LIMP	69	104	154	162	209	249	265	316	326	343	350	399	
		414	486	502	1060									
030000	LINK	*61:I	115	133	153	212	232	248	573	574	846	888	991	

		1092	1094	1191	1192								
003253	LIREG	75											
	LODCF	*1042											
	LSPKR	717											
	LUF	580											
010003	MADR	*33:I											
	MARIH	1212	1218	1229	1247	1281							
	MARIL	1212	1218	1229	1247	1281							
	MAROH	142	270	455	714	890	922	1213	1232	1250	1269		
	MAROL	125	142	270	382	456	716	856	880	891	922	1079	1213
		1231	1249	1270									
010004	MBITS	*34:I											
010005	MBSTAT	*35:I											
010006	MCRCH	*36:I											
010007	MCRCL	*37:I											
	MDR	75	106	110	164	169	225	231	273	347	352	451	455
		475	489	540	552	859	885	890	987	1002	1012	1015	1079
		1182	1210	1227	1237	1241	1245	1253	1274				
010010	MDSKS	*38:I											
010011	MDSKT	*39:I											
	MDW	127	132	319	325	504	859	981	987	1002	1015	1214	1233
		1253											
002250	MEMNBAS	*274	269										
002272	MEMPA	*290	283										
002221	MEMPF\$	*255	105	109	140	163	168	224	233	323	351	354	1681
002220	MEMPF2	*254	61	74	450	454	474	491	539	550	625	670	713
		823											
003657	MEMPF3	*1681	897	1286									
003626	MEMPFAC	*1285	1181	1206	1209	1226	1236	1240	1244	1252	1268	1272	
003656	MEMPFCF	*1680	1071										
003060	MEMPFDL	*896	847	855	858	879	883	889	983	986	1001	1011	1032
002075	MEMPFPS	*133	130										
002253	MEMPQ	*276	272										
002277	MEMPR	*294	291										
002270	MEMPS	*287	279										
002275	MEMPW	*293	281										
002266	MEMPX	*285	277	288									
020002	MO	*17:I	56	61	74	105	109	130	140	163	168	224	229
		272	277	323	346	351	354	450	454	474	488	539	550
		625	670	713	823	847	855	858	879	883	889	983	986
		1001	1011	1032	1071	1181	1206	1209	1226	1236	1240	1244	1252
		1268	1272	1286									
	MODW	58	122	141	216	230	264	355	671	715	848		
020003	MP	*18:I	61	74	105	109	130	140	163	168	224	272	277
		323	346	351	354	450	454	474	488	490	539	550	625
		670	713	823	847	855	858	879	883	889	983	986	1001
		1011	1032	1071	1181	1206	1209	1226	1236	1240	1244	1252	1268
		1272	1286										
	MR2IMH	266											
	MR2IML	266											
	MR2PCH	67	112	167	400	415	1037						
	MR2PCL	67	112	167	400	415	1037						

030016	XCRCH	*80:I
030017	XCRCL	*81:I
030015	XDATA	*79:I
030014	XPNTR	*78:I
030013	XSTAT	*77:I