

IDENTIFICATION

Product Code: MAINDEC-81-D6AB-D
Product Name: AX08 Diagnostic
Date Created: October 8, 1968
Maintainer: Diagnostic Group
Author(s): J. Kelly
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1. ABSTRACT

This unit is tested in three sections: (a) an instruction test of the logic; (b) a display test for the scope; (c) a calibration section for the A/D Converter.

2. REQUIREMENTS

2.1 Equipment

PDP-8, 8L or 8I Standard Computer

AX08 option

Adjustable Voltage Source (0.01% or better, Z out < 1.0 ohm)

2.2 Storage

2.2.1 Program Storage - The routine uses memory from address 0 to 4500.

3. LOADING PROCEDURE

3.1 Methods

Procedure for normal binary tape is followed.

4. STARTING PROCEDURE

For normal starting operation all switches should be down. Starting address is 200.

4.1 Program and/or Operator Action

Connect non-zero voltage source to input connector for channel zero.

Set "Timing Control" minimum (C.C.W.)

Load the program into memory.

Set switch register to starting address - SA = 0200

Load Address.

Press Start.

4.1.1 The program will loop in the first section of the test, and the display, if on, will read

"DIAGNOSTIC RUNNING"
"SAME VALUE IN XX ICMX"

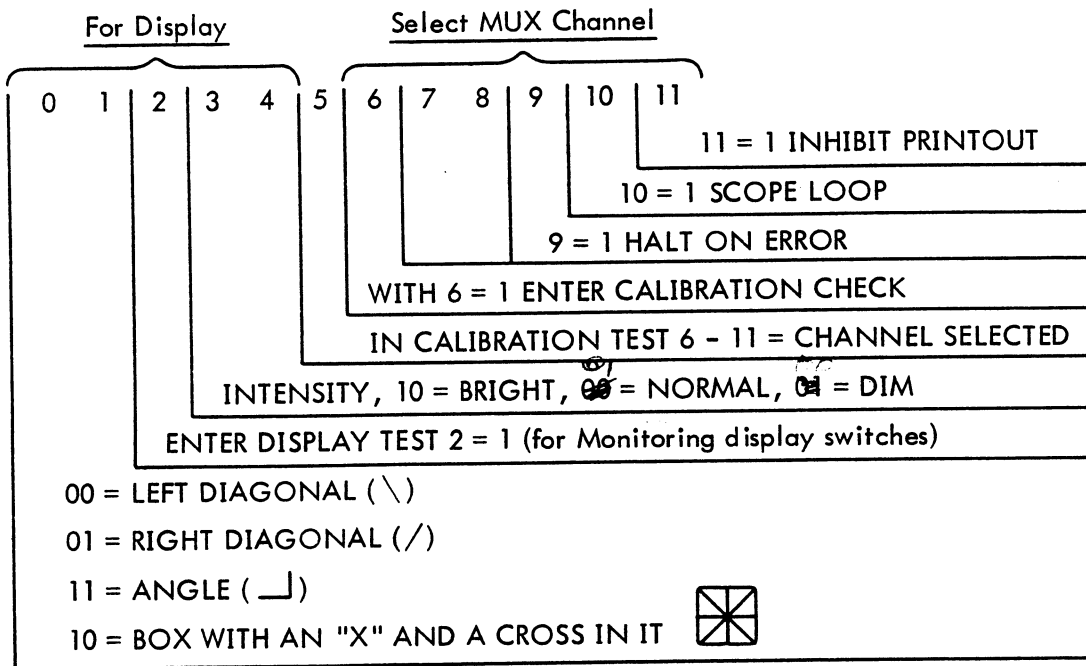
If there is an error, the teleprinter will print out the error and continue on in section test. (XX = the multiplexer channel + 1 where overflow occurs)

5. OPERATING PROCEDURE

5.1 Operational Switch Settings

With all switches down (Logical zero), the test will stay in the instruction section. With switch 2 up the test will enter the display section, from the instruction section. With switch 6 up the test will enter the A/D calibration section, from the display section.

5.1.1 Switches -



5.2 Subroutine Abstract

5.2.1 BEGIN - This is AX08 instruction test of the logic which tests that all registers and flip-flops initiated by start key are in the correct state. Also tested is the ability to set and clear the (Y) register, the skip on flag and interrupt logic for--the A/D timing, the RC clock and the crystal clock. Other logic functions of the display and the A/D converter are also tested.

5.2.2 CHTST - This is an increment test of multiplexer and assumes that (1) the display is operating; (2) the A/D is calibrated; (3) the channel zero of the multiplexer has a non-zero voltage applied to it,

and that all other channels have no voltage applied to them. This routine records the voltage it sees on channel zero, counts increments of the multiplexer until the same voltage (+/-1/2 LSB) is found again. Then uses the display for the message "SAME VALUE IN XX ICMX" (ICMX is the increment instruction).

5.2.3 Display - There are four basic patterns which can be displayed: (1) a right diagonal from the lower left corner to the upper right; (2) a left diagonal from the upper left corner to the lower right corner; (3) an angle from the middle to the left edge of the screen to the center then to the top; (4) a box with an "X" and a cross in it. These tests are designed to show inverted bit transfers from accumulator to the deflection registers, malfunctions in the deflection logic and deflection amplifier faults.

5.2.4 INIT3 - This routine is the A/D Converter calibration check. Bits 6-11 of the switch register selects the multiplexer channel, then 1000 octal conversions are made on this channel and stored in a buffer. The first word of the buffer, which is the binary value of the analog voltage is displayed in the upper left of the scope. A horizontal line is now drawn on the scope. A deviation in the amplitude of the horizontal sweep from its point of origin represents a change in the A/D Converter output for a fixed voltage in. A voltage at the converter switching point will give two levels in the horizontal sweep. A noisy converter, or voltage source may give a staircase pattern which indicates excessive noise in the system. The refresh rate of the sweep is controlled by the RC (timing control) clock adjustment on the front panel.

5.2.5 SCOPE - This subroutine call, is placed between each subtest in the instruction section and records the starting address of each subtest as it is being entered. If a scope loop is requested, it will jump to the start of the subtest that the scope loop is requested for.

5.2.6 HALT - This routine printouts an address that tags the failing subtest and the contents of the AC at the time of the failure.

5.3 Program and/or Operator Action

Loading and starting at 200 with all switches down is the start of the IOT instruction test. If an error is detected here, there will be a printout in this section. When an error is detected, and it is necessary to scope on it, place SW9 UP to halt on error, then SW10 UP to loop on it, then SW11 to DELETE printouts.

When errors in the instruction section have been corrected SW2 UP will advance the program to the display test.

SR 0 and 1 select which of the four figures are to be displayed. SR 3 and 4 control the display intensity. SR2 UP allows the program to monitor SW 0, 1, 3 and 4.

When the display is operating correctly SW6 UP will advance the program to the A/D calibration section.

Bits 6 - 11 of the switch register select the multiplexer channel which has a maximum of 27 plus 34, 35, 36 and 37 octal channels.

6. ERRORS

6.1 Error Halt and Description

<u>Halt (PC)</u>	<u>FUNCTION TESTED</u>
0205	DOES START KEY CLEAR SYNC PULSE CHANNEL?
0211	DOES START KEY CLEAR ERROR FLAG?
0221	DOES START KEY CLEAR ALL INTERRUPT ENABLES?
0231	DOES START KEY CLEAR THE RC CLOCK FLAG?
0241	NO RC CLOCK INTERRUPT UP?
0253	(Y) REGISTER EQUAL ZERO (0000)?
0264	(Y) REGISTER EQUAL SEVENS (7777)?
0275	(RADC) INSTRUCTION CLEARS (Y) REGISTER?
0304	CONTINGENCY AND PULSE CHANNEL EQUAL ZERO (0000)?
0313	WILL (ADCV) CONVERT INSTRUCTION SET A/D DONE FLAG?
0324	WILL (RADC) READ BUFFER INSTRUCTION CLEAR A/D DONE FLAG?
0334	WILL (CLER) INSTRUCTION CLEAR A/D DONE FLAG?
0341	DOES (OTEN) INSTRUCTION CLEAR THE AC?
0354	THAT (ICMX) INC MUX DOES NOT SET A/D DONE
0361	THAT (ICMX) DOES NOT CHANGE THE AC
0365	THAT (ICMX) DOES NOT CHANGE THE AC
0375	(Y) REGISTER EQUAL ZERO (0000)
0410	(Y) REGISTER EQUAL SEVENS (7777)

6.1.1 Module Callout For The AX08 - Program cannot be loaded due to bits in AC,

- a. if bits 0 to 5 B07, B05
- b. if bits 6 to 11 B08, B06

<u>Address</u>	<u>Good (AC)</u>	<u>Bad (AC)</u>	<u>Corrective Action</u>
0205	0000	XX00	A13, A15
↓	0000	Bit 0	C08
	0000	Bit 1, 2	C07
	0000	Bit 3	C06
	0000	NA	D19, C13, A13, A15
	0211	0000	

<u>Address</u>	<u>Good (AC)</u>	<u>Bad (AC)</u>	<u>Corrective Action</u>	
0221	0000	NA	C13, B14, C03, B13	
0231	0000	NA	C12, C13	
0241	0000	NA	C13	
0253	0000	XXXX	D17, D15, A11, A10, A9, D19	
↓	0000	7400	C20, B7	
	0000	0200	C20, B7	
	0000	0100	C19, B7	
	0000	0040	C19, B8	
	0000	Bit 7 or 8	C18, B8	
	0000	Bit 9 or 10	C17, B8	
	0000	0001	C16, B8	
	0264	0000	7777	A17, B14, A10, A8
	0275	7777	0000	A17, A13, A12, A16, B16
	↓	7777	0377	C20, C14, B02, B07
7777		7577	C20, B07, C14, B02	
7777		7677	C19, B07, C14, B03	
7777		7737	C19, B08, C14, B03	
(0275)		7777	C18, B08, C15, B03	
7777		7767	C18, B08, C15, B04, B03	
7777		7773	C17, B08, C15, B04	
7777		7775	C17, B08, C15, B04	
7777		7776	C16, B08, C15, B04	
0304		0000	0XXX	B12
↓	0000	Bit 10, 11	B11	
	0000	Bit 7, 8, 9	B10	
	0000	Bit 4, 5, 6	B9	
0313	0000	NA	B14, B17, A08, D23, D22, D15, D21, B21, B18, B19, B20, A11, A12, A13, D13	
↓				
0324	NA	NA	B17, D18	
0334	NA	NA	A11, A14, D18	
0341	0000	7777	A14, A11	
0354	NA	NA	A7	
0361	0000	XXXX	B14, A10	
0365	7777	XXXX	B14, A10	

<u>Address</u>	<u>Good (AC)</u>	<u>Bad (AC)</u>	<u>Corrective Action</u>
0375	0000	7777	A08, A07
0410	0000	7777	A08, A07
0421	7777	0000	A08, A07
0430	0000	0000	A08
0440	NA	NA	A08, A10
0445	NA	NA	C13, C19, A18, D15, B13, A12
0463	0000	0000	D19, D18
0470	0000	0000	D19, D18
0475	0000	0000	D13, D15, D18
0504	0000	0000	D18, A14, A11
0520	0000	0000	D18, D19
0533	0000	0000	B14, C03
0550	0000	0000	C13, C03
0570	0000	0000	B14, C03, A15
0612	0000	0000	C13, C03
0625	NA	NA	A08
0635	NA	NA	A07
0637	NA	NA	A07
0646	NA	NA	A07
0656	NA	NA	A07
0660	NA	NA	A07
0670	0000	0000	C4, F28, C10, A16, C12, C13, B16
0702	0000	0000	B16, D17
0712	0000	0000	C12, A14
0725	0000	0000	C02, C13
0743	0000	0000	B16, D17
0754	0000	0000	A15, C01
0764	0000	0000	A16
0770	0000	0000	A16, C9, C8
1014	0000	0000	C13
1025	0000	0000	C11, C12, C13, B13
1040	0000	0000	B12, C12
1053	0000	0000	C11

<u>Address</u>	<u>Good (AC)</u>	<u>Bad (AC)</u>	<u>Corrective Action</u>
0066	0000	0000	C11
1102	0000	0000	C13, C02
1112	4000	0000	C08, A13, A12, B01, B05
1122	0000	0000	C13
1137	NA	NA	D17, D15/CH 34 SHOULD HAVE NON-ZERO VOLTAGE APPLIED
1151	XXXX	7777	A16, B16/CH 34 SHOULD HAVE NON-ZERO VOLTAGE
1160	7777	NA	A16, B16
1167	0000	0000	D17, D15
1241	0000		F28
1303	0000		F28
1324			C8, C9, C10
1461	0000	0000	C14, B13, A24/EXTERNAL INTERRUPT
1503	0000	X000	E27, E28, C07/EXTERNAL STIMULUS
	0000	0X00	E26, 06/EXTERNAL STIMULUS
1524	NA	NA	D17

6.1.2 Display section of list

- if no Intensity, A21, A18, A16, A24
- cannot vary Intensity, A19, A20, B16, A24
- if Alphanumeric is displayed as a series of dots, Intensity duration is too long or not applied to scope.

0421 (RADC + 10) INSTRUCTION CLEARS THE (Y) REGISTER
0430 WILL (ADCV + 10) CONVERT INSTRUCTION SET A/D DONE FLAG?
0440 WILL (RADC + 10) READ BUFFER INSTRUCTION CLEAR A/D DONE FLAG?
0445 WILL TWO (ADCV) RAISE ERROR CONDITION?
0463 DOES (CLER), CLEAR THE ADCIP "FF"?
0470 TEST FOR NO ADC TIMING ERROR
0475 SET ERROR CONDITION
0504 DOES (CLER) CLEAR ERROR FLAG?
0520 DOES (CLER) CLEAR THE (ADCIF) "FF"?
0533 TEST A/D DONE INTERRUPT ENABLE
0550 TEST ERROR INTERRUPT ENABLE
0570 TEST A/D DONE INTERRUPT ENABLE
0612 TEST ERROR INTERRUPT ENABLE
0625 TEST A/D DONE WITH MICRO PROGRAMMED IOT'S

0635	WILL (ICMX AND ADCV) SET A/D DONE?
0637	WILL MICRO PROGRAMMED IOT RAISE ERROR FLAG"
0646	SET A/D DONE WITH (ACMX, RADCV, AND ADCV)
0656	SET A/D DONE WITH MICRO PROGRAMMED IOT'S
0660	RAISE ERROR CONDITION WITH MICRO PROGRAMMED IOT'S
0670	SET RC CLOCK FLAG
0702	RAISE ERROR WITH RC CLOCK
0712	CLEAR RC CLOCK FLAG
0725	RAISE INTERRUPT WITH RC CLOCK
0743	SET A/D DONE FLAG WITH RC CLOCK
0754	CLEAR RC CLOCK AND TEST FOR NO SKIP
0764	RC CLOCK (SLOW) SET TOO SOON
0770	RC CLOCK (SLOW) NOT SET
1014	RAISE AN INTERRUPT WITH RC CLOCK
1025	RAISE CRYSTAL CLOCK FLAG
1040	CLEAR CRYSTAL CLOCK FLAG
1053	TEST CRYSTAL CLOCK DOES NOT SET FLAG TOO SOON
1066	TEST CRYSTAL CLOCK DOES NOT SET FLAG TOO SLOW
1102	INTERRUPT ON CRYSTAL CLOCK
1112	SET CHANNEL FLAG
1122	TEST CRYSTAL INTERRUPT ENABLE
1137	(DYC) INHIBITED BY CONVERT COMMAND
1151	(DYL) INHIBITED BY CONVERT COMMAND
1160	(DXL) INHIBITED BY CONVERT COMMAND
1167	(DXC) INHIBITED BY CONVERT COMMAND
1241	TEST RC CLOCK STABILITY AT ONE EIGHTH SPEED
1303	TEST RC CLOCK STABILITY NORMAL SPEED
1324	TEST RC CLOCK FAST/SLOW RATIO
1461	TEST FOR ABSENCE OF EXTERNAL INTERRUPT
1503	TEST FOR ABSENCE OF EXTERNAL STIMULUS
1524	TEST THAT RC CLOCK DOES NOT INHIBIT ADCV

6.2 Error Recovery

Depress Continue or Restart at 200

7. RESTRICTIONS

Starting restrictions always starts at 200. There are no operation restrictions.

8. MISCELLANEOUS

Execution time for section 1 is about .1 sec.

9. PROGRAM DESCRIPTION

The three sections of this program are designed to be an increment test of the system. The first section which is a test of hardware's logic, checks that start key initiated the system correctly.

The following are tested automatically by the computer: flags, interrupts, crystal and RC clocks, Y register, timing error conditions, external registers, and other integrated logic functions that are associated with the display and analog digital converter.

The second section uses the display logic and the scope to validate the display. The switch register is used in the test to control the generation of intensity and pattern selection. At this stage of the test, the operator must determine if the display responds correctly in relation to the switch register.

The third section of the test is a check on the calibration and repetition of the A/D Converter and its respective multiplexer channel. The switch register selects the multiplexer channels; conversions on that channel are made and stored into a buffer. The buffer is then displayed on the scope. The first buffer voltage is displayed as an octal value; a deviation in horizontal sweep indicates noise in the system, measuring monotonicity, repeatability and drift. Using this routine is a subjective check on the A/D portions and the environment in which the system is installed; the quality of analog input must be considered in evaluating this display.

11. FLOW CHART

Flow of AX08 Diagnostic

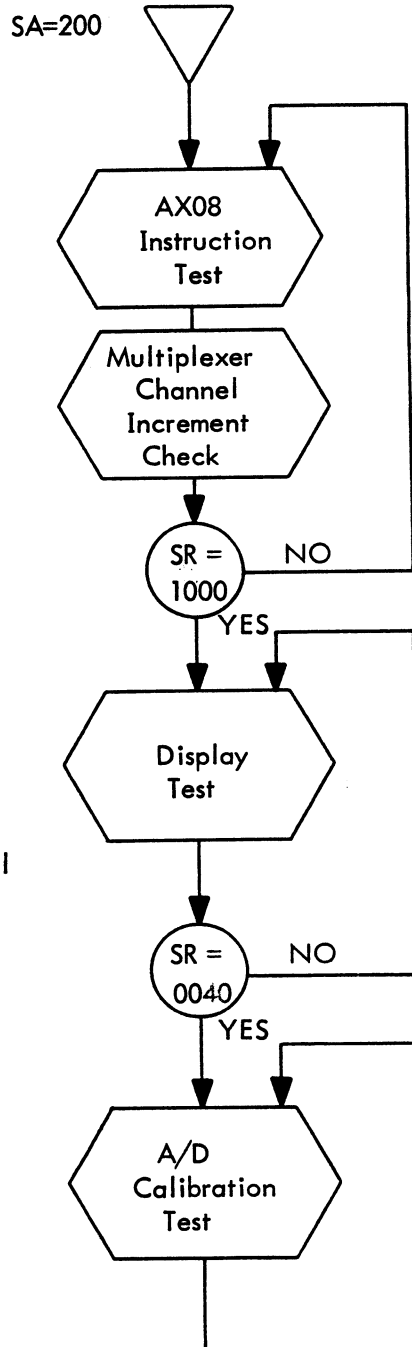
With all switches down test will stay in this section

- 11=1 Inhibit printout
- 10=1 Scope Loop
- 9=1 Halt on Error

Switch Register Control Sweep and Intensity

<u>Patterns</u>		<u>Intensity</u>	
<u>0</u>	<u>1</u>	<u>3</u>	<u>4</u>
0	0 =	1	0 = Bright
0	1 =	0	0 = Normal
1	1 =	0	1 = Dim
1	0 =		

Test indicates Binary value of Analog Converted Voltage.
 Amplitude changes in sweep indicate multi-state condition.
 Switch register 6 to 11 select multiplexer channel.



/INSTRUCTIONS FOR THE AX08

/

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/

0301	DXC=6301	/CLEAR X REGISTER
0302	DXL=6302	/LOAD X REGISTER (1) SIDE
0304	DIS=6304	/DISPLAY
0311	DYC=6311	/CLEAR Y REGISTER
0312	DYL=6312	/LOAD Y REGISTER (1) SIDE
0321	SAXK=6321	/SKIP ON CRYSTAL CLOCK
0322	SAXK=6322	/SKIP ON ADC TIMING ERROR
0324	DSF=6324	/SET BRIGHTNESS
0331	XAIN=6331	/OR EXTERNAL SENSE REGISTER INTO AC
0332	SXAD=6332	/SKIP ON A/D DONE
0334	XACL=6334	/CLEAR SENSE BIT WITH ONE IN AC
0341	SAXK=6341	/SKIP ON RC TIMING CLOCK
0342	ZIFN=6342	/ZERO IN AC INHIBIT INTERRUPT REGISTER
0344	OIFN=6344	/ONES IN AC ENABLE INTERRUPT
0351	CLER=6351	/CLEAR ADC TIMING ERROR CONDITION
0352	CLAK=6352	/CLEAR CRYSTAL CLOCK FLAG
0354	CL-K=6354	/CLEAR RC CLOCK AND FLAG
0361	ICX=6361	/INCREMENT MULTIPLEXER
0362	RADC=6362	/CLEAR AC, READ A/D BUFFER
0364	ADCV=6364	/START CONVERSION
0371	ACTX=6371	/JAM SET MULTIPLEXER
7344	MI=C LA C LL C MA RAL	
0020	0020	*20
0020	0400	M/400, -/400
0021	7400	K/400, /400
0022	7700	KM040, -0040
0023	0400	K0400, 0400
0024	7001	K0077, -0/77
0025	0000	SL1, 0
0026	0000	FI1, 0
0027	7401	M0377, -0377
0030	0034	K0034, 0034
0031	0100	K0100, 0100
0032	1000	K1000, 1000
0033	0002	K0002, 0002
0034	2002	K2002, 2002
0035	5002	K5002, 5002
0036	0004	K0004, 0004
0037	0070	C0070, 0070
0040	0200	K0200, 0200
0041	1004	K1004, 1004
0042	0340	K0340, 0340
0043	4002	K4002, 4002
0044	0010	K0010, 0010
0045	7700	K7700, /700
0046	0077	K0077, 0077
0047	7000	K7000, -1000
0050	7760	KM020, -20
0051	1002	K1002, 1002
0052	7776	K7776, /776

0003 1111
0004 42EJ
0005 35EJ
0006 3755
0007 0200
0008 0213

K1111, 1111
MSSG, MESS
CHUSC1, CHUSC
AUSTBL, USCTRL
MAXNUM, 6
K2103, 0003

0061	7772	KM0000, -6
0062	0000	CIEMA, 0
0063	0000	CIEMB, 0
0064	0000	CIEMC, 0
0065	0000	CCONTA, 0
0066	0000	CCONTB, 0
0067	0000	CCONTC, 0
0070	0000	HAD, 0
0071	4000	INLL, 4000
0072	0000	LOOP, 0
0073	0000	0
0074	0000	XER, 0
0075	0000	TEMP01, 0
0076	0000	TEMP02, 0
0077	0000	TEMP03, 0
0100	0000	TEMP04, 0
0101	0000	TEMP05, 0
0102	0000	TEMP06, 0
0103	0000	MSKHT, 0
0104	0000	CHXL, 0
0105	0000	CHYL, 0
	4454	LON=JMS I MSSG
0106	0000	STALL, 0
0107	0040	K0N40, 0040
0110	2400	XINITS, INITS
0111	4223	XSCOPE, SCUPEA
	4011	SCOPE=JMS I XSCOPE
0112	4261	XERADD, ERAUD
0113	4320	XIYPE, MESSAGE
0114	4230	XIPRIN, IPRINT
0115	1642	XSIXTY, SIXTY
0116	4202	XCRLF, CRLF
0117	1500	XIEXTB, IEXTB
0120	0000	AC, 0
0121	2000	XSWTCH, SWICH
	7000	OPR=7000
	7402	XX=7402
	4012	HALT=JMS I XERADD

0122	2147	STORA,	STURS
0123	2237	DLDLA,	DLULS
0124	2256	DRDLA,	DRULS
0125	2160	DVLTA,	DVLIS
0126	2200	DVLBA,	DVLBS
0127	2212	DHLRA,	DHLRS
0130	2224	DHLLA,	DHLLS

0131	0500	K0000,	000
0132	6324	K0324,	0324
0133	0377	K377,	377
0134	0000	XPOSR,	0
0135	0000	YPOSR,	0
0136	0400	K400,	400
0137	0777	K777,	777
0140	0002	P2,	2
0141	7400	M400,	-400
0142	7600	M200,	-200
0145	0000	COUNT,	0

4522	STUR=JMS I STURA
4525	DVLI=JMS I DVLTA
4526	DVLB=JMS I DVLBA
4527	DHLR=JMS I DHLRA
4530	DHLL=JMS I DHLLA
4523	DLDL=JMS I DDLA
4524	DRDL=JMS I DRDLA
	/SR
	/01

/00=LEFT DIAGONAL 0=REPEAT
 /01=RIGHT DIAGONAL
 /10=ANGLE 1=NLW TEST
 /11=XBOX
 *. 17/+1

0200

BRIGHTNESS

/START KEY SHOULD CLEAR SYNC PULSE CHANNEL

0200 7200
 0201 6361
 0202 6021
 0203 7440
 0204 4512
 0205 4511

 0206 6322
 0207 7410
 0210 4512
 0211 4511

 0212 1225
 0213 3001
 0214 1224
 0215 3002
 0216 6001
 0217 7410
 0220 4512
 0221 6002
 0222 5225
 0223 5402
 0224 0220
 0225 4511

 0226 6341
 0227 7410
 0230 4512
 0231 4511

 0232 1032
 0233 6340
 0234 1243
 0235 3002
 0236 6001
 0237 7410
 0240 4512
 0241 6002
 0242 7410
 0243 0240
 0244 4511

 0245 6311
 0246 6362
 0247 7650
 0250 5253
 0251 6362
 0252 4512
 0253 4511

 0254 7240
 0255 6311

```

BEGIN,  CLA
        XRIN          /READ PULSE REGISTER
        AND K7400     /BIT 0 TO 3
        SZA
        HALT          /NOT CLEARED BY START KEY
        SCOPE
/ONES START KEY CLEAR ERROR FLAG?
        SKR
        SKP          /SKIP ON ERROR FLAG
        HALT
        HALT          /ERROR FLAG SKIPPED
        SCOPE
/TEST FOR NO INTERRUPT /START KEY SHOULD CLEAR ALL INTERRUPT ENABLES
        TAU .+11
        DCA 1
        TAU .+10
        DCA 2
        ION
        SKP
        HALT          /INTERRUPT UP, START KEY
        IOP          /SHOULD CLEAR ALL INTERRUPT ENABLES
        JMP .+3
        JMP I 2       /GO TO MEMORY LOCATION ONE
        .-4          /GO TO MEMORY LOCATION TWO
        SCOPE
/ONES START KEY CLEAR RC CLOCK FLAG
        SKRK
        SKP
        HALT          /START KEY DID NOT CLEAR FLAG
        SCOPE
/TEST FOR NO RC CLOCK INTERRUPT
        TAU <1000
        ZTEN OTEN
        TAU .+7
        DCA 2
        ION          /THERE SHOULD BE NO INTERRUPT
        SKP
        HALT          /RC CLOCK INTERRUPT UP
        IOP
        SKP
        .-3
        SCOPE
/TEST READ BUFFER (Y REGISTER) AC=ZERO
LOOPA,  JYC          /CLEAR Y REGISTER
        RAUC        /READ BUFFER
        SNA CLA     /TEST
        JMP .+3     /GOOD
        RAUC        /BAD
        HALT       /AC SHOULD EQUAL 0000
        SCOPE
/TEST READ BUFFER (Y REGISTER) AC=SEVEN
        CLA CMA     /SET AC TO SEVENS
        UYC        /CLEAR Y REGISTER
  
```

0256 6362
0257 7450
0260 5264
0261 7240
0262 6362
0263 4512
0264 4511

RAUC /READ BUFFER
SNA /TEST
JMP ,+4 /GOOD
CLA CMA /BAD
RAUC /AC SHOULD EQUAL 0000
HALT /BAD AC CLEAR PULSE
SCOPE


```

/TEST READ BUFFER (Y REGISTER)
0205 7240          CLA CMA          /AC EQUAL SEVENS
0206 6312          DYL           /SET Y REGISTER
0207 6302          RAUC          /HEAD BUFFER
0210 7201          IAC
0211 7650          SNA CLA          /TEST
0212 5215          JMP ,+3        /GOOD
0213 6362          RAUC          /BAD
0214 4512          HALT          /AC SHOULD EQUAL 7777
0215 4511          SCOPE

/TEST CONTINGENCY AND PULSE CHANNEL FOR ZERO
0216 7240          CLA CMA          /AC=SEVENS
0217 6334          XRCL          /CLEAR CHANNEL
0300 7200          CLA
0301 6331          XRIN          /READ CHANNELS
0302 7440          SZA          /TEST FOR ZERO
0303 4512          HALT          /FAILED TO CLEAR
0304 4511          SCOPE

/WILL CONVERT INSTRUCTION SET THE FLAG?
0305 6364          ADCV          /START
0306 3106          UCA STALL
0307 2106          ISZ STALL        /TIME FOR FLAG TO SET
0310 5307          JMP , -1
0311 6332          SKAD          /SKIP ON DONE FLAG
0312 4512          HALT          /DONE FLAG NOT SET OR SKIP FAILED
0313 6362          RAUC          /CLEAR FOR SCOPE
0314 4511          SCOPE

/TEST THAT (RADC) CLEARS DONE FLAG
0315 6364          ADCV          /START CONVERT TO SET FLAG
0316 6332          SKAD
0317 5310          JMP , -1        /WAIT FOR FLAG
0320 6362          RAUC          /CLEAR FLAG
0321 6332          SKAD          /IS FLAG CLEARED
0322 7410          SKP          /YES
0323 4512          HALT          /NO, FLAG IS SET OR SKIP FAILED
0324 4511          SCOPE

/TEST THAT (CLER) CLEARS THE DONE FLAG
0325 6364          ADCV          /START CONVERT TO SET FLAG
0326 6332          SKAD          /SKIP ON DONE
0327 5325          JMP , -1        /WAIT FOR FLAG
0330 6351          CLER          /CLEAR DONE FLAG
0331 6332          SKAD          /TEST THAT FLAG IS CLEARED
0332 7410          SKP
0333 4512          HALT          /((CLER) DID NOT CLEAR DONE FLAG
0334 4511          SCOPE

/TEST THAT (OTEN) CLEARS THE AC
0335 7240          CLA CMA          /AC=SEVENS
0336 6344          OTEN          /CLEAR AC
0337 7440          SZA          /TEST
0340 4512          HALT          /OTEN DID NOT CLEAR AC
0341 4511          SCOPE
0342 6342          ZTEN          /CLEAR ALL INTERRUPT ENABLES

/WILL INC MUX SET DONE FLAG
0343 2106          ISZ STALL

```

0344	5343	JMP .-1	
0345	6351	CLER	
0346	0361	ICMX	/INCREMENT MUX
0347	2106	ISZ STALL	
0350	5347	JMP .-1	
0351	0352	SKAU	/SKIP ON FLAG
0352	7410	SKP	
0353	4012	HALT	/ICMX SET DONE FLAG
0354	0302	RAUC	
0355	4011	SCOPE	

```

/WILL MULTIPLEXER INSTRUCTION CHANGE AC
0356 6361      ICMX          /INCREMENT MUX
0357 7440      SZA
0360 4512      HALT          /ICMX, SET AC
0361 7240      CLA CMA
0362 6361      ICMX          /INCREMENT MUX
0363 7450      SNA
0364 4512      HALT          /ICMX+10, SET AC
0365 6362      RAUC
0366 4511      SCOPE

/ROUTINES USING IOT 637X
/TEST READ BUFFER (Y REGISTER) AC=ZERO
0370 6372      OYC          /CLEAR Y REGISTER
0371 7650      RAUC+10      /READ BUFFER
0372 5375      SNA CLA      /TEST
0373 6372      JMP ,+3      /GOOD
0374 4512      RAUC+10      /BAD
0375 4511      HALT          /AC SHOULD EQUAL 0000
0376 5777      SCOPE
0377 0400      JMP I ,+1
                , 177+1

/TEST READ BUFFER (Y REGISTER) AC=SEVEN
0400 7240      CLA CMA      /SET AC TO SEVENS
0401 6311      OYC          /CLEAR Y REGISTER
0402 6372      RAUC+10      /READ BUFFER
0403 7450      SNA          /TEST
0404 5210      JMP ,+4      /GOOD
0405 7240      CLA CMA      /BAD
0406 6372      RAUC+10      /AC SHOULD EQUAL 0000
0407 4512      HALT          /BAD AC CLEAR PULSE
0410 4511      SCOPE

/TEST READ BUFFER (Y REGISTER)
0411 7240      CLA CMA      /AC EQUAL SEVENS
0412 6312      OYL          /SET Y REGISTER
0413 6372      RAUC+10      /READ BUFFER
0414 7001      IAC
0415 7650      SNA CLA      /TEST
0416 5221      JMP ,+3      /GOOD
0417 6372      RAUC+10      /BAD
0420 4512      HALT          /AC SHOULD EQUAL 7777
0421 4511      SCOPE

/WILL CONVERT INSTRUCTION SETS THE FLAG
0422 6374      ADCV+10      /START
0423 3106      UCA STALL
0424 2106      ISZ STALL   /TIME FOR FLAG TO SET
0425 5224      JMP , -1
0426 6352      SKAD        /SKIP ON DONE FLAG
0427 4512      HALT        /DONE FLAG NOT SET OR SKIP FAILED
0430 4511      SCOPE

```



```

/TEST THAT (RADC) CLEARS DONE FLAG
0431 6374          ADCV+10          /START CONVERT TO SET FLAG
0432 6332          SKAD
0433 5232          JMP , -1          /WAIT FOR FLAG
0434 6372          RADC+10          /CLEAR FLAG
0435 6332          SKAD          /IS FLAG CLEARED
0436 7410          SKP          /YES
0437 4512          HALT          /NO, FLAG IS SET OR SKIP FAILED
0440 4511          SCOPE

/GENERATE TIMING ERROR CONDITION
0441 6374          ADCV+10          /CONVERT
0442 6374          ADCV+10          /TWO ADCV SET ERROR CONDITION
0443 6322          SKR          /SKIP ON ERROR
0444 4512          HALT          /ERROR NOT UP
0445 6332          SKAD
0446 5245          JMP , -1
0447 4511          SCOPE

/DOES (CLER) CLEAR ADCIP "FF"
0450 6374          ADCV+10
0451 6374          ADCV+10          /SET ERROR CONDITION
0452 6332          SKAD
0453 5252          JMP , -1          /WAIT FOR FLAG
0454 6351          CLER          /CLEAR ADCIP "FF"
0455 6374          ADCV+10          /CONVERT
0456 6332          SKAD          /SKIP ON FLAG
0457 5256          JMP , -1          /WAIT FOR FLAG
0460 6322          SKR          /SKIP ON ERROR
0461 7410          SKP          /NO ERROR
0462 4512          HALT          /(CLER) DID NOT CLEAR ADCIP FF
0463 4511          SCOPE

```

```

/TEST FOR ADC TIMING ERROR
0404 6351      CLER      /CLEAR ERROR CONDITION
0405 6322      SKER      /SKIP ON ERROR
0406 7410      SKP
0407 4212      HALT      /ERROR CONDITION UP
0408 4211      SCOPE

/GENERATE TIMING ERROR CONDITION
0411 6364      ADCV      /CONVERT
0412 6364      ADCV      /TWOADCV SET ERROR CONDITION
0413 6322      SKER      /SKIP ON ERROR
0414 4212      HALT      /ERROR NOT UP
0415 6332      SKAD
0416 5215      JMP , -1
0417 4211      SCOPE

/DOES (CLER) CLEAR ERROR FLAG
0420 6351      CLER      /CLEAR ERROR
0421 6322      SKER      /SKIP ON ERROR
0422 7410      SKP      /NO ERROR
0423 4212      HALT      /ERROR FLAG NOT CLEARED
0424 4211      SCOPE

/DOES (CLER) CLEAR ADCIP "FF"
0425 6364      ADCV
0426 6364      ADCV      /SET ERROR CONDITION
0427 6332      SKAD
0428 5307      JMP , -1      /WAIT FOR FLAG
0429 6351      CLER      /CLEAR ADCIP "FF"
0430 6364      ADCV      /CONVERT
0431 6332      SKAD      /SKIP ON FLAG
0432 5313      JMP , -1      /WAIT FOR FLAG
0433 6322      SKER      /SKIP ON ERROR
0434 7410      SKP      /NO ERROR
0435 4212      HALT      / (CLER) DID NOT CLEAR ADCIP FF
0436 4211      SCOPE

```

```

/SET DONE AND TEST FOR INTERRUPT WITH NO INTERRUPT ENABLES
0021 6364          ADCV          /START CONVERT
0022 6332          SKAU
0023 5322          JMP ,-1        /WAIT FOR DONE FLAG
0024 7200          CLA
0025 6342          ZTEN          /INHIBIT INTERRUPTS
0026 1330          IAD ,+7
0027 3002          JCA 2
0030 0001          ION
0031 7410          SKP
0032 4512          HALT          /INTERRUPT UP
0033 6002          IOP
0034 7410          SKP
0035 0002          .-3
0036 4511          SCOPE

```

```

/SET ERRR FLAG AND TEST FOR INTERRUPT WITH NO INTERRUPT ENABLE
0037 6364          ADCV
0040 6364          ADCV          /GENERATE ERROR FLAG
0041 6332          SKAU
0042 5341          JMP ,-1
0043 1332          IAD ,+7
0044 3002          JCA 2
0045 6001          ION
0046 7410          SKP
0047 4512          HALT          /INTERRUPT UP
0050 6002          IOP
0051 7410          SKP
0052 0047          .-3
0053 4511          SCOPE

```

```

/WILL DONE FLAG RAISE AN INTERRUPT
0054 7200          CLA
0055 1031          IAD K0100
0056 6346          ZTEN OTEN          /ENABLE ADC INTERRUPT
0057 6364          ADCV          /START CONVERT
0058 6332          SKAU
0059 5360          JMP ,-1        /WAIT FOR FLAG
0060 1371          IAD ,+7
0061 3002          JCA 2
0062 6001          ION
0063 7000          NOP
0064 6002          IOP
0065 4512          HALT          /DONE FLAG DID NOT RAISE INTERRUPT
0066 7410          SKP
0067 0572          .+1
0068 4511          SCOPE
0069 5774          JMP I ,+1
0070 0600          . 1/7+1

```

```

                                /WILL TIMING ERROR RAISE AN INTERRUPT
0070 7200                      CLA
0070 1A40                      IAD K0200
0077 0306                      ZTEN OTEN
0080 0304                      ADCV
0081 0304                      ADCV
0082 0332                      SKAU
0083 5202                      JMP ,-1
0084 1210                      IAD ,+7
0085 0302                      JCA 2
0086 0801                      ION
0087 7A00                      NOP
0088 0302                      IOF
0089 4012                      HALT /NO INTERRUPT
0090 7410                      SKP
0091 0312                      ,-1
0092 0301                      CLER
0093 4011                      SCOPE
                                /MICRO PROGRAMED IOT
0095 0302                      RAUC /CLEAR DONE
0096 7240                      CLA CMA
0097 0307                      ICMX RAUC ADCV /INC MIX, READ BUFFER, CONVERT
0098 2100                      ISZ STALL
0099 5221                      JMP ,-1
0100 0332                      SKAU /SKIP ON DONE
0101 4012                      HALT /DONE FLAG NOT SET
0102 4011                      SCOPE
                                /SET TIMING ERROR FLAG
0103 0301                      CLER
0104 0300                      ICMX ADCV
0105 0300                      ICMX ADCV
0106 2100                      ISZ STALL
0107 5231                      JMP ,-1
0108 0332                      SKAU
0109 4012                      HALT /DONE FLAG NOT SET
0110 0322                      SKER
0111 4012                      HALT /NO TIMING ERROR FLAG
0112 4011                      SCOPE
0113 0302                      RAUC
0114 0377                      ACMX RAUC ADCV /SET MIX, READ BUFFER, CONVERT
0115 2100                      ISZ STALL
0116 5242                      JMP ,-1
0117 0332                      SKAU
0118 4012                      HALT /DONE FLAG NOT SET
0119 4011                      SCOPE

```

```
          /SET TIMING ERROR FLAG
0647  6351          CLR
0650  6377          ACMX RADC ADCV /SET MUX, READ BUFFER, CONVERT
0651  6375          ACMX ADCV
0652  2106          ISZ STALL
0653  5252          JMP , -1
0654  6362          SKAD /SKIP ON DONE
0655  4512          HALT /DONE NO SET
0656  6322          SKER /SKIP ON ERROR
0657  4512          HALT /ERROR SHOULD BE UP
0660  4511          SCOPE
```

```

/TEST USING RC CLOCK CONVERTING + INTERRUPT
/TEST RC CLOCK
/ENABLE RC CLOCK AND SKIP ON FLAG
0501 7200      CLA
0502 1033      TAU K2002
0503 6346      ZTEN OTEN          /TURN ON RC CLOCK
0504 2100      ISZ STALL
0505 5204      JMP .-1
0506 6341      SKKK          /RC CLOCK FLAG SHOULD BE SET
0507 4012      HALT          /DID NOT SKIP ON RC CLOCK FLAG
0510 6354      CLRK          /CL RC CLOCK AND FLAG
0511 4011      SCOPE

/TEST FOR ADC TIMING ERROR
0512 6351      CLEAR
0513 7200      CLA
0514 1034      TAU K2002
0515 6346      ZTEN OTEN
0516 2100      ISZ STALL
0517 5216      JMP .-1
0518 6322      SKKR          /SKIP ON ADC TIMING ERROR
0519 4012      HALT          /ERROR SHOULD BE SET
0520 4011      SCOPE          /RC TIME ADJ SET FOR MIN

/TEST CLEAR RC CLOCK INSTRUCTION
0523 6354      CLRK          /CLEAR RC CLOCK AND FLAG
0524 6341      SKKK
0525 5324      JMP .-1          /SYNC ON CLOCK
0526 6354      CLRK
0527 6341      SKKK          /SKIP ON RC CLOCK
0528 7410      SKP
0529 4012      HALT          /CLEAR DID NOT WORK
0530 4011      SCOPE

/TEST RC CLOCK RAISE AN INTERRUPT
0531 6341      SKKK
0532 5313      JMP .-1          /WAIT FOR RC CLOCK FLAG
0533 1035      TAU K3002
0534 6346      ZTEN OTEN          /RC CLOCK INTERRUPT ENABLE ON
0535 1326      TAU .+7
0536 3002      DCA 2
0537 6001      ION
0538 7000      NOP          /SHOULD INTERRUPT HERE
0539 6002      IOP
0540 4012      HALT          /NO INTERRUPT
0541 7410      SKP
0542 0725      .-1
0543 6354      CLRK
0544 4011      SCOPE

```

```

/WILL RC CLOCK SET ADC DONE FLAG
0/31 6354 CLRK
0/32 6341 SKKK
0/33 5332 JMP .-1
0/34 6354 CLRK
0/35 6341 SKKK /SKIP ON RC FLAG
0/36 5332 JMP .-1 /WAIT FOR RC FLAG
0/37 2106 ISZ STALL
0/40 5337 JMP .-1 /ADC DONE SHOULD BE SET
0/41 6332 SKAD /SKIP ON ADC DONE
0/42 4512 HALT /ADC DONE NOT SET
0/43 4511 SCOPE
/CLEAR RC CLOCK AND TEST FOR NO SKIP
0/44 7200 CLA
0/45 6342 ZTEN /TURN CLOCK OFF
0/46 6354 CLRK /CL CLOCK FLAG
0/47 2106 ISZ STALL
0/50 5347 JMP .-1
0/51 6341 SKKK /SKIP ON RC CLOCK
0/52 7410 SKP
0/53 4512 HALT /CLOCK SHOULD BE OFF
0/54 4511 SCOPE
/TEST RC CLOCK (ONE EIGHT SPEED)
0/55 7200 CLA
0/56 1043 TAU K4002
0/57 6346 ZTEN UTEN /SLOW SPEED RC CLOCK ENABLE
0/60 6354 CLRK /CLEAR RC CLOCK FLAG
0/61 6341 SKKK /SKIP ON RC FLAG
0/62 7410 SKP
0/63 4512 HALT /RC FLAG SET TOO SOON
0/64 2106 ISZ STALL
0/65 5364 JMP .-1 /WAIT FOR FLAG TO SET
0/66 6341 SKKK /SKIP ON RC FLAG
0/67 4512 HALT /FLAG NOT SET
0/70 4511 SCOPE
0/71 5772 JMP I .+1
0/72 1000 . 177+1
*. 177+1
/TEST THAT RC CLOCK GENERATES INTERRUPTS
1000 7000 UPR
1001 7200 CLA /RC INTERRUPTS AND RC TIMING
1002 1051 TAU K1002
1003 6346 ZTEN UTEN
1004 2106 ISZ STALL
1005 5204 JMP .-1
1006 1215 TAU .+7
1007 5002 UCA 2
1010 6001 ION
1011 7000 UPR
1012 6002 IOP
1013 4512 HALT /NO INTERRUPT
1014 7410 SKP
1015 1014 .-1
1016 6351 CLRK

```

101/ 6354
1020 4511

CLRK
SCOPE

```
1021 3100
1022 2106
1023 5226
1024 4512
1025 5230
1026 0321
1027 5222
1030 4511

/TEST USING CRYSTAL CLOCK TO SET FLAG
DCA STALL /FLAG SHOULD BE SET 150 USEC
ISE STALL
JMP ,+3
HALT /CRYSTAL CLOCK FLAG NOT SET
JMP ,+3
SKXX /SKIP ON CRYSTAL FLAG
JMP ,-5 /NOT SET
SCOPE

PAUSE
```



```

/TAPE 2
/CLEAR CRYSTAL CLOCK FLAG WITH "IOT"
1031 0322      CLXX
1032 0321      SKXX
1033 5232      JMP , -1
1034 0322      CLXX
1035 0321      SKXX
1036 7410      SKP
1037 4212      HALT
1040 4211      SCOPE
/TEST THAT FLAG DOES NOT SET TOO SOON
1041 0322      CLXX
1042 0321      SKXX
1043 5242      JMP , -1          /SYNC ON CLOCK
1044 0322      CLXX
1045 2106      ISZ STALL
1046 2106      ISZ STALL
1047 2106      ISZ STALL
1050 0321      SKXX
1051 7410      SKP
1052 4212      HALT          /FLAG SET TOO SOON
1053 4211      SCOPE
/TEST THAT FLAG DOES NOT TAKE TOO LONG TO SET
1054 0322      CLXX
1055 0321      SKXX
1056 5255      JMP , -1          /SYNC ON CLOCK
1057 0322      CLXX          /CLEAR XTAL CLOCK FLAG
1060 1022      IAU KM0043
1061 3106      UCA STALL
1062 2106      ISZ STALL          /150 MICRO SEC
1063 5262      JMP , -1
1064 0321      SKXX          /SKIP ON XTAL CLOCK FLAG
1065 4212      HALT          /XTAL CLOCK FL TAKES TOO LONG
1066 4211      SCOPE
/WILL CRYSTAL CLOCK GENERATE AN INTERRUPT
1067 7200      CLA
1070 1023      IAU K0400          /ENABLE XTAL CLOCK INTERRUPT
1071 0346      ZTEN OTEN
1072 2106      ISZ STALL          /XTAL CLOCK FLAG SHOULD BE SET
1073 5272      JMP , -1
1074 1303      IAU , +7
1075 3002      UCA 2
1076 6001      IDN          /INTERRUPT ON
1077 7000      NOP          /SHOULD INTERRUPT HERE
1100 6002      IDP
1101 4512      HALT          /NO XTAL INTERRUPT UP
1102 7410      SKP
1103 1104      , +1
1104 4511      SCOPE
/SET CHANNEL FLAG
1105 7124      STL RAL          /0001 TO AC
1106 0346      OTEN ZTEN      /SET CHANNEL FLAG
1107 0331      XRIN          /SENSE REGISTER TO AC

```

1110 7500
1111 4012
1112 7200
1113 4011

SMA
HALT
CLA
SCOPE

/AC SHOULD=4000
/BIT 0 NOT SET

```

1114 6352          /CLEAR XTAL FLAG AND TEST FOR NO INTERRUPT WITH ENABLE UP
                   CLXK          /CLEAR CRYSTAL CLOCK FLAG
1115 1324          TAU ,+7
1116 3002          DCA 2
1117 6001          IOV
1120 7410          SKP
1121 4512          HALT          /INTERRUPT UP
1122 6002          IOF
1123 7410          SKP
1124 1121          ,--S
1125 4511          SCOPE
1126 1030          TAU K0034
1127 6371          ACMX          /MULTIPLEXER CHANNEL 34

/TEST THAT DISPLAY COMMANDS DO NOT NTERFERE WITH A/D CONVERSIONS
/THIS TEST ASSUMES THAT CHANNEL 34 IS SELECTED AND THAT
/AND THAT A FIXED NON ZERO VOLTAGE IS SUPPLIED TO CHANNEL 34
1130 6364          ADCV          /START CONVERSION
1131 7000          NOP
1132 7000          NOP          /CONVERSION IN PROGRESS
1133 6311          OYC          /THIS INSTRUCTION SHOULD BE INHIBITED
1134 6362          RAUC          /IF ZERO (OYC) NOT INHIBITED
1135 7450          SNA          /TEST
1136 4512          HALT          /OYC WAS NOT INHIBITED AND CLEARED CONVERTER
1137 4511          SCOPE

```



```

/TEST DYL IS INHIBITED DURING A/D CONVERSIONS-CH 34 SET TO HALF POSITIVE SCALE
1 6364
11 1 6332
11 2 5341
1143 7240
1144 6312
1 5 6362
1 6 7001
1147 7450
1150 4512
1 1 4511
      ADCV          /START CONVERSION
      SKAD
      JMP , -1      /WAIT FOR FLAG
      CLA CMA      /AC=7777
      DYL          /("DYL") SHOULD BE INHIBITED UNTILL RADC
      RADC        /IF AC=7777 DYL NOT INHIBITED
      IAC
      SNA          /TEST AC NOT EQUAL 7777
      HALT        /DYL NOT INHIBITED
      SCOPE       /CHANNEL 34 SHOULD HAVE A NON ZERO VOLTAGE

/TEST THAT (DXL) IS INHIBITED DURING A/D CONVERSION
1152 7240
1 3 6364
1 4 6302
1 5 6332
1156 7410
1157 4512
1 10 4511
      CLA CMA      /AC=SEVEN
      ADCV        /START CONVERSION
      DXL         /SHOULD BE INHIBITED AN NOT LOAD "X" WITH SEVENS
      SKAD        /IF "X" IS LOADED, DONE WILL SET TOO SOON
      SKP
      HALT        /DONE SET TOO SOON
      SCOPE

/TEST THAT DXC IS INHIBITED BETWEEN (ADCV) AND (RADC)
1161 6364
1 52 6332
1 53 5362
1164 6301
1165 6332
1 56 4512
1 57 4511
      ADCV        /START CONVERSION
      SKAD
      JMP , -1      /WAIT FOR FLAG
      DXC         /"DXC" SHOULD BE INHIBITED
      SKAD        /IF NOT INHIBITED WILL CLEAR ADC FLAG
      HALT        /DXC CLEARED DONE
      SCOPE

/THIS ROUTINE IS FOR SCOPING RELAY ENABLES R1, R2 AND R4
1170 1106
1 71 0037
      6346
      2106
1174 5370
1175 5776
1 76 1200
      IAU STALL
      ANJ C0070
      ZTEN OTEN
      ISZ STALL
      JMP , -4
      JMP I , +1
      , 177+1
      * . 177+1

```

```

/TEST RC CLOCK SLOW (ONE EIGHT SPEED)
RCX,   CLA
1200   /200   IAU K4002
1201   1043   ZTEN OTEN
1202   6346   DCA STALL
1203   3106   CLRK
1204   6354   SKRK
1205   6341   JMP .-1
1206   5207   CLRK
1207   6354   ISZ STALL
1210   2106   SKRK
1211   6341   JMP .-2
1212   5210   IAU STALL
1213   1106   DCA SL1
1214   3027   DCA STALL
1215   3106   CLRK
1216   6354   SKRK
1217   6341   JMP .-1
1220   5217   CLRK
1221   6354   ISZ STALL
1222   2106   SKRK
1223   6341   JMP .-2
1224   5222   IAU STALL
1225   1106   CIA
1226   7041   IAU SL1
1227   1027   SNA
1230   7450   JMP RCX1           /EQUAL
1231   5241   CMA
1232   7040   SNA
1233   7450   JMP RCX1           /MINUS ONE
1234   5241   IAU
1235   7001   CMA
1236   7040   SZA           /PLUS ONE
1237   7440   HALT
1240   4012   RCX1, SCUPE
1241   4011   /TEST RC CLOCK FAST
1242   /200   CLA
1243   1043   IAU K0002
1244   6346   ZTEN OTEN
1245   3106   DCA STALL
1246   6354   CLRK
1247   6341   SKRK
1250   5247   JMP .-1
1251   6354   CLRK
1252   2106   ISZ STALL
1253   6341   SKRK
1254   5252   JMP .-2
1255   1106   IAU STALL
1256   3026   DCA FT1
1257   3106   DCA STALL
1260   6354   CLRK
1261   6341   SKRK
1262   5261   JMP .-1
1263   6354   CLRK
1264   2106   ISZ STALL

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1265	6341	SKKK	
1266	5264	JMP , -2	
1267	1106	TAU STALL	
1270	7041	CIA	
1271	1026	TAU FT1	
1272	7450	SNA	
1273	5303	JMP RCX2	/EQUAL
1274	7040	CMA	
1275	7450	SNA	
1276	5303	JMP RCX2	/MINUS ONE
1277	7001	IAC	
1300	7040	CMA	
1301	7440	SZA	/PLUS ONE
1302	4512	HALT	
1303	4511	RCX2, SCUPE	
		/TEST FAST--SLOW RATIO OF RC CLOCK	
1304	7300	CLA CLL	/IF THIS TEST FAILS
1305	1025	TAU SL1	/RATIO OF CLOCK IS
1306	7110	RAR CLL	/NOT 8 TO 1
1307	7110	RAR CLL	
1310	7110	RAR CLL	
1311	7041	CIA	
1312	1026	TAU FT1	
1313	7450	SNA	
1314	5324	JMP RCX3	
1315	7240	CMA	
1316	7450	SNA	
1317	5324	JMP RCX3	
1320	7001	IAC	
1321	7040	CMA	
1322	7440	SZA	
1323	4512	HALT	/RATIO NOT 8 TO 1
1324	4511	RCX3, SCUPE	/THIS IS NOT TRUE
1325	6342	ZTEN	/CLEAR ENABLES
1326	6354	CLRK	/CLEAR RC FLAG
1327	5730	JMP I , +1	/USES DISPLAY TO CHECK ICMX
1330	1400	CHST	/INSTRUCTION

```

/SELECT MUX WITH SWITCHS, DISPLAY CONVERTED VALUE IN AC
1331 4340 CON3, JMS CON1
1332 4353 JMS CON2
1333 5331 JMP ,-2
1334 4340 JMS CON1 /USE ACMX, RADC, ADCV
1335 5334 JMP ,-1
1336 4353 JMS CON2 /USE ICMX RADXC ADCV
1337 5336 JMP ,-1

/DISPLAY CONVERTER VALUE IN AC, SW REGISTER 7-11 SELECT MUX
1340 7000 CON1, NOP
1341 7604 LAS
1342 6375 ACMX ADCV
1343 6362 RAUC
1344 6332 SKAU
1345 5344 JMP ,-1
1346 2106 ISZ STALL
1347 5346 JMP ,-1
1350 2106 ISZ STALL
1351 5350 JMP ,-1
1352 5740 JMP I CON1
1353 7000 CON2, NOP
1354 7604 LAS
1355 1053 IAU K777 /MINUS ONE
1356 6371 ACMX
1357 6361 ICMX
1360 6364 ADCV
1361 6362 RAUC
1362 6332 SKAU
1363 5362 JMP ,-1
1364 2106 ISZ STALL
1365 5364 JMP ,-1
1366 2106 ISZ STALL
1367 5366 JMP ,-1
1370 5753 JMP I CON2
1371 5772 JMP I ,+1
1372 1400 . 177+1

```

```

1400      1400
1400      7200
1401      5057
1402      6371
1403      6364
1404      6332
1405      5204
1406      6367
1407      3062
1410      6332
1411      5210
1412      6367
1413      2057
1414      5070
1415      1070
1416      7041
1417      1062
1420      7650
1421      5241
1422      1070
1423      7040
1424      1062
1425      7650
1426      5241
1427      1062
1430      7040
1431      1070
1432      7650
1433      5210
1434      1057
1435      7041
1436      1107
1437      7640
1440      5210
1441      1050
1442      3106
1443      4517
1444      2106
1445      5243
1446      4511

*. 177+1
/TEST FOR NUMBER OF CHANNELS ON MULTIPLEXER
CHTST,  CLA
      DCA MUXNUM          /CHANNEL ZERO
      ACMX
      ADCV          /FIRST CONVERT
      SKAD
      JMP , -1
      ICMX RAUC ADCV          /SECOND CONVERT FIRST READ
      DCA CTEMA
CHTST2, SKAD
      JMP , -1
      ICMX RAUC ADCV          /3RD CONVERT 2ND READ
      ISZ MUXNUM
      DCA BAD
      TAU BAD
      CIA
      TAU CTEMA          /FIRST READ
      SNA CLA
      JMP CHTST1
      TAU BAD
      CMA
      TAU CTEMA          /FIRST READ
      SNA CLA
      JMP CHTST1
      TAU CTEMA
      CMA
      TAU BAD
      SNA CLA          /
      JMP CHTST2          /TEST THE REST
      TAU MUXNUM          /NOT EQUAL +/- 1/2 LSB
      CIA          /CHANNEL
      TAU K0040          /EQUAL TO MAXIMUM
      SZA CLA          /NO--NOT 40
      JMP CHTST2
CHTST1, TAU K0020
      DCA STALL
      JMS I XTEXTB          /SAME VALUE IN X ICMX
      ISZ STALL
      JMP , -2
      SCOPE

```

```

/TEST CONTINGENCY REGISTER WAIT 36 MILL SEC
1447 7240          CLA CMA
1450 6334          XRCL          /CLEAR CONTINGENCY CHANNEL
1451 7200          CLA
1452 2106          ISZ STALL      /WAIT 36 MSEC FOR
1453 5252          JMP ,-1          /EXTERNAL STIMULUS
1454 2106          ISZ STALL
1455 5254          JMP ,-1
1456 6331          XRIN          /READ CHANNELS
1457 7440          SZA          /TEST FOR ZERO
1460 4512          HALT          /EXTERNAL STIMULUS WAS APPLIED
1461 7240          CLA CMA
1462 6334          XRCL          /CLEAR CHANNELS
1463 4511          SCOPE
1464 6354          CLRK

/LET S1, S2, OR S3 TRIGGER EXTERNAL INTERRUPT
/VALUE OF Y REGISTER CONSTANTLY INCREASING
/VALUE OF Y REGISTER IN AC IF INTERRUPT OCCUR

1465 1041          TAU K1004          /EXTERNAL INTERRUPT ENABLE
1466 6346          ZTEN OTEN      /SELECT ENABLES
1467 1305          TAU VAL1          /INTERRUPT RETURN
1470 5002          UCA 2
1471 3106          UCA STALL      /EQUAL (Y REGISTER)
1472 6001          ION          /INTERRUPT ON
1473 6313          OYC DYI          /LOAD Y REGISTER
1474 7000          NOP
1475 7000          NOP          /TIME FOR INTERRUPT
1476 7001          IAC          /INCREMENT (Y VALUE)
1477 2106          ISZ STALL      /DONE ALL VALUES
1500 5273          JMP ,-5          /NO
1501 5303          JMP ,+2         /YES -- TURN INTERRUPT OFF
1502 4512          HALT          /INTERRUPT OCCURED, AC=(Y-REGISTER)
1503 6002          IOP
1504 7410          SKP
1505 1502          VAL1,        , -3
1506 6342          ZTEN
1507 7240          CLA CMA
1510 6334          XRCL          /CLEAR CONTINGENCY CHANNEL
1511 4511          SCOPE

/TEST THAT RC CLOCK DOES NOT INHIBIT ADCV
/ECO SEP 11,1968

1512 6354          CLRK
1513 6351          CLER
1514 1034          TAU K2002          /CLER CV AND CM
1515 6346          ZTEN OTEN      /RC CLOCK INITIATE CONVERT
1516 6341          SKRK
1517 5316          JMP ,-1          /WAIT FOR FLAG
1520 6364          ADCV          /NOW DO A ADCV, GENERATE ERROR
1521 6354          CLRK          /CLEAR CLOCK FLAG
1522 6322          SKER          /SKIP ON ERROR
1523 4512          HALT          /ERROR NOT UP
1524 6342          ZTEN
1525 6332          SKAD

```

```
1026 5325      JMP , -1          /WAIT FOR FLAG
1027 6354      CLRK             /CLEAR A/D FLAG
1030 6362      HAUC
1031 4511      SCOPE
1032 6351      CLER
1033 6342      ZTEN
/CR,LF AT END OF PASS IF ERROR

1034 7260      CLA
1035 1013      TAU I XTYPE     /TEST FLAG
1036 7440      SZA
1037 4516      JMS I XGRF      /GRF TO TTY
1040 3513      DCA I XTYPE     /CLEAR FLAG
1041 7504      LAS
1042 7006      RTL
1043 7710      SPA CLA
1044 5521      JMP I XSWTCH    /TO DISPLAY TEST
1045 5746      JMP I , +1      /LOOP ON INSTRUCTION TEST
1046 0245      LOOPA
```



```

1600 1600
1600 7402
1601 6351
1602 1060
1603 3104
1604 1044
1605 3105
1606 4515
1607 0057
1610 1635
1611 1635
1612 4454
1613 4543
1614 0411
1615 0107
1616 1617
1617 2324
1620 1103
1621 4022
1622 2516
1623 1611
1624 1607
1625 4543
1626 2301
1627 1505
1630 4026
1631 0114
1632 2505
1633 4011
1634 1640
1635 3030
1636 4011
1637 0315
1640 3000
1641 5600

*. 17/+1
TEXTB, XX
CLEAR
TAU K0003
UCA CHXL
TAU K0015
UCA CHYL
JMS I XSIXTY
MUMNUM
TEXTB1
TEXTB1
JMS I MSSG /DISPLAY OUTPUT
4543 /DIAGNOSTIC RUNNING
0411
0107
1617
2324
1103
4022
2516
1611
1607
4543
2301 /SA
1505 /ME
4026 /SPACE V
0114 /AL
2505 /UE
4011 /SPACE I
1640 /N SPACE
TEXTB1, 3030 /XX
4011 /IC
0315 /MX
3000
JMP I TEXTB

```

1642	7402	SIXTY,	HLI	
1643	7000		NOP	
1644	7000		NOP	/STORE INIT NEXT TIME
1645	7200		CLA	
1646	1642		TAU I , -4	/ADDRESS OF OPERAND
1647	3251		DCA , +2	
1650	5652		JMP I , +2	
1651	0000		0	/ADDRESS OPERAND
1652	1654		SIXTY+12	/CHANGING REFERENCE (P)
1653	5245		JMP SIXTY+3	
1654	1651		TAU I SIXTY+7	/AC (OPERAND)
1655	0327		AND K0007	
1656	3322		DCA MASKA	/000X
1657	1651		TAU I SIXTY+7	/AC (OPERAND)
1660	0330		AND K0070	
1661	3323		DCA MASKB	/00X0
1662	1651		TAU I SIXTY+7	/AC (OPERAND)
1663	0331		AND K0700	
1664	3324		DCA MASKC	/0X00
1665	1651		TAU I SIXTY+7	/AC (OPERAND)
1666	0332		AND K7000	
1667	3325		DCA MASKD	/X000
1670	1324		TAU MASKC	/0X00
1671	7112		RTH CLL	
1672	7010		RAX	/0X00 RS3 00X0
1673	1325		TAU MASKD	/X0X0
1674	7012		RTH	
1675	7010		RAX	
1676	1326		TAU MASKD+1	/X0X0 RS3 0X0X
1677	3324		DCA MASKC	/TEMP STORAGE
1700	2242		ISZ SIXTY	/INCREMENT FOR STORAGE
1701	4252		JMS SIXTY+10	/FIND STORAGE ADDRESS
1702	1324		TAU MASKC	/6X6X
1703	3651		DCA I SIXTY+7	/STORE OPERAND AS SPECIFIED
1704	1323		TAU MASKB	/00X0
1705	7004		RAL	
1706	7006		RTL	/00X0 SL3 0X00
1707	1322		TAU MASKA	/0X00+000X=0X0X
1710	1326		TAU MASKD+1	/0X0X+6060=6X6X
1711	3325		DCA MASKD	/TEMP STORAGE ADDRESS
1712	2242		ISZ SIXTY	/INCREMENT FOR STORAGE
1713	4252		JMS SIXTY+10	/FIND STORAGE ADDRESS
1714	1325		TAU MASKD	/6X6X
1715	3651		DCA I SIXTY+7	/STORE OPERAND AS SECIFIED
1716	1333		TAU SIX12	/HOUSE KEEPING
1717	3252		DCA SIXTY+10	
1720	2242		ISZ SIXTY	/INCREMENT FOR RETURN
1721	5642		JMP I SIXTY	/RETURN

1/22	0000	MASKA,	0
1/23	0000	MASKH,	0
1/24	0000	MASKC,	0
1/25	0000	MASKD,	0
1/26	6060		0060
1/27	0007	K0007,	0007
1/30	0070	K0070,	0070
1/31	0700	K0700,	0700
1/32	7000	K7000,	7000
1/33	1654	SIX12,	SIXTY+12

```

* . 17/+1
2000 2000
2000 7604 SWITCH, LAS /DISCOVER WHAT TEST OPERATOR WANTS
2001 7104 CLL RAL /MOVE SR0,1 INTO LINK AC FOR TEST
2002 7530 S2L SPA
2003 7410 SKP
2004 5237 JMP LDIAG /HE WANTS LEFT DIAGONAL
2005 7040 CMA
2006 7530 S2L SPA
2007 7410 SKP
2010 5243 JMP RDIAG /HE WANTS RIGHT DIAGONAL
2011 7060 CMA CML
2012 7730 S2L SPA CLA
2013 5247 JMP ANGLE /HE WANTS THE ANGLE
2014 5271 JMP XBOX

2015 0000 KEYS, 0
2016 7604 LAS /SAVE ITENSITY BITS
2017 0131 AND K0600 /MOVE TO AC 10, 11
2020 7106 CLL RTL
2021 7006 RTL
2022 7006 RTL /
2023 1132 TAU K6324 /ADD BASIC IOT TO BITS
2024 3225 DCA EXECUT /STORE
2025 0000 EXECUT, 0 /EXECUTE
2026 7604 LAS /GET SWITCHES
2027 7106 CLL RTL
2030 7710 SPA CLA /SHALL WE REPEAT
2031 5200 JMP SWITCH /NO
2032 7604 LAS
2033 0107 AND K0040
2034 7640 S2A CLA
2035 5510 JMP I XINT3
2036 5615 JMP I KEYS /YES
/LEFT DIAGONAL SUBROUTINE
2037 4326 LDIAG, STUL /SET TOO UPPER LEFT
2040 4523 DLUL /DRAW LEFT DIAGONAL LINE
2041 4215 JMS KEYS /CHECK THE KEYS
2042 5237 JMP LDIAG /REDRAW

2043 4522 RDIAG, STUR /SET TOO UPPER RIGHT
2044 4524 DRUL /DRAW RIGHT DIAGONAL LINE
2045 4215 JMS KEYS /CHECK THE KEYS
2046 5243 JMP RDIAG /REDRAW

2047 7300 ANGLE, CLA CLL
2050 6303 UXC DXL /CLEAR X
2051 6313 UYC DYL /CLEAR Y
2052 1142 TAU M200
2053 3143 DCA COUNT /SET COUNTER
2054 1140 TAU P2
2055 6307 UXC DXL DIS /DRAW
2056 2143 ISZ COUNT /DONE YET
2057 5254 JMP ,-3 /NO

```

2060	7300	CLA CLL	
2061	1142	IAD M200	/SET UP COUNTER
2062	3143	UCA COUNT	
2063	1140	IAD P2	
2064	6317	DYC DYI DIS	/DRAW
2065	2143	ISZ COUNT	
2066	5263	JMP .-3	/DONE YET
2067	4215	JMS KEYS	/EXIT
2070	5247	JMP ANGLE	/REDRAW
2071	4316	XBOX, STLL	
2072	4525	DVLT	
2073	1133	IAD K377	
2074	6303	DXC DXL	
2075	3134	UCA XPOSR	
2076	4526	DVLT	
2077	4336	SJLR	
2100	4525	DVLT	
2101	6313	DYC DYI	
2102	3135	UCA YPOSR	
2103	4530	UHLL	
2104	4326	STUL	
2105	4523	DLUL	
2106	4522	STUR	
2107	4524	DRUL	
2110	4326	STUL	
2111	4527	UHLR	
2112	4336	STLR	
2113	4530	UHLL	
2114	4215	JMS KEYS	
2115	5271	JMP XBOX	

2116 0000
 2117 7300
 2120 6303
 2121 3134
 2122 1136
 2123 6313
 2124 3135
 2125 5716
 2126 0000
 2127 7300
 2130 6301
 2131 3134
 2132 1133
 2133 6313
 2134 3135
 2135 5726
 2136 0000
 2137 7300
 2140 1136
 2141 6313
 2142 3135
 2143 1137
 2144 6303
 2145 3134
 2146 5736
 2147 0000
 2150 7300
 2151 1137
 2152 6303
 2153 3134
 2154 1133
 2155 6313
 2156 3135
 2157 5747
 2160 0000
 2161 1141
 2162 3143
 2163 1135

SILLS, 0

CLA CLL
 UXC DXL
 UCA XPOSR
 IAD K400
 UYC DYL
 UCA YPOSR
 JMP I STLLS

/SET TO 0400

STULS, 0

CLA CLL
 UXC
 UCA XPOSR
 IAD K377
 UYC DYL
 UCA YPOSR
 JMP I STULS

STLRS, 0

CLA CLL
 IAD K400
 UYC DYL
 UCA YPOSR
 IAD K777
 UXC DXL
 UCA XPOSR
 JMP I STLRS

STURS, 0

CLA CLL
 IAD K777
 UXC DXL
 UCA XPOSR
 IAD K377
 UYC DYL
 UCA YPOSR
 JMP I STURS

DVLTS, 0

IAD M400
 UCA COUNT
 IAD YPOSR

2164	1140		TAD P2	
2165	6317		OYC DYI DIS	
2166	2143		ISZ COUNT	
2167	5364		JMP , -3	
2170	7300		CLA CLL	
2171	5760		JMP I DVLTS	
	4316		SILL=JMS SILLS	
	4326		STUL=JMS SIULS	
	4336		STLR=JMS SILRS	
	2200		*, 17/+1	
2200	0000	DVLBS,	0	
2201	1141		TAU M400	
2202	3143		OCA COUNT	
2203	1135		TAD YPOSR	
2204	1052		TAD K7776	/MINUS 2
2205	6317		OYC DYI DIS	
2206	2143		ISZ COUNT	
2207	5204		JMP , -3	
2210	7300		CLA CLL	
2211	5600		JMP I DVLBS	
2212	0000	DHLRS,	0	
2213	1141		TAD M400	
2214	3143		OCA COUNT	
2215	1134		TAD XPOSR	
2216	1140		TAD P2	
2217	6307		OXC DXL DIS	
2220	2143		ISZ COUNT	
2221	5216		JMP , -3	
2222	7300		CLA CLL	
2223	5612		JMP I DHLRS	

2224	0000	DHLLS,	0
2225	7300		CLA CLL
2226	1141		IAD M400
2227	3143		OCA COUNT
2230	1134		TAD XPOSR
2231	1052		TAD K7776
2232	6307		UXC DXL DIS
2233	2143		ISZ COUNT
2234	5231		JMP , -3
2235	7300		CLA CLL
2236	5624		JMP I DHLLS
2237	0000	DLCLS,	0
2240	7300		CLA CLL
2241	1141		TAD M400
2242	3143		OCA COUNT
2243	1134	MYPX,	TAD XPOSR
2244	1140		IAD P2
2245	6303		UXC DXL
2246	3134		OCA XPOSR
2247	1135		TAD YPOSR
2250	1052		TAD K7776
2251	6317		UYC DYL DIS
2252	3135		OCA YPOSR
2253	2143		ISZ COUNT
2254	5243		JMP MYPX
2255	5637		JMP I DLCLS
2256	0000	DRDLS,	0
2257	7300		CLA CLL
2260	1141		TAD M400
2261	3143		OCA COUNT
2262	4522		STUR
2263	1134	MYMX,	TAD XPOSR
2264	1052		TAD K7776
2265	6303		UXC DXL
2266	3134		OCA XPOSR
2267	1135		TAD YPOSR
2270	1052		TAD K7776
2271	6317		UYC DYL DIS
2272	3135		OCA YPOSR
2273	2143		ISZ COUNT
2274	5263		JMP MYMX
2275	5656		JMP I DRDLS

2400	2400	*, 177+1
2401	5205	JMP INIT3
	0010	PNTN=10
2402	0000	X, 0
2403	0000	Y, 0
2404	0000	RCNT, 0
	2514	ADBUF, ADBUF=1
		PAUSE

```

/TAPE 3
/THREE STATE SCOPE DISPLAY
2405 7326 INIT3, CLA STL RTL /POSITIVE TWO
2406 6346      ETEN OTEN
2407 6354      CLRK
2410 1047 INISAM, TAU KM1000
2411 3143      UCA COUNT
2412 1204      TAU ADBUFR
2413 3010      DCA PNTR
2414 7604 SAMLOP, LAS
2415 6375      ACMX ADCV /LOAD MUX WITH SWITCHES, CONVERT
2416 6332      SKAD
2417 5216      JMP , -1 /WAIT FOR FLAG
2420 6362      RAUC /READ BUFFER
2421 3410      DCA I PNTR /STORE SKP
/FOR SCOPING WITHOUT INDEXING MUX REPLAC PLACE A WITH A NOP
2422 5235      JMP SAM1
2423 7604      LAS /READ SWITCHES, SUBTRACT ONE
2424 1053      TAU K7777 /LOAD MUX, INCREMENT MVX
2425 6371      ACMX
2426 6361      ICMX /CONVERT
2427 6364      ADCV
2430 6332      SKAD
2431 5230      JMP , -1 /WAIT FOR FLAG
2432 6362      RAUC /READ BUFFER
2433 3410      DCA I PNTR /STORE
2434 2143      ISZ COUNT
2435 2143      ISZ COUNT SAM1,
2436 5214      JMP SAMLOP /MORE SAMPLES
2437 1050      TAU KM0020
2440 3203      UCA RCNT

2441 1204 INIDIS, TAU ADBUFR /BUFFER
2442 3010      UCA PNTR
2443 1024      TAU KM0777

2444 3143      UCA COUNT
2445 3201      UCA X /X REFERENCE SETUP
2446 1410      TAU I PNTR
2447 7041      CMA IAC
2450 3202      UCA Y /Y REFERENCE SETUP

```

2451	4276	JMS STATE	/VALUE OF CONVERTED WORD
2452	1410	DISLOP, TAD I PNTR	/NEXT WORD
2453	1202	TAU Y	/REFERENCE IT
2454	7006	RTL	
2455	7006	RTL	
2456	7006	RTL	
2457	0045	AND K7700	
2460	0313	JYC DYI	/LOAD Y
2461	7200	CLA	
2462	1201	TAD X	
2463	6307	JXC DXL DIS	/LOAD X
2464	7001	IAC	
2465	3201	JCA X	/RESTORE X INCREMENTED
2466	2143	ISZ COUNT	/DONE
2467	5252	JMP DISLOP	/NO
2470	6341	SKRK	/SKIP ON RC CLOCK
2471	5241	JMP INIDIS	/RC CLOCK IS REFRESH RATE
2472	6354	CLRK	/CLEAR CLOCK
2473	2203	ISZ RCNT	/BASIC TIME COUNT
2474	5241	JMP INIDIS	/REFRESH DISPLAY
2475	5210	JMP INISAM	/FILL BUFFER WITH NEW
2476	7402	STATE, XX	
2477	6351	CLER	
2500	1060	TAD K0003	
2501	3104	JCA CHXL	
2502	1042	TAD K0340	
2503	3105	JCA CHYL	
2504	4515	JMS I XSIXTY	
2505	2515	AUBUF	
2506	2511	,+3	
2507	2512	,+3	
2510	4454	JMS I MSSG	
2511	6060	0000	
2512	6060	0000	
2513	0000	0	
2514	5676	JMP I STATE	
2515	0000	AUBUF, 0	
	3515	*AUBUF+1000	

3600

*. 17/+1

/FILE NAME: DSCPAK

```

/DISPLAY STRIPPED ASCII CHAR IN AC: DSC
/SAMPLE CALLING SEQUENCE -
/      LDM          /GET HALFWORD
/      USC          /DISPLAY IF NON ZERO
/      JMP .-2      /DISPLAY THE NEXT HALFWORD

```

4455

USC=JMS I CHDSCI

/TEMPORARY STORAGE:

```

0076      CHCNT3=TEMP02
0077      CHCNT2=TEMP03
0100      CHCNT1=TEMP04
0101      CHR01=TEMP05
0075      CH+AC=TEMP01
0102      CHPNT=TEMP06
0075      CHYS=TEMP01

```

/DISPLAY TABLE EXCEPTIONS

```

7777      SPACE=-1
0005      ENUIS=5
0001      BKSPC=1
0002      RESET=2
0003      LFEE0=3
0004      CRETN=4
0000      IGNOR=0

```

600	0000	CHUSC,	0	
601	7104		CLL RAL	
602	1006		TAU ADSTBL	
603	3102		UCA CHPNT	
604	1502		TAU I CHPNT	
605	2102		ISZ CHPNT	
606	7440		SZA	
607	5225		JMP CHSET1	/NOT SPECIAL CHARACTER
610	1502		TAU I CHPNT	
611	1360		TAU CHJMP	
612	3213		UCA ,+1	
613	5600		JMP I CHUSC	
/DISPATCH TABLE FOR ABOVE JMP				
614	3676	CHJMPL,	CHSPA	/JUMP TABLE: SPACE
615	3671		CHEND+1	/IGNORE
616	3700		CHBKS	/BACKSPACE
617	3715		CHREST	/NEXT 4 CHARACTERS RESET X, Y, DELTA, INTENSITY
620	3751		CHLF	/DO A LINE FEED
621	3747		CHCR	/DO A CARRIAGE RETURN
622	3670		CHEND	/END OF TEXT
623	3101	CHSET1,	UCA CHROT	
624	1104		TAU CHXL	
625	6303		DXC DXL	
626	7344		MTW	/NUMBER OF WORDS IS TWO
627	3076		UCA CHCNT3	
630	7344	CHSET2,	MTW	/NUMBER OF LINES IS TWO
631	3077		UCA CHCNT2	
632	1061	CHSET3,	TAU KM0006	/NUMBER OF POINTS IN A LINE IS SIX
633	3100		UCA CHCNT1	
634	1105		TAU CHYL	/REPOSITION Y AT BOTTOM OF CHARACTER
635	3075		UCA CHYS	/RECORD PRESENT Y POSITION
636	1101	CHDIS,	TAU CHROT	
637	7104		CLL RAL	/NO, GET FIRST BIT INTO LINK
640	3101		UCA CHROT	/STORE CODE WORD FOR NEXT BIT
641	1075		TAU CHYS	/INTENSIFICATION POSITION
642	6313		OYC DYL	
643	7430		SZL	/DISPLAYS IF LINK=1
644	6304		DIS	
645	1361		TAU CHSIZ	/GO NEXT POSSIBLE DOT-
646	3075		UCA CHYS	/KEEP RECORD OF PRESENT POSITION
647	2100		ISZ CHCNT1	/DO ALL THIS SIX TIMES
650	5236		JMP CHDIS	
651	1104		TAU CHXL	
652	1361		TAU CHSIZ	
653	6303		DXC DXL	
654	3104		UCA CHXL	
655	2077		ISZ CHCNT2	/HAS SECOND HALF BEEN DONE?
656	5232		JMP CHSET3	/NO, DO IT
657	1502		TAU I CHPNT	/GET SECOND WORD
660	3101		UCA CHROT	
661	2076		ISZ CHCNT3	
662	5230		JMP CHSET2	

3563 1361
3564 7104
3565 1104
3566 3104
3567 5600

TAD CHSIZ /BOTH DONE
CLL RAL
TAD CHXL
UCA CHXL /SPACE 2 INCREMENTS
JMP I CHDSC

3570 2200
 3571 6303
 3572 1364
 3573 6313
 3574 7200
 3575 5500

CHEND, ISZ CHDSC
 DXC DXL
 TAD K0401
 OYC OYL
 CLA
 JMP I CHDSC
 /SPACE: MOVE X RIGHT 6 INCREMENTS
 CHSPA, JMS GET6 /GET X FOR WHOLE CHARACTER
 JMP CHRKS+2

3700 4305
 3701 7041
 3702 1104
 3703 3104
 3704 5500

/BACKSPACE: MOVE X LEFT ONE CHARACTER
 CHRKS, JMS GET6
 CMA IAC
 TAD CH_xL /MOVE X POINTER LEFT
 JCA CHXL /ONE CHARACTER
 JMP I CHDSC

3705 0000
 3706 1361
 3707 7106
 3710 3075
 3711 1361
 3712 7104
 3713 1075
 3714 5705

/GETS SIX TIMES CHAR SIZE
 GET6, 0
 TAD CHSIZ
 CLL RTL /4 TIMES SIZE
 JCA CHFAC
 TAD CHSIZ
 CLL RAL /PLUS 2 TIMES SIZE
 TAD CHFAC /IS SIX TIMES SIZE
 JMP I GET6

3715 4454
 3716 1362
 3717 0363
 3720 7106
 3721 7006
 3722 7004
 3723 3104

/SELECT NEW X POSITION
 CHREST, LDH
 TAD KM0001
 AND K0017
 CLL RTL
 RTL
 RAL
 JCA CHXL

3724 4454
 3725 0363
 3726 7106
 3727 7006
 3730 7004
 3731 7041
 3732 1364
 3733 3105

/SELECT NEW Y POSITION
 CHYPOS, LDH
 AND K0017
 CLL RTL
 RTL
 RAL
 CMA IAC
 TAD K0401
 JCA CHYL


```

/CHARACTER SIZE SELECTION
3/34 4454 CHCSZ, LDH
3/35 0363 AND K0017 /ELIMINATE ALL BUT BITS 8-11
3/36 7104 GLL RAL
3/37 3361 UCA CHSIZ /STORE DESIRED CHARACTER SIZE

/INTENSIFICATION SELECTION
3/40 4454 CHINT, LDH
3/41 0060 AND K0003 /ELIMINATE ALL BUT BITS 10 AND 11
3/42 1365 TAD KDSB /SET INTENSITY
3/43 3344 UCA ,+1
3/44 6324 USB /WILL BE DSB X
3/45 5600 JMP I CHDSC

3/46 5600 JMP I CHDSC

/CARRIAGE RETURN: RETURN X TO LEFT MARGIN
3/47 3104 CHCR, UCA CHXL
3/50 5600 JMP I CHDSC

/LINE FEED: MOVE Y DOWN 8 INCREMENTS
3/51 1361 CHLF, TAD CHSIZ /8 TIMES CHAR SIZE
3/52 7106 GLL RTL
3/53 7004 RAL
3/54 7041 GMA IAC /SUBTRACT FROM Y POSITION
3/55 1105 TAD CHYL
3/56 3105 UCA CHYL /NEW Y POSITION
3/57 5600 JMP I CHDSC

/CONSTANTS USED THIS PAGE ONLY
3/60 5615 CHJMP, JMP I CHJMPL+1

/VARIABLES FOR THIS PAGE
3/61 0004 CHSIZ, 4 /CHARACTER SIZE CONSTANT

3/62 7777 K0001, -1
3/63 0017 K0017, 17
3/64 0401 K0401, 401

3/65 6324 KUSB, USB

```

		USCTBL. 0	/@ SPECIAL, MEANS END OF TEXT
3/66	0200		
3/67	0205	ENDIS	
3/70	7711	//11	/A
3/71	1177	1177	
3/72	7745	//45	/B
3/73	4532	4532	
3/74	3641	3641	/C
3/75	4122	4122	
3/76	7741	//41	/D
3/77	4136	4136	
4000	7751	//51	/E
4001	5141	5141	
4002	7711	//11	/F
4003	1101	1101	
4004	3641	3641	/G
4005	5132	5132	
4006	7710	//10	/H
4007	1077	1077	
4010	0077	0077	/I
4011	0000	0000	
4012	2040	2040	/J
4013	4037	4037	
4014	7714	//14	/K
4015	2241	2241	
4016	7740	//40	/L
4017	4040	4040	
4020	7706	//06	/M
4021	0677	0677	
4022	7704	//04	/N
4023	1077	1077	
4024	7741	//41	/O
4025	4177	4177	
4026	7711	//11	/P
4027	1106	1106	
4030	1621	1621	/Q
4031	3156	3156	

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03	711	7711	/R
03	3146	3146	
034	2245	2245	/S
035	4531	4531	
036	0101	0101	/T
037	7701	7701	
038	7740	7740	/U
039	4077	4077	
042	3740	3740	/V
043	2017	2017	
044	7730	7730	/W
045	4077	4077	
046	6314	6314	/X
047	1463	1463	
050	0770	0770	/Y
051	7007	7007	
052	6151	6151	/Z
053	4543	4543	
054	0617	0617	/[DISPLAYED AS #
055	1706	1706	
056	1057	1057	/\ DISPLAYED AS DOWN ARROW
057	1000	1000	
060	2313	2313	/] DISPLAYED AS %
061	6462	6462	
062	0475	0475	/?
063	0400	0400	
/SPECIAL, DOES BACKSPACE			
064	0000	0	
065	0001	BKSPC	
/SPACE IS A SPECIAL CHARACTER			
066	0000	0	
067	7777	SPACE	
070	0057	0057	/:
071	0000	0000	
/" SPECIAL, MARKS PROG INPUT TO TEXT BUFFER, NOT DISPL			
072	0000	0	
073	0000	IGNOR	
/# SPECIAL, DOES LINE FEED			
074	0000	0	
075	0003	LFEE0	

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PAGE 39-1

0	0000	0	/S SPECIAL, DISPLAY RESET FOLLOWS
	002	RESET	
1	0000	0	/X SPECIAL, DOES CARRIAGE RETURN
01	0004	CRETN	
	0717	0717	/8
	7010	7010	
04	0000	0	/I SPECIAL, MARKS KBD INPUT TO TEXT BUFFER, NOT DISPLA
	0000	IGNOR	
05	7741	7741	/(DISPLAYED AS [
07	4100	4100	
	0041	0041	/) DISPLAYED AS]
	4177	4177	
12	2214	2214	/* DISPLAYED AS LITTLE X
	1422	1422	
14	0416	0416	/+
15	0400	0400	
	0050	0050	/.
17	5000	5000	
	0404	0404	/-
	0400	0400	
22	0040	0040	/,
	0000	0000	
	010	2010	//
25	0402	0402	
	3641	3641	/0
7	4136	4136	
30	0042	0042	/1
1	7740	7740	
32	6251	6251	/2
33	5146	5146	
4	2241	2241	/3
35	4532	4532	
45	1412	1412	/4
7	7710	7710	
40	2745	2745	/5
41	4531	4531	

4142	3645	3645	/6
4143	4530	4530	
4144	6111	6111	//
4145	0503	0503	
4146	3245	3245	/8
4147	4532	4532	
4150	0651	0651	/9
4151	5136	5136	
4152	0033	0033	/:
4153	0000	0000	
4154	0053	0053	/;
4155	3200	3000	
4156	1422	1422	/<<
4157	4100	4100	
4160	0012	0012	/=
4161	1212	1212	
4162	4122	4122	/>
4163	1400	1400	
4164	0251	0251	/?
4165	0502	0502	
	4200		

*. 17/+1

4200 7402
 4201 7240
 4202 1200
 4203 3010
 4204 1410
 4205 3103
 4206 1103
 4207 7012
 4210 7012
 4211 7012
 4212 0046
 4213 4455
 4214 7610
 4215 5410
 4216 1103
 4217 0046
 4220 4455
 4221 5204
 4222 5410

/LOAD HALF WORD AN DISPLAY
 MSG, XX

CLA CMA
 TAU MSG
 DCA 10
 TAU I 10
 DCA MSRHT
 TAU MSRHT
 RTR
 RTR
 RTR
 AND K0077
 USC
 SKP CLA
 JMP I 10
 TAU MSRHT
 AND K0077
 USC
 JMP MSG+4
 JMP I 10

```

/SCOPE LOOP CHECK
/SCOPE WITH SWITCH BIT 10=1
SCOPEA, XX
4223 7402      LAS
4224 7604      AND K0002
4225 0033      SZA CLA
4226 7640      JMP I RETURN
4227 5533      IAU SCOPEA
4230 1223      JCA RETURN
4231 5233      JMP I SCOPLA
4232 5523

RETURN, BEGIN
4233 0200      JMP I RETURN
4234 5533

/I INHIBIT PRINT OUT WHEN BIT 11=1
IPRINT, XX
4235 7402      DCA AC          /SAVE AC
4236 3120      LAS
4237 7504      RAR
4240 7010      SNL CLA
4241 7620      JMP ,+6
4242 5250      IAU IPRINT
4243 1230      IAU K/7/6      /MINUS 2
4244 1052      DCA IPRINT
4245 3230      IAU I IPRINT
4246 1530      DCA IPRINT
4247 3230      IAU AC          /RESTORE AC
4250 1120      JMP I IPRINT
4251 5530

/GENERATE CR,LF
CRLF, XX
4252 7402      JMS I XIYPE
4253 4513      4543
4254 4543      0000
4255 0200      KCC
4256 0032      ICF
4257 0042      JMP I CRLF
4260 5552

```

```

/PRINTOUT CONTENTS OF AC AND ERROR ADDRESS
ERA00, XX
4261 7402 JMS I XIPRIN /TEST FOR INHIBIT PRINT
4262 4514 IOF
4263 6002 JMS I XSIXTY
4264 4515 ERA00
4265 4261 .+4
4266 4272 .+4
4267 4273 JMS I XTYPE /TYPE ERROR ADDRESS
4270 4513 4543
4271 4543 6000
4272 6060 6000
4273 6060 4000
4274 4000 JMS I XSIXTY
4275 4515 AC
4276 0120 .+4
4277 4303 .+4
4300 4304 JMS I XTYPE /TYPE AC
4301 4513 4040
4302 4040 6060
4303 6060 6060
4304 6060 0000
4305 0000 IOF
4306 6042 KCC
4307 6032 LAS
4310 7604 /TEST FOR HALT
4311 7012 /BIT 9=1, (0004)
4312 7010 RAR
4313 7620 SNL CLA
4314 5661 JMP I ERA00
4315 1120 IAD AC
4316 7402 HLI
4317 5661 JMP I ERA00

```

PAUSE

```

/TAPE 4
/DIGITAL 8-18-U
/MESSAGE TYPE-OUT
/CALL WITH A JMS MESSAGE
/WITH DATA FOLLOWING
/RETURN FOLLOWING END OF MESSAGE
/COUE(00)

```

4320	0000	MESSAGE,	0		
4321	7240		CLA CMA		/SET C(AC)=-1
4322	1320		IAD MESSAGE		/ADD LOCATION
4323	3010		JCA 10		/AUTO-INDEX REGISTER
4324	1410		IAD I 10		/FETCH FIRST WORD
4325	3336		JCA MSRGHT		/SAVE IT
4326	1336		IAD MSRGHT		
4327	7012		RIR		
4330	7012		RTR		/ROTATE 6 BITS RIGHT
4331	7012		RTR		
4332	4337		JMS TYPECH		/TYPE IT
4333	1336		IAD MSRGHT		/GET DATA AGAIN
4334	4337		JMS TYPECH		/TYPE RIGHT HALF
4335	5324		JMP MESSAGE+4		/CONTINUE
4336	0000	MSRGHT,	0		/TEMPORARY STORAGE
4337	0000	TYPECH,	0		/TYPE CHARACTER IN C(AC)6-11
4340	0370		AND MASK77		
4341	7450		SNA		/IS IT END OF MESSAGE?
4342	5410		JMP I 10		/YES: EXIT
4343	1371		IAD M40		/SUBTRACT 40
4344	7500		SMA		/<40?
4345	5350		JMP ,+3		/NO
4346	1372		IAD C340		/YES: ADD 300
4347	5365		JMP MTP		/TO CODES <40
4350	1373		IAD M3		/SUBTRACT 3
4351	7440		SZA		/IS IT ZERO?
4352	5355		JMP ,+3		/NO
4353	1374		IAD C212		/YES: CODE 43 IS
4354	5363		JMP MTP		/LINE-FEED (212)
4355	1375		IAD M2		/SUBTRACT 2
4356	7440		SZA		/IS IT ZERO?
4357	5362		JMP ,+3		/NO
4360	1376		IAD C215		/YES: CODE 45 IS
4361	5365		JMP MTP		/CARRIAGE-RETURN (215)
4362	1377		IAD C245		/ADD 200 TO OTHERS >40
4363	6046	MTP,	ILS		/TRANSMIT CHARACTER
4364	6041		ISF		/WAIT FOR FLAG
4365	5364		JMP ,.-1		/NOT SET YET
4366	7200		CLA		/SET: CLEAR C(AC)
4367	5737		JMP I TYPECH		/RETURN

4370	0077	/CONSTANTIS	
4371	7740	MASK77,	77
4372	0340	M40,	-40
4373	7775	C340,	340
4374	0212	M3,	-3
4375	7776	C212,	212
4376	0215	M2,	-2
4377	0245	C215,	215
		C245,	245

}

THERE ARE NO ERRORS

SYMBOL TABLE

AC	0120
ACMA	6371
AUBUF	2515
AUBUFK	2404
AUCV	6364
AUSIBL	0056
ANGLE	2047
BAU	0070
BEGLY	0200
BRSPC	0001
CCONTA	0055
CCONTB	0056
CCONTC	0057
CHBAS	3700
CHCNT1	0100
CHCNT2	0077
CHCNT3	0076
CHCR	3747
CHCS	3734
CHDIS	3636
CHDSC	3600
CHDSCI	0055
CHEND	3670
CHFAC	0075
CHINT	3740
CHJMP	3750
CHJMPL	3614
CHLF	3751
CHPNT	0102
CHRES1	3715
CHRUI	0101
CHSET1	3623
CHSET2	3630
CHSET3	3632
CHSIK	3751
CHSPA	3676
CHTST	1400
CHTST1	1441
CHTST2	1410
CHXL	0104
CHYL	0105
CHYPOS	3724
CHYS	0075
CLER	6351
CLRK	6354
CLXK	6352
CUN1	1340
CUN2	1353
CUN3	1331
CUUNT	0143
CRETN	0004
CRLF	4252
CIEMA	0052

SYMBOL TABLE

CIEMB	0063
CIEMC	0064
COO70	0037
C212	4374
C215	4376
C245	4377
C340	4372
UHLL	4530
UHLLA	0130
UHLLS	2224
UHLR	4527
UHAKA	0127
UHAKS	2212
UIS	6324
UISLDP	2452
ULUL	4523
ULDLA	0123
ULDLS	2237
URDL	4524
URDLA	0124
URDLS	2256
USH	6324
USC	4455
USCIBL	3766
UVLB	4526
UVLBA	0126
UVLBS	2200
UVLI	4525
UVLTA	0125
UVLTS	2160
UAC	6301
JAL	6302
JYC	6311
JYL	6312
ENDIS	0005
ENADD	4261
EXECUI	2025
FI1	0026
GET6	3705
HAL1	4512
ICMX	6361
IGNOR	0000
INIDIS	2441
INISAM	2410
INIT3	2405
INLL	0071
IPRINI	4235
KUSB	3765
KEYS	2015
KM0001	3762
KM0006	0061
KM0020	0050
KM0043	0022

SYMBOL TABLE

KM0777	0024
KM1000	0047
K0002	0033
K0003	0050
K0004	0036
K0007	1/27
K0015	0044
K0017	3/63
K0034	0036
K0043	0107
K0070	1/30
K0077	0046
K0103	0031
K0200	0040
K0340	0042
K0400	0023
K0401	3/64
K0600	0131
K0700	1/31
K1000	0032
K1002	0051
K1004	0041
K2002	0034
K3002	0035
K377	0133
K400	0136
K4002	0043
K0324	0132
K1000	1/32
K1400	0021
K1700	0045
K177	0137
K1776	0052
K1777	0053
LUH	4454
LUIAG	2037
LFEEJ	0003
LOOP	0072
LUOPA	0245
MASKA	1/22
MASKB	1/23
MASKC	1/24
MASKD	1/25
MASK77	4370
MESSAGE	4320
MESG	4200
MSRGI	4336
MSRHT	0103
MSSG	0054
MIP	4363
MIW	7344
MUXNUM	0057
MYMX	2263

SYMBOL TABLE

MYPX	2243
M0377	0027
M2	4375
M200	0142
M3	4373
M40	4371
M400	0141
M/400	0020
UPR	7000
JLEN	6344
PNTK	0010
P2	0140
RADC	6352
RUNT	2403
RUX	1200
RUX1	1241
RUX2	1303
RUX3	1324
RUIAG	2043
RESET	0002
RETURN	4233
SAMPL0P	2414
SAM1	2435
SCOPE	4011
SCOPEA	4223
SIX1Y	1642
SIX12	1733
SKAD	6332
SKER	6322
SKRK	6341
SKXK	6321
SL1	0025
SPACE	7777
SIAL	0106
SIATE	2476
SILL	4316
SILLS	2116
SILR	4336
SILKS	2136
SIUL	4326
SIULS	2126
SIUR	4322
SIURA	0122
SIURS	2147
SWTCH	2000
TEMP01	0075
TEMP02	0076
TEMP03	0077
TEMP04	0100
TEMP05	0101
TEMP06	0102
EXT0	1600
EXT01	1635

SYMBOL TABLE

TYPECH	4337
VAL1	1505
X	2401
XBOX	2071
XCRLE	0116
XCR	0074
XERAJU	0112
XIN13	0110
XIPRIN	0114
XPOSR	0134
XRCL	6334
XRLN	6331
XSCOPE	0111
XSIXY	0115
XSWICH	0121
XLEXIB	0117
XTYPE	0113
XX	7402
Y	2402
YPOSR	0135
ZLEN	6342

SYMBOL TABLE

IGNOR	0000
BRSPC	0001
RESET	0002
LFEEJ	0003
CHFIN	0004
ENDIS	0005
PVTR	0010
M/400	0020
K/400	0021
KM0040	0022
K0400	0023
KM0777	0024
SL1	0025
FL1	0026
M0377	0027
K0034	0030
K0100	0031
K1000	0032
K0002	0033
K2002	0034
K3002	0035
K0004	0036
C0070	0037
K0200	0040
K1004	0041
K0340	0042
K4002	0043
K0015	0044
K/700	0045
K0077	0046
KM1000	0047
KM0020	0050
K1002	0051
K/776	0052
K/777	0053
MSSG	0054
CHDSC1	0055
AUSTBL	0056
MUXNUM	0057
K0003	0060
KM0000	0061
CIEMA	0062
CIEMB	0063
CIEMC	0064
CCONTA	0065
CCONTB	0066
CCONTC	0067
BAD	0070
INLL	0071
LUOP	0072
XER	0074
CHYS	0075
TEMP01	0075

SYMBOL TABLE

UMFAC	0075
UMCR13	0076
TEMP02	0076
UMCR12	0077
TEMP03	0077
UMCR11	0100
TEMP04	0100
TEMP05	0101
UMR01	0101
UMR01	0102
TEMP06	0102
MSR01	0103
UMXL	0104
UMYL	0105
SIALL	0106
K0040	0107
XIN13	0110
XSCOPE	0111
XERRADU	0112
XIYFE	0113
XIPRIN	0114
XSIXY	0115
XURLF	0116
XIEX1B	0117
AC	0120
XSWTCH	0121
STORA	0122
ULDLA	0123
URDLA	0124
UVL1A	0125
UVLBA	0126
UMLKA	0127
UMLLA	0130
K0600	0131
K0324	0132
K377	0133
XPOS2	0134
YPOS2	0135
K400	0136
K177	0137
P2	0140
M400	0141
M200	0142
LUUN1	0143
BEG1V	0200
LUOPA	0245
RUX	1200
RUX1	1241
RUX2	1303
RUX3	1324
CUN3	1331
CUN1	1340
CUN2	1353

SYMBOL TABLE

CHTST	1400
CHTST2	1410
CHTST1	1441
VAL1	1505
TEXT4	1600
TEXT51	1635
SIXTY	1642
MASKA	1722
MASKB	1723
MASKC	1724
MASKD	1725
K0007	1727
K0072	1730
K0700	1731
K7000	1732
SIX12	1733
SWTCH	2000
KEYS	2015
EXECUI	2025
LU1AG	2037
KU1AG	2043
ANGLE	2047
XBOX	2071
SILLS	2116
SIULS	2126
SILRS	2136
SIURS	2147
UVLIS	2150
UVLBS	2200
UHLRS	2212
UHLLS	2224
ULDLS	2237
MYPX	2243
URDLS	2256
MYMX	2263
X	2401
Y	2402
RCN1	2403
AUBUFK	2404
INIT3	2405
INISAM	2410
SAMLOP	2414
SAM1	2435
INIDIS	2441
UISLOP	2452
SIATE	2476
AUBUF	2515
CHDSC	3600
CHJMPL	3614
CHSET1	3623
CHSET2	3630
CHSET3	3632
CHDIS	3636

SYMBOL TABLE

UMEND	3670
UMSPA	3676
UMBKS	3700
GET6	3705
UMRESI	3715
UMYRJS	3724
UMCSZ	3734
UMINT	3742
UMCR	3747
UMLF	3751
UMJNP	3750
UMSIK	3751
KM0001	3752
K0017	3753
K0401	3754
KUSB	3755
USGIBL	3756
MSG	4200
SCOPEA	4223
RETURN	4233
IPRINT	4235
URLF	4252
ERAUD	4251
SILL	4316
MESSAGE	4320
SIUL	4326
SILK	4336
MORGH	4336
TYPECH	4337
MIP	4363
MASK77	4370
140	4371
U340	4372
M3	4373
U212	4374
M2	4375
U215	4376
U245	4377
LUH	4454
USC	4455
SCOPE	4511
HALI	4512
SIUR	4522
UL0L	4523
UK0L	4524
UVLI	4525
UVLB	4526
UHLR	4527
UHLL	4530
UXC	6301
UXL	6302
UIS	6304
UYC	6311

SYMBOL TABLE

UTL	6312
SAXX	6321
SAEK	6322
JSB	6324
XKIN	6331
SKAU	6332
XKCL	6334
SARK	6341
E IEN	6342
UIEN	6344
CLER	6351
CLXA	6352
CLRX	6354
ICMX	6361
KADU	6362
AUCV	6364
ALMX	6371
JPR	7000
MIW	7344
XA	7402
SPACE	7777

