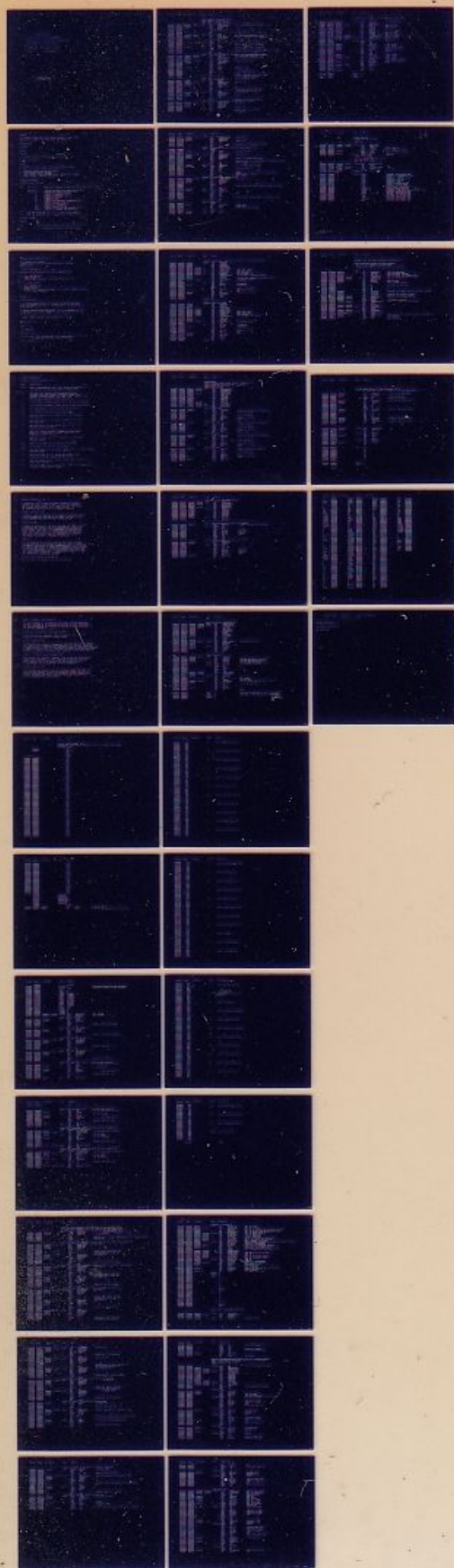


# LAB-11

SCOPE CONTROL TEST  
MD-11-D6F-C

EP-D6F-C-DL  
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IDENTIFICATION

PROJECT CODE: MAINDEC-11-00FC-0  
PROJECT NAME: LAB-11 SCOPE CONTROL TEST  
DATE CREATED: MARCH 1, 1972  
MAINTAINER: DIAGNOSTIC GROUP  
AUTHOR: RAYMOND SHOOP

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1. ABSTRACT

THIS PROGRAM TESTS THE LAB-11 SCOPE CONTROL, X AND Y AXIS DAC'S AND THE VR20 (TWO COLOR POINT PLOT DISPLAY),

2. REQUIREMENTS

2.1 EQUIPMENT

LAB-11

2.2 STORAGE

THE PROGRAM OCCUPIES MEMORY FROM 8 TO 5700,

3. LOADING PROCEDURE

3.1 METHOD

PROCEDURE FOR NORMAL BINARY TAPES SHOULD BE FOLLOWED,

1. ABSOLUTE LOADER MUST BE IN MEMORY,
2. PLACE BINARY TAPE IN READER,
3. LOAD ADDRESS 07500 (DETERMINED BY ADDRESS OF LOADER),
4. PRESS "START" (PROGRAM WILL LOAD),

4. STARTING PROCEDURE

4.1 CONTROL SWITCH SETTINGS

200 SWR 4 = 0 LOOP THRU COMMAND, STATUS REGISTER AND DISPLAY TESTS,

SWR 4 = 1 LOOP ON SELECTED (VIA SWR 0-3) PATTERN;  
SWR 0-3 = 0 COMMAND AND STATUS REGISTER TEST,  
= 1 DISPLAY A HORIZONTAL LINE,  
= 2 DISPLAY A VERTICAL LINE,  
= 3 DISPLAY A SQUARE,  
= 4 DISPLAY A "X",  
= 5 DISPLAY ALPHA-NUMERIC CHARACTER SET,  
= 6 DISPLAY CHANNEL 1 AND CHANNEL 2,  
= 7 COLOR DELAY ADJUSTMENT,  
= 10 DISPLAY COLOR PATTERN,  
= 11 DISPLAY A VERTICAL AND DIAGONAL LINE,  
= 12-17 COMMAND AND STATUS REGISTER TEST

204 SWR 0-5 DETERMINE THE A TO D CHANNEL TO BE SAMPLED;  
SWR 6-7 DETERMINE THE A TO D GAIN OF THE CHANNEL,

4.2 STARTING ADDRESS

ADDRESS	TEST
200	COMMAND, STATUS REGISTER AND DISPLAY SEQUENCE TEST
204	A TO D KNOB DISPLAY TEST - MUST HAVE ADDR

4.3 PROGRAM AND/OR OPERATOR ACTION

LOAD PROGRAM INTO MEMORY,  
SELECT TEST BY LOADING APPROPRIATE STARTING ADDRESS,  
PRESS "START"

5. OPERATING PROCEDURE

5.1 COMMAND, STATUS REGISTER AND DISPLAY SEQUENCE TEST

1. LOAD ADDRESS 200.  
2. PRESS "START",  
PROGRAM WILL RING BELL AFTER EACH PASS THRU TEST.

5.2 A TO D DISPLAY TEST

1. LOAD ADDRESS 204.  
2. PRESS "START",  
PROGRAM WILL DISPLAY SELECTED A TO D CHANNEL NUMBER AND THE  
A TO D VALUE ON SCOPE.

6. ERRORS

6.1 ERROR REPORTING

IF AN ERROR OCCURS DURING THE COMMAND AND STATUS REGISTER  
TEST, THE PROGRAM WILL HALT. REGISTER 0 WILL CONTAIN EXPECTED  
VALUE OF DAC.

TO RESUME TESTING PRESS "CONTINUE". IF IT IS DESIRED TO LOOP  
ON THE TEST THAT FAILS REPLACE THE HALT INSTRUCTION WITH A  
240 (NOP).

NO ERROR CONDITIONS ARE GIVEN DURING OTHER TESTS.

7. RESTRICTIONS

NONE

8. MISCELLANEOUS

8.1 EXECUTION TIME

SEQUENCE TEST - THE TELETYPE BELL WILL RING AFTER EVERY PASS  
WHICH IS APPROXIMATELY EVERY 90 SECONDS.

ALL OTHER TESTS - N/A.

9. PATTERN DESCRIPTION

9.0 COMMAND AND STATUS REGISTER TEST

TEST DESCRIPTION

- T0-T7 THESE TESTS EXERCISES THE X AND Y DAC'S TO MAKE CERTAIN THAT ALL BITS MAY BE SET, CLEARED AND READ BACK,
- T8 TEST THAT INIT CLEARED THE FOLLOWING CSR BITS; LIGHTPEN FLAG (15), DISPLAY INTERRUPT ENABLE (6), LIGHTPEN INTERRUPT ENABLE (5), MODE (4-3), INTENSITY (2) CHANNEL (10), COLOR (9) AND SET READY (7),
- T9 TEST DISPLAY INTERRUPT ENABLE (6) MAY BE SET AND CLEARED,
- T10 TEST LIGHTPEN INTERRUPT ENABLE (5) MAY BE SET AND CLEARED,
- T11 TEST MODE CONTROL (4-3) MAY BE SET AND CLEARED,
- T12 TEST INTENSITY (2) MAY BE SET AND CLEARED
- T13 TEST THAT READY (7) IS CLEARED WHEN X DAC IS LOADED WITH MODE 01,
- T14 TEST THAT READY (7) IS CLEARED WHEN Y DAC IS LOADED WITH MODE 10,
- T15 TEST THAT READY (7) WILL RETURN (SET) AFTER IT HAD BEEN CLEARED BY INTENSIFY,
- T16 TEST THAT DISPLAY INTERRUPT ENABLE (6) WILL ALLOW READY (7) TO INTERRUPT TO VECTOR ADDRESS 140 WITH PROCESSOR PRIORITY LEVEL 3,
- T17 TEST THAT DISPLAY DOES NOT INTERRUPT WITH PROCESSOR PRIORITY LEVEL 4,
- T18 TEST THAT CHANNEL (10) MAY BE SET AND CLEARED,
- T19 TEST COLOR (9) MAY BE SET AND CLEARED,
- T20 TEST THAT READY (7) WILL RETURN CLEARED AFTER A CHANGE IN COLOR (GREEN TO RED),
- T21 TEST THAT READY (7) WILL RETURN SET AFTER A DELAY FOLLOWING A CHANGE IN COLOR (GREEN TO RED),
- T22 TEST THAT READY (7) WILL RETURN CLEARED AFTER A CHANGE IN COLOR (RED TO GREEN),
- T23 TEST THAT READY (7) WILL RETURN SET AFTER A DELAY FOLLOWING A CHANGE IN COLOR (RED TO GREEN),

9.1 DISPLAY HORIZONTAL LINE

A HORIZONTAL LINE IS DISPLAYED ON THE SCOPE BY INITIALLY SETTING THE X AND Y DAC'S TO ZERO AND THEN INCREMENTING THE X VALUE WHILE HOLDING THE Y VALUE AT ZERO, THE POINTS ARE DISPLAYED USING THE DISPLAY INTERRUPT ENABLED,

9.2 DISPLAY VERTICAL LINE

A VERTICAL LINE IS DISPLAYED ON THE SCOPE IN THE SAME MANNER AS FOR A HORIZONTAL LINE (REF 9.1) EXCEPT NOW THE Y VALUE IS INCREMENTED WHILE HOLDING THE X VALUE AT ZERO,

9.3 DISPLAY SQUARE

A SQUARE IS DISPLAYED BY INITIALLY SETTING THE X AND Y VALUES TO NEGATIVE FULL SCALE, THEN X IS INCREMENTED TO POSITIVE FULL SCALE (BOTTOM LINE) THEN Y IS INCREMENTED TO POSITIVE FULL SCALE (RIGHT LINE) THEN X IS DECREMENTED TO NEGATIVE FULL SCALE (TOP LINE) AND FINALLY Y IS DECREMENTED TO NEGATIVE FULL SCALE (LEFT LINE); MODE 01 (INTENSIFY ON LOADING X) AND MODE 10 (INTENSIFY ON LOADING Y) ARE USED,

9.4 DISPLAY X

AN X IS DISPLAYED BY INITIALLY SETTING THE X AND Y VALUES TO NEGATIVE FULL SCALE AND THEN INCREMENTING BOTH TO POSITIVE FULL SCALE (LOWER LEFT TO UPPER RIGHT DIAGONAL) THEN X IS RESET TO NEGATIVE FULL SCALE, Y REMAINS AT POSITIVE FULL SCALE AND THEN X IS INCREMENTED WHILE Y IS DECREMENTED UNTIL BOTH REACH FULL SCALE AGAIN (UPPER LEFT TO LOWER RIGHT DIAGONAL), MODE 01 (INTENSIFY ON LOADING X) IS USED,

9.5 DISPLAY ALPHA-NUMERIC CHARACTER SET

THE ALPHABET AND NUMBERS 1 THRU 0 ARE DISPLAYED,

9.6 DISPLAY CHANNEL 1 AND CHANNEL 2

THE TEXT "CHANNEL 1" IS DISPLAYED ON CHANNEL 1 SWITCH POSITION,  
THE TEXT "CHANNEL 2" IS DISPLAYED ON CHANNEL 2 SWITCH POSITION,  
THE COMBINED MESSAGE WILL APPEAR IF THE CHANNEL SELECTOR SWITCH IS  
IN THE 1 & 2 POSITION.

9.7 COLOR DELAY ADJUSTMENT (SHORT-LONG DELAYS)

NO PATTERN WILL BE DISPLAYED, THIS IS USED TO ADJUST THE TWO  
DELAYS ON THE COLOR DISPLAY CONTROL MODULE.

9.10 DISPLAY COLOR PATTERN

THIS ROUTINE WILL DISPLAY A BOX AROUND THE OUTER DEGE OF THE SCREEN  
AND A SMALL "X" IS DISPLAYED IN THE CENTER, THIS PATTERN IS PLOTTED  
IN GREEN AND THEN IN RED, THE END RESULT IS THAT ALL DOTS (RED AND GREEN)  
CONVERGE AND THE PATTERN WILL APPEAR TO BE ORANGE IN COLOR, THIS TEST  
IS USED TO ADJUST THE GAIN OF THE RED AMPLIFIER IN THE VR20 DISPLAY.

9.11 DISPLAY A VERTICAL AND A DIAGONAL LINE

THIS ROUTINE WILL DISPLAY A VERTICAL LINE AT THE LEFT SEDE OF THE  
SCREEN AND A DIAGONAL LINE FROM UPPER LEFT CORNOR TO THE LOWER  
RIGHT CORNOR, THIS IS TO TEST THE INITIAL DEFLECTION DELAY  
OF THE CONTROL AND THE SETTLING TIME OF THE SCOPE.

9.12 DISPLAY A TO D VALUE

THIS ROUTINE WILL DISPLAY THE A TO D CHANNEL NUMBER AND THE A TO D  
VALUE OF THAT CHANNEL, SWR 0-9 DETERMINE THE CHANNEL SAMPLED AND  
SWR 6-7 DETERMINE THE GAIN OF THAT CHANNEL, THE TOP NUMBER ON THE  
DISPLAY IS THE CHANNEL BEING SAMPLED, THE BOTTON NUMBER IS THE  
A TO D CONVERSION FOR THAT CHANNEL.

LAB-11 SCOPE CONTROL TEST  
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 RAYMOND SHOOP

	200000		,00
	000040		,HEPT 40
			,+2
			HALT
			,ENDR
			,+2
000000	000002		HALT
000002	000000		,+2
000004	000004		HALT
000006	000000		,+2
000010	000012		HALT
000012	000000		,+2
000014	000010		HALT
000016	000000		,+2
000020	000022		HALT
000022	000000		,+2
000024	000026		HALT
000026	000000		,+2
000030	000032		HALT
000032	000000		,+2
000034	000036		HALT
000036	000000		,+2
000040	000042		HALT
000042	000000		,+2
000044	000046		HALT
000046	000000		,+2
000050	000052		HALT
000052	000000		,+2
000054	000056		HALT
000056	000000		,+2
000060	000062		HALT
000062	000000		,+2
000064	000066		HALT
000066	000000		,+2
000070	000072		HALT
000072	000000		,+2
000074	000076		HALT
000076	000000		,+2
000100	000102		HALT
000102	000000		,+2
000104	000106		HALT
000106	000000		,+2
000110	000112		HALT
000112	000000		,+2
000114	000116		HALT
000116	000000		,+2
000120	000122		HALT
000122	000000		,+2
000124	000126		HALT
000126	000000		,+2
000130	000132		HALT
000132	000000		,+2



000134	000136		,02
000136	000000		HALT
000140	000142		,02
000142	000000		HALT
000144	000146		,02
000146	000000		HALT
000150	000152		,02
000152	000000		HALT
000154	000156		,02
000156	000000		HALT
000160	000162		,02
000162	000000		HALT
000164	000166		,02
000166	000000		HALT
000170	000172		,02
000172	000000		HALT
000174	000176		,02
000176	000000		HALT

NOP=240  
 CC=177776  
 STACK=776  
 SREG=177578  
 SCALE1=11  
 SCALE2=22

000200	000167	000634
000204	000167	005114

,0200
JMP CSRTST
JMP KNOB

SEQUENCE TEST  
 IA TO 0 KNOB DISPLAY MUST HAVE ADDR

PALX11

V003

4=FEB=72

3101

PAGE 2

001000 001000  
 001002 003774  
 001004 000000  
 001006 000000  
 001010 177564  
 001012 177566  
 001014 176756  
 001016 176760  
 001020 176762  
 001022 176770  
 001024 176772  
 001026 177570  
 001030 000140  
 001032 000144  
 001034 000000  
 001036 000000  
 001040 012767 000040 177770  
 001046 012767 000340 176722  
  
 001054 005077 177736  
 001060 017700 177732  
 001064 001402  
 001066 000000  
 001070 000771  
  
 001072 005077 177722  
 001076 017700 177716  
 001102 001402  
 001104 000000  
 001106 000771  
  
 001110 012777 177777 177700  
 001116 017700 177674  
 001122 022700 177777  
 001126 001402  
 001130 000000  
 001132 000766  
  
 001134 012777 177777 177650  
 001142 017700 177652  
 001146 022700 177777  
 001152 001402  
 001154 000000  
 001156 000766  
  
 001160 005000  
 001162 005077 177630  
 001166 005200  
 001170 005277 177622  
 001174 020077 177616  
 001200 001402  
 001202 000000  
 001204 000765  
 001206 022700 003777

,=1000  
 LOWLMTI 0  
 HILMTI 3774  
 LOWI 0  
 HIGHI 0  
 TCSRI 177564  
 TDBRI 177566  
 SCSRI 176756  
 XREGI 176760  
 YREGI 176762  
 ADCSI 176770  
 ADOB1 176772  
 SHRI 177570  
 SVECI 140  
 LPVECI 144  
 TIMSVI 0  
 TICKSI 0  
 CSRTSTI MOV 040,TICKS  
 MOV 0340,CC  
 ITEST XREG CAN BE SET = 0  
 T01 CLR 0XREG  
 MOV 0XREG,%0  
 BEQ T1  
 HALT  
 BR T0  
 ITEST THAT YREG CAN BE SET = 0  
 T11 CLR 0YREG  
 MOV 0YREG,%0  
 BEQ T2  
 HALT  
 BR T1  
 ITEST THAT XREG CAN BE SET = -1  
 T21 MOV 0-1,0XREG  
 MOV 0XREG,%0  
 CMP 0-1,%0  
 BEQ T3  
 HALT  
 BR T2  
 ITEST THAT YREG CAN BE SET = -1  
 T31 MOV 0-1,0YREG  
 MOV 0YREG,%0  
 CMP 0-1,%0  
 BEQ T4  
 HALT  
 BR T3  
 ITEST THAT XREG WILL ACCEPT A COUNT PATTERN (0=3777)  
 T41 CLR %0  
 CLR 0XREG  
 T4A1 INC %0  
 INC 0XREG  
 CMP %0,0XREG  
 BEQ T4B  
 HALT  
 BR T4  
 T4B1 CMP #3777,%0

ICONTAINS 174000 FOR 3RD QUADRANT  
 ICONTAINS 177774 FOR 3RD QUADRANT

!SET TIMER  
 !SET PRIORITY 7  
  
 !ERROR, XREG NOT CLEARED  
  
 !ERROR, Y REG NOT CLEARED  
  
 !ERROR, XREG NOT = -1  
  
 !ERROR, YREG NOT = -1  
  
 !INITIALIZE COUNT PATTERN  
 !01 TO PATTERN  
 !DID XREG COUNT?  
 !ERROR, XREG NOT = %0

PALX11	V003	4-FEB-72	3101	PAGE 2-1	
001212	001365			BNE	T4A
				TEST THAT YREG WILL ACCEPT A COUNT PATTERN (0-3777)	
001214	005000		T5I	CLR	X0
001216	005077	177570		CLR	0YREG
001222	005200		T5AI	INC	X0
001224	005277	177570		INC	0YREG
001230	020077	177564		CHP	X0,0YREG
001234	001402			BEG	T50
001236	000000			HALT	
001240	000765			BR	T5
001242	022700	003777	T50I	CHP	03777,X0
001246	001365			BNE	T5A
				TEST THAT XREG WILL ACCEPT A COUNT PATTERN (4000-7777)	
				BIT 11 SHOULD SET BITS 12-15	
001250	012700	173777	T6I	MOV	0173777,X0
001254	012777	003777		MOV	03777,0XREG
001262	005277	177530	T6AI	INC	0XREG
001266	005200			INC	X0
001270	020077	177522		CHP	X0,0XREG
001274	001402			BEG	T60
001276	000000			HALT	
001300	000763			BR	T6
001302	022777	177777	T60I	CHP	0177777,0XREG
001310	001364			BNE	T6A
				TEST THAT YREG WILL ACCEPT A COUNT PATTERN (4000-7777)	
				BIT 11 SHOULD SET BITS 12-15	
001312	012700	173777	T7I	MOV	0173777,X0
001316	012777	003777		MOV	03777,0YREG
001324	005277	177470	T7AI	INC	0YREG
001330	005200			INC	X0
001332	020077	177462		CHP	X0,0YREG
001336	001402			BEG	T70
001340	000000			HALT	
001342	000763			BR	T7
001344	022777	177777	T70I	CHP	0177777,0YREG
001352	001364			BNE	T7A

TEST THAT INIT CLEARED THE FOLLOWING STATUS REGISTER BITS:  
 LP FLAG (15), DISPLAY INT EN (6), LP INT EN (9), MODE (4-3),  
 INTENSITY (2), CHANNEL (10), COLOR (9), AND SET READY (7);

```

001354 017700 177434 T01 MOV 0SCSR,X0 ;MOVE STATUS REGISTER TO X0
001360 022700 000200 CMP #200,X0 ;IS READY SET?
001364 001403 BEQ T9
001366 000000 HALT ;ERROR, BIT 7 (READY) IS ONLY ONE THAT SHOULD BE SET,
001370 000005 RESET ;TRY AGAIN
001372 000770 BR T0

;TEST THAT DISPLAY INTERRUPT ENABLE (BIT 6) MAY BE SET AND CLEARED.
001374 052777 000100 177412 T91 BIS #100,0SCSR ;SET BIT 6
001402 017700 177406 MOV 0SCSR,X0
001406 022700 000300 CMP #300,X0
001412 001402 BEQ T9A
001414 000000 HALT ;ERROR, BIT 6 OR 7 NOT SET
001416 000766 BR T9 ;OR OTHER BITS PICKED UP
001420 042777 000100 177366 T9A1 BIC #100,0SCSR ;CLEAR BIT 6
001426 017700 177362 MOV 0SCSR,X0
001432 022700 000200 CMP #200,X0
001436 001402 BEQ T10
001440 000000 HALT ;ERROR, BIT 6 NOT CLEARED
001442 000766 BR T9A

;TEST THAT LIGHT PEN INTERRUPT ENABLE (BIT 5) MAY BE SET AND CLEARED
001444 052777 000040 177342 T101 BIS #40,0SCSR ;SET BIT 5
001452 017700 177336 MOV 0SCSR,X0
001456 022700 000240 CMP #240,X0
001462 001402 BEQ T10A
001464 000000 HALT ;ERROR BIT 5 OR 7 NOT SET
001466 000766 BR T10 ;OR OTHER BITS PICKED UP
001470 042777 000040 177310 T10A1 BIC #40,0SCSR ;CLEAR BIT 5
001476 017700 177312 MOV 0SCSR,X0
001502 022700 000200 CMP #200,X0
001506 001402 BEQ T11
001510 000000 HALT ;ERROR BIT 5 NOT CLEARED
001512 000766 BR T10A

;TEST THAT MODE CONTROL (BITS 4-3) CAN BE SET AND CLEARED
001514 052777 000010 177272 T111 BIS #10,0SCSR ;SET BIT 3
001522 017700 177266 MOV 0SCSR,X0
001526 022700 000210 CMP #210,X0
001532 001402 BEQ T11A
001534 000000 HALT ;ERROR, BIT 3 OR 7 NOT SET
001536 000766 BR T11 ;OR OTHER BITS PICKED UP
001540 042777 000010 177240 T11A1 BIC #10,0SCSR ;CLEAR BIT 3
001546 017700 177242 MOV 0SCSR,X0
001552 022700 000200 CMP #200,X0
001556 001402 BEQ T11B
001560 000000 HALT ;ERROR BIT 3 NOT CLEARED
001562 000766 BR T11A
001564 052777 000020 177222 T11B1 BIS #20,0SCSR
001572 017700 177216 MOV 0SCSR,X0
001576 022700 000220 CMP #220,X0
001602 001402 BEQ T11C
001604 000000 HALT ;ERROR BIT 4 OR 7 NOT SET
001606 000766 BR T11B
  
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001610 042777 000020 177170 T11C1 BIC #20,0SCSR I CLEAR BIT 4
001616 017700 177172 MOV #SCSR,X0
001622 022700 000200 CMP #200,X0
001626 001402 BEQ T110
001630 000000 HALT I ERROR BIT 4 NOT CLEARED
001632 000766 BR T11C
001634 052777 000030 177152 T11D1 BIS #30,0SCSR I SET BITS 4-3
001642 017700 177146 MOV #SCSR,X0
001646 022700 000230 CMP #230,X0
001652 001402 BEQ T11E
001654 000000 HALT I ERROR BITS 4,3, OR 7 NOT SET
001656 000766 BR T110 I OR OTHER BITS PICKED UP
001660 042777 000030 177120 T11E1 BIC #30,0SCSR I CLEAR BITS 4,3,
001666 017700 177122 MOV #SCSR,X0
001672 022700 000200 CMP #200,X0
001676 001402 BEQ T12
001700 000000 HALT I ERROR BITS 4, 3 NOT CLEARED
001702 000766 BR T11E
I TEST THAT INTENSITY (BIT 2) MAY BE SET OR CLEARED
001704 052777 000004 177102 T121 BIS #4,0SCSR I SET BIT 2
001712 017700 177076 MOV #SCSR,X0
001716 022700 000204 CMP #204,X0
001722 001402 BEQ T12A
001724 000000 HALT I ERROR BIT 2 OR 7 NOT SET
001726 000766 BR T12 I OR OTHER BITS PICKED UP
001730 042777 000004 177050 T12A1 BIC #4,0SCSR I CLEAR BIT 2
001736 017700 177052 MOV #SCSR,X0
001742 022700 000200 CMP #200,X0
001746 001402 BEQ T13
001750 000000 HALT I ERROR BIT 2 NOT CLEARED
001752 000766 BR T12A
I TEST THAT READY IS CLEARED BY LOADING XREG
001754 105777 177034 T131 TSTB #SCSR I IS READY SET
001760 100402 BHI T13A
001762 000000 HALT I ERROR, READY NOT SET
001764 000773 BR T13
001766 012777 000010 177020 T13A1 MOV #10,0SCSR I ENABLE INTENSIFY ON LOADING X REG,
001774 005077 177020 CLR #YREG
002000 105777 177010 TSTB #SCSR
002004 100402 BHI T13B
002006 000000 HALT I ERROR, LOAD YREG SHOULDNT CLEAR READY
002010 000766 BR T13
002012 005077 177000 T13B1 CLR #XREG I LOAD XREG, SHOULD CLEAR READY
002016 105777 176772 TSTB #SCSR
002022 100030 BPL T15
002024 000000 HALT I ERROR READY NOT CLEARED
002026 000752 BR T13

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002030 105777 176760          TEST THAT READY IS CLEARED BY LOADING Y REGISTER,
T14I  TSTB  0SCSR          IIS READY SET
002034 100402                OMI  T14A
002036 000000                HALT
002040 000773                BR  T14          IERROR, READY NOT SET
002042 212777 000020 176744 T14A1  MOV  020,0SCSR      IENABLE INTENSITY ON LOADING Y REG,
002050 005077 176742          CLR  0XREG
002054 105777 176734          TSTB  0SCSR
002060 100402                OMI  T140
002062 000000                HALT
002064 200761                BR  T14          IERROR, LOAD X REG SHOULDN'T CLEAR READY
002066 005077 176720 T14B1  CLR  0YREG
002072 105777 176710          TSTB  0SCSR
002076 100002                BPL  T15
002100 000000                HALT
002102 200752                BR  T14          IERROR, READY NOT CLEARED
IREADY SHOULD RETURN AFTER INTENSIFY SET
002104 205277 176704 T15I  INC  0SCSR          IENABLE INTENSIFY
002110 212700 177600          MOV  0=200,00
002114 205200                INC  00
002116 201376                ONE  1=2          IDELAY
002120 105777 176670          TSTB  0SCSR          IIS READY SET
002124 100402                OMI  T10
002126 200000                HALT
002130 200765                BR  T15          IERROR READY FAILED TO SET AFTER INTENSIFY

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I TEST DISPLAY INTERRUPT ENABLE
I TEST PROPER VECTOR RETURN
I TEST READY TO CAUSE INTERRUPT
002132 712777 002270 176670 T161 MOV 0Y100,0SVEC INITIALIZE INTERRUPT RETURN
002140 712720 002270 MOV 0STACK,X0
002144 105777 176644 TSTB 0SCSR
002150 100422 BHI T16A
002152 702020 HALT ERROR, NOT SET
002154 700760 BR T16
002156 712767 002142 175612 T16A1 MOV 0140,CC ISET PROCESSOR PRIORITY LEVEL 3
002164 712777 002171 176672 MOV 0101,0SCSR IENABLE INTERRUPT AND INTENSIFY
002172 712720 177072 MOV 0=200,X0
002176 705220 INC X0
002220 701370 BNE ,=2
002222 700070 HALT ERROR, DIDN'T FIND INTERRUPT
002224 700752 BR T16
002226 105777 176672 T16B1 TSTB 0SCSR IRETURN HERE AFTER INTERRUPT
002212 100422 BHI T17
002214 702020 HALT ERROR, RECEIVED INTERRUPT BIT READY NOT SET
002216 700745 BR T16
I TEST THAT DISPLAY DOES NOT INTERRUPT WITH PROCESSOR PRIORITY 4
002220 712767 002270 175550 T171 MOV 0200,CC ISET PROCESSOR PRIORITY LEVEL 4
002226 712777 002272 176574 MOV 0Y17A,0SVEC INITIALIZE INTERRUPT RETURN
002234 712720 002270 MOV 0STACK,X0
002240 712777 002171 176540 MOV 0101,0SCSR INITIALIZE DISPLAY
002246 712700 177072 MOV 0=200,X0
002252 705220 INC X0
002254 701370 BNE ,=2
002256 105777 176532 TSTB 0SCSR IIS READY SET?
002262 100422 BHI T18
002264 702020 HALT ERROR READY NOT SET
002266 700754 BR T17
002270 700070 T17A1 HALT T17
002272 700752 BR T17 ERROR INTERRUPT SHOULDN'T OCCUR WITH PROCESSOR PRIORITY 4;
I TEST THAT CHANNEL (BIT 10) MAY BE SET AND CLEARED
002274 705077 176514 T181 CLR 0SCSR
002300 752777 002320 176570 BIS 0200,0SCSR ISET BIT 10
002306 717720 176572 MOV 0SCSR,X0
002312 722700 002272 CMP 0200,X0
002316 701422 BEQ T18A
002320 702020 HALT ERROR, BIT 10 OR 7 NOT SET
002322 702764 BR T18 OR OTHER BITS PICKED UP
002324 742777 002322 176462 T18A1 BIC 0200,0SCSR ICLEAR BIT 10
002332 717720 176456 MOV 0SCSR,X0
002336 722720 002272 CMP 0200,X0
002342 701422 BEQ T19
002344 700020 HALT ITEST
I TEST THAT THE COLOR (BIT 9) MAY BE SET AND CLEARED
002346 752777 001020 176440 T191 BIS 0100,0SCSR ISET BIT 9
002354 717720 176434 MOV 0SCSR,X0
002360 732700 001020 BIT 0100,X0 ITEST BIT 9
002364 701022 BNE T19A
002366 702020 HALT ERROR BIT 9 DID NOT SET
002370 700760 BR T19 ITRY AGAIN

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002372	042777	001000	176414	T19A1	BIC	#1000, #SCSR	ICLEAR BIT 9
002400	017700	176410			MOV	#SCSR, X0	
002404	032700	001000			BIT	#1000, X0	ITEST BIT 9
002410	001402				BEQ	T20	I
002412	000000				HALT		IERROR, BIT 9 FAILED TO CLEAR
002414	000760				BR	T19A	
002416	000005				IRESET THE MACHINE AND NOW TEST THE COLOR DELAY LOGIC		
002420	105777	176370		T201	RESET		
002424	100370				TSTB	#SCSR	IWAIT FOR READY
002426	052777	001000	176360	T20A1	BPL	,=2	
002434	017700	176354			BIS	#1000, #SCSR	ISET BIT 9
002440	032700	000200			MOV	#SCSR, X0	
002444	001402				BIT	#200, X0	ITEST THAT READY WENT DOWN
002446	000000				BEQ	T21	I
002450	000762				HALT		IREADY FAILED TO CLEAR DURING A CHANGE IN COLOR
002452	012701	001000		T211	BR	T20	ITRY AGAIN
002456	105777	176332		T21A1	MOV	#1000, X1	ISET UP A COUNTER
002462	100404				TSTB	#SCSR	I
002464	005301				BMI	T22	IFLAG DID COME UP
002466	001373				DEC	X1	
002470	000000				BNE	T21A	IDELAY
002472	000751				HALT		IDONE FAILED TO SET AFTER A COLOR CHANGE
					BR	T20	ITRY AGAIN
002474	042777	001000	176312	T221	ICHANGE TO GREEN TEST COLOR DELAYS		
002502	017700	176306			BIC	#1000, #SCSR	ICLEAR BIT 9
002506	032700	000200			MOV	#SCSR, X0	
002512	001402				BIT	#200, X0	
002514	000000				BEQ	T23	
002516	000760				HALT		IDONE FAILED TO CLEAR AFTER A CHANGE IN COLOR
002520	012701	001000		T231	BR	T22	
002524	105777	176264		T23A1	MOV	#1000, X1	
002530	100404				TSTB	#SCSR	
002532	005301				BMI	T24	
002534	001373				DEC	X1	
002536	000000				BNE	T23A	
002540	000755				HALT		IDONE FAILED TO SET AFTER A CHANGE IN COLOR
					BR	T22	
002542	000005				IEND OF BASIC TEST		
002544	004767	002430		T241	RESET		
002550	000404				JSR	X7, TIMER	ITEST TIME
002552	007405				BR	T24A	IMORE TIME
002554	000005			T24B1	BR	PIC0	ITIME UP, NEXT PATTERN
002556	000167	176256			RESET		
002562	000167	176266		T24A1	JMP	CSRTST	
					JMP	T0	



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;DISPLAY HORIZONTAL LINE USING INTERRUPT, NON STORE DISPLAY.
002566 016700 176224 PIC01 MOV XREG,X0
002572 016701 176222 MOV YREG,X1
002576 012700 000776 MOV @STACK,X6
002602 012707 000600 176226 MOV @000,TICKS
002610 012707 003774 176170 PB1 MOV @3774,HIGH ;SET HIGH LIMIT
002616 012707 004000 176160 MOV @4000,LOW ;SET LOW LIMIT
002624 012707 000140 175144 PDI MOV @140,CC ;SET PRIORITY 3
002632 012777 002710 176170 MOV @P0RET,@SVEC ;INITIALIZE INTERRUPT VECTOR
002640 016703 176142 MOV HIGH,X3
002644 012702 000014 MOV @14,X2 ;INITIALIZE INCREMENTS BETWEEN POINTS
002650 052777 000100 176130 BIS @100,@SCSR ;INTERRUPT ENABLE
002656 005011 CLR (1)
002660 060210 PE1 ADD X2,(0) ;INCREMENT
002662 005277 176126 INC @SCSR ;INTENSIFY
002666 000001 WAIT
002670 021003 CMP (0),X3 ;DONE ALL POINTS?
002672 001372 BNE PE ;NO
002674 016710 176104 MOV LOW,(0) ;YES RE-INITIALIZE
002700 004767 002274 JSR X7,TIMER
002704 000766 BR PF+2
002706 000401 BR PIC1
002710 000002 P0RET1 RTI

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;DISPLAY VERTICAL LINE
002712 016700 176102 PIC11 MOV YREG,X0
002716 016701 176074 MOV XREG,X1
002722 012700 000776 MOV @STACK,X6
002726 012707 000600 176102 MOV @000,TICKS
002734 012707 003774 176044 MOV @3774,HIGH ;SET HIGH LIMIT
002742 012707 004000 176034 MOV @4000,LOW ;SET LOW LIMIT
002750 012707 000140 175020 MOV @140,CC ;SET PRIORITY 3
002756 012777 003034 176044 MOV @P1RET,@SVEC ;INITIALIZE INT, VECTOR
002764 016703 176016 MOV HIGH,X3
002770 012702 000014 MOV @14,X2 ;
002774 052777 000100 176012 BIS @100,@SCSR ;INTERRUPT ENABLE
003002 005011 CLR (1)
003004 060210 PF1 ADD X2,(0) ;INCREMENT
003006 005277 176002 INC @SCSR ;INTENSIFY
003012 000001 WAIT
003014 021003 CMP (0),X3 ;DONE ALL POINTS
003016 001372 BNE PF ;NO
003020 016710 175760 MOV LOW,(0) ;YES
003024 004767 002150 JSR X7,TIMER
003030 000766 BR PF+2
003032 000401 BR PIC3
003034 000002 P1RET1 RTI

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;PINCUSHION
;PLOT A SQUARE FROM LOWER LEFT TO LOWER RIGHT TO
;UPPER RIGHT TO UPPER LEFT TO LOWER LEFT,
;NON STORE DISPLAY
003036 012767 003774 175742 PIC3I MOV #3774,HIGH
003044 012767 174000 175732 MOV #174000,LOW
003052 012706 000776 MOV #STACK,X6
003056 012767 000300 175752 MOV #300,TICKS
003064 016701 175726 MOV XREG,X1
003070 016702 175724 MOV YREG,X2
003074 016703 175714 MOV SCRR,X3
003100 012704 000014 MOV #14,X4
003104 012767 000340 174664 MOV #340,CC
003112 016777 175666 175670 P3I MOV LOW,OXREG
003120 016777 175668 175672 MOV LOW,OYREG

;DRAW BOTTOM LINE
003126 016700 175654 MOV HIGH,X0
003132 012713 000010 MOV #10,(3)
003136 105713 P3AI TSTB (3) ;ENABLE INTENSIFY ON LOADING X
003140 100370 BPL ,=2 ;WAIT FOR READY
003142 060411 ADD X4,(1)
003144 020011 CMP X0,(1) ;DONE ALL POINTS?
003146 001373 BNE P3A ;NO

;DRAW RIGHT LINE
003150 012713 000020 MOV #20,(3) ;ENABLE INTENSIFY ON LOADING Y
003154 105713 P3BI TSTB (3) ;WAIT FOR READY
003156 100370 BPL ,=2
003160 060412 ADD X4,(2)
003162 020012 CMP X0,(2) ;DONE ALL POINTS?
003164 001373 BNE P3B ;NO

;DRAW TOP LINE
003166 012713 000010 MOV #10,(3) ;ENABLE INTENSIFY ON LOADING X
003172 016700 175606 MOV LOW,X0
003176 105713 P3CI TSTB (3) ;WAIT FOR READY
003200 100370 BPL ,=2
003202 160411 SUB X4,(1)
003204 020011 CMP X0,(1) ;DONE ALL POINTS?
003206 001373 BNE P3C ;NO

;DRAW LEFT LINE
003210 012713 000020 MOV #20,(3) ;ENABLE INTENSIFY LOADING Y
003214 105713 P3DI TSTB (3) ;WAIT FOR READY
003216 100370 BPL ,=2
003220 160412 SUB X4,(2)
003222 020012 CMP X0,(2) ;DONE ALL POINTS?
003224 001373 BNE P3D ;NO
003226 004767 001746 JSR X7,TIMER
003232 000727 BR P3

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I PLOT AN X WITH NON STORE DISPLAY
003234 012767 004000 175542 PIC4I MOV #4000,LOW
003242 012767 003774 175530 MOV #3774,HIGH
003250 012766 000770 MOV #STACK,X6
003254 012767 000600 175554 MOV #600,TICKS
003262 016701 175530 PIC4BI MOV XREG,X1
003266 016702 175526 MOV YREG,X2
003272 016703 175510 MOV SCSR,X3
003276 016700 175504 MOV HIGH,X0
003302 012704 000014 MOV #14,X4
003306 016712 175472 P4I MOV LOW,(2)
003312 011211 MOV (2),(1)

I PLOT LINE BEGINNING IN LOWER LEFT CORNER
003314 012713 000010 MOV #10,(3) IENABLE INTENSIFY ON LOADING X
003320 100370 P4AI TSTB (3)
003322 100370 BPL ,=2
003324 060412 ADD X4,(2) I=4 TO Y
003326 060411 ADD X4,(1) I=4 TO X
003330 021100 CMP (1),X0 IDONE?
003332 001372 BNE P4A INO
003334 100370 TSTB (3)
003336 100370 BPL ,=2

I PLOT LINE BEGINNING IN UPPER LEFT CORNER
003340 016712 175442 MOV HIGH,(2)
003344 016711 175434 MOV LOW,(1)
003350 100370 P4BI TSTB (3)
003352 100370 BPL ,=2
003354 160412 SUB X4,(2) I=4 TO Y
003356 060411 ADD X4,(1) I=4 TO X
003360 021100 CMP (1),X0 IDONE?
003362 001372 BNE P4B INO
003364 004767 001610 JSR X7,TIMER
003370 000746 BR P4

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003372 012767 000400 175430 IPLOT NON STORE CHARACTER SET
003400 012767 174000 000200 PIC6I MOV 0400,TICKS
003406 012767 000000 000170 PIC6AI MOV 0174000,XPOS
003414 012704 000022 MOV 00,YPOS
003420 012704 000776 MOV 0SCALE2,X4
003424 005077 175364 MOV 0STACK,X6
003430 004767 000012 CLR 0SCSR
003434 004767 001540 JSR X7,PIC00
003440 000757 JSR X7,TIMER
003442 006167 000440 BR PIC6A
003446 012767 177734 000134 PIC6BI JMP PIC7
003454 016705 175334 MOV 0=36,,CHRCOL ICHARACTERS PER ROW
003460 012702 003614 MOV SCSR,X5
003464 004767 000010 GEN1I JSR 0A,X2
003470 005207 000114 INC X7,CHAR
003474 001373 BNE CHRCOL
003476 000207 RTS X7

IPLOT CHARACTER
003500 016767 000100 000104 CHAR1 MOV YPOS,YPT
003506 052715 000020 BIS 020,(5) IENABLE INTENSIFY ON LOADING Y
003512 012700 177773 MOV 0=5,X0 IINITIALIZE COLUMN COUNT
003516 012701 177771 CHAR1I MOV 0=7,X1 IINITIALIZE ROW COUNT
003522 112203 MOVB (2)+,X3 IPUT CHARACTER POINTS IN X3
003524 106103 CHAR2I ROLB X3
003526 100010 BPL CHAR3 INC
003530 105715 TSTB (5)
003532 100370 BPL ,=2
003534 016777 000046 175254 MOV XPOS,0XREG
003542 016777 000036 175250 MOV YPOS,0YREG
003550 060467 000030 CHAR3I ADD X4,YPOS
003554 005201 INC X1 I=1 TO ROW
003556 001362 BNE CHAR2 IPINISH ROW
003560 016767 000026 000010 MOV YPT,YPOS IREINITIALIZE ROW FOR NEXT COLUMN
003566 060467 000014 ADD X4,XPOS
003572 005200 INC X0 I=1 TO COLUMN COUNT
003574 001350 BNE CHAR1
003576 060467 000004 ADD X4,XPOS
003602 000207 RTS X7 IEXIT

003604 000000 YPOS: 0 ICONTAINS Y POSITION AT ANY GIVEN TIME
003606 000000 XPOS: 0 ICONTAINS X POSITION AT ANY GIVEN TIME
003610 000000 CHRCOL: 0
003612 000000 YPT: 0

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003614	170	AI	,BYTE 170,21,21,21,170
003615	021		
003616	021		
003617	021		
003620	170		
003621	177	BI	,BYTE 177,111,111,111,06
003622	111		
003623	111		
003624	111		
003625	060		
003626	070	CI	,BYTE 70,101,101,101,42
003627	101		
003628	101		
003631	101		
003632	042		
003633	177	DI	,BYTE 177,101,101,101,70
003634	101		
003635	101		
003636	101		
003637	070		
003640	177	EI	,BYTE 177,111,111,111,101
003641	111		
003642	111		
003643	111		
003644	101		
003645	177	FI	,BYTE 177,11,11,11,1
003646	011		
003647	011		
003650	011		
003651	001		
003652	070	GI	,BYTE 70,101,121,121,02
003653	101		
003654	121		
003655	121		
003656	062		
003657	177	HI	,BYTE 177,10,10,10,177
003660	010		
003661	010		
003662	010		
003663	177		
003664	000	II	,BYTE 0,101,177,101,0
003665	101		
003666	177		
003667	121		
003670	070		
003671	060	JI	,BYTE 00,100,100,100,77
003672	100		
003673	100		
003674	170		
003675	077		
003676	177	KI	,BYTE 177,10,20,42,101
003677	010		
003700	024		
003721	042		

003702	101		
003703	177	LI	,BYTE 177,100,100,102,102
003704	100		
003705	100		
003706	100		
003707	100		
003710	177	MI	,BYTE 177,4,10,4,177
003711	004		
003712	010		
003713	004		
003714	177		
003715	177	NI	,BYTE 177,4,10,20,177
003716	004		
003717	010		
003720	020		
003721	177		
003722	070	OI	,BYTE 70,101,101,101,70
003723	101		
003724	101		
003725	101		
003726	070		
003727	177	PI	,BYTE 177,11,11,11,0
003730	011		
003731	011		
003732	011		
003733	006		
003734	070	OI	,BYTE 70,101,121,141,170
003735	101		
003736	121		
003737	141		
003740	170		
003741	177	RI	,BYTE 177,11,31,51,100
003742	011		
003743	031		
003744	051		
003745	100		
003746	040	SI	,BYTE 40,111,111,111,02
003747	111		
003750	111		
003751	111		
003752	062		
003753	001	TI	,BYTE 1,1,177,1,1
003754	071		
003755	177		
003756	001		
003757	001		
003760	077	UI	,BYTE 77,100,100,100,77
003761	100		
003762	120		
003763	100		
003764	077		
003765	037	VI	,BYTE 37,40,100,40,37
003766	040		
003767	100		
003770	040		

003771	037		
003772	177	W1	,BYTE 177,20,10,20,177
003773	020		
003774	010		
003775	020		
003776	177		
003777	143	X1	,BYTE 143,24,10,24,143
004000	024		
004001	010		
004002	024		
004003	143		
004004	003	Y1	,BYTE 3,4,170,4,3
004005	004		
004006	170		
004007	004		
004010	003		
004011	141	Z1	,BYTE 141,121,111,105,103
004012	121		
004013	111		
004014	105		
004015	103		
004016	000	N11	,BYTE 0,102,177,100,0
004017	172		
004020	177		
004021	100		
004022	000		
004023	142	N21	,BYTE 142,121,111,105,102
004024	121		
004025	111		
004026	105		
004027	102		
004030	042	N31	,BYTE 42,101,111,111,60
004031	101		
004032	111		
004033	111		
004034	060		
004035	030	N41	,BYTE 30,24,22,177,20
004036	024		
004037	022		
004040	177		
004041	020		
004042	047	N51	,BYTE 47,105,105,105,71
004043	105		
004044	105		
004045	105		
004046	071		
004047	070	N61	,BYTE 70,111,111,111,62
004050	111		
004051	111		
004052	111		
004053	062		
004054	101	N71	,BYTE 101,41,21,11,7
004055	041		
004056	021		
004057	011		

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004060 007  
 004061 060  
 004062 111  
 004063 111  
 004064 111  
 004065 060  
 004066 040  
 004067 111  
 004070 111  
 004071 111  
 004072 070  
 004073 070  
 004074 121  
 004075 111  
 004076 105  
 004077 070  
 004100 000  
 004101 000  
 004102 000  
 004103 000  
 004104 000

N01 ,BYTE 06,111,111,111,06

N91 ,BYTE 46,111,111,111,76

N01 ,BYTE 76,121,111,105,76

SPACE1 ,BYTE 0,0,0,0,0

004100

.EVEN



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                                ICHANNEL 1 CHANNEL 2
004106 012706 000776          PIC7I  MOV  #STACK,X6      ISET UP STACK
004112 012707 000600 174710      MOV  #000,TICKS    ISET UP A TIMER
004120 016705 174670          MOV  SCSR,X9       ISET UP R9 FOR STATUS REGISTER POINTER
004124 012704 000022          MOV  #SCALE2,X4    ISET UP SCALE SIZE <CHARACTER SIZE>
004130 012777 000000 174650      PIC7AAI MOV #0,0SCSR   ISET UP SCOPE CONTROL
004136 012707 006400 177442      MOV  #6400,XPOS    ILOAD X POSITION
004144 012707 000000 177432      MOV  #0,YPOS       ILOAD Y POSITION
004152 012707 000011 000120      MOV  #9,,P7CNT     ISAVE THE NUMBER OF CHARACTERS
004160 012707 004312 000122      MOV  #CH1,P7PNT    ISAVE CHANNEL 1 POINTER
004166 017702 000110          PIC7AI MOV  #P7PNT,X2    IMOVE MESSAGE POINTER INTO R2 FOR DISPLAY ROUTINE
004172 004707 177302          JSR  X7,CHAR       IDISPLAY A CHARACTER
004176 062707 000002 000104      ADD  #2,P7PNT     IADD 2 TO THE MESSAGE POINTER
004204 005307 000076          DEC  P7CNT        IDECREMENT CHARACTER COUNT
004210 001306          BNE  PIC7A        INOT FINISHED WITH ALL CHARACTERS
004212 012777 002004 174574      MOV  #2004,0SCSR  ISET UP X POS FOR CHANNEL 2
004220 012707 006400 177360      MOV  #6400,XPOS    ISET UP Y
004226 012707 007000 177350      MOV  #7000,YPOS    ISET UP CHARACTER COUNT
004234 012707 000011 000044      MOV  #9,,P7CNT     ISET UP CHANNEL 2 POINTER
004242 012707 004334 000040      MOV  #CH2,P7PNT    ISET UP
004250 017702 000034          PIC7BI MOV  #P7PNT,X2    IDISPLAY A CHARACTER
004254 004707 177220          JSR  X7,CHAR       IADD 2 TO THE POINTER
004260 062707 000002 000022      ADD  #2,P7PNT     IDECREMENT COUNT
004266 005307 000014          DEC  P7CNT        INOT FINISHED
004272 001306          BNE  PIC7B        ICHECK THE RUNTIME OF THIS ROUTINE
004274 004707 000700          JSR  X7,TIMER     INOT FINISHED
004300 000713          BR   PIC7AA       IFINISHED, NEXT TEST
004302 000107 000050          JMP  PIC0
004306 000000          P7CNTI 0
004310 000000          P7PNTI 0
004312 003626          CH1I   C
004314 003657          H
004316 003614          A
004320 003715          N
004322 003715          N
004324 003640          E
004326 003703          L
004330 004100          SPACE
004332 004010          N1
004334 003626          CH2I   C
004336 003657          H
004340 003614          A
004342 003715          N
004344 003715          N
004346 003640          E
004350 003703          L
004352 004100          SPACE
004354 004023          N2

                                ICOLOR DELAY ADJUSTMENT ROUTINE
004356 012706 000776          PIC8I  MOV  #STACK,X6
004362 012707 012000 174446      MOV  #12000,TICKS
004370 016703 174420          MOV  SCSR,X3
004374 012713 001000          LOP1I  MOV  #1000,(3)      ICHANGE TO RED

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004400	105713		TSTB	(3)	IWAIT FOR COLOR DONE
004402	100370		BPL	,=2	
004404	005013		CLR	(3)	ICHANGE TO GREEN
004406	105713		TSTB	(3)	IWAIT FOR COLOR DONE
004410	100370		BPL	,=2	
004412	004707	000562	JSR	X7,TIMER	
004416	000700		BR	LOP1	IDD AGAIN

ICOLOR PINCUSHION-COLORS SHOULD OVERLAY TO BECOME ORANGE  
 IDRAW A BOX AROUND THE SCREEN AND A "X" IN THE CENTER  
 IDRAW IN GREEN THEN IN RED

004420	005005		PIC100:	CLR	X9	ISET UP FOR COLOR PATTERN
004422	012700	000770		MOV	#STACK,X6	
004426	012707	000500	174402	MOV	#500,TICKS	
004434	012707	003700	174344	PIC101:	MOV	#3700,HIGH
004442	012707	174000	174334		MOV	#174000,LOW
004450	016701	174342		MOV	XREG,X1	
004454	016702	174340		MOV	YREG,X2	
004460	016703	174330		MOV	SCSR,X3	
004464	012704	000100		MOV	#100,X4	
004470	012707	000340	173300	MOV	#340,CC	
004476	016777	174302	174312	PIC10A:	MOV	LOW,#XREG
004504	016777	174274	174300		MOV	LOW,#YREG
004512	105713			TSTB	(3)	I TEST CONTROL FOR READY
004514	100370			BPL	,=2	

004516	016700	174264		IBOTTOM LINE	MOV	HIGH,X0	
004522	012713	000010			MOV	#10,(3)	ISET UP MODE
004526	050513				BIS	X5,(3)	ISET UP COLOR BIT
004530	105713			PIC10B:	TSTB	(3)	ICHANGE IN COLOR, WAIT FOR DONE
004532	100370				BPL	,=2	
004534	060411				ADD	X4,(1)	IADD R4 TO XPOS
004536	020011				CMP	X0,(1)	I TEST IT, DONE ?
004540	001373				BNE	PIC10B	INO
004542	105713				TSTB	(3)	IWAIT FOR LAST DOT
004544	100370				BPL	,=2	

004546	112713	000020		IRIGHT LINE	MOVB	#20,(3)	ICHANGE MODE
004552	050513				BIS	X5,(3)	ICOLOR BIT
004554	105713			PIC10C:	TSTB	(3)	IWAIT
004556	100370				BPL	,=2	
004560	060412				ADD	X4,(2)	IADD R4 TO YPOS
004562	020012				CMP	X0,(2)	I TEST IT, DONE ?
004564	001373				BNE	PIC10C	INO
004566	105713				TSTB	(3)	IWAIT FOR LAST DOT
004570	100370				BPL	,=2	

004572	112713	000010		ITOP LINE	MOVB	#10,(3)	ICHANGE MODE
004576	050513				BIS	X5,(3)	ICOLOR BIT
004600	016700	174200			MOV	LOW,X0	I
004604	105713			PIC10D:	TSTB	(3)	IREADY
004606	100370				BPL	,=2	
004610	160411				SUB	X4,(1)	ISUB R4 FROM XPOS
004612	020011				CMP	X0,(1)	I TEST IT, DONE ?

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004614	001373			BNE	PIC10D	INO	
004616	105713			TSTB	(3)	IWAIT FOR LAST DOT	
004620	100370			BPL	,=2		
				ILEFT LINE			
004622	112713	000020		MOVB	#20,(3)	ICHANGE MODE	
004626	050513			BIS	X5,(3)	I.COLOR BIT	
004630	105713			PIC10E1	TSTB	(3)	IREADY
004632	100370			BPL	,=2		
004634	160412			SUB	X4,(2)	ISUB R4 FROM YPOS	
004636	020012			CMF	X0,(2)	ITEST IT, DONE ?	
004640	001373			BNE	PIC10E	INO	
004642	105713			TSTB	(3)	IWAIT FOR LAST DOT	
004644	100370			BPL	,=2		
				INOW DRAW THE X			
004646	012767	007000	174130	PIC111	MOV	#7000,LOW	ISET UP LOW LIMIT
004654	012767	000400	174124		MOV	#4000,HIGH	ISET UP HIGH LIMIT
004662	105013				CLRB	(3)	ICLEAR CONTROL
004664	016700	174116			MOV	HIGH,X0	ISET OP
004670	012704	000040			MOV	#40,X4	ISET UP R4
004674	016712	174104			MOV	LOW,(2)	ISET UP Y POS
004700	011211				MOV	(2),(1)	ISET UP X POS
004702	112713	000010			MOVB	#10,(3)	ISET UP CONTROL
004706	050513				BIS	X5,(3)	I.COLOR BIT
004710	105713			PIC11A1	TSTB	(3)	IWAIT FOR READY
004712	100370				BPL	,=2	
004714	060412				ADD	X4,(2)	IADD R4 TO YPOS
004716	060411				ADD	X4,(1)	IADD R4 TO XPOS
004720	021100				CMF	(1),X0	ITEST IT, DONE ?
004722	001372				BNE	PIC11A	INO
004724	105713				TSTB	(3)	
004726	100370				BPL	,=2	
004730	016712	174052			MOV	HIGH,(2)	ICHANGE Y POS
004734	016711	174044			MOV	LOW,(1)	ICHANGE X POS
004740	105713			PIC11B1	TSTB	(3)	IREADY
004742	100370				BPL	,=2	
004744	160412				SUB	X4,(2)	ISUB R4 FROM YPOS
004746	060411				ADD	X4,(1)	IADD R4 TO XPOS
004750	021100				CMF	(1),X0	ITEST IT, DONE ?
004752	001372				BNE	PIC11B	INO
004754	105713				TSTB	(3)	IWAIT FOR LAST POINT
004756	100370				BPL	,=2	
004760	032705	001000			BIS	#1000,X5	ITEST COLOR BIT
004764	001004				BNE	PIC11C	
004766	052705	003000			BIS	#3000,X5	
004772	105013				CLRB	(3)	
004774	000017				BR	PIC10	
004776	005005			PIC11C1	CLR	X5	
005000	105013				CLRB	(3)	
005002	004767	000172			JSR	X7,TIMER	IHAS TIME EXPIRED ?
005006	000612				BR	PIC10	INE

THIS ROUTINE DISPLAYS THE VERTICAL AND DIAG. LINE

```

005010  216720  174020  PIC121  MOV  SCSR,X0  ISET UP CONTROL
005014  212720  202720  MOV  STACK,X0
005020  212760  207020  174010  MOV  07000,TICKS  ISET UP TIMER
005026  012710  200210  MOV  010,(0)  ISET BIT 3
005032  012721  202220  MOV  0200,X1  ISET UP R1
005036  212724  202320  MOV  0300,X0
005042  216722  173720  MOV  XREG,X2  ISET UP XREG
005046  216723  173740  MOV  YREG,X3  ISET UP Y REG
005052  212767  174020  222114  MOV  0174000,POS1X  ISET UP VERTICAL
005060  212767  203720  222124  PIC12A1  MOV  03700,POSV  ISET UP Y POS
005066  212767  174020  222124  MOV  0174000,POS2X  ISET UP DIAG,
005074  105710  TSTB  (0)  IRPADY ?
005076  102370  BPL  ,=2
005100  216713  220260  MOV  POSV,(3)  ILOAD V POS
005104  216712  202264  MOV  POS1X,(2)  ILOAD X POS
005110  100107  200250  SUB  R1,POSV  ISUB R1 FROM VPOS
005114  202107  202050  ADD  R1,POS2X  IADD R1 TO XPOS
005120  105710  TSTB  (0)  IRPADY ?
005122  100370  BPL  ,=2
005124  216713  202242  MOV  POSV,(3)  ILOAD V POS
005130  216712  202242  MOV  POS2X,(2)  ILOAD X POS
005134  222767  223020  222034  CMP  03000,POS2X  ITEST POSX
005142  201351  RNE  PIC120  INORE POINTS TO PLOT
005144  204767  222232  JSR  R7,TIMER  INAS TIME EXPIRED ?
005150  202743  BR  PIC12A  INO
005152  212777  202227  173632  MOV  0207,OTCSR
005160  105777  173624  TSTB  OTCSR
005164  102375  BPL  ,=4
005166  202147  175362  JMP  T240

005172  200020  POSV1  2
005174  200020  POS1X1  2
005176  202020  POS2X1  2

```

```

;TIMER ROUTINE
; ENTER VIA JSR X7,TIMER
; SWR 4=0

```

```

005200 017767 173622 173620 TIMER1 MOV 0SWR,TIMSV
005206 032767 000020 173620          BIT 020,TIMSV
005214 001000          ONE TIMER2          ;BIT 4 SET ?
005216 005367 173614          DEC TICKS          ;NO, DECREMENT TICKS
005222 001002          BNE TIMER1
005224 062716 000002          ADD 02,(0)          ;ADD 2 TO STACK POINTER
005230 000207          TIMER1 RTS X7          ;RETURN

```

```

; SWR 4=1 SELECT TEST TO LOCK ON
; SWR 3=00 TEST NUMBER

```

```

005232 042767 177760 173574 TIMER21 BIC 0177760,TIMSV
005240 006367 173570          ASL TIMSV
005244 062767 005264 173562          ADD #ROUTPT,TIMSV
005252 017767 173556 173554          MOV 0TIMSV,TIMSV
005260 000177 173550          TIMER41 JMP 0TIMSV

```

```

005264 002554          ROUTPT: T240          ;CONTROL AND STATUS TEST
005266 002566          PIC0          ;DISPLAY A HORIZONTAL LINE
005270 002712          PIC1          ;DISPLAY A VERTICAL LINE
005272 003036          PIC3          ;DISPLAY A SQUARE
005274 003234          PIC4          ;DISPALY A "X"
005276 003372          PIC6          ;DISPLAY CHARACTER SET
005300 004106          PIC7          ;DISPLAY CHANNEL TEST
005302 004356          PIC8          ;COLOR DELAY ADJUSTMENT
005304 004420          PIC100          ;DISPLAY COLOR PATTERN
005306 005010          PIC12          ;DISPLAY A VERTICAL AND DIAGONAL LINE
005310 002554          T240          ;CONTROL AND STATUS TEST
005312 002554          T240          ;CONTROL AND STATUS TEST
005314 002554          T240          ;CONTROL AND STATUS TEST
005316 002554          T240          ;CONTROL AND STATUS TEST
005320 002554          T240          ;CONTROL AND STATUS TEST
005322 002554          T240          ;CONTROL AND STATUS TEST

```

!KNOBS- MUST HAVE ADDR TO EXECUTE THIS ROUTINE

!READ SWITCHES- USE 0-9 AS OCTAL NUMBER

! DO AN A TO D SAMPLE OF THAT CHANNEL

! BITS 7-0 ARE USED AS THE "GAIN" OF THE CHANNEL

005324	012700	000776		KNOB1	MOV	#STACK,X6	!SET UP THE STACK
005330	016705	173460			MOV	BCSR,X9	!SET UP SCOPE CONTROL
005334	012704	000022			MOV	#SCALE2,X4	!SET UP SCALE <CHARACTER SIZE>
005340	012767	006400	176240		MOV	06400,XPOS	!SET UP CHANNEL SCOPE POINTER
005346	012767	001000	176230		MOV	01000,YPOS	
005354	017701	173446			MOV	0SWR,X1	!SET UP SWR
005360	010167	000270			MOV	X1,P12CT	!SAVE SWITCH VALUE
005364	000257				CCC		
005366	006001				ROR	X1	!THE GAME OF ROTATION
005370	006001				ROR	X1	!
005372	006001				ROR	X1	!
005374	004767	000200			JSR	X7,CONVT	!CONVERT THE FIRST DIGIT OF CHANNEL NUMBER
005400	016701	000250			MOV	P12CT,X1	
005404	004767	000170			JSR	X7,CONVT	!CONVERT THE SECOND NUMBER
005410	012767	006400	176170		MOV	06400,XPOS	!SET UP A TO D VALUE POINTER
005416	012767	000000	176160		MOV	00,YPOS	
005424	000367	000224			SHAB	P12CT	! A SHUFFLE ROUTINE
005430	032767	100000	000210		BIT	0100000,P12CT	!TEST THE "GAIN" OF THE CHANNEL
005436	001003				BNE	LPTA1	
005440	052767	000020	000200		BIS	020,P12CT	
005446	032767	040000	000200	LPTA1:	BIT	040000,P12CT	
005454	001003				BNE	LPTA2	
005456	052767	000010	000170		BIS	010,P12CT	
005464	042767	140347	000162	LPTA2:	BIC	0140347,P12CT	
005472	005267	000156			INC	P12CT	
005476	016777	000152	173310		MOV	P12CT,0ADCS	!THE CHANNEL NO, AND THE "GAIN" ARE COMPLETED
005504	105777	173312			TSTB	0ADCS	!GO A TO D
005510	100375				BPL	,=4	!WAIT FOR DONE

! TO GET HERE THE A TO D DONE FLAG HAS COME UP  
! SAVE THE CONVERTED VALUE AND DISPLAY IT ON THE VR20 DISPLAY

```

005512 217701 173306      MOV      @A00B,X1      !SAVE A TO D CONVERSION
005516 216167 000134      MOV      X1,P12SV
005522 P00301              SWAB     X1           !SHUFFLE THE DATA
005524 006001              ROR     X1
005526 004767 000046      JSR     X7,CONVT     !DISPLAY THE FIRST DIGIT
005532 216701 000120      MOV      P12SV,X1
005536 206101              ROL     X1
005540 P00101              ROL     X1
005542 P00301              SWAB     X1
005544 P04767 000030      JSR     X7,CONVT     !DISPLAY THE SECOND DIGIT
005550 216701 000122      MOV      P12SV,X1
005554 006001              ROR     X1
005556 P06001              ROR     X1
005560 P06001              ROR     X1
005562 004767 000012      JSR     X7,CONVT     !DISPLAY THE NEXT DIGIT
005566 216701 000064      MOV      P12SV,X1
005572 P04767 000002      JSR     X7,CONVT     !DISPLAY THE LAST DIGIT
005576 P00652      BR      KNOB

```

```

005600 042701 177770      CONV1:  BIC      #177770,X1
005604 P12700 005634      MOV      @TAB1,X0
005610 005701              TST     X1
005612 201404      CONV1:  BEQ     CONV2
005614 P62700 200002      ADD     #2,X2
005620 005301              DEC     X1
005622 000773              BR      CONV1
005624 P11002      CONV2:  MOV      @X0,X2
005626 P04767 175646      JSR     X7,CHAR
005632 200207      RTS     7

```

```

005634 004073      TAB1:  NO
005636 204016      Y1
005640 004023      Y2
005642 204030      Y3
005644 204035      Y4
005646 204042      Y5
005650 004047      Y6
005652 204054      Y7

```

```

005654 200020      P12CTI 0
005656 0000P0      P12SVI 0
000021      ,END

```

A	003614	P12CT	005654	SCALE2	000022	T9A	001222
ADCS	001022	P12SV	005656	SCSR	001014	T9B	001242
ADDB	001024	P1RET	003034	SPACE	004100	T6	001250
M	003621	P3	003112	SREG	177570	T6A	001262
C	003620	P3A	003136	STACK	000776	T6B	001302
CC	177770	P3B	003154	SVEC	001030	T7	001312
CH1	004312	P3C	003176	SWR	001026	T7A	001324
CH2	004334	P3D	003214	T	003753	T7B	001344
CHAR	003500	P4	003306	T0	001054	T8	001354
CHAR1	003510	P4A	003320	T1	001072	T9	001374
CHAR2	003524	P4B	003350	T10	001444	T9A	001420
CHAR3	003550	P7CNT	004306	T10A	001470	TAB1	005634
CHRCOL	003610	P7PNT	004310	T11	001514	TCSR	001010
CONVT	005600	P8	002610	T11A	001540	TDDR	001012
CONVT1	005612	PD	002624	T11B	001564	TICKS	001036
CONVT2	005624	PE	002660	T11C	001610	TIMER	005200
CSRTST	001040	PF	003004	T11D	001634	TIMER1	005230
D	003633	PIC0	002566	T11E	001660	TIMER2	005232
E	003640	PIC1	002712	T12	001704	TIMER4	005260
F	003645	PIC10	004434	T12A	001730	TIMSV	001034
G	003652	PIC10B	004420	T13	001754	U	003760
GEN1	003464	PIC10A	004476	T13A	001766	V	003765
H	003657	PIC10C	004530	T13B	002012	W	003772
HIGH	001006	PIC10D	004554	T14	002030	X	003777
HILMT	001002	PIC10E	004604	T14A	002042	XPOS	003606
I	003664	PIC10F	004630	T14B	002066	XREC	001016
J	003671	PIC11	004646	T15	002104	Y	004004
K	003676	PIC11A	004710	T16	002132	YPOS	003604
KYOB	005324	PIC11B	004742	T16A	002156	YPT	003612
L	003703	PIC11C	004776	T16B	002206	YREC	001020
LOP1	004374	PIC12	005010	T17	002220	Z	004011
LOW	001004	PIC12A	005060	T17A	002270		
LOWLMT	001000	PIC12B	005074	T18	002274		
LPTA1	005446	PIC3	003036	T18A	002324		
LPTA2	005464	PIC4	003234	T19	002346		
LPVEC	001032	PIC4B	003262	T19A	002372		
M	003710	PIC6	003372	T2	001110		
N	003715	PIC6A	003400	T20	002416		
N0	004073	PIC6B	003446	T20A	002426		
N1	004016	PIC7	004106	T21	002452		
N2	004023	PIC7A	004166	T21A	002456		
N3	004030	PIC7AA	004130	T22	002474		
N4	004035	PIC7B	004250	T23	002520		
N5	004042	PIC8	004356	T23A	002524		
N6	004047	POS1X	005174	T24	002542		
N7	004054	POS2X	005176	T24A	002562		
N8	004061	POSY	005172	T24B	002554		
N9	004066	Q	003734	T3	001134		
NOP	000240	R	003741	T4	001160		
O	003722	ROUTPT	005264	T4A	001166		
P	003727	S	003746	T4B	001206		
P2RET	002710	SCALE1	000011	T5	001214		



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ERRORS DETECTED: 0

RUN-TIME: 10 SECONDS

5K CORE USED