the Club Of Microprocessor Programmers, Users, and Technical Experts David Graves, Editor •

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# A PROM Programmer for the SC/MP LCDS

Application Note AN-189 Fran Terry Keith Winter

# **ABSTRACT**

This application note describes for the user of the SC/MP Low Cost Development System (LCDS) a method of programming MM5204 or MM4204 Programmable Read Only Memories (PROMs) that is both inexpensive and highly efficient.

# INTRODUCTION

In the development cycle, there is a point in software development between read/write memory program debug and commitment to mask programmed ROMs. This is generally filled by using erasable PROMs; this allows the user to test the program in the end application, and then to correct any errors that occur. Also, for the small quantity user, in the end application PROMs may be more practical to use instead of ROMs. This can be inconvenient, however, if a PROM programmer is not readily available.

With the method described in this application note, the LCDS user can construct, using wire-wrap techniques, an inexpensive PROM programmer that plugs into the SC/MP LCDS backplane and programs a 512-by-8 PROM in less than 10 seconds. The only additional item required is a 65 V power supply capable of delivering 500 mA.

# **CAPABILITIES**

The driver software has the ability to copy a PROM into memory for subsequent duplication, to verify a PROM against memory, to program a PROM from any memory area, and to verify that a PROM is erased.

An added feature of the PROM programmer is an LED that is active when the high voltage is being applied to the PROM socket.

# NOTE

Damage to the PROM and/or the programmer may result if the PROM is inserted or removed when the LED is turned on.

Listed at the end of this article are two versions of the driver software. If the user has a Teletype<sup>®</sup>, the first program can be used. If no Teletype is available, the second program uses the LCDS control panel for all entries. ®Trademark of the Teletype Corporation.

# **EXAMPLES OF TELETYPE OPERATION**

Doug Hall, Hardware Consultant

The Teletype (TTY) program works in conjunction with the TTY DEBUG package contained on the LCDS Motherboard. The following are some examples of TTY operational routines; the user's read/write memory is assumed to be located from X'1000 to X'17FF.

## NOTE

The 65V power supply should be turned on throughout all of the following operations.

(A dash [-] denotes a debug prompt, a question mark [?] denotes a programmer prompt.)

# Loading an LM Tape and Programming

-L1000 CR (CR = carriage return)	Load tape into memory starting at address X'1000.
-G0 CR	After tape loads, the user transfers to programmer software.
?P1000 CR	Check PROM for erased condition, then program from X'1000.
?V1000 CR	Verify PROM against memory.
?	Ready for next command.

# NOTE

The PROM is now programmed. Pressing the HALT button returns to the DEBUG monitor if desired. The following examples show the initial system state to be in DEBUG.

# **Duplicating a PROM**

-G0 CR	Transfer to programmer routines.
	Put PROM to be duplicated in socket on programmer card.
?C1000 CR	Copy PROM data into memory starting at $X'1000$ .
	Put blank PROM in socket.
?P1000 CR	Program PROM.
?V1000 CR	Verify PROM.
?	Ready for next command.

# **Program PROM Without Check for Erased Condition**

· ·	
-G0 CR	Transfer to programmer routines.
	Put PROM in socket.
?Y1000 CR	Program PROM from X'1000 without check for erased.
?V1000 CR	Verify PROM.
?	Ready for next command.

# **Checking PROM for Erased Condition**

-G0 CR Transfer to programmer routines.

Put PROM in socket.

?E PROM is checked.

? Ready for next command.

# Listing Contents of a PROM

-G0 CR Transfer to programmer routines.

Put PROM in socket.

?C1000 CR Copy PROM contents into

memory.

Press HALT button to transfer

to DEBUG routines.

-T1000:11FF CR Type contents of buffer area.

# **Error Messages**

If PROM cannot be programmed:

?P1000 CR

BAD PROM @0XXX where 0XXX denotes the address

of the PROM that cannot be

programmed

If PROM is not erased:

?P1000 CR NOT ERASED

or

?E

**NOT ERASED** 

If PROM does not verify against memory:

?V1000 CR NO VERIFY

# **EXAMPLES OF PANEL OPERATION**

For panel operation, the user enters the starting address of the routine to be executed into the Program Counter and the address to be used for copying, verifying against, or programming from into Pointer 1. After placing the PROM in the socket, the RUN button is pressed. The system halts when the operation is completed or if an error is detected. The error halts and their explanations follow:

X'0035 PROM is not erased.

X'0085 PROM cannot be programmed.

X'015A PROM does not verify.

The following are entry points:

X'0001 Check PROM for erased condition.

X'0035 Program PROM without check for erased.

X'0048 Program PROM with check for erased.

X'0101 Copy PROM into memory.

X'012C Verify PROM against memory.

When using the panel program, the HALT INST switch on the LCDS Motherboard must be in the DEBUG position before execution. Other than the method of inputting commands and parameters, the TTY program and PANEL program are functionally identical.

Generalized flowcharts of the PROM programmer software routines follow the listings.

These programs are intended to be assembled at X'0000 so they can be placed in PROM on the SC/MP CPU card. For the P-channel card, an MM5204 is used. On the N-channel card, an 87S296 bipolar PROM must be used. If N-channel is used, the delay constants in the programming routines must be doubled to allow the correct timing for the programming pulses.

## **BOARD CONSTRUCTION**

Referring to the schematic diagram, figures 1 and 2, standard wire-wrap techniques are used in the construction of the board. Refer to photo 1 for a suggested placement layout. This placement should be followed as closely as possible, as the transistor drivers and their associated passive components should be near the PROM socket to reduce line inductance. The decoding and control circuits are placed near the board edge connector for access to the data and address buses.

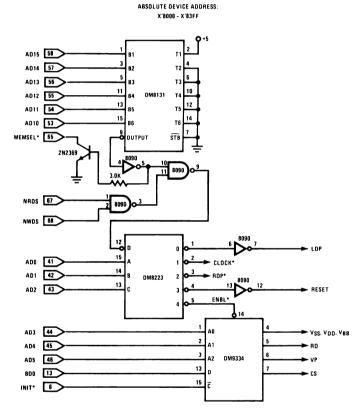


Figure 1.

It is suggested that a low or zero insertion force socket be used for the PROM to make insertion and removal easier. This also reduces the possibility of bent pins which can cause errors in programming or damage to the part.

Three waveform photos are included to aid in verification and debug of the circuit. Photo 2 shows the programming pulse from the DM9334 addressable latch and at pin 4 of the PROM. Photo 3 shows the voltage levels of input data for both the logic "0" and logic "1" states. Photo 4 shows the levels of  $V_{BB}$  and  $V_{DD}.$  All these values are shown during the time of the programming pulse.

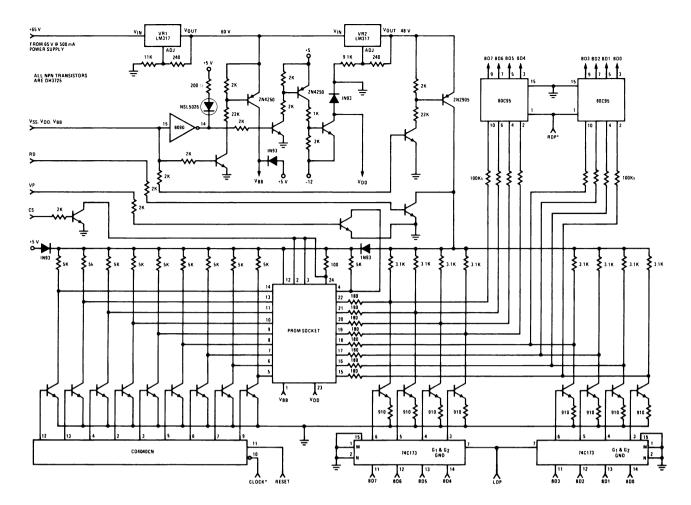


Figure 2.

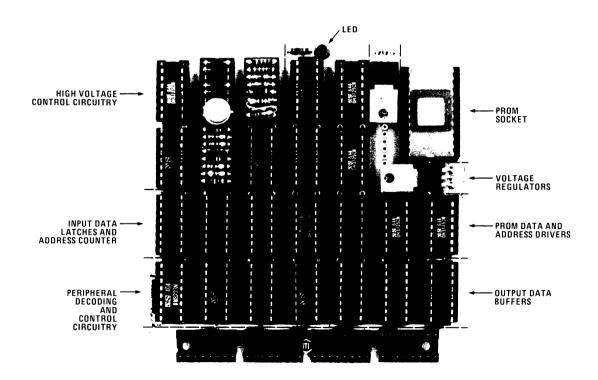


Photo 1.

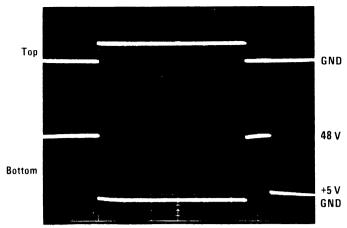


Photo 2. top: Vp @ 5 V/DIV & 200 μs/DIV bottom: Vp (PROM) @ 20 V/DIV & 200 μs/DIV

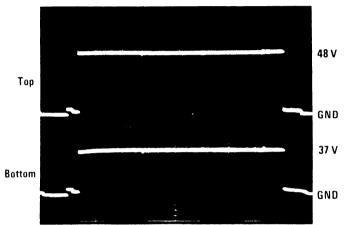


Photo 3. top: DATA "0" @ 20 V/DIV & 300 μs/DIV bottom: DATA "1" @ 20 V/DIV & 300 μs/DIV

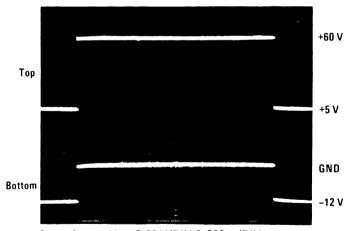


Photo 4. top: VBB @ 20 V/DIV & 300  $\mu$ s/DIV bottom: VDD @ 10 V/DIV & 300  $\mu$ s/DIV

A suggested board for construction is National Semiconductor part no. IPC-16C/801 prototyping board. However, any prototype board that has a 72-pin edge connector on 0.100 inch centers (plug compatible with the SC/MP LCDS bus) and room for at least 32 16-pin IC sockets can be substituted.

Each TTL and CMOS circuit should be bypassed by a 0.1  $\mu$ F capacitor across V<sub>CC</sub> and GND as well as bulk capacitors across V<sub>CC</sub> and GND and -12 V and GND at the input to the board. These capacitors should be tantalum and should be in the  $20\,\mu$ F to  $30\,\mu$ F range.

# **PARTS LIST**

Type	Description	Quantity
DH3725CN	Quad Core Drivers	6
MM74C173	Quad Latch	2
DM80C95N	Hex Tri-State Buffer	2
CD4040N	12-Stage Binary Counter	1
DM8223N	1-of-8 Decoder	1
DM8131N	6-Bit Bus Comparator	1
DM8090N	Miscellaneous Gates	1
DM9334N	Addressable Latch	1
NSL5026	LED	1
2N4250	PNP Transistor	2
2N2905	PNP Transistor	1
1N93	Germanium Diode	4
LM317T	Voltage Regulator	2
RESISTORS	May be Resistor Arrays	62

## CONCLUSIONS

This PROM programmer greatly extends the use of the SC/MP LCDS as a prototyping/development system by giving the user the ability to program PROMs for debug and test purposes while remaining much less expensive than commercially available PROM programmers. Also, since it is to be used in the LCDS, no special formats for the data are required. Load modules created by the SC/MP LCDS can be loaded by the firmware provided without conversion to binary, complemented binary, or BPNF formats.

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57 (7) (7)	of a cal	ENEL	 	3 4	ORDER CODE TO CLEAR COUNTER ORDER CODE TO ENABLE CONTROL	166	ENTRY	POINT	TO PROGRAM P	ROM W/CHECK FOR ERASED
*,* *	k4F	PHTC		07AE2	LATCH PUT CHARACTER POINTER	167 168				MOST SIGNIFICANT ADDRESS TO
	7591 71850	GECHO GHE :	-	07 <b>A91</b> 07B50	GET CHARACTER WARCHO POINTER FOINTER TO GET 4 HEX DIGITS	169 170	, LEAST	SIGNIE	ICANT ADDRES	S DUE TO COUNTER INVERSION
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tere.	7.2 Euro	STACK	=	ογγριο	.STACK POINTER TO MOTHER- . BOARD R/W MEMORY	0084 3704 0086 4F33				
<b>7</b> 	PEEE	HI LO	=	-17 -18	- TEMPORARY LOCATIONS OFFSET FROM STACK POINTER	0088 3F 173 0089 C601		1.D	@1(P2)	RETRIEVE ADDR FROM STACK
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71 72	FFFC FFFC	HENT	=	-20 -21		176 008F CAED		ST	SAVLO(P2)	SAVE IN R/W MEMORY
7%	EEE -	DPLO DPH1	=	-27 -23		178 0091 CAEC		ST	SAVHI(P2)	
74 75			PAGE	OCOMMAND II	NPUT PROCESSING	179 0093 043A 180 0095 31		LDT XPAL	P1	CHECK PROM FOR ERASED
77		COMMA	AND ENTR	Y ROUTINE		181 0096 3D 182 0097 C2FD		XPPC LD	P1 SAVL0(P2)	
- Ocen	0-08		NOP			183 0099 31 184 009A C2EC		XPAL LD	P1 SAVHI(P2)	
96 81 (50)		ENTRY	LD1	H(STACK)	INITIALIZE STACK FIR.	185 0090 F402 186 009E 35		ADI XPAH	2 P1	,ADD 512 OFFSET
82 000 83 000	3 36		XPAH LDI	P2 L (STACK)		187 009F 0401 188 00A1 CAEF	SET:	LDJ ST	) HI(P2)	SET UPPER LOC COUNT
84 000 85		PROMPT	≯PAL	P?		189 00A3 0400 190 00A5 CAEE		LDI ST	0 LO(P2)	SET LOWER LOC COUNT
3A 000	7   42E 9   37L4		.98	PS: MESG	PROMPT FOR COMMAND	191 00A7 CB03 192	NXTLOC:	šτ	CLR(P3)	CLEAR PROM COUNTER
600	B 1638					193 00A9 C5FF 194 00AB 01	WATE CO.	LD XAE	@-1(P1)	GET DATA TO PROGRAM
87 606				PRMET		195	THSLOC:			SAVE IN EXTENSION REG.
	9 3704		- IS	P3.GECHO	.60 TO GET CHAR W/ECHO	196 00AC C401 197 00AE 35		XE AH	H(PPROM) Pi	SET ADDR. OF PROGRAMM RTN
001.	4 9033 6 3E					198 OOAF CAEC 199 OOB1 C421		ST LDI	SAVHI(P2) L(PPROM)-1	SAVE PTR ADDR.
82 001 20 001			ANI XAF	07F	MASK OUT PARITY. JE ANY SAVE CHAR IN E REG	200 00B3 31 201 00B4 CAED		XPAL ST	P1 SAVLO(P2)	
91 001 92 001			LDI XPAH	H(CMDTBL)	SET FIR TO COMMAND TABLE	202 00B6 0 <b>4FF</b> 203 00B8 CAEB		LDI ST	-2 HCNT (P2)	SET COUNT SAVE HIT COUNT IN RAM
93 001 94 001	D 04F0		I DJ XPAL	I. (CMDTBL)		204 205 OORA 3D	60	XPPC	P1	
95 002 96		CLOOP:	čáľ.			206 00BB 60 207 00BF 981B		XRF	ok	,CHECK PROM DATA ,PROM DATA CORRECT, DO X+5X
97 000		1,1,111,5	LD	@3(P1)	GET COMMAND CHAR	208 OORE BAER 209 OOCO 9CF8		DLD	HONT (P2)	DECREMENT HIT COUNT
98 002° 99 002°	5 60		VRE	ERROR	END OF TABLE, INPUT ERROR CHECK FOR CORRECT COMMAND	210	NPROG.	JNZ	60	, CHECK FOR MAX. HIT
100 002	8 CSEE		UN7 LTI	(LOMP @-1(F1)	NOT RIGHT, TRY NEXT FOUND COMMAND, GET ADDR	211 0002 047B 0004 3704		JS	P3, MESG	HIT COUNT OVER MAX, BAD PROM
102 002 103 002	R CSEE		XAF LD	@-1(F1)	SAVE TEMPORARILY IN E. REG	0006-1633 0008-3 <b>F</b>				
104 0021 105 0021	F 40		XPAH LDE	P1		212 0009 01DD 213	LOC		BADPRM	
104 002			XEAL XEEC	P1 P1	/EXECUTE COMMAND	214 000B 04B2 215 000D 33		LDI XEAL	L(PHEX)=1 P3	
108-003 109	1 9004	ERROR	·IMF	PROMPT		214 00CE C2EE 217 00DO 3E		LD XPPC	HI(P2) P3	
110 003			LDI	L(PUTC)-1 P3		218 00D1 02FF 219 00D3 02		L.D. OCt.	t.0(P2)	CLEAR CARRY/LINK FLAG
112 003 113 003	6 (43F) 8 3F		LDJ XPPC	7?7 P3		220 00D4 F4FF 221 00DA 3F		ADJ XPPC	-1 P3	CORRECT COUNT
114 000 115			JMP	PROMPT		222 00 <b>D7</b> 9090 223	UK	IMF	RETN2	
116 117			PAGE	1PROM ACCES	S AND PROGRAMMING ROUTINES	224 0009 02 225 000A 0400	.,	CCU	0	
118 119		ROUTI	NE TO C	HECK PROM FO	OR ERASED CONDITION	224 OODE CAE9 227 OODE FAEB		ST	DPHI(P2) HCNT(P2)	CLEAR UPPER D. P. COUNT
120 121		THIS	SUBROUT	INE IS ALSO	CALLED BY "PROG " TO VERIFY	228 00E0 CAER 228 00E2 02		ST CCL	HONT (P2)	COMPLEMENT HIT COUNT
122			INF PRI	M IS ERASED		030 00F3 F2EB 231 00F5 CAEA		ADD ST	HONT (P2)	CLEAR CARRY/LINK FLAG COMPUTE 5X
123 124 003		FRASED:	į TiT	H(PPRGMR)	SET ADDR OF PROGRAMMER	232 00E7 0400		LDI	DPt.0(P2) 0	
125 003 126 003	F 0400		KPAH LDI	P3 L(PPRGMR)		233 OOF9 F2E9 234 OOFB CAF9		A PAPE		
127 004: 128 004	1 0401			P3				ADD ST	ЛРНІ(Р2) ПРНІ(Р2)	+ 2X
129 004	3 CAFE		XPAL LDI	1	SET UPPER COUNT	235 OOED 02 234 OOEE 02EA		ST CCL LD	DPHI(P2) DPLO(P2)	. 2X
100 004	5 CBOC			1 HI(P2) RD(P3)	,SET UPPER COUNT ;STACK IS EMPTY, USE AS PTR ;SET READ MODE	235 OOFD 02 234 OOEF 02FA 237 OOFO F2FA 238 OOF2 CAFA		ST CCL LD ADD ST	DPHI(P2) DPLO(P2) DPLO(P2) DPLO(P2)	· 2X
131 004 132 004	5 0B00 7 0B10		LDI ST	HI(P2)	STACK IS EMPTY, USE AS PTR.	235 OOFB 02 234 OOFF 02FA 237 OOFO FZFA 238 OOFZ 0AFA 239 OOF4 0ZF9 240 OOF6 FZF9		ST CCL LD ADD ST LD ADD	DPHI(P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHI(P2) DPHI(P2)	. 2X
131 004	5 CBOC 7 CB1C 9 C4OO B CAEF		LDI ST ST ST	HI(P2) RD(P3) CS(P3)	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET	235 OOFD 02 236 OOEE C2FA 237 OOFO F2FA 238 OOF2 CAFA 239 OOF4 C2F9 240 OOF6 F2F9 241 OOF8 CAF9 242 OOFA 02		ST CCL LD ADD ST LD ADD ST CCL	DPHI (P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2)	. 2X
131 004 132 004 133 004	5 CBOC 7 CB1C 9 C4OO B CAEF D CBO3	ELOOP:	LDI ST ST ST LDI ST	HI(P2) RD(P3) CS(P3) O LO(P2)	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT	235 OOFD 02 234 OOFD 02FA 237 OOFD F2FA 238 OOF2 CAFA 239 OOF4 C2F9 240 OOF8 CAF9 241 OOF8 CAF9 242 OOFA 02 243 OOFB C2FA 244 OOFB F2FA		ST CCL LD ADD ST LD ADD ST	DPHI(P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHI(P2) DPHI(P2)	
131 004 132 004 133 004 134 004 135 004	5 CBOC 7 CB1C 9 C400 B CAEF D CBOS F CBOO	FLOOP:	LDI ST ST ST LDI ST ST	HI(P2) RD(P3) CS(P3) O LO(P2) CLR(P3)	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  ·CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR .READ .READ DATA OUT OF PROM	235 OOFE 02 234 OOFE C7FA 237 OOFO F2FA 238 OOF2 CAEA 239 OOF4 C2F9 240 OOF6 F2F9 241 OOF8 CAE9 242 OOFB C2FA 243 OOFB C2FA 245 OOFE CAEA 245 OOFE CAEA		ST CCL LD ADD ST LD ADD ST CCL LD	DPHI (P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) HONT (P2)	
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005	5 CBOC 7 CB1C 9 C400 B CAEF D CBOS F CBOO 1 C302 3 9C0B 5 CBO1	FL00P:	LDI ST ST ST LDI ST ST ST LD LD JNZ ST	HI(P2) RD(P3) CS(P3) O LD(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3)	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT ERASED ,DATA OK, BUMP COUNTER	235 OOFB 02 234 OOFB C2FA 237 OOFB F2FA 238 OOF2 C4FA 239 OOF5 C2F9 240 OOF6 F2F9 241 OOFB C4F9 242 OOFB C2FB 244 OOFB C2FB 244 OOFB C2FB 245 OOFF C4FA		ST CCL LD ADD ST LD ADD ST CCL LD ADD ST	DPHJ (P2)  DPLO(P2) DPLO(P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHJ (P2)	. 4x
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005 140 005 141 005	5 CBOC 7 CB1C 9 C400 B CAEF F CBOO 1 C302 3 9C0B 5 9C0B 7 BAEE 9 9CFA	FLOOP:	LDI ST ST LDI ST ST ST ST LD UNZ ST DLD UNZ	HI(P2) RD(P3) OS(P3) OLO(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLR(P3) LO(P2) ELOOP	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT ERASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET	235 OOFR 02 234 OOFR C2FA 237 OOFR F2FA 238 OOF2 CAEA 239 OOF4 C2F9 240 OOF4 C2F9 241 OOF8 CAE9 242 OOF8 C2FR 242 OOF8 C2FR 244 OOF8 C2FR 245 OOFF CAEA 245 OOFF CAEA 247 O103 F2F9 248 0105 CAE9 249	ዮዮኒ ዮ	ST CCL LD ADD ST LD ADD ST CCL LD ADD ST LDI ADD ST	DPHJ (P2)  DPLO(P2) DPLO(P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPLO (P2) DPLO (P2) DPLO (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2)	. 4x ;5x
131 004 132 004 133 004 134 004 135 004 137 005 138 005 139 005 140 005 141 005 142 005 143 005	5 CBOC 7 CB1C 9 CAOO 9 CAOO 1 CBOS F CBOO 1 CBO2 3 9COB 5 CBO1 7 BAEE 9 9CFA B BAFF D 94F2	FLOOP:	LDI ST ST ST LDI ST ST LD UNZ ST DLD UNZ DLD UP	HI(P2) RD(P3) CS(P3) O LO(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP	STACK IS EMPTY, USE AS PTR. SET READ MODE SELECT PROM SOCKET SET LOWER COUNT CLEAR PROM COUNTER CLEAR BATA LATCHES FOR READ AREAD DATA OUT OF PROM DATA NOT ZERO? NOT ERASED DATA OK, BUMP COUNTER DECREMENT LOWER COUNT NOT DONE YET DECREMENT UPPER COUNT NOT DONE YET	235 OOFR 02 234 OOFR COPA 237 OOFO FZEA 238 OOFZ CAEA 239 OOFA CZEP 240 OOFA CZEP 241 OOFA CAE 242 OOFA 02 243 OOFA CAEA 244 OOFA CAEA 244 OOFA CAEA 245 OOFA CAEA 246 0101 CAOO 247 0103 FZEP 249 0105 CAEP 249 0105 CAEP 250 0107 3D 251 0108 BAEA	ዮዬ( ዮ	ST CCC. LD ADD ST LD APD ST CCC. LD ADD ST LDI APD ST LDI APD ST	DPHJ(P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2) DPHJ(P2)	.4X  ;5X ;PROGRAM PROM ;DECREMENT LOWER COUNT
131 004 132 004 134 004 135 004 136 005 137 005 138 005 140 005 141 005 142 005 144 005 145	5 CBOC 7 CB1C 9 C400 B CAEF D CBO3 F CBOO 1 C302 3 9C0B 5 CBOD 7 BAEE 9 9CFA B BAFF D 94F2 F 3D	FLOOP:	LDI ST ST ST LDI ST ST JNZ ST DLD JNZ DLD JP XPPC	HI(P2) RD(P3) CS(P3) O LO(P2) CLR(P3) CLR(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1	STACK IS EMPTY, USE AS PTR. SET READ MODE SELECT PROM SOCKET SET LOWER COUNT  CLEAR PROM COUNTER CLEAR DATA LATCHES FOR READ READ DATA OUT OF PROM DATA NOT ZERO? NOT ERASED DATA OK, BUMP COUNTER DECREMENT LOWER COUNT NOT DONE YET DECREMENT UPPER COUNT NOT DONE YET PROM IS ERASED	235 OOFB 02 234 OOE6 C2FA 237 OOF6 F2FA 238 OOF2 CAEA 239 OOF4 C2F9 240 OOF6 F2F9 241 OOF8 CAE9 242 OOFB C2FB 244 OOFB F2FB 244 OOFB F2FA 245 OOFF CAEA 246 O101 C4O0 247 0103 F2F9 248 0105 CAE9 249 0105 CAE9 249 0107 3D 251 0108 BAEA 252 0104 BAEA	PRI P	ST CCC. LD ADD ST CCC. LD ADD ST CCC. LD ADD ST ADD ST ADD ST XPPC DLD ADD DLD DLD DLD DLD	DPHI(P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI(P2) DPHI(P2) DPHI(P2) HCNT(P2) DPLO(P2) DPLO(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPLO(P2) PPHI(P2) DPLO(P2) PRLP BRLP BPHI(P2)	.4X ;5X ;PROGRAM PROM ;DECREMENT LOWER COUNT ,NOT DONE DECREMENT UPPER COUNT
131 004 132 004 133 004 134 004 135 004 137 005 138 005 140 005 141 005 142 005 144 005 145 006 146 006	5 CBOC 7 CB		LDI ST ST ST LDI ST ST LD UNZ ST DLD UNZ DLD UP	HI(P2) RD(P3) CS(P3) O LO(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP	STACK IS EMPTY, USE AS PTR. SET READ MODE SELECT PROM SOCKET SET LOWER COUNT CLEAR PROM COUNTER CLEAR BATA LATCHES FOR READ AREAD DATA OUT OF PROM DATA NOT ZERO? NOT ERASED DATA OK, BUMP COUNTER DECREMENT LOWER COUNT NOT DONE YET DECREMENT UPPER COUNT NOT DONE YET	235 OOFB 02 234 OOFB CPFA 237 OOFB FZFA 238 OOFZ CAEA 238 OOFZ CAEA 239 OOFA CZF9 240 OOFA 02 242 OOFB CZF8 242 OOFB CZF8 244 OOFB FZFA 245 OOFF CAEA 246 O101 CZF9 248 0105 CAE9 248 0105 CAE9 249 0107 SD 251 0108 BAEA 252 0107 SAEA 253 0107 BAE9 253 0107 BAE9 254 0106 BAE9 254 0106 BAE9 255 0107 CZF9 255 0107 CZF9	<b>ዮ</b> ዮ( ዮ	ST LD APP ST LD ST LD APP ST LD APP ST LD APP ST LD APP ST LD LD APP ST LD LD APP ST LD LD APP LD APP LD APP LD LD APP LD	DPHJ (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPLO(P2) O DPHJ (P2) O DPHJ (P2) O DPHJ (P2) DPLO (P2) PPLO (P2) PRL P SAVLO (P2)	.4X ;5X ;PROGRAM PROM :DECREMENT LOWER COUNT .NOT DOME
131 004 132 004 133 004 134 004 135 004 137 005 138 005 140 005 141 005 142 005 144 005 145 006 006 006	5 CBOC 7 C400 8 CAFF 0 C800 1 C302 3 9C0B 5 CBO1 7 BAFF 9 9CFA B BAFF F 3D 0 C47B 2 37C4 4 1633 4 3F		LDI ST ST ST LDI ST ST ST JNZ ST JNZ DLD JNZ DLD JNZ DLD JNZ DLD JNZ DLD JNZ DLD JNZ DLD JNZ DLD JNZ DLD JNZ DLD JNZ ST DLD JNZ ST DLD JNZ ST DLD JNZ ST ST JNZ ST ST JNZ ST JNZ ST JNZ ST JNZ ST JNZ ST JNZ ST JNZ ST JNZ ST DLD DLD JNZ ST DLD DLD JNZ ST DLD DLD DLD DLD DLD DLD DLD DLD DLD DL	HI(P2) RD(P3) 0 LO(P2) CLR(P3) CLR(P3) LOAD(P3) RDPRM(P3) ROT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG	STACK IS EMPTY, USE AS PTR. SET READ MODE SELECT PROM SOCKET SET LOWER COUNT  CLEAR PROM COUNTER CLEAR DATA LATCHES FOR READ DATA DATA OUT OF PROM DATA NOT ZERO? NOT ERASED DATA OK, BUMP COUNTER DECREMENT LOWER COUNT NOT DONE YET DECREMENT UPPER COUNT NOT DONE YET PROM IS ERASED GO TO MESSAGE RTN	235 OOFR 02 234 OOFR CPFA 238 OOF2 CAEA 238 OOF2 CAEA 239 OOF4 C2F9 240 OOFA C2F9 241 OOFA C2F 242 OOFR C2FR 243 OOFR C2FR 244 OOFF CAEA 245 OOFF CAEA 246 O101 CAE9 248 0105 CAE9 249 249 250 O107 SD 251 O108 BAEA 252 O106 SAE9 253 O106 SAE9 254 O106 SAE9 254 O106 SAE9 255 O110 C2FD 255 O110 C2FD 255 O110 C2FD	<b>ዮ</b> ዮ! ዮ	ST. LD ADD ST. LD ADD ST. LD ADD ST. LD ADD ST. ADD ST	DPHI (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) PRLP PRLP PRLP SAVLO(P2) PI SAVLO(P2) PI SAVLO(P2)	.4x  ;5x ;PROGRAM PROM ;DECREMENT LOWER COUNT .NOT DONE ,DECREMENT UPPER COUNT .NOT DONE
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005 139 005 140 005 141 005 142 005 144 006 006 006 006 147 006	5 CBOC 7 CBOC 7 CBOC 9 C400 B CAFF D CBOO 1 C302 3 9C0B 5 CBOE 5 PBOF 9 9CFA B PAF2 F 3D 0 C47B 2 37C4 3 4 1693 4 1693 6 7 01C4		LDI ST ST ST LDI ST ST ST LD JNZ ST DLD JNZ DLD JPZ DLD JPZ DLD JPZ DLD JPZ DLD JPS DLD JPS DEST DEST DEST DEST DEST DEST DEST DES	HI(P2) RD(P3) 0 LO(P2) CLR(P3) LO(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT ERASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ;PROM JS ERASED ,GO TO MESSAGE RTN  .PTR TO MESSAGE	235 OOFR 02 234 OOER C2FA 238 OOF2 CAFA 238 OOF2 CAFA 239 OOF4 C2F9 240 OOF4 C2F9 241 OOF8 CAF9 241 OOF8 C2FR 242 OOFR C2FR 245 OOFF CAFA 245 OOFF CAFA 245 OOFF CAFA 247 O103 F2F9 248 0105 CAF9 249 250 0107 80 251 0106 80EA 252 0106 94F7 255 0110 C2FD 255 0110 C2FD 255 0110 C2FD 256 0112 31 257 0113 C2FC 258 0115 35	PFN P	ST CCL LD ADD ST LD ADD ST CCL LD ADD ST XPPC DLD JN7 DLD JP LD JP LD JP LD JP LD JP LD JP LD JP LD JP JP JP JP JP JP JP JP JP JP JP JP JP	DPHJ (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPLO(P2) DPLO(P2) DPHJ (P2) PSAVLO(P2) PJ SAVLO(P2) PJ	.4x  ;5x  ;PROGRAM PROM :DECREMENT LOWER COUNT :NOT DONE :DECREMENT UPPER COUNT :NOT DONE :RESTORE P)
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005 139 005 140 005 141 005 142 005 144 005 145 006 006 006 147 006 148 149 006 147 006	5 CBOC 7 CBOC 7 CBOC 9 C400 B CAFF D CBOO 1 C302 3 9C0B 5 CBOE 5 PBOF 9 9CFA B PAF2 F 3D 0 C47B 2 37C4 3 4 1693 4 1693 6 7 01C4	NOT:	LDI ST ST ST LDI ST ST ST ST UNZ ST UNZ ST UNZ ST UND UNZ ST UND UNZ ST UND	HI(P2) RD(P3) O (CR(P3) O (LO(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG PROMPT	STACK IS EMPTY, USE AS PTR. SET READ MODE SELECT PROM SOCKET SET LOWER COUNT  CLEAR PROM COUNTER CLEAR DATA LATCHES FOR READ DATA NOT ZERO? NOT ERASED DATA NOT ZERO? NOT ERASED DATA OK, BUMP COUNTER DECREMENT LOWER COUNT NOT DONE YET DECREMENT UPPER COUNT NOT DONE YET PROM IS ERASED  GO TO MESSAGE RTN  PTR TO MESSAGE RETURN TO COMMAND PROCESS	235 OOFR 02 234 OOFR 02P 237 OOFO F2FA 238 OOF2 CAFA 238 OOF2 CAFA 239 OOFA 62PP 241 OOFA 62PP 242 OOFA 02 243 OOFB C2FB 244 OOFA 02 243 OOFB C2FB 244 OOFB CAFP 244 OOFB CAFP 245 OOFF CAFA 245 OOFF CAFA 245 OOFF CAFA 250 OOFA 02 251 OOFB CAFP 253 OOFB 02FB 253 OOFB 04FF 255 OOFB 04FF 256 OOFB 04FF 256 OOFB 04FF 257 OOFB 04FF 258 OOFB 04FF 259 OOFB 04		ST CCL LD ADD ST LD ADD ST LD ADD ST LDI ADD ST LDI ADD DLD JN7 DLD JN7 LD LD LD LD LD LD ADD ST LD LD ADD ST LD LD ADD ST LD LD ADD ST LD ADD ST LD ADD ST	DPHI(P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) PPHI(P2) PRLP SAVHI(P2) PI SAVHI(P2) PI SAVHI(P2) PI SAVHI(P2) PI LO(P3) LO(P3)	.4x  ;5x  ;PROGRAM PROM ;DECREMENT LOWER COUNT ,NOT DONE ;DECREMENT UPPER COUNT ,NOT DONE ;RESTORE P)  ;RUMP PROM COUNTER ;DECREMENT LOWER LOC COUNT
131 004 132 004 133 004 134 004 135 004 136 005 137 005 139 005 140 005 141 005 142 005 144 006 145 006 006 006 006 148 148	5 CBOC 7 CBOC 7 CBOC 9 C400 B CAFF D CBOO 1 C302 3 9C0B 5 CBOE 5 PBOF 9 9CFA B PAF2 F 3D 0 C47B 2 37C4 3 4 1693 4 1693 6 7 01C4	NOT:	LDI ST ST ST LDI ST ST ST ST UNZ ST UNZ ST UNZ ST UND UNZ ST UND UNZ ST UND	HI(P2) RD(P3) O (CR(P3) O (LO(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG PROMPT	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT ERASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ;PROM JS ERASED ,GO TO MESSAGE RTN  .PTR TO MESSAGE	235 OOFB 02 234 OOEB CPEA 238 OOFC CPEA 238 OOFC CAEA 238 OOFC CAEA 238 OOFC CAEA 240 OOEA CPE9 241 OOFB CAE9 242 OOFB CAE9 243 OOFB CAEA 245 OOFF CAEA 245 OOFF CAEA 246 OTOT AE9 248 OTOT AE9 249 250 OTOT 3D 251 OTOR SAEA 252 OTOT SAE9 253 OTOT SAE9 253 OTOT SAE9 253 OTOT SAE9 254 OTOT SAE9 255 OTTO CAEP 256 OTTO CAEP 257 OTTO CAEP 257 OTTO CAEP 258		ST CCCL LD ADD ST LD ADD ST CCCL LD ADD ST CCCL LD ADD ST LD ADD DIP LD JN7 LD LD JP LD JP LD XPAL LD XPAL LD XPAL ST	DPHI(P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPHI(P2) DPLO(P2) O DPHI(P2) O DPHI(P2) O DPHI(P2) O DPHI(P2) DPLO(P2) PRLP PRLP SAVLO(P2) PI SAVHI(P2) PI CLK(P3)	.4X  ;5X  ;PROGRAM PROM :DECREMENT LOWER COUNT :NOT DONE :DECREMENT UPPER COUNT :NOT DONE :RESTORE P)  ;BUMP PROM COUNTER
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005 139 005 140 005 141 005 142 005 144 006 145 006 147 006 147 006 148 006 148 006 149 006 149 006 150	5 CROC 7 CR1C 7	NOT:	LDI ST ST ST LDI ST ST ST ST UNZ ST UNZ ST UNZ ST UND UNZ ST UND UNZ ST UND	HI(P2) RD(P3) O (CR(P3) O (LO(P2) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG PROMPT	STACK IS EMPTY, USE AS PTR. SET READ MODE SELECT PROM SOCKET SET LOWER COUNT  CLEAR PROM COUNTER CLEAR DATA LATCHES FOR READ DATA NOT ZERO? NOT ERASED DATA NOT ZERO? NOT ERASED DATA OK, BUMP COUNTER DECREMENT LOWER COUNT NOT DONE YET DECREMENT UPPER COUNT NOT DONE YET PROM IS ERASED  GO TO MESSAGE RTN  PTR TO MESSAGE RETURN TO COMMAND PROCESS	235 OOFB 02 234 OOFB CPFA 238 OOFC CPFA 238 OOFC CPFA 238 OOFC CPFA 239 OOFA CPF9 240 OOFA CPF9 241 OOFA CPF9 242 OOFB CPFA 245 OOFF CPFA 245 OOFF CPFA 245 OOFF CPFA 246 O101 CPF9 248 O105 CPF9 248 O105 CPF9 249 250 O107 SD 251 O108 BAEA 252 O106 SAE9 253 O106 SAE9 253 O106 SAE9 253 O107 SAE9 254 O106 CPF9 255 O110 CPF9 256 O117 SD 257 O117 SE		ST CCCL LID ADD ST LD ID ADD ADD ADD ADD ADD ADD ADD ADD ADD	DPHI (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPLO(P2) OPPHI (P2) OPPHI (P2) OPPHI (P2) PPHI (P2) PHI (P3) P	.4X  ; FROGRAM PROM ; PROGRAM PROM ; DECREMENT LOWER COUNT ; NOT DONE ; DECREMENT UPPER COUNT ; NOT DONE ; RESTORE P)  ; BUMP PROM COUNTER ; DECREMENT LOWER LOC COUNT ; NOT DONE
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005 139 005 140 005 141 005 142 005 144 005 145 006 006 147 006 148 149 006 150 151 152 153 154 006	5 CROC 7 CRIC 7	NOT: RETN2 , ENTRY	LDI ST ST ST ST ST ST ST ST UDZ ST ST JNZ ST DLD JPZ JNZ DLD JPS DBYTF JMP	HI(P2) RD(P3) O (CP2) CLR(P3) CLR(P3) CLR(P3) LOAD(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG  ROTMSG PROMPT TO PROGRAM F	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT FRASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ,PROM JS ERASED ,GO TO MESSAGE RTN  .PTR TO MESSAGE ;RETURN TO COMMAND PROCESS .PROM W/O CHECK FOR ERASED	235 OOFR 02 234 OOFR 029 237 OOFO FZEA 238 OOFZ CAEA 238 OOFZ CAEA 239 OOFA CZEP 241 OOFA 02 242 OOFA 02 243 OOFR CZER 245 OOFR CZER 245 OOFR CAEA 245 OOFR CAEA 247 O103 FZEP 248 0105 CAEP 249 0107 80 250 0107 80 251 0108 RAEA 252 0104 9CFB 253 0106 94F7 255 0110 CZER 255 0110 CZER 256 0115 31 257 0113 CZEC 258 0115 35 259 260 0116 CB01 261 0116 CB01 263 0116 CB01 264 0116 CBCR		ST CCL LD ADD ST LD ADD ADD ADD ADD ADD ADD ADD ADD ADD	DPHJ (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPHJ (P2) DPLO(P2) O DPHJ (P2) O DPHJ (P2) DPHJ (P2) DPHJ (P2) PJ DPHJ (P2) PJ DPHJ (P2) PJ SAVLO(P2) PJ SAVLO(P2) PJ CLK (P3) LO(P2) NXTLOC HT (P2) NXTLOC	.4X  ;5X  ;PROGRAM PROM ;DECREMENT LOWER COUNT .NOT DONE .DECREMENT UPPER COUNT .NOT DONE .RESTORE P)  ;RUMP PROM COUNTER .DECREMENT LOWER LOC COUNT ;NOT DONE .DECREMENT UPPER LOC COUNT :NOT DONE
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005 139 005 140 005 141 005 142 005 143 005 144 006 145 006 146 006 147 006 150 151 152 153 154 006 006 006 006	5 CROC 7 CRIC 7	NOT: RETN2 , ENTRY	LDI ST ST ST LDI ST ST ST ST LD JNZ ST DLD J	HI(P2) RD(P3) CS(P3) O LO(P2) CLR(P3) LOAD(P3) ROPRM(P3) NOT CLK(P3) ELOOP HI(P2) ELOOP P1 P3, MESG  NOTMSG PROMPT TO PROGRAM F	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT FRASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ,PROM JS ERASED ,GO TO MESSAGE RTN  .PTR TO MESSAGE ;RETURN TO COMMAND PROCESS .PROM W/O CHECK FOR ERASED	235 OOFB 02 234 OOFB C2FA 237 OOFB C2FA 238 OOF2 CAEA 238 OOF2 CAEA 238 OOFB C2F9 240 OOFB C2F9 241 OOFB C2F9 243 OOFB C2F9 243 OOFB C2F9 244 OOFB C2F9 244 OOFB C2F9 245 OOFB C2F9 246 OOOB C2F9 247 OOOB C2F9 248 OOOB C2F9 250 OOOT SAE9 251 OOOB SAEA 252 OOOB SAEA 252 OOOB SAEA 253 OOOB SAEA 254 OOOB SAEA 255 OOOB SAEA 257 OOOB SAEA 258 OOOB SAEA 258 OOOB SAEA 258 OOOB SAEA 267 OOOB SAEA 268 OOOB SAEA 267 OOOB SAEA	UPDATE	ST CCCL LO ADD ST LD JW P LD	DPHI (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPLO(P2) DPLO(P2) DPHI (P2) PPHI (P2) PRLP SAVHI (P2) PI CLK (P3) LO(P2) NXTLOC HT (P2) NXTLOC RETNI O RD(P3)	. 4X  ; 5X  , PROGRAM PROM DECREMENT LOWER COUNT NOT DONE DECREMENT UPPER COUNT NOT DONE RESTORE P)  , RUMP PROM COUNTER DECREMENT LOWER LOC COUNT NOT DONE DECREMENT UPPER LOC COUNT NOT DONE PROGRAMMING DONE , TURN OFF READ MODE AND
131 004 132 004 133 004 134 004 135 004 136 137 005 138 005 139 005 140 005 141 005 142 005 144 006 147 006 148 106 148 106 150 151 150 151 150 151 150 006 151 006 155 007 155 007	5 CROC 7 CR1C 7	NOT: RETN2 , ENTRY	LDI ST JNZ ST DLD	HI(P2) RD(P3) RD(P3) O LO(P2) CLR(P3) LOAD(P3) NOT CLR(P3) NOT CLR(P3) ELOOP HI(P2) ELOOP P1 P3, MESG  NOTMSG PROMPT TO PROGRAM F P3, GHEX H(PPRGMR) P3	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT FRASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ,PROM JS ERASED ,GO TO MESSAGE RTN  .PTR TO MESSAGE ;RETURN TO COMMAND PROCESS .PROM W/O CHECK FOR ERASED	235 OOFB 02 234 OOFB C2FA 237 OOFB C2FA 238 OOF2 CAEA 239 OOF4 C2F9 240 OOFA C2F9 241 OOFB CAEA 243 OOFB C2FA 243 OOFB C2FA 244 OOFB C2FA 245 OOFB C2FA 246 O101 C4OO 247 O103 C2F9 248 O105 CAEA 250 O107 3D 251 O108 BAEA 252 O104 9CFB 253 O107 BAE9 254 O107 BAE9 254 O107 BAE9 255 O110 C2FD 255 O110 C2FD 255 O110 C2FD 255 O117 S2F2 255 O116 C8F1 257 O113 C2FC 258 O115 S5 259 260 O116 C8O1 261 O118 BAEF 264 O116 BAEF 264 O116 BAEF 264 O116 BAEF 264 O117 BAEF 264 O117 CAEB 265 O117 BAEF 266 O117 C8F1 267 O127 C4OO 268 O124 CBOT 269 O126 BBIC 269 O128 BBIC 270	UPDATE	ST LDE	DPHI (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPLO(P2) O DPHI (P2) DPHI (P2) O DPHI (P2) O DPHI (P2) DPLO (P2) PRLP SAVLO (P2) PI CLK (P3) LO (P2) NXTLOC HI (P2) NXTLOC HI (P2) NXTLOC RETNI O RD (P3) CS (P3)	. 4X  ; 5X  ; PROGRAM PROM ; DECREMENT LOWER COUNT ; NOT DONE ; DECREMENT UPPER COUNT ; NOT DONE ; RESTORE P)  ; RUMP PROM COUNTER ; DECREMENT LOWER LOC COUNT ; NOT DONE ; PROGRAMMING DONE ; TURN OFF READ MODE AND ; CHIP SELECT
131 004 132 004 133 004 134 004 135 004 136 005 137 005 138 005 140 005 141 005 142 005 144 006 147 006 148 148 149 006 151 152 153 154 006 006 007 155 007 155 007	5 CROC 7 CR1C R 1 CR1	NOT: RETN2 , ENTRY	LDI ST DLD JNZ ST ANA LD J	HI(P2) RD(P3) RD(P3) O LO(P2) CLR(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP P1 P3, MESG  NOTMSG PROMPT TO PROGRAM F P3, GHEX  H(PPROMR) P3 L(PPROMR) P3	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT ERASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ,PROM JS ERASED ,GO TO MESSAGE RIN  PTR TO MESSAGE ;RETURN TO COMMAND PROCESS PROM W/O CHECK FOR ERASED  ,GET ADDR TO PROG FROM	235 OOFR 02 234 OOFR 027 238 OOF2 CAEA 237 OOFO F2EA 238 OOF2 CAEA 239 OOF4 C2F9 241 OOFA C2F9 242 OOFA 02 243 OOFB CAEA 245 OOFB CAEA 245 OOFB CAEA 245 OOFB CAEA 246 O101 CAOO 247 O103 F2F9 248 0107 FAEA 250 0107 3D 251 0108 BAEA 252 010A BAEA 253 010G BAEA 253 010G BAEA 254 010F 24F7 255 0110 C2FD 255 0111 C2FC 255 0113 C2FC 255 0114 C2FC 256 0115 35 259 260 0116 CB01 241 0118 BAEF 244 011F BAEF 244 011F BAEF 244 011F BAEF 244 011F BAEF 245 0112 9051 246 247 0129 CB01 248 0124 CB01 249 0124 CB01	UPDATE	ST LDE ST LDE ST LDE ST LDI	DPHI (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPLO(P2) O DPHI (P2) O DPHI (P2) PI DPHI (P2) PI DPHI (P2) PI CLK (P3) LO(P2) NXTLOC HT (P2) NXTLOC HT (P2) NXTLOC HT (P2) NXTLOC RETNI O RD (P3) CS (P3) LOAD (P3) LOAD (P3)	.4X  ;5X  ;PROGRAM PROM ;DECREMENT LOWER COUNT ,NOT DONE ;DECREMENT UPPER COUNT ,NOT DONE ;RESTORE P)  ;BUMP PROM COUNTER ;DECREMENT LOWER LOC COUNT ;NOT DONE ;DECREMENT UPPER LOC COUNT ;NOT DONE ;PROGRAMMING DONE ;TURN OFF READ MODE AND ;CHIP SELECT ;SEND DATA TO PROGRAMMER
131 004 132 004 133 004 134 004 135 004 136 005 138 005 139 005 140 005 141 005 142 005 144 006 147 006 147 006 148 006 151 155 154 006 006 006 155 007 155 007 157 007 158 007 158 007 158 007	5 CROC 7 CR1C 7	NOT: RETN2 , ENTRY	LDI ST ST ST LDI ST ST ST LDI ST ST LD JNZ ST PLD JNZ ST PLD JNZ APPC JS  DBYTF JMP  POINT JS  LDI XPAL LDI XPAL LDI ADI	HI(P2) RD(P3) RD(P3) O LO(P2) CLR(P3) CLR(P3) RDPRM(P3) NOT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG  NOTMSG PROMPT TO PROGRAM F P3, GHEX  H(PPROMR) P3 L(PPROMR) P3 Q1(P2) 2	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  .CLEAR PROM COUNTER ;CLEAR DATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT FRASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ,PROM JS ERASED ,GO TO MESSAGE RTN  .PTR TO MESSAGE ;RETURN TO COMMAND PROCESS .PROM W/O CHECK FOR ERASED	235 OOFR 02 234 OOFR 027 237 OOFO F2FA 238 OOF2 CAFA 238 OOF4 C2F9 240 OOFA C2F9 241 OOFA 02 243 OOFR 02FR 244 OOFR 02 243 OOFR 02FR 244 OOFR 02 248 OOFR 02FR 245 OOFR 02FR 245 OOFR 02FR 245 OOFR 02FR 246 OOTA 07 250 OTA 07 250 OTA 07 251 OTA 8AF9 252 OTA 8AF9 253 OTA 8AF9 254 OTA 8AF9 255 OTTA 8AF9 255 OTTA 8AF9 257 OTTA 8AF9 257 OTTA 8AF9 258 OTTA 8AF9 258 OTTA 8AF9 258 OTTA 8AF9 259 OTTA 8AF9 250 OTTA 8AF9 250 OTTA 8AF9 251 OTTA 8AF9 252 OTTA 8AF9 253 OTTA 8AF9 254 OTTA 8AF9 255 OTTA 8AF9 255 OTTA 8AF9 255 OTTA 8AF9 256 OTTA 8AF9 257 OTTA 8AF9 257 OTTA 8AF9 258 OTTA 8AF9 258 OTTA 8AF9 259 OTTA 8AF9 259 OTTA 8AF9 250 OTTA	UPDATE	ST LDI ST LDI ST LDI ST LDI ST LDI ST LLDI ST LDI ST LLDI ST L	DPHI (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPLO(P2) O DPHI (P2) DPHI (P2) O DPHI (P2) PRLP DPHI (P2) PRLP DPHI (P2) PRI (P2) PRI (P2) PRI (P3) LO(P2) NXTLOC HI (P2) NXTLOC HI (P2) NXTLOC RETNI O RD (P3) CS(P3) LOAD (P3) I VSS(P3) USS(P3) O7F	. 4X  ; 5X  ; PROGRAM PROM ; DECREMENT LOWER COUNT ; NOT DONE ; DECREMENT UPPER COUNT ; NOT DONE ; RESTORE P)  ; RUMP PROM COUNTER ; DECREMENT LOWER LOC COUNT ; NOT DONE ; PROGRAMMING DONE ; TURN OFF READ MODE AND ; CHIP SELECT
131 004 132 004 133 004 134 004 135 004 136 137 138 005 139 005 140 005 141 005 142 006 144 006 147 006 148 006 147 006 148 149 006 150 151 152 153 154 006 006 006 007 155 007 155 007 157 007 158 007	5 CROC 7 CR1C 7	NOT: RETN2 , ENTRY	LDI ST ST ST ST ST ST ST LDI ST ST JNZ ST DLD JNZ DLD JNZ DLD JWP  DBYTF JMP  POINT  LDI XPAH LDI XPAH LDI XPAH LDI XPAL LD	HI(P2) RD(P3) CS(P3) O LO(P2) CLR(P3) LOAD(P3) ROPRM(P3) ROT CLK(P3) LO(P2) ELOOP HI(P2) ELOOP P1 P3, MESG  NOTMSG PROMPT TO PROGRAM F P3, GHEX  H(PPROMR) P3 L(PPROMR) P3 L(PPROMR) P3 (P1(P2)	;STACK IS EMPTY, USE AS PTR. ;SET READ MODE ;SELECT PROM SOCKET ;SET LOWER COUNT  :CLEAR PROM COUNTER ;CLEAR BATA LATCHES FOR ,READ ,READ DATA OUT OF PROM ,DATA NOT ZERO? NOT ERASED ;DATA OK, BUMP COUNTER ;DECREMENT LOWER COUNT ;NOT DONE YET ;PROM IS ERASED ,GO TO MESSAGE RTN  -PTR TO MESSAGE ;RETURN TO COMMAND PROCESS -PROM W/O CHECK FOR ERASED ,GET ADDR TO PROG FROM  ,GET UPPER BYTE OF ADDR	235 OOFR 02 234 OOFR 026 238 OOF2 CAFA 238 OOF2 CAFA 238 OOF2 CAFA 239 OOF8 C2F9 240 OOF8 C2F9 241 OOF8 CAF9 242 OOF8 CAF9 243 OOF8 CAF9 244 OOF8 CAF9 244 OOF8 CAF9 245 OOF8 CAF9 246 OOOR CAF9 247 OOO8 CAF9 248 OOF8 CAF9 250 OOO7 3D 251 OOO8 CAF9 252 OOO 9CF8 253 OOO 9CF8 253 OOO 9CF8 253 OOO 9CF8 254 OOF8 CAF9 255 OOO 9CF8 255 OOO 9CF8 255 OOO 9CF8 255 OOO 9CF8 256 OOO 9CF8 257 OOO 9CF8 258 OOO 9CF8 258 OOO 9CF8 258 OOO 9CF8 258 OOO 9CF8 267 OOO 9CF8 268 OOO 9CF8 267 OOO 9CF8 268 OOO 9CF8 267 OOO 9CF8 268 OOO 9CF8 268 OOO 9CF8 268 OOO 9CF8 268 OOO 9CF8 269 OOO 9CF8 267	UPDATE	ST CCCL LO ADD ST LD ADD JW P LD JW	DPHI (P2)  DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPHI (P2) DPLO(P2) DPLO(P2) DPLO(P2) DPHI (P2) PRLP SAVELO(P2) PI CLK (P3) LO(P2) NXTLOC HT (P2) NXTLOC RETNI 0 RD (P3) CS (P3) LOAD (P3) I VSS (P3)	.4x  ;5x  ;PROGRAM PROM ;DECREMENT LOWER COUNT ,NOT DONE ;DECREMENT UPPER COUNT ,NOT DONE ;RESTORE P)  ;RUMP PROM COUNTER ;DECREMENT LOWER LOC COUNT ;NOT DONE ;PROGRAMMING DONE ;PROGRAMMING DONE ;TURN OFF READ MODE AND ; CHIP SELECT ;SEND DATA TO PROGRAMMER ;TURN ON VSS VOLTAGE

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```
278 0137 8800
279 0139 0400
                                                                        DELAY 1 MS
                                                                                                                                     373 O1EB 00
                                                                                                                                                                              BYTE 0
                                        LDI
                                                                                                                                     374
                                                                                                                                                               PRMET
 280 0138 CR14
                                                    VP(F3)
20
0
                                                                         THEN DEE VE
                                                                                                                                     375 01EC 0D0A
376 01EE 3F
                                                                                                                                                                              DBYTE ODOA
 281 013D 0414
282 013F 8F00
                                                                          WAIT 100 MICROSECONDS
                                        LEG
                                                                                                                                                   00
                                        DL V
                                                                                                                                           01EE
 787 0136 8600
283 0141 0400
284 0143 0804
285 0145 0414
                                        LDJ
ST
                                                                                                                                     377
                                                                        TURN OFF VSS VOLTAGE
WAIT 100 MICROSECONDS
                                                    .
VSS(P3)
                                                                                                                                                                   COMMAND TABLE
                                                                                                                                     379
                                        LEGI
                                                    20
 28A 0147 8F00
287 0149 CB0C
                                                                                                                                     380
                                                                                                                                                               CMDTRU
                                                                        SET UP READ MODE
                                                                                                                                     381 01F0 50
                                                                                                                                                                              BYTE
                                                                                                                                     381 0160 50
382 0161 0081
383 0163 59
                                                                                                                                                                              DBYTE PROG-1
 288 014B CB10
                                         ST
                                                    OS(P3)
 289 014D 0400
290 014E 0800
291 0151 0302
                                        UDI
ST
                                                                                                                                                                               BYTE
                                                     .
.OAD(P3)
                                                                        CLEAR DATA LATCHES READ DATA FROM PROM
                                                                                                                                     384 01F4 006A
385 01F6 45
                                                                                                                                                                              DBYTE WOCHK-1
                                                    RDPRM(P3)
                                        LE
                                                                                                                                                                              DBYTE ERASED-1
 292 0153 3D
293 0154 9000
                                                                                                                                     386 01EZ 003A
                                        YEEC
                                                                                                                                     387 01F9 56
388 01FA 0179
                                        IME
                                                                                                                                                                              DBYTE VERIFY-1
 294
 00E
                              CORY PROM TO RANGE IN MEMORY
                                                                                                                                     389 OIFC 43
                                                                                                                                                                               RYTE
 296
297
                                                                                                                                     390 01FD 0155
391 01FF 00
                                                                                                                                                                               DBYTE COPY-1
BYTE O
                           CORY
                                                                                                                                                                              BYTE
 277
298 0156 0401
0158 3504
015A A531
0150 3D
                                        .19:
                                                   P1. SETED
                                                                        SET READ MODE
                                                                                                                                     392
393
                                                                                                                                                                              END
                                                                                                                                                    0000
                                                                                                                                                                                          CLOOP
CPLOOP
ELOOP
                                                                                                                                                                                                                                 0003
001C
0004 #
 299 0150 CA01
                                                                         RETRIEVE ADDR. FROM STACK
ADD 512 OFFSET
                                                                                                                                                               CLK
COPY
DPLO
                                                                                                                                                                           0001
0156
FFEA
                                        LE
                                                    @1 (P2)
                                                                                                                                    BADPRM 01DD
                                                                                                                                                                                                      0021
                                                                                                                                                                                                                     CLR
299 0150 FA01
300 015F F402
301 0161 35
302 0162 0601
303 0164 31
                                        ADI
XEAH
                                                                                                                                    CMDTBL 01F0
                                                                                                                                                                                                      0165
0051
                                                                                                                                                                                                                     CS
ENBL
                                                                                                                                    DPHI
                                        L.Fi
                                                                                                                                                0001
7B50
                                                                                                                                                                           003B
                                                                                                                                                                                                                      GECHO
HI
                                                                                                                                                                                                                                 7A91
                                                    @1 (P2)
                                                                                                                                     ENTRY
                                                                                                                                                               ERASED
                                                                                                                                                                                           ERROR
                                                                                                                                                                                                      0033
                                                                                                                                     GHEX
                                                                                                                                                               GO
LOAD
                                                                                                                                                                                           HCNT
                                                                                                                                                 FFEE
                                                                                                                                                                                                                      MESG
 204
                           CELLODE
                                                                                                                                     ıο
                                                                                                                                                                           0000
                                                                                                                                                                                          LOC
                                                                                                                                                                                                      OOCB
                                                                                                                                                                                                                                 7B17
                                                                         GET PROM DATA
STORE INTO MEMORY
BUMP PROM COUNTER
                                                                                                                                                               NOTMSG
NXTLOC
                                                                                                                                                                           01C4
                                                                                                                                                                                          NOVFY
OK
PHEX
 305 01A5 0302
                                                    RDPRM(P3)
                                                                                                                                     NOT
                                                                                                                                                 0060
                                                                                                                                                                                                      019B
                                                                                                                                                                                                                      NPROG
                                                                                                                                                                                                                                 0002
                                        LĐ
 306 0167 CDEE
307 0169 CB01
                                                                                                                                                                                                                      P1
PPRGMR
                                                                                                                                                                                                                                0001
8000
                                                                                                                                     NVRFY
                                                                                                                                                 01D1
                                                    @-1(F1)
                                         ST
                                                                                                                                                                           0003
                                                                                                                                                                                                       7BB3
                                         ST
                                                    CLK (P3)
                                                                                                                                     P2
PPROM
                                                                                                                                                               P3
PRLP
                                                                                                                                                                                                                     PROG
 308 OLAR RAFE
                                        DI D
                                                    LOCE20
                                                                         DECREMENT LOC COUNTER LOW
                                                                                                                                                0122
                                                                                                                                                                           0107
                                                                                                                                                                                          PRMPT
                                                                                                                                                                                                      OIEC
                                                                                                                                                                                                                                 0082
                                                                                                                                                                                                                     RDPRM
SAVLO
THSLOC
 309 016D 9CF6
                                         JNZ
                                                                                                                                    PROMPT
RETN1
                                                                                                                                                0007
                                                                                                                                                               PUTC
RETN2
                                                                                                                                                                                           RD
SAVHI
                                                                                                                                                                                                                                0002
FFED
310 016F BAEF
311 0171 94F2
312
313 0173 0400
314 0173 5
315 0177 0406
314 0178 31
317 0179 30
318
319
320
                                                                         DECREMENT LOC COUNTER HIGH
 310 01AE BAEE
                                        DUD
JP
                                                    HI (P2)
                                                    CPLOOP
                                                                                                                                     SET
                                                                                                                                                               SETRD
                                                                                                                                                                           0186
                                                                                                                                                                                          STACK
                                                                                                                                                                                                      77D0
                                                                                                                                                                                                                                 00AC
0014
                                                                                                                                     UPDATE 0116
                                                                                                                                                               VERTEY
                                                                                                                                                                           0178
                                                                                                                                                                                           VI NOF
                                                                                                                                                                                                      0189
                           RETN1
                                        LDT
                                                    H(PROMPT)
                                        XE AH
                                                    r:
L(PROMPT)-1
                                        ÛП
                                                                                                                                    NO ERROR | INF:
SOURCE CHECKCOM = 1980
                                         XP'AL
                                        XPEC
                              VERIFY FROM AGAINST RANGE IN MEMORY
 320
                           VERTEY
 321
322 017A 0401
0170 3504
017E A531
0180 3D
323 0181 6601
                                                    P1/SETRD
                                                                        / SET READ MODE
                                                                                                                                                                            TITLE PNLPGM,
                                                                                                                                                                                                       SC/MP PROM PROGRAMMER
                                                                                                                                                                "PNLPGM" IS A PROGRAM THAT ALLOWS THE SC/MP LCDS
TO PROGRAM MM5204 OR MM4204 PROMS USING THE
PANEL FOR ALL INPUTS FROM THE USER.
                                        LΠ
                                                    @1 (P2)
324 0133 F402
325 0185 35
326 0186 0601
327 0188 31
                                        ADI
                                                                         ADD 512 OFFSET
                                        XPAH
                                                                                                                                                                THE USER MUST ENTER THE STARTING HEX ADDRESS TO
BE PROGRAMMED FROM OR COPIED TO INTO POINTER #1
BEFORE EXECUTING EACH ROUTINE
                                        LD.
                                                    @1 (P2)
                                        XPAL
 328
329 0189 6302
                           ML DOE
                                                                                                                                                                THE PROGRAM REQUIRES THAT THERE ARE 512
                                        LD
                                                    RDPRM(P3)
                                                                         GET DATA FROM PROM
                                        XOR
JN7
ST
                                                    @-1(P1)
NOVEY
CLK(P3)
                                                                         COMPARE AGAINST MEM DATA
DOES NOT VERJFY
BUMP PROM COUNTER
 300 0188 ESEE
                                                                                                                                                                CONTINUOUS MEMORY LOCATIONS UPWARDS FROM THE CONTENTS OF POINTER #1
300 0100 PSFF
331 0180 9000
332 0180 9000
333 0191 PAFF
334 0193 90F4
335 0195 PAFF
336 0197 94F0
337 0199 90D8
                                                                                                                                                               "PNLPGM" USES MEMORY ON THE LCDS MOTHERBOARD FOR
TEMPORARY STORAGE. THEREFORE, USER R/W MEMORY
CAN BE ANYWHERE, EXCEPT AS SHOWN BELOW
                                        DLD
JNZ
DLD
                                                    LO(P2)
                                                                          DECREMENT LOC COUNTER LOW
                                                   VLOOP
HI(P2)
                                                                         NOT DONE
DECREMENT LOC COUNTER HIGH
                                                                                                                                    18
19
20
                                        . IF
                                                    VI DOP
                                                                         NOT DONE
                                                                                                                                                                "PNLPGM" CAN BE ASSEMBLED ANYWHERE THE USER HAS MEMORY SPACE EXCEPT IN THE FOLLOWING LOCATIONS
                                        JMF
                           NOVEY
 339 0198 0478
                                        .19
                                                    P3, ME56
                                                                         , GO TO MESSAGE ROUTINE
      019B 37C4
019F 1633
01A1 3F
                                                                                                                                                                                                       LOCATIONS OCCUPIED BY
                                                                                                                                                                  X 8000 -- X183EE
                                                                                                                                                                                                       PROGRAMMER HARDWARE
LOCATIONS USED BY LCDS
                                                                                                                                    23
24
25
26
27
                                                                                                                                                                  X17000 -- X17EEE
 340-01A2-01D1
341-01A4-20CD
                                          DBYTE NVREY
                                                                                                                                                                 THE ENTRY POINTS ARE
                                        JMF
                                                    RETN1
 342
                           SETED
 343 01A6 047B
01A8 3704
01AA 4F33
                                        JS.
                                                    P3, GHEX
                                                                         GET ADDR. TO COPY TO
                                                                                                                                                                                  ADDRESS
                                                                                                                                     28
29
30
32
33
34
35
38
39
                                                                                                                                                                  NAME
 01AC 3F
344 01AD 0486
345 01AF 37
                                                                                                                                                                CKERSD
                                                                                                                                                                                  X 10001
                                                                                                                                                                                                  CHECK PROM FOR ERASED
                                                                                                                                                                                                  PRORGAM PROM WITHOUT CHECK
FOR ERASED
                                                    H(PPRGMR)
                                                                         PUT ADDR OF PROGRAMMER
                                                                                                                                                                 MOICH!
345 01AF 87
344 01R0 (400
347 01R2 33
348 01R3 (401
350 01R7 0R0C
351 01R7 0R0C
352 01RR (400
353 01RD (AF0
354 01R1 (R00
355 01C1 (R00
357 01C3 3R
357
358
357
                                         XF AH
                                                                                                                                                                                                  PROGRAM PROM WITH CHECK FOR
                                        LDI
                                                    L (PPRGMR)
                                                                                                                                                                 PROG
                                                                                                                                                                                  Y:0049
                                                                                                                                                                                                  ERASED
COPY PROM INTO MEMORY
                                                                         SET UPPER LOC COUNTER
                                                                                                                                                                COPY
                                                                                                                                                                                  X:0101
                                        LDI
                                                                                                                                                                                                  VERIFY PROM AGAINST MEMORY
                                                                                                                                                                 VERTEY
                                        ST
                                                    HI+2(P2)
                                                                                                                                                                                  X 10120
                                        ST
                                                    RD(P3)
                                                                        SET READ MODE
SELECT PROM SOCKET
                                                                                                                                                                 "PNLPGM" HALTS WHEN FINISHED OR ON ERRORS
                                                    CS(P3)
                                                                                                                                    40
                                        LDI
                                                                                                                                                                ERROR HALTS ARE
                                        8T
8T
                                                    L0+2(P2)
                                                                                                                                                                                 PROM NOT FRASED
PROM CANNOT BE PROGRAMMED
PROM DOES NOT VERIEY
                                                                                                                                                                  x 0035
x 0085
                                                                         CLEAR PROM COUNTER
                                                    CLR (P31
                                                                         CLEAR PROM DATA LATCHES
                                        ST
                                                    LOAD (P3)
                                                                                                                                                                   X 015A
                                                                                                                                                                 THE "HALT INST" SWITCH ON THE LODS MOTHERBOARD MUST BE IN THE "DEBUG" POSITION BEFORE EXECUTION
                                          PAGE
                                                    IMESSAGES AND COMMAND TARLES
                                                                                                                                    47
                                                                                                                                    49
                              MESSAGES
                                                                                                                                                                            PAGE
                                                                                                                                                                                        POINTERS AND CONSTANTS
 361
361
362
363 0164 000A
364 0166 4E4F
0168 5420
0164 4552
0166 4153
016F 4544
                           NOTMS6
                                                                                                                                    50
                                          DBYTE ODOA
                                                                                                                                                                             =0
                                          ASCII NOT ERASED
                                                                                                                                    57
53
                                                                                                                                                 0001
                                                                                                                                                 0002
0003
                                                                                                                                    57
57
58
59
 365 0100 00
                                                                                                                                                  8000
                                                                                                                                                             PERCME
                                                                                                                                                                                     08000
                                                                                                                                                                                                    PERIPHERAL ADDR OF PROM
                                          BYTE O
                                                                                                                                                                                                   PERIPHERAL ADDR OF PROM PROSENTER OF PROSENTER OF POR PROS VOLTAGE ORDER CODE FOR READ VOLTAGE ORDER CODE FOR CHIP SELECT ORDER CODE TO LOAD HATA ORDER CODE TO LOAD HATA ORDER CODE TO LOAD HATA ORDER CODE TO LOAD HATA
                           NVRFY
 366
367 0101 000A
                                          DBYTE ODOA
ASCII (NO VERIFY
                                                                                                                                                  0014
 368 01D3 4E4F
01D5 2056
01D7 4552
                                                                                                                                                             RD
VSS
CS
                                                                                                                                    60
61
                                                                                                                                                  ODO
                                                                                                                                                  0004
                                                                                                                                                                                     04
                                                                                                                                                                                     oic
                                                                                                                                                  6016
                                                                                                                                    62
63
54
65
       01D9 4946
01DB 59
                                                                                                                                                             LOAD
                                                                                                                                                  0000
                                                                                                                                                                                                    ORDER CODE TO READ PROM
 369 01DC 00
370
                                                                                                                                                              RDERM
                                          BYTE O
                           BADERM
                                                                                                                                     66
67
                                                                                                                                                                                                     DATA
                                                                                                                                                                                                   CORDER CODE TO CLEAR COUNTER CORDER CODE TO ENABLE CONTROL
 371 010D 000A
                                          DBYTE ODOA
                                                                                                                                                  0003
 372 01DF 4241
01E1 4420
01E3 5052
                                          ASCLI "BAD PROM AT
                                                                                                                                     68
                                                                                                                                                  0004
                                                                                                                                                             ENBI
                                                                                                                                     ķ
                                                                                                                                                                                                      LATCH
                                                                                                                                                  7.756
                                                                                                                                                              RAM
                                                                                                                                                                                     07700
                                                                                                                                                                                                   .RAM POINTER TO MOTHERBOARD
. R/W MEMORY
       01E5 4E4D
                                                                                                                                                                                                   TEMPORARY LOCATIONS IN RAM
       01E7 2041
01E9 5420
                                                                                                                                                              Нſ
```

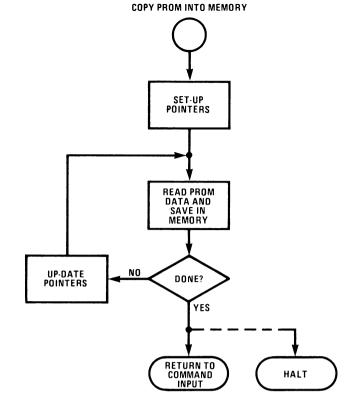
FEFT

1.0

75	FFFF	SAVLO	<del>2.</del>	-7		193 0085	02		CCL		
74	EEED EEEC	SAVHT HONT	<u></u>	-3 -4		194 0086 195 0088			LDI ST	O DPHI(P2)	CLEAR UPPER D. P. COUNT
77	EEFE	DPLO		-5		196 008A	FAFC		CAD	HONT (P2)	COMPLEMENT HIT COUNT
7(3 7(3	FFFA	DPH)		[		197 0080 198 008E			ST CCL	HONT (P2)	;CLEAR CARRY/LINK FLAG
80 81			PAGE	PROM AC	CESS AND PROGRAMMING ROUTINES	199 008F	F2FC		ADD	HONT (P2)	COMPUTE 5X
80		ROUT	INE TO	CHECK PROM	FOR ERASED CONDITION	200 0091 201 0093			ST LDJ	DPLO(P2) O	
83 84 (	3000 08		NOP			202 0095 203 0097			ADD ST	DPHI(P2) DPHI(P2)	, 2X
25		CKERSO				204 0099	02		CCL		, 24
	0001 0408   0003 31		L.DJ XPAL	L(ERASED) = P1	1	205 009A 206 009C			LD ADD	DPLO(P2) DPLO(P2)	
	0004 6400 - 0006 35		L DIT XPAH	H(ERASED) P1		207 009E	CAEB		ST	DPLO(P2)	
90 (	0007 3D		XPPC	Pi		208 00 <b>A</b> 0 209 00 <b>A</b> 2			LD ADD	DPHI(P2) DPHI(P2)	
91 ( 92	00-8000		HAI_T		HALT IF ERASED	210 00A4 211 00A6			ST CCL	DPHI(P2)	; 4X
93					O CALLED BY "PROG " TO	212 00 <b>A</b> 7	C2FC		LD	HCNT(P2)	
94 95		VERTI	Y THA	THE PROM I	S ERASED	213 00A9 214 00AB			ADD ST	DPLO(P2) DPLO(P2)	
96 07 d	Sooo cano	ERASED				215 00AD			LDI	0	
99.0	0009 C4D0 - 000B 32		L D T XEAL	L (RAM) P2	· INIT RAM POINTER	216 00AF 217 00B1			ADD ST	DPHI(P2) DPHI(P2)	. 5Y
29 ( 100 (	0000 0 <b>477</b> 000 <b>E</b> 06		LDJ XPAH	H(RAM) P2		218 219 00B3	30	PRLP.	XPPC	P1	FROGRAM PROM
101		ERAS2				220 00B4	BAFB		DL D	DPLO(P2)	DECREMENT LOWER COUNT
	000F C480 - 0011 37		XF:AH	H(PPRGMR) P3	SET ADDR OF PROGRAMMER	221 00B6 222 00B8			JINZ DLD	PRLP DPHI(P2)	- NOT DONE - DECREMENT UPPER COUNT
	0012 0400 - 0014 33		LDI XPAL	L(PPRGMR) P3		223 00BA 224 00BC			JP LD	PRLP SAVLO(P2)	NOT DONE
106. 0	0015 0401		LDJ	1	SET UPPER COUNT	225 00BE	31		XPAL.	P1	RESTORE P1
	0017 CA00 - 0019 CB0C -		ST	HI(P2) RD(P3)	:STACK IS EMPTY, USE AS PTR. ->SET READ MODE	226 00BF 227 0001			LD XEAH	SAVHI(P2) P1	
109 0	001B CB1C		ST	CS(P3)	SELECT PROM SOCKET	228		UPDATE			
	001D C400 001F CAFF		I.DI ST	0 LO(P2)	SET LOWER COUNT	229 0002 230 0004			ST DLD	CLK(P3) LO(P2)	DECREMENT LOWER LOC COUNT
	0021 CB03 0023 CB00		ST ST	CLR(P3) LOAD(P3)	CLEAR PROMICCUNTER CLEAR DATA LATCHES FOR READ	231 000A 232 0008			JN7 DLD	NXTLOC HI(E2)	,NOT DONE :DECREMENT UPPER LOC COUNT
114		FLOOP:				233 000A	949F		JP	NXTLOC	NOT DONE
	0025 0302   0027 900B		UD UNZ	RDPRM(P3) NOT	⇒READ DATA OUT OF PROM ⇒DATA NOT ZERO? NOT ERASED	234 0000 235	00	PPROM	HAL T		HALT WHEN DONE
	0029 CB01		ST	CLK(P3)	DATA OK BUMP COUNTER	236 00CD			LEU	0	
	002B BAFF 002D 90FA		DLD JNZ	LO(P2) ELOOP	; DECREMENT LOWER COUNT ; NOT DONE YET	237 000F 238 00D1			ST ST	RD(P3) CS(P3)	TURN OFF READ MODE AND CHIP SELECT
	002F BA00   0031 94F2		DUD JP	HT (P2) ELOOP	DECREMENT UPPER COUNT	239 0003	40		LDE		
122 0	2033 3D			PI	FROM IS ERASED	240 00Л4 241 00Л6			ST LDJ	LOAD(P3) 1	SEND DATA TO PROGRAMMER
123 124 C	0034-00	NOT.	HALT		HALT IF PROM NOT ERASED	242 00D8 243 00DA			ST LDJ	VSS(P3) 07F	TURN ON VSS VOLTAGE WAIT 500 MICROSECONDS
125 126		ENTE				244 0000	8F00		Dt. Y	0	
127			POINI	TO PROGRAM	PROM W/O CHECK FOR ERASED	245 000E 246 00E0			ST UDI	VP(P3) OFF	TURN ON PROGRAM PULSE
128 129 (	0035-02	WOOHK:	cot			247 00E2 248 00E4			DL.Y LDI	0	DELAY 1 MS
130 0	0036 0477		LDT	H(RAM)	, INIT RAM POINTER	249 00E6	CB14		ST	VP(P3)	.TURN OFF VP
	0038-36 0039-0400 -		XPAH LDJ	P2 L(RAM)		250 00F8 251 00FA			L.D.J. DL.Y	20 0	- WAIT 100 MICROSECONDS
133 0	003B 32		XPAL	P2		252 00EC	C400		LDI	0	
135.0	0030 0480 003E 37		LDI XPAH	H(PPRGMR) P3		253 00EE 254 00E0			ST LDI	VSS(P3) 20	;TURN OFF VSS VOLTAGE WAIT 100 MICROSECONDS
	003F C400   0041 33		LDI XPAL	L(PPRGMR) P3		255 00F2 256 00F4			DLY	O	
138 0	0042 35		XPAH	P1		257 00F4	CRIC		ST ST	RD(P3) CS(P3)	-SET UP READ MODE -SELECT PROM SOCKET
	0043 F402 0045 35		ADI XPAH	2 P1	ADD 512 OFFSET	258 00F8 259 00FA			LDI ST	O LOAD (PB)	CLEAR DATA LATCHES
	0046 9019		JMF	SET		260 00FC	0302		LD	RDPRM(P3)	PEAD DATA FROM PROM
				TO PROGRAM	PROM W/CHECK FOR ERASED	261 00FF			XPPC UMP	P1 PPROM	
142 143		- ENTRY	POINT			262 OOFF			CH H		
147					M MOST SIGNIFICANT ADDRESS	243		CORV		O DONCE IN	MEIMORY
142 143 144 145 146		PROM TO LE	JS PRO TAST SI	GRAMMED FROM	M MOST SIGNIFICANT ADDRESS DDRESS DUE TO INVERSION OF	26 <b>4</b> 26 <b>5</b>				O RANGE IN	MEMORY
142 143 144 145		PROM	JS PRO TAST SI	GRAMMED FROM	M MOST SIGNIFICANT ADDRESS DDRESS DUE TO INVERSION OF	243 26 <b>4</b> 265 266	02	CORY CORY	PROM T	O RANGE IN	MEMORY
142 143 144 145 146 147 148 149	00 <b>4</b> 8 07	PROM TO LE	JS PRO (AST SJ (ER.	GRAMMED FROM	M MOST SIGNIFICANT ADDRESS DDRESS DUE TO INVERSION OF	263 264 265 266 267 0101 268 0102	0477		PROM T CCL LDI	H(RAM)	MEMORY
142 143 144 145 146 147 148 149 150 0	048 02 049 0400	PROM TO LE COUNT	JS PRO CAST SJ TER. CCL LDJ	GRAMMED FROM	M MOST SIGNIFICANT ADDRESS DDRESS DUE TO INVERSION OF	263 264 265 266 267 0101	0477 36		PROM T		MEMORY
142 143 144 145 146 147 148 149 150 0	049 0400 048 32	PROM TO LE COUNT	JS PRO CAST SJ CER. CCL LDJ XPAL	GRAMMED EROI GNIFICANT AI L(RAM) P2	M MOST SIGNIFICANT ADDRESS DDRESS DUE TO INVERSION OF	263 264 265 266 267 0101 268 0102 269 0104 270 0105 271 0107	0477 36 0400 32		CCL LDI XPAH LDI XPAL	H(RAM) P? L(RAM) P2	MEMORY - INIT RAM POINTER
142 143 144 145 146 147 148 149 150 0 151 0 152 0 153 0	0049 C4D0 004B 32 004C C477 004E 36	PROM TO LE COUNT	JS PRO CAST SI CER. CCL LDI XPAL LDI XPAH	GRAMMED FROM GNIFICANT AN L.(RAM) P2 H.(RAM) P2 P2 P2	DDRESS DUE TO INVERSION OF	263 264 265 266 267 0101 268 0102 269 0104 270 0105 271 0107 272 0108 273 0109	C477 36 C4D0 32 31 CAFE		CCL LDI XPAH LDI XPAL XPAL ST	H(RAM) P2 L(RAM) P2 P1 SAVLO(P2)	
142 143 144 145 146 147 148 149 150 0 151 0 152 0 153 0 154 0	0049 C4D0 004B 32 004C C477 004E 36 004F 31	PROM TO LE COUNT	JS PRO CAST SI TER. CCL LDI XPAL LDI	GRAMMED EROI GNIFICANT AI L.(RAM) P.2 H.(RAM)	M MOST SIGNIFICANT ADDRESS DDRESS DUE TO INVERSION OF  SAVE ADDRESS	2/48 2/64 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 01008	0477 36 0400 32 31 0AFE 35		CCL LDI XPAH LDI XPAL XPAL ST XPAH	H(RAM) P2 L(RAM) P2 P1 SAVL0(P2) P1	·INIT RAM POINTER
142 143 144 145 146 147 148 149 150 0 151 0 153 0 154 0 155 0	0049 C4B0 004B 32 004C C477 004E 36 004F 31 0050 CAFE	PROM TO LE COUNT	JS PRO AST SI ER. CCL LDI XPAL LDI XPAH XPAH XPAL ST XPAH	GRAMMED FROM GNJFICANT AL L(RAM) P2 H(RAM) P2 P1 P1 SAVLO(P2)	DDRESS DUE TO INVERSION OF	2/43 2/64 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 0108 2/75 0100 2/76 010E	C477 36 C4DO 32 31 CAFE 35 F4O2 CAFD		CCL LDI XPAH LDI XPAL XPAL XPAH ADI ST	H(RAM) P2 L(RAM, P2 P1 SAVLO(P2) P1 2 SAVHI(P2)	JNIT RAM POINTER  ADD 512 OFFSET
142 143 144 145 146 147 150 0 151 0 152 0 153 0 154 0 157 0 158 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 C4D0 004B 32 004C C477 004E 36 004F 31 0050 CAFE 0052 35 0053 CAFD	PROM TO LE COUNT	IS PROTACT STATES AND A STATES	GRAMMED FROM GNIFICANT AL L.(RAM) F2 H(RAM) F2 F1 SAVLO(F2) F1 SAVHI(P2) L.(FRAS2)-1	DDRESS DUE TO INVERSION OF	2/48 2/64 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 0106 2/76 0106 2/77 0110	C477 36 C4D0 32 31 CAFE 35 F402 CAFD C401 35C4		CCL LDI XPAH LDI XPAL XPAL XPAL ST XPAH ADI	H(RAM) P7 L(RAM) P2 P1 SAVL0(P2) P1	·INIT RAM POINTER
142 143 144 145 146 147 148 150 0 151 0 152 0 153 0 154 0 157 0 158 0 157 0 158 0 159 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 C4D0 0048 32 004C C477 004E 36 004F 31 0050 CAFE 0052 35	PROM TO LE COUNT	JS PROTAST SI FER. CCL LDI XPAL LDI XPAH XPAH XPAH ST XPAH ST	GRAMMED FROM GNIFICANT AL L.(RAM) P2 H(RAM) P1 SAVLO(P2) P1 SAVLO(P2)	DDRESS DUE TO INVERSION OF	2/43 2/64 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 010E 2/75 010C 2/76 010E 2/77 0110 011/2 0114	C477 36 C4D0 32 31 CAFE 35 F402 CAFD C401 35C4 5931		CCL LDI XPAH LDI XPAL XPAL XPAH ADI ST	H(RAM) P2 L(RAM, P2 P1 SAVLO(P2) P1 2 SAVHI(P2)	JNIT RAM POINTER  ADD 512 OFFSET
142 143 144 145 146 147 148 150 0 151 0 152 0 154 0 155 0 157 0 158 0 157 0 158 0 159 0 160 0 161 0 16 160 160	0049 C4D0 0048 32 0040 C477 0046 36 004F 31 0050 CAFF 0052 35 0053 C40F 0057 31 0058 3D	PROM TO LE COUNT	IS PROJECT SITES OF THE PROJEC	GRAMMED FROM GNIFICANT AI L.(RAM) F2 H(RAM) F2 SAVLO(F2) F1 SAVLO(F2) L(ERAS2)-1 F1 F1 F1 SAVLO(F2)	DDRESS DUE TO INVERSION OF	2/48 2/64 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 0106 2/76 0106 2/76 0106 2/77 0110 0114 0116 2/78 0117	0477 36 0400 32 31 0AFE 35 F402 0AFD 0401 3504 5931 30 02FD		CCL LDI XPAH LDI XPAL XPAL XPAH ADI ST JS	H(RAM) P2 1 (RAM) P2 P1 SAVL0(P2) P1 2 SAVH1(P2) P1-SETRD	JNIT RAM POINTER  ADD 512 OFFSET
142 143 144 145 146 147 148 150 0 151 0 152 0 153 0 154 0 155 0 156 0 157 0 158 0 0 158 0 0 0 158 0 0 0 0 0 158 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 (400) 0048 (32) 0040 (347) 0040 (36) 0040 (36) 0050 (36) 0050 (36) 0050 (406) 0053 (406) 0057 (31) 0058 (31) 0050 (22ED)	PROM TO LE COUNT	IS PROJECT SITES.  CCL LDI XPAH XPAL ST LDI XPAH ST LDI XPAL XPAL XPAL XPAL XPAL XPAL XPAL XPAL	GRAMMED FROM GNIFICANT AL L.(RAM) F2 H(RAM) F2 F1 SAVLO(P2) F1 SAVHI(P2) L(FRAS2)-1 F1 SAVLO(P2) F1 SAVLO(P2)	DDRESS DUE TO INVERSION OF  ;SAVE ADDRESS. ;CHECK PROM FOR FRASED	2/48 2/64 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 0106 2/76 0106 2/77 0110 0112 0114 0116	0477 36 04D0 32 31 0AFE 35 6402 0AFD 0401 3504 5931 3D 02FD 35		CCL LDI XPAH LNI XPAL XPAL ST XPAH ADI ST JS	H(RAM) P2 L(RAM) P1 SAVL0(P2) P1 SAVL0(P2) P1 SAVHI(P2) P1:SETRD	.INIT RAM POINTER ,ADD 512 OFFSET .SET READ MODE
142 143 144 145 146 147 148 150 0 151 0 152 0 153 0 154 0 155 0 156 0 157 0 158 0 159 0 160 0 161 0 162 0 163 0 164 0 164 0 164	0049 C4D0 0048 32 004C C477 004C 36 004F 31 0050 CAFE 0052 35 0053 CAFD 0057 31 0059 C2FE 0058 31	PROM TO LE COUNT	IS PROJECT SITES.  CCL LDI XPAL LDI XPAH XPAL ST XPAH ST LDI XPAL XPAL XPAL XPAL XPAL XPAL XPAL XPAL	GRAMMED FROM GNIFICANT AL L.(RAM) P2 H(RAM) P1 SAVLO(P2) P1 SAVHI(P2) L.(ERAS2)-1 P1 SAVLO(P2) P1 SAVLO(P2) P1	DDRESS DUE TO INVERSION OF	2/48 2/44 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 010E 2/75 010C 2/74 010E 2/77 0110 0112 0114 0116 2/79 0117 2/80 0114 2/81 0116	0477 36 0400 32 31 04FE 55 F402 04FD 0401 3504 5931 30 02FE	EGPY-	CCL LDI XPAH LDI XPAL XPAH ADI ST JS	H(RAM) P2 L(RAM) P2 P1 SAVL0(P2) P1 SAVHI(P2) P1-SETED  SAVHI(P2) P1	.INIT RAM POINTER ,ADD 512 OFFSET .SET READ MODE
142 143 144 145 146 148 150 151 152 0 153 0 154 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 169 0 161 0 162 0 164 0 165 0 166 0 166 0 167 0 168 0 168 0 169 0 0 169 0 0 169 0 0 0 169 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 C4D0 004B 32 004C C477 004E 36 004F 31 0050 CAFE 0052 35 0053 C40F 0055 C40F 0058 3D 0059 C2FE 005C C2FD 005C C2FD 005C 35 0060 35	PROM TO LE COUNT	IS PROJECT SITES.  CCL LDI XPAL LDI XPAL ST XPAL LDI	L(RAM) P2 H(RAM) P2 H(RAM) P2 SAVLO(P2) P1 SAVLO(P2) L(FRAS2)-1 P1	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET	2/43 2/44 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 0106 2/76 0106 2/76 0106 2/76 0112 0114 0116 2/79 0117 2/79 0117 2/80 0117 2/80 0117 2/81 0117 2/81 0117 2/81 0117 2/82 0117 2/83 0110	0477 36 74P0 32 31 7AFE 35 F402 C401 35F4 5931 70 C2FE 31 C302		CCL LDI XPAH LDI XPAL XPAL XPAH ADI ST JS	H(RAM) P2 1 (RAM) P2 P1 SAVL0(P2) P1 2 SAVHI(P2) P1-SFTRD  SAVHI(P2) P1 RDPRM(P3)	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS
142 143 144 145 146 147 150 151 152 0 153 0 154 0 157 0 158 0 157 0 158 0 0 158 0 0 0 158 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 C4D0 004B 32 004C C477 004E 36 004F 31 0050 CAFE 0052 35 0053 CAFD 0057 31 0058 3D 0050 C2FE 005B 31 005C C2FD 005E F402 0060 35	PROM TO LE COUNT PROG.	IS PROJECT SITES.  CCL LDI XPAL LDI XPAL ST LDI XPAL XPAL XPAL XPAL XPAL XPAL XPAL LDI XPAL LDI ADI XPAL LDI ADI XPAL LDI ADI XPAL LDI ADI XPAL LDI	GRAMMED FROM GNIFICANT AN L.(RAM) P2 H.(RAM) P2 P1 SAVLO(P2) P1 SAVLO(P2) L.(ERAS2)-1 P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVHI(P2) 2 P1	DDRESS DUE TO INVERSION OF  ;SAVE ADDRESS. ;CHECK PROM FOR FRASED	248 264 265 266 267 0101 268 0102 269 0104 270 0105 271 0107 272 0108 273 0109 274 010E 275 010C 276 010E 277 0110 0112 0114 0116 278 0117 279 0117 280 0114 281 011C 282 283 011D 284 011F	0477 36 7400 32 31 0466 35 6460 6401 357 6401 367 6270 35 6276 6302 6002	EGPY-	CCL LDI XPAL IDI XPAL XPAL XPAH ADI ST XPAH LD XPAH LD XPAL LD XPAL LD	H(RAM) P2 L(RAM) P2 P1 SAVL0(P2) P1 2 SAVH1(P2) P1, SETRD  SAVH1(P2) P1 SAVL0(P2) P1 SAVL0(P2) P1 SAVL0(P2) P1	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY
142 143 144 145 146 148 150 151 152 0 154 0 157 0 158 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 C4D0 004R 32 004C C477 004E 36 004F 31 0050 C4FF 0053 C4FF 0053 C4FD 0057 31 0059 C2FE 0058 31 0056 C2FD 0056 F402 0060 35 0064 C401 0064 C400 0067 C46F	PROM TO LE COUNT PROG.	IS PROTAST STEEL S	GRAMMED FROM GNIFICANT AL L.(RAM) P2 H(RAM) P1 SAVLO(P2) P1 SAVHI(P2) L(ERAS2)-1 P1 P1 P1 SAVHO(P2) P1 SAVHI(P2) 2 P1 HI(P2) 0 LO(P2)	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT  SET LOWER LOC COUNT	2/48 2/64 2/65 2/66 2/67 2/68 2/67 2/69 2/69 2/70 2/70 2/70 2/70 2/70 2/70 2/70 2/70	0477 36 7400 32 31 0466 35 6402 0401 5901 90 70 70 70 0266 31 0302 0666 08666	EGPY-	CCL LDI XPAH LDI XPAL XPAL XPAL XPAH ADI XFAH LD XPAL LD ST ST ST ST ST ST ST ST ST ST ST ST ST	H(RAM) P2 L(RAM) P2 P1 SAVLO(P2) P1 2 SAVHI(P2) P1.SFTRD  SAVHI(P2) P1 SAVLO(P2) P1 RDPRM(P3) @~1(P1) CLK(P3)	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS
142 143 144 145 146 148 150 151 152 0 154 0 157 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 159 0 169 0 0 169 0 0 169 0 0 169 0 0 169 0 0 169 0 0 169 0 0 169 0 0 169 0 0 0 169 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 (*400) 0048 32 0040 (*277) 0046 36 0047 31 0050 (*31) 0050 (*31) 0050 (*31) 0057 31 0059 (*32) 0058 31 0050 (*32) 0050 (*32) 0050 (*32) 0060 (*35) 0041 (*401) 0043 (*400) 0047 (*400) 0047 (*400)	PROM TO LE COUNT PROG.	JS PROCAST SI	GRAMMED FROM GNIFICANT AL L(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVHI(P2) L(FRAS2)-1 P1 P1 SAVLO(P2) P1 SAVHI(P2) P1 HI(P2) O LO(P2) CLR(P3)	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT  CLEAR PROM COUNTER	2/43 2/44 2/65 2/66 2/67 0101 2/68 0102 2/69 0104 2/70 0105 2/71 0107 2/72 0108 2/73 0109 2/74 0106 2/75 0106 2/75 0106 2/77 0110 011/4 011/6 2/79 0117 2/79 0119 2/80 011/4 2/81 011/6 2/82 2/83 011/10 2/84 011/6 2/85 01/11 2/85 01/11 2/85 01/11 2/85 01/11 2/85 01/11 2/85 01/11 2/85 01/11 2/85 01/11 2/85 01/11 2/85 01/12 2/85 01/12	C477 C4D0 32 31 CAFE 35 F402 C401 30 C2FD 35 C2FE 31 C302 CDFF CR01 BAFF 9CFA	EGPY-	CCL LDI XPAH LDI XPAL XPAL XPAH ADI ST JS LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL DD XPAL DD XPAL DD XPAL XPAL XPAL XPAL XPAL XPAL XPAL XPAL	H(RAM) P2 L(RAM) P2 P1 SAVLO(P2) P1 2 SAVHI(P2) P1.SFTRD  SAVHI(P2) P1 RDPRM(P3) @-1(P1) CLK(P3) LO(P2) CPLOOP HI(P2)	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH
142 143 144 145 146 147 148 150 151 152 0 154 0 157 0 158 0 157 0 158 0 0 158 0 0 158 0 0 0 158 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 C4D0 004R 32 004C C477 004E 36 004F 31 0050 C4FF 0053 C4FF 0053 C4FD 0057 31 0059 C2FE 0058 31 0056 C2FD 0056 F402 0060 35 0064 C401 0064 C400 0067 C46F	PROM TO LE COUNT PROG.	IS PROTAST STEEL S	GRAMMED FROM GNIFICANT AL L.(RAM) P2 H(RAM) P1 SAVLO(P2) P1 SAVHI(P2) L(ERAS2)-1 P1 P1 P1 SAVHO(P2) P1 SAVHI(P2) 2 P1 HI(P2) 0 LO(P2)	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT  SET LOWER LOC COUNT	248 264 265 266 267 0101 268 0102 269 0104 270 0105 271 0107 272 0108 273 0109 274 010E 275 010C 276 010E 277 0110 0112 0114 0116 278 0117 279 0119 280 0114 281 011C 282 283 011D 284 011F 285 0121 287 0125 288 0127 289 0129	C477 36 614D0 37 37 38 38 646P 6402 6401 3866 6401 3866 626P 626P 626P 626P 626P 626P 626P 6	EGPY-	GCL LDI XPAL XPAL XPAL XPAL ADI ST JS LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL XPAL XPAL XPAL XPAL XPAL XPAL XPAL	H(RAM) P2 L (RAM) P2 P1 SAVHI (P2) P1-SETRD  SAVHI (P2) P1 RDPRM(P3) e-1 (P1) L (K(P3) L (P2) L (P(P2) L (P(P3) L (P3) L (P(P3) L (P(P3) L (P3) L (P(P3) L (P(P3) L (P3) L (P(P3) L (P3) L (P(P3) L (P3)	JNIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE
142 143 144 145 146 148 149 150 151 0 152 0 153 0 154 0 155 0 156 0 157 0 164 0 167 0 168 0 169 0 169 0 171 0 172 0 173	0049 C4D0 004R 32 004C C477 004E 36 004F 31 0050 C4FF 0053 C4FF 0053 C4FF 0057 31 0059 C2FF 0058 31 005C C2FD 005E F402 0060 35 0061 C401 0063 C400 0065 C400	PROM TO LE COUNT PROG.	JS PROCAST SI ER.  CCL LDI LDI XPAH LDI XPAH XPAH LDI XPAH XPC LDI XPAH LDI XPAH LDI XPAH LDI XPAH LDI XPAH LDI ST LDI ST LDI XAE	L(RAM) P2 H(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR PROM COUNTER  GET DATA TO PROGRAM SAVE IN EXTENSION REG.	2/48 2/44 2/65 2/64 2/65 2/67 2/68 2/67 2/69 2/69 2/79 2/70 2/70 2/70 2/70 2/70 2/70 2/70 2/70	C477 36 614D0 37 37 38 38 646P 6402 6401 3866 6401 3866 626P 626P 626P 626P 626P 626P 626P 6	COPY-	CCL LDI XPAH XPAL XPAL XPAH ADI ST ADI XPAH LD XPAL LD ST FILD JP HALT	H(RAM) P2 L(RAM) P2 P1 SAVLO(P2) P1 2 SAVHI(P2) P).SFTRD  SAVHI(P2) P1 RDPRM(P3) e~1(P1) CLK(P3) LO(P2) CPLOOP LOOP	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE
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142 143 144 145 146 148 149 150 151 152 0 153 0 154 0 157 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 158 0 0 0 158 0 0 0 0 158 0 0 0 0 158 0 0 0 0 158 0 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 158 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 158 0 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 0 158 0 0 158 0 0 0 0 158 0 0 0 0 158 0 0 0 0 158 0 0 0 0 158 0 0 0 158 0 0 0 0 158 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 (4NO 004R 32 004C (2477 004E 36 004F 31 0050 (AFF 0059 (24F) 0059 (27F 0059 (27F 0050 35 0050 (2400 0045 (2400 0045 (2400 0045 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0046 (2400 0047 (2406 0047	PROM TO LE COUNT PROG.	JS PROCAST SI	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H.(RAM) P2 P1 SAVLO(P2) P1 SAVHI(P2) L.(ERAS2)-1 P1 SAVHI(P2) P1 SAVHI(P2) P1 SAVHI(P2) Q-1(P1) H.(PPROM) P1 SAVHI(P2)	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR PROM COUNTER  GET DATA TO PROGRAM SAVE IN EXTENSION REG.	248 264 265 266 267 0101 268 0102 269 0104 270 0105 271 0107 272 0108 273 0109 274 010E 275 010C 276 010E 277 0110 0112 0114 0116 278 0117 279 0119 280 0114 281 011C 282 283 011D 284 011F 285 0121 286 0123 287 0125 288 0127 299 0128 291	C477 32 31 CAPE 35 F402 CAPD 35C4 5921 30 C2FE 31 CCDFF CCR01 BAPF 9CFA BAPF 9CFA BAPF 9CFA BAPF 9CFA	COPY-	CCL LDI XPAL XPAL XPAL XPAH LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL VPAL VPAL VPAL VPAL VPAL VPAL VPAL V	H(RAM) P2 L(RAM) P2 P1 SAVLO(P2) P1 2 SAVHI(P2) P).SFTRD  SAVHI(P2) P1 RDPRM(P3) e~1(P1) CLK(P3) LO(P2) CPLOOP LOOP	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE
142 143 144 145 146 147 148 149 150 151 0 152 0 154 0 157 0 160 0 161 0 162 0 164 0 167 0 169 0 171 0 172 0 173 0 174 0 177 0 178 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 179 0 180 0 180	0049 (4NO 004R 32 004C (2477 004E 36 004F 31 0050 (AFF 0053 (AFF 0053 (AFF) 0057 31 0059 (22FE 0058 31 005C (22FD 005E 7402 0060 35 0061 (401 0063 (A90 0065 (2400 0065 (2400 0065 (2400 0065 (2400 0065 (2400 0067 (AFF 0069 (B03) 0068 (SFF 0060 (2400 0066 (2400 0065 (2400 0067 (AFF 0060 (2400 0067 (AFF 0060 (2400 0061 (AFF) 0060 (2400 0061 (AFF) 0063 (AFF) 0063 (AFF) 0073 (AFF) 0073 (AFF)	PROM TO LE COUNT PROG.	JS PROCAST SI ER.  CCL LDI XPAH XPAH XPAH XPAH XPPC LDI XPAH LDI X	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVLO(P2) P1 P1 P1 SAVLO(P2) P1 1 HI(P2) 0 LO(P2) CLR(P3) e-1(P1) H(PPROM) P1 SAVHI(P2) L(ERROM) P1 SAVHI(P2) L(ERROM) P1 SAVHI(P2) L(PROM) P1 SAVHI(P2) L(PROM) P1	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR FROM COUNTER CLEAR FROM COUNTER SAVE IN EXTENSION REG. SET ADDR. OF PROGRAMMING RIN	2/43 2/64 2/65 2/64 2/65 2/66 2/67 2/69 2/69 2/69 2/79 2/70 2/70 2/70 2/70 2/70 2/70 2/70 2/70	C477 36 614D0 32 31 64FF 35 F402 64FD 35674 5231 30 62FF 31 C302 CDFF CB01 BAFF 9CFA BAPF 9CFA 00 02 6477	CPL OOP-	CCL LDI XPAH LDI XPAH ST XPAH ADI ST XPAH LD XPAL LD XPAL LD ST DLD JP HALT Y PROM	H(RAM) P2 L(RAM) P2 P1 SAVLO(P2) P1 2 SAVHI(P2) P1.SFTRD  SAVHI(P2) P1 RDPRM(P3) e~1(P1) CLK(P3) LO(P2) CPLOOP HI(P2) CPLOOP HI(P2) CPLOOP HI(PA)	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE
142 143 144 145 146 147 148 150 151 0 152 0 154 0 157 0 158 0 161 0 162 0 167 0 168 0 177 0 178 0 177 0 178 0 178 0 179 0 181 0 182 0 181 0 182 0 183 0 183 0 183 0 183 0 183 0 183 0 183 0 183 0 183 0 183	0049 C4D0 0048 32 0040 C477 004E 36 004F 31 0059 C4FF 0059 C4FF 0059 C2FE 0058 31 0059 C2FE 0058 31 0059 C2FE 0060 35 0061 C401 0063 C400 0067 C401 0068 C5FF 006B C5FF 006B C5FF 006B C5FF 006C C400 0070 35 0071 C4FD 0073 C4CC 0075 31	PROM TO LE COUNT PROG.	JS PROCAST SI GRAT SI ER.  CCL LDI LDI XPAH ST AH ST AH ST LDI XPAL LDI XPAL LDI ST ST LDI ST ST LDI ST LDI XAE  LDI XAE  LDI XAE  LDI XAE  LDI	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVLO(P2) P1 P1 P1 SAVLO(P2) P1 P1 SAVLO(P2) P1 1 HI(P2) 0 LO(P2) CLR(P3) P-1(P1) H(PPROM) P1 SAVLO(P2) L(PPROM) -1 P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SA	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR FROM COUNTER CLEAR FROM COUNTER SAVE IN EXTENSION REG. SET ADDR. OF PROGRAMMING RIN	248 264 265 266 267 268 269 269 270 269 270 270 272 272 273 273 273 275 276 277 277 277 277 277 277 277 277 277	C477 36 64D0 32 31 64PE 35 6402 64PD 75931 702PE 35 62PE 31 6392 62PE 8400 94P2 00 02 6477 36	CPL OOP-	CCL LDIAM INTERPRETATION OF THE PROME TO STAND O	H(RAM) P2 L(RAM) P2 P1 SAVLO(P2) P1 2 SAVHI(P2) P1-SETRD  SAVHI(P2) P1 RDPRM(P3) @-1(P1) LO(P2) CPLOOP H(P2) CPLOOP AGAINST RAM	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE
142 143 144 145 146 148 150 151 152 0 153 0 154 0 157 0 158 0 157 0 158 0 0 158 0 158 0 158 0 158 0 0 158 0 0 158 0 0 158 0 158 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 0 158 0 0 0 158 0 0 158 0 0 158 0 0 0 158 0 0 0 0 158 0 0 0 0 158 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	0049 (*410) 0048 32 0040 (*277) 0046 36 0047 31 0050 (*375) 0050 (*375) 0053 (*407) 0053 (*407) 0059 (*276) 0050 (*276) 0051 (*370) 0056 (*401) 0056 (*401) 0056 (*401) 0057 (*376) 0061 (*401) 0062 (*400) 0067 (*400) 0067 (*376) 0068 (*376) 0068 (*376) 0069 (*376) 0069 (*376) 0060 (*376) 0060 (*376) 0060 (*376) 0061 (*376) 0062 (*376) 0063 (*376) 0064 (*376) 0065 (*376) 0066 (*376) 0067 (*376) 0075 (*376)	PROM TO LE COUNT PROG. SET NXTLOC: THSLOC:	JS PROCAST SI GREEN SI CCL LDI LDI XPAL ST AH ST AH ST AH ST ABI XPAC LDI XPAL LDI XPAL LDI XPAL LDI XAE LDI XAE LDI XPAL LDI XAE LDI XPAL ST AH ST ABI XAE LDI XAE	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVHI(P2) L(ERAS2)-1 P1 P1 P1 SAVLO(P2) P1 P1 H1(P2) 0 LO(P2) CLR(P3) P-1 P1 H1(PPROM) P1 H(PPROM) P1 P1 SAVHI(P2) CLR(P3)	DDRESS DUE TO INVERSION OF  SAVE ADDRESS.  CHECK PROM FOR ERASED  ADD 512 OFFSET  SET UPPER LOC COUNT  SET LOWER LOC COUNT  CLEAR PROM COUNTER  GET DATA TO PROGRAM  SAVE IN EXTENSION REG.  SET ADDR. OF PROGRAMMING RIN  SAVE PIR ADDR.	243 244 265 266 267 0101 248 0102 249 0104 270 0105 271 0107 272 0108 273 0109 274 010E 275 010C 276 010E 277 0110 0112 0114 0116 278 0117 279 0119 280 0114 281 011C 282 283 011D 284 011F 285 0121 286 0123 287 0125 288 0127 289 0129 290 0128 291 292 293 0120 294 295 012C 296 012D 297 012F 298 0130 299 0132	C477 36 61400 32 31 6466 6402 6460 6402 6461 6402 6461 6461 6461 6461 6461 6461 6461 646	CPL OOP-	GCL LDI XPAL XPAL XPAL ST XPAH LD XPAL LD XPAL LD XPAL LD XPAL LD XPAL LD ST DLD JP HALT Y PROM	H(RAM) P2 L (RAM) P2 P1 SAVHI(P2) P1-SETRD  SAVHI(P2) P1 RDPRM(P3) e~1(P1) LIK(P3) LO(P2) CPLOOP H(P2) AGAINST RAM H(RAM) P2 L(RAM) P2	INIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE
142 143 144 145 146 147 148 149 150 151 0 152 0 154 0 157 0 158 0 157 0 168 0 167 0 168 0 171 0 172 0 173 0 174 0 177 0 178 0 179 0 179 0 181 0 182 0 183 0 184 0 184	0049 (4NO 0048 32 0040 (2477 0046 36 0046 (31) 0050 (AFF 0053 (AFF) 0053 (AFF) 0053 (AFF) 0057 31 0059 (22F6 0058 31 0050 (22F6 0058 31 0050 (22F6 0058 31 0050 (22F6 0059 (22F6	PROM TO LE COUNT PROG.	JS PROCAST SI  COLLUDI LDI XPAH XPAH XPAL XPPC LDI XPAH XPPC LDI XPAH LDI X	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVLO(P2) P1 P1 P1 SAVLO(P2) P1 P1 SAVLO(P2) P1 1 HI(P2) 0 LO(P2) CLR(P3) P-1(P1) H(PPROM) P1 SAVLO(P2) L(PPROM) -1 P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SAVLO(P2) SAVLO(P2) P1 SAVLO(P2) SA	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR PROM COUNTER  GET DATA TO PROGRAM SAVE IN EXTENSION REG.  SET ADDR. OF PROGRAMMING RIN SAVE PIR ADDR.  SET COUNT SAVE HIT COUNT IN RAM	243 264 265 266 267 0101 268 0102 269 0104 270 0105 271 0107 272 0108 273 0109 274 0106 275 0100 276 0106 277 0110 0112 0114 0116 279 0119 280 011A 281 011C 282 283 011D 284 011F 285 0121 286 0123 287 0125 288 0127 299 0129 290 0128 291 292 293 0120 291 292 293 0120 294 295 012C 296 012D 297 012F 298 0130 299 0132 300 0133 301 0134	C477 36 61400 32 31 6461 6402 6461 6502 6461 6502 6661 6662 6661 6662 6662 6662 6662 66	CPL OOP-	CCL LDI XPAL LD XPAL XPAL XPAL XPAL XPAL XPAL XPAL XPAL	H(RAM) P2 L (RAM) P2 P1 SAVL0(P2) P1 2 SAVHI(P2) P1. SETRD  SAVHI(P2) P1 RDPRM(P3) e~1(P1) CLK(P3) LO(P2) CPLOOP HI(P2) CPLOOP HI(P2) CPLOOP HI(P2) CPLOOP P2 P1 RAM) P2 P1 RAM	JINIT RAM POINTER  JADO 512 OFFSET  SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE  JOE IN MEMORY
142 143 144 145 146 147 148 150 151 0 152 0 154 0 157 0 158 0 160 0 161 0 162 0 163 0 164 0 167 0 168 0 171 0 172 0 173 0 174 0 177 0 188 0 188 0 188 0 188	0049 (*400 0048 32 0048 32 0048 32 0048 32 0048 31 0059 (*400 0055 31 0059 (*400 0065 400 006	PROM TO LE COUNT PROG. SET NXTLOC: THSLOC:	JS PROCAST SI ER. CCL LDI LDI XPAH XPAH XPAC LDI XPAC XPAC LDI XPAC X	GRAMMED FROM GNIFICANT AI L(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVHI(P2) L(FRAS2)-1 P1 P1 SAVLO(P2) P1 SAVHI(P2) Q LO(P2) CLR(P3) @-1(P1) H(PPROM) P1 SAVHI(P2) Q LO(P2) CLR(P3)	DDRESS DUE TO INVERSION OF  SAVE ADDRESS  CHECK PROM FOR FRASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR FROM COUNTER CHECK PROM COUNTER GET DATA TO PROGRAM SAVE IN EXTENSION REG. SET ADDR. OF PROGRAMMING RIN SAVE PIR ADDR.	243 264 265 266 267 268 269 269 269 270 270 270 271 272 273 273 273 274 275 276 276 277 277 277 277 277 277 277 277	C477 36 C400 32 31 C400 35 E402 C401 35C4 55031 30 C200 C200 C200 C801 BAFF 9CF6 2467 00 02 C477 36 C400 31 CAFE 32 CAFE 31 CAFE 32 CAFE 31 CAFE 32 CAFE 32 CAFE 32 CAFE 32 CAFE 32 CAFE 33 CAFE 325	CPL OOP-	CCL LDIAH LDI XPAL ST AH LD AND LD AN	H(RAM) P2 1 (RAM) P2 P1 SAVLO(P2) P1 2 SAVHI (P2) P1 SAVHI (P2) P1 RDPRM(P3) @-1 (P1) C1 (K(P3) LO(P2) CPLOOP H(P2) CPLOOP H(RAM) P2 L (RAM) P2 P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1	JNIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER LOW DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE MSE IN MEMORY  JULIAN JOHN JOHN JOHN JOHN JOHN JOHN JOHN JOH
142 143 144 145 146 147 148 150 151 0 152 0 153 0 154 0 157 0 158 0 164 0 167 0 168 0 177 0 172 173 0 174 0 177 0 177 0 177 0 178 0 188 0 188 0 187 0 188	0049 (*400 0048 32 0040 0047 32 0040 0047 31 0050 0045 31 0050 0059 0059 0059 0050 0050 0050 005	PROM TO LE COUNT PROG. SET NXTLOC: THSLOC:	IS PRODUCT STATE OF S	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVHI(P2) L(FRAS2)-1 P1 P1 P1 SAVHI(P2) 2 P1 H1(P2) 0 LO(R2) CLR(P3) P-1 P1 H1(PPROM) P1 SAVHI(P2) L(PPROM)-1 P1 SAVHI(P2) P1 L(PPROM)-1 P1 SAVHI(P2) L(PROM)-1 P1 SAVHI(P2) P1 L(PPROM)-1 P1 SAVHI(P2) P1 L(PPROM)-1 P1 SAVHI(P2) P1 CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 CLR(P3) P1 SAVHI(P2) P1 CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) CLR(P	DDRESS DUE TO INVERSION OF  SAVE ADDRESS.  CHECK PROM FOR ERASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR PROM COUNTER  GET DATA TO PROGRAM SAVE IN EXTENSION REG.  SET ADDR. OF PROGRAMMING RIN SAVE PIR ADDR.  SET COUNT SAVE HIT COUNT IN RAM  CHECK PROM DATA PROM DATA CORRECT, DO X+5X DECREMENT HIT COUNT	243 264 265 266 267 268 269 269 269 270 269 271 272 272 273 273 273 273 274 275 277 277 277 277 277 277 277 277 277	C477 36 6100 32 31 6466 6402 6461 35 6266 6266 6266 6366 6366 6366 6366 6	CPL OOP-	CCL LDIAH LDI LDIAH LDI LDIAH LDI LDIAH LDI LDIAH LDI LDIAH	H(RAM) P2 1 (RAM) P2 P1 2 SAVHI(P2) P1-SETRD  SAVHI(P2) P1 RDPRM(P3) P-1(P1) CH(P3) 1.0(P2) CPL00P H(P2) CPL00P H(RAM) P2 P1 P2 P1 2 SAVHI(P2)	JNIT RAM POINTER  , ADD 512 OFFSET .SET READ MODE .RETRIEVE ADDRESS .GET PROM DATA .STORE INTO MEMORY .RUMP PROM COUNTER LOW .DECREMENT LOC COUNTER LOW .DECREMENT LOC COUNTER HIGH .NOT DONE .HALT WHEN DONE .GE IN MEMORY .INIT RAM POINTER .ADD 512 OFFSET
142 143 144 145 146 147 148 149 150 151 0 152 0 154 0 157 0 158 0 158 0 157 0 158 0 158 0 158 0 158 0 158 0 168 0 171 0 172 0 173 0 174 0 177 0 178 0 178 0 188 0 188 0 188 0 188 0 188 0 188 0 188 0 189 0 199	0049 (*400 0048 32 0040 0048 32 0040 0346 32 0046 34 0046 31 0050 035 0466 0052 35 0050 046 046 0050 035 0460 0050 035 035 035 035 035 035 035 035 0	PROM TO LE COUNT PROG. SET NXTLOC: THSLOC:	JS PROCAST SI ER.  CCL LDI LDI XPAH XPAH XPAL XPPC LDI XPAH XPAL XPPC LDI XPAH LDI X	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 L(PPROM) P1 SAVLO(P2) CLR(P3) P1 SAVLO(P2) CLR(P3) P1 SAVLO(P2) P1 OK	CHECK PROM DATA  CHECK PROM DATA  CHECK PROM FOR ERASED  ADD 512 OFFSET  SET UPPER LOC COUNT  CLEAR PROM COUNTER  GET DATA TO PROGRAM  SAVE IN EXTENSION REG.  SET ADDR. OF PROGRAMMING RIN  CALE ARE ADDR.  CHECK PROM DATA  CHECK FOR MAX. HIT	243 264 265 266 267 0101 268 0102 269 0104 270 0105 271 0107 272 0108 273 0109 274 010B 275 010C 276 010E 277 0110 0112 0114 0116 279 0119 280 011A 281 011C 282 283 011D 284 011F 285 0121 286 0123 287 0125 288 0127 289 0129 290 012B 291 292 293 294 295 012C 296 012D 297 012F 298 0130 299 0133 300 0133 301 0134 302 0136	C477 36 C400 32 31 C466 35 F402 C460 35 C460 35 C260 35 C260 35 C260 36 C302 C660 36 C802 C660 36 C7 C802 C660 37 C802 C660 37 C802 C660 37 C802 C660 38 C660 38 C660 38 C660 38 C660 C660 C660 C660 C660 C660 C660 C66	CPL OOP-	CCL LDI XPAL XPAL XPAL XPAL XPAL XPAL XPAL XPAL	H(RAM) P2 L (RAM) P2 P1 SAVLO(P2) P1 2 SAVHI(P2) P1.SFTRD  SAVHI(P2) P1 RDPRM(P3) @-1(P1) CLK(P3) LO(P2) CPLOOP  H(RAM) P2 L(RAM) P2 P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1 SAVLO(P2) P1	JNIT RAM POINTER  ADD 512 OFFSET SET READ MODE  RETRIEVE ADDRESS  GET PROM DATA STORE INTO MEMORY RUMP PROM COUNTER LOW DECREMENT LOC COUNTER LOW DECREMENT LOC COUNTER HIGH NOT DONE HALT WHEN DONE  MEET IN MEMORY  JULIAN STATEMENT LOC COUNTER HIGH NOT DONE HELT WHEN DONE  JULIAN STATEMENT HIGH JULIAN STATEM
142 143 144 145 146 147 148 149 150 151 0 152 0 154 0 157 0 158 0 158 0 157 0 158 0 158 0 158 0 158 0 158 0 168 0 171 0 172 0 173 0 174 0 177 0 178 0 178 0 188 0 188 0 188 0 188 0 188 0 188 0 188 0 189 0 199	0049 (*400 0048 32 0040 0047 32 0040 0047 31 0050 0045 31 0050 0059 0059 0059 0050 0050 0050 005	PROM TO LE COUNT PROG. SET NXTLOC: THSLOC:	IS PRODUCT STATE OF S	GRAMMED FROM GNIFICANT AI L.(RAM) P2 H(RAM) P2 P1 SAVLO(P2) P1 SAVHI(P2) L(FRAS2)-1 P1 P1 P1 SAVHI(P2) 2 P1 H1(P2) 0 LO(R2) CLR(P3) P-1 P1 H1(PPROM) P1 SAVHI(P2) L(PPROM)-1 P1 SAVHI(P2) P1 L(PPROM)-1 P1 SAVHI(P2) L(PROM)-1 P1 SAVHI(P2) P1 L(PPROM)-1 P1 SAVHI(P2) P1 L(PPROM)-1 P1 SAVHI(P2) P1 CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 CLR(P3) P1 SAVHI(P2) P1 CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) P1 SAVHI(P2) CLR(P3) CLR(P	DDRESS DUE TO INVERSION OF  SAVE ADDRESS.  CHECK PROM FOR ERASED  ADD 512 OFFSET  SET UPPER LOC COUNT CLEAR PROM COUNTER  GET DATA TO PROGRAM SAVE IN EXTENSION REG.  SET ADDR. OF PROGRAMMING RIN SAVE PIR ADDR.  SET COUNT SAVE HIT COUNT IN RAM  CHECK PROM DATA PROM DATA CORRECT, DO X+5X DECREMENT HIT COUNT	2/43 2/44 2/45 2/64 2/65 2/66 2/67 2/69 2/69 2/10 2/10 2/10 2/10 2/10 2/10 2/10 2/10	C477 36 C400 32 31 C4FF 35 F402 C401 35C4 5931 30 C2FB 31 C302 CDFF CR01 BAFF 9CF6 BA60 94F2 00 02 C477 36 C4FE 31 CAFE 35 C4FE 35 C4FE 35 C4FE	CPL OOP-	CCL LDIAH LDI LDIAH LDI LDIAH LDI LDIAH LDI LDIAH LDI LDIAH	H(RAM) P2 1 (RAM) P2 P1 2 SAVHI(P2) P1-SETRD  SAVHI(P2) P1 RDPRM(P3) P-1(P1) CH(P3) 1.0(P2) CPL00P H(P2) CPL00P H(RAM) P2 P1 P2 P1 2 SAVHI(P2)	JINIT RAM POINTER  , ADD 512 OFFSET .SET READ MODE  ; RETRIEVE ADDRESS  .GET PROM DATA .STORE INTO MEMORY .RUMP PROM COUNTER LOW .DECREMENT LOC COUNTER LOW .NOT DONE .NOT DONE .HALT WHEN DONE .GE IN MEMORY .INIT RAM POINTER .ADD 512 OFFSET

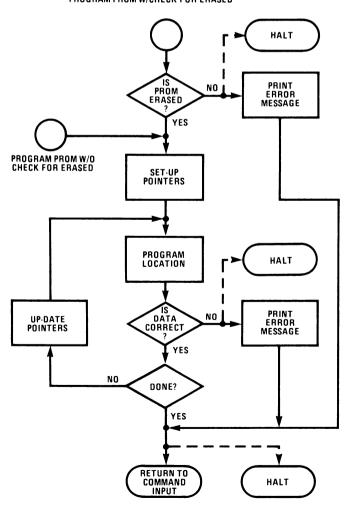
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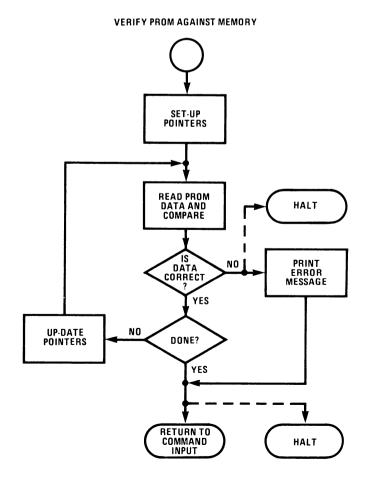
30% 0142 C2FD		(3)	SAVHI (P2)	PETET	EVE ADD	RESS	
307 0144 35		XEAH	F:1	7 ((1,1)(1)	VE. HIVE		
308 0145 C2FF		LD	5AVL0(P2)				
309 0147 31		XPAL	P1				
310	VLOOP	21 111	' '				
311 0148 0302	V (	LD	RDPRM(P3)	CET D	ATA ERO	M DDOM	4
312 014A E5EE		XOR	@-1(P1)				MORY DATA
313 014C 9COB		JINZ	NOVEY		NOT VER		HING TAURE
314 014F CB01		ST	CLK (P3)		PROM CO		
315 0150 BAFE		DLD	L0(P2)				ITER LOW
316 0152 90F4		JNZ	VLOOP	NOT D		COOK	HIEK LOW
317 0154 BA00		DLD	HI (P2)			0.000	ITER HIGH
318 015A 94F0						U COOK	NEK HIGH
319 0158 00		JP UOL7	VLOOP	, NOT D			
	N. 1979 (1879)	HAL T		HALL	WHEN DO	NF.	
320	NOVEY	T				_	
321 0159 00 322	or roo	HAL T		, HAL I	ON ERRO	ĸ	
	SEILBD		ULCESSONS.	CUT A			OMME
323 015A 0480		L.D.I	H (PPRGMR)	PUT A		PROGR	KAMMER
324 0150 37		XPAH	P3	IN F	3		
325 015D 0400		F 1/1	L (PPRGMR)				
326 015F 33		XF'AI	P3				
327 0160 0401		1. 10.1	1	FSET U	PPER LO	C COUN	ITER
328 01A2 CA00		ST	HI(P2)				
329 0164 CBOC		ST	RD(P3)		FAD MODI		
330 016A CB1C		ST	CS(P3)	- SELECT	T PROM :	SOCKET	
331 0168 0400		L.D.I	0				
332 016A CAFE		ST	LO(P2)				
333 0160 CB03		ST	OLR(P3)		PROM C		
33 <b>4</b> 016F 0800		ST	LOAD(P3)	→ CLEAR	PROM D	ATA LA	ATCHES
335 0170 3D		XEEC	F1				
336 0000		EΝD					
CKERSD 0001 ≠	CLE	0001		0003	COPY	0101	*
CPL00P 011D	08	001C		FFFA	DPLO	FFFB	
ELOOP 0025	ENBL	0004 *		200F	ERASED		
GO 007C	HONT	FFFC		0000	LO.	FFFF	
LOAD 0000	NOT	0034		0159	NPROG	0084	#
NXTLOC 006E	OK.	0085		0001	P2	0002	
P3 0003	PPROMR		PPROM 0	DOCD	PRLP	00B3	
PR06 0048 №	F:AM	7710		3000	RDFRM	0002	
SAVHI FFFD	SAVEO	FFFF	SET 0	0061	SETED	015A	
THSLOC 006F *	UPDATE	0002 *	VERIFY (	0120 *	VL00P	0148	
VP 0014	VSS	0004	WOOTHK C	0035 *			



NO ERROR LINES SOURCE CHECKSUM = C17D

# PROGRAM PROM W/CHECK FOR ERASED





NOTE: DASHED LINES INDICATE PANEL PROGRAM ERRORS & EXITS.

# New Library Programs

# PACE BASIC PROGRAM SL0048A BIORHYTHM

Source paper tapes \$5.00 each

This program plots the three biorhythm curves (physical, emotional, and intellectual) for any time period after the given birthdate.

1 DIM T(12) 2 N\$="000102030405060708091011121314151617181920212223242526" 3 N#=N#+"2728293031" 4 REM BIORHYTHM CREATED BY JOY AND RICHARD FOX 6 PRINT "DO YOU WISH AN INTRODUCTION TO BIORHYTHM?" 8 INPUT "YES OR NO"; A\$ 9 IF A\$="NO" THEN 27 10 PRINT 11 PRINT TAB(25); "BJORHYTHM" 12 PRINT 13 PRINT 15 PRINT " THE PURPOSE OF BIORHYTHM IS TO PREDICT A PHYSICAL," 16 PRINT "EMOTIONAL AND INTELLECTUAL PATTERN THAT INDICATES YOUR" 17 PRINT "UP AND DOWN DAYS FOR ANY PERIOD OF TIME. BJORHYTHM CAN" 18 PRINT "SHOW WHICH DAYS WERE GOOD OR BAD FOR YOU BEGINNING WITH" 19 PRINT "YOUR BIRTH. IT CAN ALSO SHOW YOU WHICH OF YOUR FUTURE" 20 PRINT "DAYS WILL BE GOOD OR BAD FOR YOU." 21 PRINT " THESE PREDICTIONS ARE BASED ON SCIENTIFIC STUDIES TO" 22 PRINT "DETERMINE WHY ACCIDENTS OCCUR. IT WAS LEARNED THROUGH" 23 PRINT "THESE STUDIES THAT A PHYSICAL CYCLE OCCURS EVERY 23 DAYS," 24 PRINT "AN EMOTIONAL CYCLE EVERY 28 DAYS, AND AN INTELLECTUAL" 25 PRINT "CYCLE EMERY 33 DAYS." 26 PRINT 27 PRINT "PLEASE TYPE YOUR BIRTH DATE USING THE FOLLOWING FORMAT" 28 PRINT "MM.DD.YY. FXAMPLE: JANUARY 17, 1942 = 01,17,42" 40 INPUT M.D.Y. 45 PRINT "AT WHAT DATE ARE YOU INTERESTED IN BEGINNING BIORHYTHM?" 46 PRINT "(THE YEAR MUST BE GREATER THAN YOUR BIRTH YEAR)" 50 INPUT M1, D1, Y1 55 JF Y1 <= Y THEN 45 60 PRINT "HOW MANY DAYS DO YOU WISH TO HAVE PLOTTED?" 65 INPUT D2 80 DATA 31,28,31,30,31,30,31,31,30,31,30,31 110 REM M=MONTH, D=DAY, Y=YEAR 120 REM DS=TOTAL NUMBER OF DAYS FLARSED 130 D3=0 140 IF MD2 THEN 200 150 IF INT(Y/4)-(Y/4)<>0 THEN 200 160 D3=1 190 REM T=DAYS IN EACH MONTH 200 FOR J=1 TO 12 210 READ T(J) 230 NEXT I 240 DS=T(M)-D+DS 250 FOR I=M+1 TO 12

260 D3=T(I)+D3 270 NEXT I

```
280 REM YS=YEAR COUNTER FROM BIRTH TO DISPLAY
290 Y3=Y
299 Y3=Y3+1
305 IF Y3D=Y1 THEN 400
310 IF INT(Y3/4)-(Y3/4)=0 THEN 320
315 D3=D3+365
316 GOTO 299
320 DS=DS+366
325 GOTO 299
400 IF M1<=2 THEN 450
405 JF JNT(Y1/4)-(Y1/4)<>0 THEN 450
410 DB=DB+1
450 FOR J=1 TO M1-1
455 DS=T(T)+DS
460 NEXT I
470 D3=D1+D3
475 PRINT "PHYSICAL CYCLE = P"
480 PRINT "EMOTIONAL CYCLE = E"
490 PRINT "INTELLECTUAL CYCLE = I"
491 PRINT
492 PRINT
493 PRINT
500 PRINT "DATE";
505 PRINT TAB(13); "DOWN":
510 PRINT TAB(35); "CRITICAL";
520 PRINT TAB(62); "UP"
525 PRINT "----"; TAB(13);
526 PRINT "-----
530 LET M4=M1
540 LET D4=D1
550 LET Y4=Y1
560 \text{ REM M4}, D4, Y4 = DATE PRINTED OUT IN PLOTTING CHART
570 GOTO 580
571 REM F=FRACTION INTO CYCLE
580 F=(D3/23)~INT(D3/23)
600 REM X=THE ARGUMENT FOR THE SINE FUNCTION
610 X=F*2*3, 1416
640 REM P=THE PHYSICAL POSITION ON THE GRAPH
650 P = INT((SIN(X)+1)*25+0 5)
455 REM E≃EMOTIONAL POSITION ON THE GRAPH
660 \text{ F=} (D3/28) - \text{INT} (D3/28)
670 X=F*2*3, 1416
680 E=INT((SIN(X)+1)*25+0.5)
690 REM I=INTFLLECTUAL POSITION ON THE GRAPH
700 F=(D3/33)-INT(D3/33)
710 X=F*2*3, 1416
720 I = INT((SIN(X)+1)*25+0.5)
721 REM PRINT THE DATE
722 Y4=Y4 MOD 100
723 PRINT MIDs(Ns,M4*2+1,2);"/";
724 PRINT MID$(N$,D4*2+1,2);"/";
725 PRINT MID$(N$,INT(Y4/10)*2+2,1);
726 PRINT MIDs(Ns, (Y4-INT(Y4/10)*10)*2+2,1); TAB(13);
730 As="
732 A$=A$+" "
736 As=LEFTs(As,E)+"E"+MIDs(As,E+2)
738 A$=LEFT$(A$,P)+"P"+MID$(A$,P+2)
740 As=LEFTs(As, I)+"I"+MIDs(As, I+2)
742 IF J=P THEN A$=LEFT$(A$, I)+"*"+MJD$(A$, I+2)
```

```
744 TF T=F THEN As=LEFT$(As, T)+"*"+MTD$(As, T+2)
746 JF PHE THEN ASHLEFTS(AS, E)+"*"+MIDS(AS, E+2)
747 PRINT A$
748 IF D2=1 THEN 999
750 D2=D2-1
800 DS=DS+1
810 D4=D4+1
815 IF M4<>2 THEN 820
816 IF D4<>22 THEN 820
817 JF INT(Y4/4)-(Y4/4)<>0 THEN 820
818 GOTO 570
820 JF D4<=T(M4) THEN 570
830 M4=M4+1
835 D4=1
840 IF M4>12 THEN 870
850 GOTO 570
870 M4=1
880 Y4=Y4+1
900 GOTO 570
999 GETC=$7F3B
1010 CALL GETC 1 WAIT FOR RESPONSE BEFORE NEXT
1020 RESTORE
1030 PRINT LIN(4);
1040 INPUT "AGAIN"; A$
1050 IF A$<>"NO" THEN 1
1060 END
```

# SC/MP assembly program SL0049A reflex

Source paper tape \$5.00 each

Program listing see pages 11 and 12

REFLEX is a reflex test program that runs on the SC/MP LCDS. It can be on a PROM in the LCDS PROM socket, or it can be entered into RAM by hand. The program uses the LED's on the LCDS. A dash appears at the left side of the LED's and shifts right, across the LED's. When the dash disappears, the player hits any key on the keyboard. The reflex time is then displayed on the LED's. If you hit a key before the dash disappears, the LED's will display the message ERROR.

To start the program, hit INIT, then hit RUN.

Contributed by:

Chuck Bennett CB Systems 16126 Larch Way Lynnwood, WA 98036 (206) 624-5998

# **GOOD BOOKS?**

If you run across a book which you think other COMPUTE members would profit knowing about, why not write a brief review . . . including the name and address of the publisher and the price and send it to:

COMPUTE/208 National Semiconductor 2900 Semiconductor Dr. Santa Clara, CA 95051 Attn: Book Nook

# IMP-16 ASSEMBLY PROGRAM SLOOSOA PRTMOD

Source paper tapes \$5.00 each

Program listing, see page 12

This program modifies the "HP" command in the IMP-16 Editor program for automatic form feeds with a high speed printer. This overlay patch provides a form feed to the printer after every 60 lines, and two form feeds at the end of the printout. These modifications prevent the printer from printing across page boundaries and ejects the paper for easy removal after the printing is completed.

The patch can be loaded into memory or onto the disc with the disc loader. The overlay cannot be done with the disc loader as it creates too many output sectors on the disc and will overwrite the next program.

Contributed by:

Craig J. Bradley — ARGO Systems 1069 E. Meadow Dr., Palo Alto, CA 94303 (415) 494-6600

1 2 3			- 81.00	IP ASSEMBLY 49A REFLE E SOME, RE	×
4 000	oo oo		_	1	
5	0000	CNTR1	=	00	
6	0001	CNTR2	=	01	
7	0002	CNTRG	=	02	
8	0003	CNTR4		03	
9	0004	D104	_	04	
10	0005	D163	=	05	
1 1	0006	FOTO:	=	Oz.	
12	0007	D161	=	0.7	
13	0008	D160	=	O:B	
14	0009	DIGA		0.9	
15	0080	COUNTY	-	08:0	
1.6	0010	COUNT?	12	010	
17					
18,000	01 0470	START	LDJ	070	SET P1
19 000	)3 3 <u>5</u>		XF:AH	1	
20 000	04 0477		LEG	077	-SET P2

```
21 0006 3A
22 0007 047A
23 0009 37
                                                                                                                                                                                                                            CRAIG J BRADLEY
                                                                                                                                                                             PROGRAMER
                                          XE'AH
                                                                                                                                                                                                                            ARGOSYSTEMS INC
                                         LDI
                                                    074
                                                                       SET PS
                                                                                                                                                  16
17
                                                                                                                                                  18
19
 24 000A 046E
                                         LOI
                                                    OAE
                                                                                                                                                                                 TO MODIEY THE PROGRAM
 25 0000
                                          YPAL
                                                                                                                                                                                      MODIFY THE PROGRAM
LOAD THE EDITOR FROM PAPER TAPE
(DO NOT LOAD FROM DISC AS THIS WILL START
THE PROGRAM AND CHANGE THE CODE)
LOAD THIS PROGRAM FROM PAPER TAPE
PUNCH A LM PAPER TAPE USING RAMDUMP FROM
LOCATION 0000 TO ODGE
  26 000D 0400
                                                                                                                                                  20
21
22
23
24
25
                                          t.nr
                                                     ONTR3(2)
 27 000E CA02
                                          91
 28 0011 CA03
29 0013 FA08
30 0015 CA09
                                                     CNTR4(2)
DIGO(2)
                                          ST
ST
                                          ST.
                                                    DIGA(2)
 31 0017 0420
37 0019 01
33 001A 0410
                                          LDI
                                                     020
                                                                       SET FIRST DASH
                                                                                                                                                  26
27
28
                                                                                                                                                                                      USING DSCLOR WRITE THE PROGRAM TO OSC ON
THE DISC
DSCLOR COMMANDS
                                                     COUNT2
                                                                       SET ONTR 2
                                          LDJ
 34 0010 0A01
35 0016 0A80
36 0020 0A00
37 0022 0440
                                          ST
                                                     (NTR2(2)
                                                                                                                                                                                               '0|R
'MP 050
'085 0
                                                    COUNT1
COTR1(2)
                                                                                                                                                  29
30
31
32
33
34
35
36
37
                                          \otimes T
                                          LDT
ST
                                                    040
                                                                       FIRST DASH
                                                                                                                                                                                              PRIM DESCRIBE READS PT
160 OCEO START ADDR OF EDITIA
NSCIPE WILL WRITE TO DISC. PRINT
ADDRESS RANGES AND DISC SECTORS
(0050:0069)
 38 0024 0980
39 0026 011F
                                                    -128(1)
01E(1)
                                                                       JOET KYBD
                                          LD.
 40 0029 0405
                                          ΔΝΙΤ
 40 0028 040F
41 002A 905D
42 002C BAOD
43 002E 90FA
                                           INZ
                                                    FRROR
                                                                       DEC ONTR 1
                                                     ONTR1 (2)
                                          DLD
JN7
                                                    LOOP
 44 0030 BA01
45 0032 90EA
                                                     CNTR2(2)
                                                                       - DEC CNTR 2
                                                                                                                                                  38
39
                                                                                                                                                                                             JE DSCLOR IS USED TO DO THE OVERLAY TOO MANY DISC SECTORS WILL BE USED AND THE PROGRAM WILL OVER-WRITE THE NEXT PROGRAM ON THE DISC.
                                                    L00P2
                                                                                                                                                                                NOTE
 46 0034 01
                                                                       NEXT DASH
                                          XAF
 47 0035 10
48 0036 90F1
                                          SR
                                                                                                                                                  41
                                                                                                                                                  42
43
                                          JNZ
                                                    DASH
 49 0038 0900
                                                                       BLANK DISPLY
                                          ंग
                                                     (1)
 50 003A 03
51 003B C4AA
                                                                       DEC INC ONTR 3
                                                                                                                                                  44
45
46
47
                                                                                                                                                                                DEFINITIONS
                           COUNT
                                          LDI
                                                    170
 52 003D 8F00
53 003F 0202
54 0041 F000
55 0043 0A02
                                                                                                                                                                0030 A MAXONT =60
                                                                                                                                                                                                                             - MAX LINES / PAGE
                                          DL Y
                                          LĐ
                                                    ONTR3(2)
                                          DAJ
ST
                                                                                                                                                  48
49
50
                                                                                                                                                                               BASE PAGE DEFINITIONS
                                                     0
CNTR3(2)
                                                                                                                                                                0014 A DEVICE =0014
0040 A HOA =0040
 56 0045 0203
57 0047 F000
58 0049 0A03
59 004B 011F
                                          ιn
                                                     CNTR4(2)
                                          DAT
ST
                                                    O CNTR4(2)
                                                                                                                                                   51
52
53
54
                                                                                                                                                                 0072 A SPUTC
                                                                       GET KIRD
                                          1 D
                                                    01E(1)
 60 004F F1F6
61 004F 98F9
62 0051 F203
                                          ANI
IZ
                                                  OF
OUNT
                                                                       , MASK 4 MSB
                                                                                                                                                                                TOP SECTOR DEFINITIONS
                                                                                                                                                  55
56
57
                                                                                                                                                                 0765 A HSPRT
                           CONVERT
                                         1.0
                                                    ONTR4(2)
                                                                     GET MSD
 63 0053 10
64 0054 10
65 0055 10
                                                                                                                                                                              SPACE 5
                                          SB
                                                                                                                                                                0005 A
                                                                                                                                                       0000
                                                                                                                                                                               =0079
                                          ≤E
                                                                                                                                                                              .
CHANGE TYPET POINTER TO TMESST IN PROM
 A6 005A 10
67 0057 01
                                                                                                                                                  60
                                                                                                                                                  61
62 0079 7EC3 A
                                          XAE
                                                                                                                                                                             STYPE
                                          UD
ST
UD
                                                                                                                                                                                                         07EC3
 A8 0058 0380
                                                     -128(3)
 69 005A CA04
70 005C C203
71 005E D40F
                                                                                                                                                  63 007A
                                                    DJG4(2)
CNTR4(2)
                                                                                                                                                   64
65
                                                                      - GET MSD -1
                                                                                                                                                                                CHANGE PRINTER ROUTINE POINTER
                                          ANI
 71 0056 1140F
72 0060 01
73 0061 0380
74 0063 0805
75 0065 0202
76 0067 10
77 0068 10
78 0069 10
                                          XAE
LD
ST
                                                                                                                                                  66
                                                                                                                                                       DOZE DZAS A ADHSE
                                                                                                                                                   67
                                                                                                                                                                                             MORD
                                                                                                                                                                                                         HSPRT1
                                                                                                                                                       0080
                                                                                                                                                                               =02A9
                                                     DJ63(2)
                                          LD
SR
SR
                                                     CNTR3(2)
                                                                       JOSET LIST +1
                                                                                                                                                  70
                                                                                                                                                                                NO-OF CARD READER COMMAND
                                                                                                                                                   71
72
                                                                                                                                                                                             WORD
                                          SB
 78 0069 11
79 0068 10
80 0068 01
81 0060 0380
                                                                                                                                                                               =069F
                                          SR
XAE
                                                                                                                                                       02AA
                                                                                                                                                 73 02HH
74
75
76
77 069F 2917 A
                                                                                                                                                                                 REPLACES INSTRUCTION
                                                                                                                                                                                                                             1.T 1.1A
                                                      -128(3)
                                          LD
ST
 82 DOME CANA
                                                    DIG2(2)
 83 0070 0202
                                                     ONTR3(2)
                                                                                                                                                                                           JSR
                                                                                                                                                                                                         FORMED
                                                                                                                                                                                                                             FORM FEED ROUTINE
 84 0072 P40F
85 0074 01
86 0075 C380
87 0077 CA07
88 0079 C404
                                          ANI
                                                                                                                                                                               =06B7
                                                                                                                                                       06A0
                                          XΔE
                                          ιD
                                                                                                                                                  80
                                                                                                                                                                                THIS SUBROUTINE OUTPUTS 2 FORM FEEDS
AT THE FND OF FACH PRINTOUT AND BESTORES
THE LINE COUNT TO MAXIMUM
IT BEPLACES THE "TYPE" SUBROUTINE
                                                                                                                                                  81
82
                                                    DIG1(2)
                                          ST
                           DISBLY
                                          LDI
                                                    04
                                                                       :SET P2 TO DJG 4
 89 007F 32
90 007F C420
91 007F 01
                                                                                                                                                  83
                                                    2
020
                                                                                                                                                                                 IT REPLACES THE TYPE SUBROUTINE WHICH "MESG" IN PROM IS NOW USED FOR
                                                                       SET TO LEFT DIGIT
                                                                                                                                                  84
                                          I DI
                           1,0091
                                          YΔF
 92 007F 0501
93 0081 0980
                                                                                                                                                  86
                                          t D
ST
                                                                                                                                                  87 0687 8014 A FORMED-
88 0688 FO7F A
89 0689 2101 A
                                                                                                                                                                                          1.0
                                                                                                                                                                                                          O. DEVICE
                                                     -128(1)
                                                                                                                                                                                                          O, ADHSP
                                                                                                                                                                                                                               .IS DEVICE PRINTER?
 94 0083 01
                                          XAF
 95 0084 10
96 0085 90F7
97 0087 90F0
                                                                                                                                                                                            JMP
                                                                                                                                                                                                                              : YES
                                                                                                                                                  90 06BA 2105 A
91 06BB 4000 A
92 06BC 2014 A
                                                                                                                                                                                            IMP
                                                                                                                                                                                                          $FND
                                                                                                                                                                                                                               Ni i
                                          JNZ
                                                    1.00P1
                                                                                                                                                                                            I.I
JSR
                                                                                                                                                                                                          0.00
@DEVICE
                                                                                                                                                                                                                                FORM FEED
                                                    DISPLY
079
DIG4(2)
                                           IME
 98 0089 0479
99 008B 0A04
                                          LDJ
                                                                                                                                                                                                                               COUTPUT FE
                                                                       :SET ERROR MSG
                                                                                                                                                  93 06BD 2014 A
94 06BE 4030 A
95 06BE B102 A
                                                                                                                                                                                            JSR
                                                                                                                                                                                                          @DEVICE
                                                                                                                                                                                                                               CONTRUCT FE
                                                                                                                                                                                                          O. MAXONT
O. MALNONT
100 008D C450
101 008F CA05
102 0091 CA06
103 0093 CA08
                                          LOI
                                                     050
                                                                                                                                                                                                                              RESET COUNT
                                                     DJ63(2)
DJ62(2)
                                                                                                                                                                                            ST
                                                                                                                                                   96
                                                                                                                                                       0600 4010 A $END
                                                                                                                                                                                                          1.16
                                                                                                                                                                                                                               INSTRUCTION REPLACED
                                                                                                                                                  97 06C1 0200 A
98 06C2 07B0 A ALNONT
                                          ST
                                                     DIGO(2)
                                                                                                                                                                                             WORD
                                                                                                                                                                                                          LNENT
104 0095 C45C
105 0097 CA07
106 0099 C400
                                          EDI
ST
                                                     050
                                                                                                                                                  99
                                                                                                                                                                0003 A
                                                                                                                                                                               SPACE 3
                                                     DIG1(2)
                                                                                                                                                 100 0603
                                          LDI
107 009R CA09
108 009D 90DA
109 0000
                                                     DIGA(2)
                                                                                                                                                 102
                                                                                                                                                                                 THIS SUBROUTINE COUNTS LINE FEEDS AND
                                                     DISPLY
                                                                                                                                                                                 SUBSTITUTES FORM FFEDS AT THE END OF
FACH PAGE
IT REPLACES THE CARD READER SUBSOUTINE
                                                                                                                                                 103
                                            END
                                                                                                                                                 104
105
                                                                                                                                                                                IT REPLACES THE CARD READER SUBMOUTING CORPETC WHICH IS DISSABLED IF THE CARD READER IS USED THIS ROUTINE CAN BE SUBSTITUTED FOR THE PRINTER ROUTINE AND THE PRINTER ROUTINE PLACED IN PROM
                                                                                                                                                 106
CNTR1
           0000
                            CNTR2
                                        0001
                                                        CNTR3
                                                                     0002
                                                                                     ONTR4
                                                                                                 0003
CONVER 0051 *
DASH 0019
                            COUNT
                                        0034
                                                        COUNT1
DJG1
                                                                     0080
                                                                                     COUNT2 0010
DIG2 0006
DASH
DIGS
                            D160
D164
                                                                     0007
                                                                                                                                                 108
                                                                                      DISPLY 0079
                                                                                                                                                 109
            0005
                                        0004
                                                         DIGA
                                                                     0009
                                                                                                                                                  110
                                                                                     LOOP2
ERROR
            0089
                            LOOP
                                        0026
                                                         LOOP
                                                                     007E
            0001
                                                                                                                                                 112 07A9 F04C A HSPRT1
                                                                                                                                                                                            SKNE
                                                                                                                                                                                                          O. HOA
                                                                                                                                                                                                                               JINE EFED?
                                                                                                                                                 113 07AA 7D05 A
114 07AB 2103 A
115 07AC 4C3C A
                                                                                                                                                                                            DS7
JMP
                                                                                                                                                                                                          LNENT
SOUT
                                                                                                                                                                                                                                END OF PAGE?
NO ERROR LINES
SOURCE CHECKSUM = A828
                                                                                                                                                                                            1 T
                                                                                                                                                                                                          O. MAXCINT
                                                                                                                                                       07AD A102 A
07AE 4C0C A
                                                                                                                                                                                                           O LINCINT
                                                                                                                                                                                                                              RESET COUNT
                                                                                                                                                                                                          o.oc
@PRIC
                                                                                                                                                                                           1.7
                                                                                                                                                                                            JMP
WORD
WORD
                                                                                                                                                 118 07AE 2501 A $OUT
                                                                                                                                                                                                                              DUTPUT CHAR
                                                                                                                                                 119 07B0 003C A LNCNT
120 07B1 0765 A PRTC:
                                                                                                                                                                                                         MAXONT
HSPRT
                                                                                                                                                                                                                              PRINTER ROUTINE
                                          JMP-16 ASSEMBLY PROGRAM
                                          ... 26 ASSEMBLY
SLOOSOA PRIMOD
TITLE PRIMOD
                                                                                                                                                 121
                                                                                                                                                                                              PAGE
                                                                                                                                                 122
                                                                                                                                                                 0000 A
                                              ITLE PRIMOD
      0000
                                                                                                                                                 ADHSP
                                                                                                                                                             007F
                                                                                                                                                                                 AUNCHT
                                                                                                                                                                                             0602
                                                                                                                                                                                                        Α
                                                                                                                                                                                                                 DEVICE 0014
                                                                                                                                                                                                                                        Δ
                                                                                                                                                FORMED 0687
HSPRT1 07A9
                                                                                                                                                                                 HOA
LINCINT
                                                                                                                                                                                                                             0745
0030
                            ; HIGH SPEED PRINTER FORM FEED MODIFICATION
                                                                                                                                                                                              0040
                                                                                                                                                                                                                  HSPRT
                                                                                                                                                                                              07B0
                                                                                                                                                                                                                  MAXONT
                               THIS PROGRAM IS AN OVERLAY PATCH FOR
                                                                                                                                                 PRIC
                                                                                                                                                             07B1
                                                                                                                                                                        Δ
                                                                                                                                                                                 SPUTC
                                                                                                                                                                                              0072
                                                                                                                                                                                                        Δŧ
                                                                                                                                                                                                                  STYPE
                                                                                                                                                                                                                              0079
                               THIS PROGRAM IS AN OVERLAY PATCH FOR THE IMPHA EDITOR (EDITIA REV F 12/17/75) IF OTHER REVISION LEVEL EDITORS ARE USED IT WILL BE NECESSARY TO CHANGE THE ASSEMBLER ADDRESS DIFFCTIVES TO RELOCATE THE PATCHES AND REDEFINE THE RASE PAGE DEFINITIONS.
 10
 11
12
13
14
                                                                                                                                                NO ERROR LINES
SOURCE CHECKSUM =A681
```

# **SC/MP-II Microprocessor Highlights**

# Introduction

The SC/MP-II architecture was designed to meet the needs of designers of low-cost control systems. The following summary of important features and the illustrations showing how to take advantage of these in your design prove our point: SC/MP-II is an ideal low-cost microprocessor for your control systems.

# **Features**

- Multiple Addressing Modes
- AUTO Indexed Addressing
- Logical, Arithmetical, and Control Instructions
- Byte Manipulation
- Binary and Decimal Arithmetic
- Full Range and Relative Jump
- Conditional and Unconditional Jump
- I/O and Memory Expandability
- Expandable Vectored Interrupts
- · External, Variable-Length Stack
- Bus Control Logic (Hardware)
- Separate Serial I/O Port
- Three User-Accessible Control Outputs, Two Sense Inputs
- Variable "Time Delay" Instruction
- Separate Address and Data Buses
- On-Chip Clock Generator
- TTL Compatible
- Single +5 V Supply, Low Power Dissipation (225 mW)
- Four STATUS Monitor Flag Outputs

# **User Benefits**

Applications programs are easy to write and are memory efficient.

Provides simplified system design.

Allows DMA and multiprocessor configuration.

Allows *serial data transfer* for communication and data acquisition system.

Eliminates external address decoding and allows asynchronous sampling of two discrete inputs.

Allows system timing functions.

Eliminates need for external address latch.

Eliminates external components.

Eliminates special buffers.

Saves power.

Easy control logic/debug panel implementation.

Note: For brevity, the name SC/MP used in text throughout the remainder of this publication refers to the SC/MP-II microprocessing unit.

# SERIAL-IN/SERIAL-OUT PORT

SC/MP has a versatile serial-transfer port which uses the EXTENSION register to shift data into and out of serial devices. The serial transfer is accomplished using the SIO Instruction, which shifts data through the EXTENSION register one bit at a time.

The serial I/O port is conveniently used in a variety of applications. ANALOG-TO-DIGITAL CONVERTERS can be implemented simply by using a low-cost comparator to compare an analog voltage to successive digital approximations shifted out by SC/MP as shown in figure 1. The analog signal is converted into an 8-bit digital word and is stored in memory.

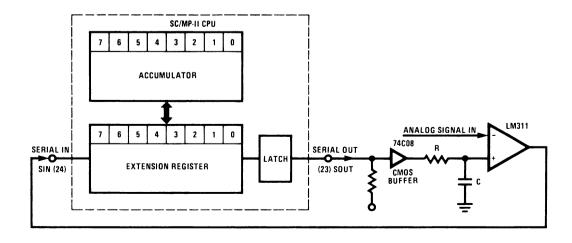


FIGURE 1. SC/MP-II as an Analog to Digital Converter

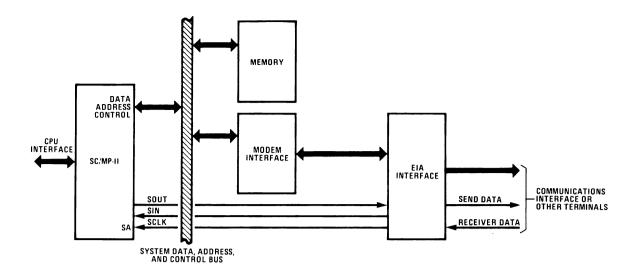


FIGURE 2. SC/MP-II as an Intelligent USRT

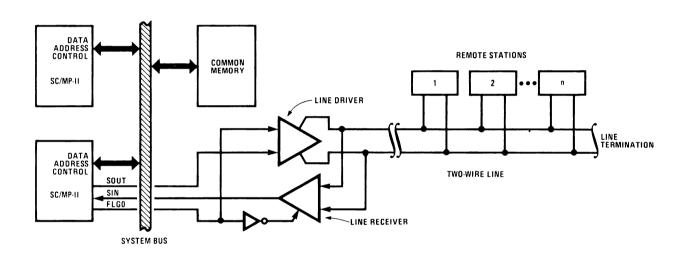


FIGURE 3. SC/MP-II as a Two-Wire Line System Controller

The serial I/O port can also be used as an intelligent USRT capable of operating at up to 4800 baud (see figure 2).

For the two-wire lines used in data acquisition systems, remote peripheral controls, and process controls, SC/MP can be designed as an intelligent controller operating at 9600 baud using standard protocols (see figure 3).

# DISTRIBUTED INTELLIGENCE BUS CONTROL LOGIC

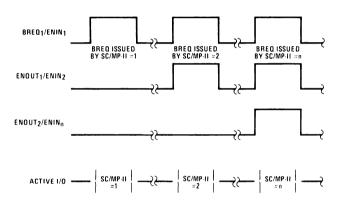
SC/MP-II is specifically designed with multiprocessor bus allocation logic for distributed processing or Direct Memory Access applications. These techniques are often useful in improving system performance. The buscontrol logic is explained in the following paragraphs.

Before SC/MP can transfer data, it must have access to the system address/control and data buses. Bus access is controlled by three signals — Bus Request (BREQ), Enable Input (ENIN), and Enable Output (ENOUT). For simple systems, BREQ and ENOUT need not be used, and ENIN can be permanently enabled. Bus access is always controlled by SC/MP, and data transfers from one peripheral to another must go through the processor.

In larger systems, especially those with peripherals that feature high-speed data transfers, Direct Memory Access (DMA) is a method frequently used to effect the fastest data transfers possible between peripherals and memory. Using this technique, data transfers can be directly implemented without involving SC/MP (other than for control functions).

Figure 4 shows a multiprocessor configuration using three SC/MPs. All three SC/MPs share common memory and peripherals and are executing their individual programs.

The three control signals (BREQ, ENIN, and ENOUT) provide both bus-access and priority-select functions. The Enable Input (ENIN) for SC/MP Number 1 is tied to the wire-ANDed BREQ. Thus, if a bus request is issued by the Number 1 processor, it has priority and controls the bus; that is, the input/output cycle for SC/MP Number 1 is active. With SC/MP Number 1 controlling the bus, the Enable Out (ENOUT<sub>1</sub>) signal is low and other processors in the string are locked out. If both SC/MP Number 2 and SC/MP Number "n" initiate a bus request (BREQ2 and BREQn set high) while SC/MP Number 1 is controlling the bus, the following operations occur. ENOUT<sub>1</sub> is low until SC/MP Number 1 is finished; then, it goes high. At this time, ENOUT 1 and ENIN 2 go high; thus, SC/MP Number 2 takes control of the bus. In short, if all processors issue a bus request simultaneously, the string is served on a priority-select basis - SC/MP Number 1 first, SC/MP Number 2 second, SC/MP Number 3 third, and so on.



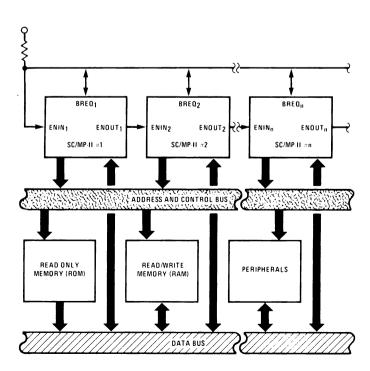


FIGURE 4. Multiprocessor Configuration

Conversely, if SC/MP Number "n" issues a bus request and there are no others awaiting service,  $\mathsf{ENIN}_n$  is high and the request is granted.

Any one of the SC/MP microprocessors shown in figure 4 can be replaced by a DMA peripheral; the BREQ, ENIN, and ENOUT control signals are used in exactly the same way. Thus, a system designer can economically distribute system functions among several processors and intelligent peripherals. This increases system throughput and eliminates the large hardware/software overhead penalty imposed upon a single processor trying to handle multiple tasks with fast peripherals.

# CONDITION SENSING AND CONTROL FLAG LINES

Unlike many other processors which rely on external I/O ports for communication with the outside world, SC/MP has inputs and outputs built into the processor (see figure 5). These are single-bit sense and control lines under the direct control of the programmer, and they are accessed through simple instructions. These I/O lines can be used to directly drive indicators and relays as well as to read process sensors and switches.

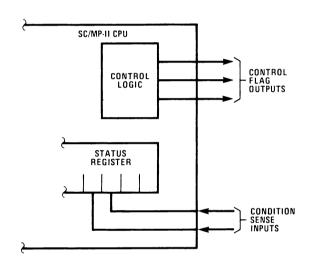


FIGURE 5. SC/MP-II Condition Sensing and Control Flag Lines

Such built-in functions allow the designer to do away with external address decoders and latches in many applications. Additionally, the direct software control that these functions allow means faster programs that require less memory.

The end result for the system designer is lower cost due to less hardware and simpler, easier-to-develop software.

# **DELAY**

Many microprocessor applications call for some type of timing loop. These timing loops generally are inaccurate, take up processor time, and consume program memory space. While the processor is sitting in its timing loop, peripherals on the data bus can access the memory only at a reduced speed. SC/MP has eliminated these problems through the DELAY instruction. The DELAY instruction provides a simple, programmable delay which can be set over a 10,000-to-1 range with crystal accuracy. During the delay time, SC/MP does not require access to the data bus; thus, peripherals or other DMA devices can access memory at full speed. The ability to control

the period of the delay under program control is particularly useful for sequencers, programmable signal generators, and digital phase-locked loops. In these applications, SC/MP's powerful instruction set virtually eliminates the need for additional external hardware.

# PARALLEL INPUT/OUTPUT BUSES

SC/MP-II features an 8-bit TRI-STATE® data bus and separate, latched address bus. These features allow the designer to ignore CPU bus loading between I/O cycles and to eliminate external address latches in his system.

SC/MP-II provides all control lines needed to economically build parallel ports onto these buses. Additionally, it provides a series of control signals which can be used in specialized applications to cut system parts count and to provide a higher level of system control. These signals include:

DELAY Indicates the start of a DELAY instruction.

HALT Indicates SC/MP-II has executed a HALT instruction.

I-FETCH Indicates the start of a new instruction fetch.

READ Indicates a memory fetch.

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# AND MUCH MORE . . .

The SC/MP is designed to interface with standard memories and peripheral devices rather than with costly dedicated support chips. Following are some examples of parts and techniques required to expand SC/MP features.

- DM74C151 (8-to-1 MUX) to expand one serial input to 8
- DM74C42 (1-to-8 DEMUX) to expand one serial output to 8
- DM74LS138 (DECODER) to expand one read/write strobe to 8
- AM3705 (ANALOG MUX) to select among 8 analog signals
- DM74C923 (KEYBOARD ENCODER) to directly SCAN a 20-key keyboard
- DM8318 (PRIORITY ENCODER) and DM81LS95 (TRI-STATE® OCTAL BUFFER) to provide 8 prioritized interrupts
- DM74LS138 (DECODER) to encode three output flags to 8
- Software control to provide variable-length stack
- DP8304 (8-bit Bidirectional BUS TRANSCEIVER) to provide buffer and drive capability for 8-bit parallel 1/O bus

# Dictionary of SC/MP-II Support

A super microprocessor -SC/MP-II. The SC/MP-II is presently available in plastic as well as ceramic package for commercial temperature range of  $0^{\circ}$  to  $70^{\circ}C$ . (For industrial and MIL users this is a  $-40^{\circ}C$  to  $+85^{\circ}C$  product.)

Following is the summary and brief description of support products for SC/MP-II.

- SC/MP-II Retrofit Kit ISP-8K/205
   Allows users easy upgrade of his SC/MP Kit for compatibility evaluation of SC/MP and SC/MP-II.
- 2) NIBL Kit

  NIBL National Industrial Basic Language

NIBL is a higher level programming language for SC/MP systems, designed for low speed control applications. Programs written in this language resemble FORTRAN or BASIC programs in which all variables are integers.

- NIBL provides such standard BASIC statements as: LET: PRINT: INPUT: IF/THEN: FOR/NEXT: GOTO: GOSUB: RETURN, etc.
- NIBL allows arbitrary integer arithmetic and logical expressions involving +, -, \*, /; AND, OR, NOT; Hex or decimal constants.
- NIBL allows tests for =, >, <, >=, <=, or <> (not =).
- NIBL has several special features which allow the programmer to get close to the machine:

LINK to machine code subrouting;

STAT for reading, writing or testing SC/MP status bits; '@', an operator which allows reading, writing, or testing of any byte in the address space of SC/MP.

NIBL occupies 4K of ROM and requires at least 2K of RAM, of which all but the first 256 (10) bytes are available for user program. It is totally self-contained as to I/O but is restricted to a 110 baud rate. It will be available as either:

- A set of 8 5214 ROMs
   ISP-8F/351 available now
- A set of 2 2316A ROMs ISP-8F/352 available now
- 3) 'SUPAK' Line by Line Resident Assembler for LCDS.

SUPAK is a 4K ROM-resident program development utility package for SC/MP LCDS + teletype. It consists of three programs:

A line-by-line assembler:

Accepts a program in limited assembly language from keyboard (or paper tape reader) and assembles it directly into RAM

• A paper tape line editor:

Allows insertion, deletion or replacement of lines of program source code; punches leader or trailer

A PROM tape punch program:

Punches the contents of a specified memory range, in BPNF or complemented binary format, onto paper tape

SUPAK requires the LCDS firmware but will run on either a SC/MP OR SC/MP-II LCDS. It will be available as:

A set of 8 MM5204/MM5214 ROMs
 Part Number ISP-8F/111

4) SC/MP-II CPU Card

Plug Compatible in LCDS with SC/MP CPU Application Card

Part Number: ISP-8C/100N (U.S. Card)

ISP-8C/100NE (Euro Card)

5) SC/MP-II LCDS Retrofit Kit

Objective is to upgrade SC/MP LCDS in customer location for SC/MP-II development

LCDS Retrofit Kit consists of:

a) SC/MP-II CPU Card

b) Firmware PROM/ROM

c) Documentation

Part Number: ISP-8P/301K (U.S. LCDS Retrofit Kit)

ISP-8P/301KE (Euro LCDS Retrofit Kit)

6) SC/MP-II LCDS

Factory assembled LCDS to support SC/MP-II based Application Development

Part Number: ISP-8P/301N (U.S. SC/MP-II LCDS)

ISP-8P/301NE (Euro SC/MP-II LCDS)

7) SC/MP-II RAM CARD

SC/MP RAM Application Card compatible RAM Card using higher speed RAM for SC/MP-II based application for 2K x 8 configuration

Part Number: ISP-8C/002N

For information on items 1, 2, and 3 contact Hash Patel, (408) 737-5175. For information on items 4, 5, 6, and 7 contact Bob Pecotich, (408) 737-6116.



# EXTENDED Temperature Range SC/MP II

There has been a number of inquiries for SC/MP II operating over extended temperature range.

Guess what? It is here now . .

Our lowest power, N-CH silicon gate technology, 8 bit processor operating on single +5V supply, i.e., SC/MP II is natural for extended temperature range as well as military applications.

The extended temperature range, i.e., -40°C to +85°C, parts will be guaranteed to meet all parameters described in SC/MP II data sheet printed March, 1977.

Call Hash Patel (408) 737-5175 for further information.

# SOFTWARE UPDATE

SPROM – IMP-16 – Firmware paper tape generator program: addr 324 should be 6229.

Corrections to the IMP-16 SC/MP Prom Programming Software, SPRSFT

Instructions for Revisions A & B of SPRSFT (Part # 4360943) should be modified to the following values:

addr	data
05BA	2100
05BB	2040
0040	2040
0041	4400
0042	0201



# ROGR AMMING



# IDBIT

Occasionally, during the execution of a routine, it may be desirable to wait for an interrupt before proceeding through the rest of the routine. The easiest way to do this using PACE is to use the jump (JMP) instruction to put the program in a tight loop that can be exited only by generating an interrupt. The following example illustrates this technique.

Main Program	Interrupt Program 1
Program	Program
: :	• •
JMP1 ; Await Interrupt	RTI
Program (Continued) •	Interrupt Program 2
•	Program
•	•
	• DTI 4
	KII1

The .-1 at the JMP instruction causes the Program Counter to be decremented by 1, thereby causing the JMP instruction to be executed, ad infinitum (or until an interrupt is generated). Upon receiving an interrupt, the PC is stored on the stack and the interrupt routine is then executed. To continue with the main program simply execute an RTI, with no displacement value, (see Interrupt Program 1) and the program execution will continue from just below the JMP instruction.

To return to await another interrupt, simply execute an RTI with a displacement value of -1 (see Interrupt Program 2). A -1 will be added to the stored PC on the top of the Stack and the JMP instruction will then be re-executed until another interrupt is generated.

17

Doug Hall

# the



# Dear Georgia:

Thanks so much for sending me copies of my article in the latest COMPUTE. I was glad you were able to publish it, and look forward to seeing whether or not readers will use and extend its applications.

I recently placed a note in BYTE, the small systems journal for hobbyists, soliciting all hobby users of PACE to get together and share their hints and kinks. So far I've had about several replies and they keep coming in. If we get a viable group formed we will keep you advised of our activities.

Best regards, Sincerely,

Jock Millenson 5929 Keith Ave. Oakland, CA 94618

If other PACER users would like to be involved in Jock's club contact him at the above address.

# Gentlemen, et al:

I have been receiving COMPUTE since its inception, and consider it a valuable addition to the maelstrom of microprocessor literature with which the industry abounds. Cybertronics has been involved since the beginning as a provider of IC's and supportive hardware, engineering services group, and custom systems house. We have lately been involved heavily in environmental control and energy management applications and the software therewith associated.

I would like to invite your readers to send for our catalogue (\$1.00), a 48 page compendium of necessary items, accompanied by a 20 page price list. In addition, I would appreciate the appending of our name and address to the list of "MICROPROCESSOR CONSULTANTS" on the back cover — since we have arrived by default at the state of the art in Louisville, and are busily integrating process control and related micro-based capability into local industry.

Thanks, and keep up the good work!

Steven K. Roberts, President Cybertronics Incorporated Microprocessor Systems & Components 312 Production Ct., Louisville, KY. 40299, (502) 499-1551 To: Georgia Marszalek

Solution to possible problems with SC/MP Keyboard Kit.

Immediately after assembly I began experiencing undesired double digit entries and failure to enter a pair of eights and other unexplainable phenomena with the keyboard kit. Several anxious phone calls later to your very service oriented and cooperative field experts, my board looked like it had contracted a fungus with all of the added piggy backed pullups and de-coupling caps. The problem stubbornly persisted. Chips were swapped, even the CPU itself. Timing, addressing, the Rom, VCC noise, etc. were carefully scrutinized for any ambiguity and still no solution.

The tip off finally came with the realization that the LEDS were very bright, which meant they were driven hard. Your calculator read out, if it is similar to others with all segs pulled down, should require app 25-35 ma. The 7442 can't handle that kind of current without sacrificing saturation volts (especially with all segs firing).

Solution: Replace DM 7442 with DM 7445, (Pin compatible open collector).

P.S. Maybe I'm being over elaborate with the solution explanation, but I have spent many frustrating hours localizing the problem, as well as investing in a second CPU chip, and wish to insure that no one else need to. The keyboard kit works great otherwise and have done some promoting of it myself to others.

Bob Bowes 2275 Cooley Place Pasadena, Calif. 91104

Editor's note: This change is being incorporated in future versions of the Keyboard Kit. Thanks, Bob for your comments.

Attention: Georgia Marszalek, Editor

# Gentlemen:

In the March issue of Compute, your answer to a letter published in Bit Bucket stated in part, that you would welcome endorsements of consultants.

Our company, Schwien Engineering, has been working with one of your consultants, Microprocessor Corporation of America for several months. The project has now led to a microprocessor prototype. Throughout this project, the personnel of Microprocessor Corporation of America have been creative and tireless.

They have contributed significantly beyond that required by our contract. I would not hesitate to recommend their services to any prospective user.

John Shaffer General Manager Schwien Engineering Inc. 2882 Metropolitan Place Pomona, CA 91767

	INC.	A/ -		Bit Microprocessor Family	AVAII ADII ITY	DOIGE
	Chips		PART NUMBER  IPC-16A/520D DP8300N DP8301D DP8302J	PACE CPU Chip (750ns) Monolithic Bus Transceiver (BTE) Monolithic 8-Bit I/O Port (MILE) Monolithic System Timing Element (STE)	Now Now 3 Qtr., '77 Now	\$ 25.0 \$ 6.9 \$ 7.0
	Cards		IPC-16C/100 IMP-16C/001B IPC-16C/001P IPC-16C/002B IPC-16C/002P IPC-16C/001 IPC-16C/011 IPC-16C/012B IPC-16C/012P IPC-16C/801 IPC-16C/801 IPC-16P/802	PACE CPU Card ROM/PROM Socket Card — 1K x 16 Capacity (MM5203Q) ROM/PROM Card with 1K x 16 (eight) MM5203Q's Inserted ROM/PROM Socket Card — 2K x 16 Capacity (MM5204Q) ROM/PROM Card with 2K x 16 (eight) MM5204Q's Inserted RAM Card with 1K x 16 (MM2102) Memory LCDS Common Bus RAM Card 1K x 16 (MM2102) Memory LCDS Common Bus ROM/PROM Socket Card with 2K x 16 Capacity (MM5204Q) LCDS Common Bus ROM/PROM Card with 2K x 16 (eight) MM5204Q's Inserted Wire Wrap Prototyping Card Common Bus Cable Card ASM	Now	\$ 285.0 \$ 124.0 \$ 359.0 \$ 132.0 \$ 405.0 \$ 161.0 \$ 132.0 \$ 405.0 \$ 4405.0
30 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	Systems		IPC-16P/108 IPC-16P/108H	PACE 8K Development System† PACE 8K Development System and Heavy Duty† Supply Implete Resident System Software – IPC-16S/901C)  PACE Development System Static RAM Card (4K x 16) PACE Development System ROM/PROM Socket Card (8K x 16) PACE Development ROM/PROM Card (8K x 16) PACE Low Cost Development System (LCDS)	Now Now Now Now Now	\$4,910.0 \$5,460.0 \$725.0 \$ 370.0 \$1,110.0 \$ 585.0
	Systems	•	IPC-16P/100 IPC-16P/805 IPC-16P/812 IPC-16P/840	IMP16/PACE System Conversion Kit (CPU Card, PACE Software and Development System Firmware) PROM Programmer for Development System Centronics Printer Floppy Disc Operating System: Dual Floppy Disc Drive; Interface Card; ROM Resident Firmware Card; Software on Diskette (requires 12K Memory) Paper Tape Reader (Plessey 1000 cps)	Now Now Now Now	\$1,000.0 \$ 750.0 \$3,700.0 \$4,500.0
	Software		IPC-16S/101C IPS-16S/102P IPC-16S/201C IPC-16S/901C	IMP-16 Based Cross Assembler – 8K Memory Required (paper tape) Fortran IV Cross Assembler for 16-Bit or Larger Word Computers (Cards) Basic Interpreter - 8K Memory Required (paper tape) Resident System Software Package: Source Editor; 4K, 8K and Conversational Assemblers, Absolute and General Loaders; Hardware Diagnostics; plus DEBUG and Utility Software (paper tape) IMP/16 PACE Translator and PACE Cross Assembler Available Through Timeshare Utility Companies Floppy Disc Operating System Software Package on Diskette (copies)	Now Now Now	\$ 100.0 \$ 495.0 \$ 100.0 \$ 200.0

Other system memory sizes are available. Consult price schedule.
 \* Prices shown for chips and cards are for quantities of 25 and up. All other prices are for quantities of one and up.
 Consult National's OEM Price Schedule for other quantity prices.
 NOTE: Prices and new product availabilities subject to change without notice; consult your National sales representative or distributor for current prices & product listings.

 NEW =	PART NUMBER	DESCRIPTION	AVAILABILITY	PRICE*
rature	IPC-16A/927 IPC-16A/928 IPC-16S/969Y IPC-16P/840Y IPC-16S/201Y IPC-16P/301Y IPC-16P/108Y	Logic Designer's Guide System Design Manual Assembly Language Programming Manual PACE DOS Users Manual PACE Basic Users Manual PACE LCDS Users Manual PACE Development System Users Manual IPC-16A/520 Data Sheet DP8300N Data Sheet DP8302J Data Sheet	Now Now Now Now Now Now Now Now	\$ 5.00 \$ 5.00 \$ 5.00 \$ 5.00 \$ 5.00 \$ 10.00 FREE FREE

SC/MP 8-Bit Microprocessor Family						
	NE	w =	PART NUMBER	DESCRIPTION	AVAILABILITY	PRICE*
	Chips	•	ISP-8A/500D ISP-8A/600D/N DP8304D ISP-8A/650D/N INS2656 MM5235	SC/MP CPU Chip SC/MP-II CPU Chip Bus Transceiver 128 x 8 RAM with 16 Prog. I/O Ports ROM/RAM/I/O 8K x 8 ROM	Now Now Now 3 Otr., '77 3 Otr., '77	\$ 15.00 \$ 15.00/12.00 \$ 5.70 ————————————————————————————————————
	Cards	-	ISP-8C/100 ISP-8C/100N ISP-8C/002N ISP-8C/004B ISP-8C/004P IPC-8C/801 ISP-8P/802	SC/MP CPU Card with 256 x 8 RAM, 512 x 8 ROM/PROM Socket SC/MP-II CPU Card with 256 x 8 ROM/PROM Socket RAM Card (2K x 8 Static Memory RAM, 512 x 8) PROM/ROM Socket Card - 4K x 8 (accepts 8 MM5204Q/MM5214) PROM/ROM Memory Card - 4K x 8 (with 8 blank MM5204Q) Wire Wrap Prototyping Card Common Bus Cable Card ASM	Now Now Now Now Now Now	\$238.00 \$238.00 \$152.00 \$119.00 \$499.00 \$35.00 \$145.00
	Systems	•	ISP-8P/301K ISP-8P/301 ISP-8P/301N ISP-8K/200 ISP-8K/205 ISP-8K/220 ISP-8K/400	SC/MP-II LCDS Retrofit Kit SC/MP Low-Cost Development System (includes CPU Application Card) SC-MP-II Low-Cost Development System (includes CPU Application Card) SC/MP Kit – An Introductory Package for New Users SC/MP-II Retrofit Kit SC/MP Kit Fully Assembled and Tested SC/MP Keyboard Kit – Hex Keyboard/Display	Now Now Now Now Now Now	\$199.00 \$499.00 \$499.00 \$ 99.00 \$ 18.50 \$125.00 \$ 95.00
	Software	-	ISP-8S/100C ISP-8S/101C ISP-8S/103C ISP-8S/102P ISP-8F/111 ISP-8F/351	IMP-16 Based Cross Assembler — 4K (paper tape) IMP-16 Based Macro Cross Assembler — 8K (paper tape) PACE-P Based Macro Cross Assembler — 8K (paper tape) Fortran IV Cross Assembler for 16-Bit Word or Larger Computers SC/MP-II LCDS Firmware Assembler Package (SUPAK): Line Assembler, Source Editor, P/N Tape Generator (in 8 MM5214 ROMs) SC/MP-II National Industrial Basic Lang. (NIBL) Firmware (in 8 MM5214 ROMs) SC/MP-II NIBL Firmware (in 2 MM2316A ROMs)	Now Now Now Now Now	\$150.00 \$150.00 \$150.00 \$150.00 \$495.00 \$300.00 \$260.00 \$ 85.00
	Literature	-	ISP-8S/994Y 4200079A 420305239-001A	SC/MP Assembly Language Programming Manual SC/MP-II Brochure SC/MP - Technical Description SC/MP Applications Handbook SC/MP-II Data Sheet (ISP-8A/600) SC/MP Data Sheet (ISP-8A/500)	Now Now Now Now Now	\$ 10.00 FREE \$ 3.00 \$ 5.00 FREE FREE

<sup>\*</sup>Prices shown for chips and cards are for quantities of 25 and up. All other prices are for quantities of one and up.

Consult National's OEM Price Schedule for other quantity prices.

NOTE: Prices and new product availabilities subject to change without notice; consult your National sales representative or distributor for current prices & product listings.

Support Devices and Literature						
	NEV	V =	PART NUMBER	DESCRIPTION	AVAILABILITY	PRICE*
Universal Interface			DP8212N/J INS8255D 81LS95/98 DM8542N MM74C173/174N DM74LS173/174N DM8546N LM555CN/556CN DM74147N/748N DS8833N DS8835N DM74LS138N DP8301D DP8304 INS8253 INS8257 INS8259 BP8350	8-Bit I:O Port Programmable Parallel Interface Tri-State* Octal Buffers Quad I:O Register 4-Bit CMOS Latches 4-Bit Tri-State* Latches 4-Bit Tri-State* Latches 4-Bit I Low Power Schottky Latches Tri-State* 8-Bit Universal I/O Shift Reg. Interval Timer Priority Encoder (Interrupt/DMA Control) Tri-State* Quad Bus XCVR Bi-Directional Bus Driver Inv. 1-of-8 Binary Decoder (replaces Intel 8205) Monolithic 8-Bit I/O Port Octal Bus Driver Programmable Timer Programmable DMA Controller Programmable Interrupt Controller Programmable CRT Controller	Now	\$ 3.30/3.90 \$12.80 \$ 7.70 \$ 5.60 \$ 1.26 \$ 3.20; 2.48 \$ 3.40; 1.65 \$ 4.80 \$ .66; 1.15 \$ 4.00; 2.48 \$ 2.35 \$ 2.35 \$ 1.55 \$ 7.00 \$ 5.30
Human Interface			MM74C922/3 MM5740AAX/N DM8544N DS8859, 69N CD4511CN DS8692, 3, 4 DM8678XXX/N/J	16 & 20-Key Keyboard Encoders 90-Key Keyboard Encoder Tri-State* Quad Switch Debouncer Hex Latch/Led Driver 7-Segment Latch Decoder Driver Seiko Printer Interface Set CRT Character Generator	Now Now Now Now Now Now	\$ 4.55/ 4.65 \$14.40 \$ 1.20 \$ 1.50 \$ 2.76 Contact Factory \$17.60/20.40
Instrument & Machine Interface			DM8334N ADC0800PCN ADC1210, 11 DAC1200, 02CN CD4051CN DAC1201, 03CN	8-Bit Bit-Addressable Latch 8-Bit A-to-D Converter CMOS A-to-D Converter (12/10 Bit) 12-Bit D-to-A Converter (Binary/BCD) 8-Ch. Analog Mux'Demux 10-Bit D-to-A Converter	Now Now Now Now Now	\$ 4.00 \$ 9.60 \$33.85 \$33.00 \$ 1.26 \$27.00
Memory with Input/Output		•	INS2656 ISP-8A/650D/N	ROM/RAM/I/O 128 x 8 RAM with 16 Prog I/O Port	3 Qtr., 77 3 Qtr., 77	_
RAMs			MM2114 MM5257 MM2102/2N MM5269N MM5270, 80D MM74C920D MM2111-2N MM2102AN-4	1k x 4 Static RAM 4k x 1 Static RAM 1k x 1 Static RAM 256 x 4 Static RAM with Latched Inputs 4k x 1 Dynamic RAMs 1k x 1 CMOS Static RAM 256 x 4 Static RAM, Common I/O 1k x 1 Static RAM, 450ns	3 Qtr., '77 3 Qtr., '77 Now Now Now Now Now Now Now Now Now	\$ 2.80 \$ 3.85 \$14.40.18.00 \$14.60 \$ 3.85 \$ 3.00
ROMs		•	MM5214N MM5242N MM2316A DM85S28XXX/J/N MM5235	512 x ROM 1k x 8 NMOS ROM 2k x 8 ROM 1k x 8 ROM (Pinout Similar to MM2708) 8K x 8 ROM	Now Now Now Now 3 Qtr., 77	\$23.00 \$15.00 Contact Factory \$48.88/46.35
PROMs			DM2704N MM5204Q MM1702AQ MM2708Q DM87S222N DM74S472N DM87S296N	512 x 8 PROM with 2708 Pinouts 512 x 8 Erasable PROM 256 x 8 Erasable PROM 1k x 8 Erasable PROM 256 x 8 PROM with Latched Inputs (20 pin DIP) 512 x 8 PROM (20 pin DIP) 512 x 8 PROM	Now Now Now Now 3 Qtr., '77 3 Qtr., '77 Now	\$21.25 \$35.40 \$28.45 Contact Factory
Communications			MM5307AA/N MM5303N INS57101 INS8251 INS1671 INS1771-1 INS2651 INS2652	Baud Rate Gen./Prog. Real Time Clock UART Asynchronous Communication Element Programmable Communications Interface Astro Communications Interface Floppy Disc Controller USART/Baud Rate Gen. Multi Protocol Comm. (SDLC)	Now Now 3 Qtr., '77 3 Qtr., '77 Now Now 3 Qtr., '77 3 Qtr., '77	\$14.00 \$ 7.20 — — — — —
Literature		-		TTL Products Catalog Interface Products Catalog Special Function Products Catalog Memory Products Catalog Microprocessor Full Spectrum Brochure Microprocessor Cards & System Brochure Microprocessor Training Brochure	Now Now	\$ 4.00 \$ 4.00 \$ 3.00 \$ 3.00 FREE FREE FREE

<sup>\*</sup> Prices shown for chips and cards are for quantities of 25 and up. All other prices are for quantities of one and up.

Consult National's OEM Price Schedule for other quantity prices.

NOTE: Prices and new product availabilities subject to change without notice; consult your National sales representative or distributor for current prices & product listings.



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17452 Irvine Blvd., Suite B Tustin, California 92680 (714) 832-8113 TWX: 910-595-1523

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Representative of Electronic Products 3501 Lake Eastbrook S.E. Grand Rapids, Michigan 49506 (616) 942-1320

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Stan Clothier Co Stan Clothier Co. 7423 Washington Avenue S. Minneapolis, Minnesota 55435 (612) 944-3456 TWX: 910-576-3415

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Cen Tech 6310 Ash Raytown, Missouri 64111 (816) 358-8100 TWX: 910-777-2007

Cen Tech 514 Earth City Plaza #341 Earth City, Missouri 63045 (314) 291-4230 TWX: 910-762-0698

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Mid-Atlantic Regional Office
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Englewood Cliffs, New Jersey 07632 (201) 461-5959 TWX: 710-991-9734

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Electra Sales Corp. 104 Pickard Drive Syracuse, New York 13211 (315) 455-5783 TWX: 710-541-0418

Electra Sales Corp. 474 Thurston Road Rochester, New York 14619 (716) 436-4030, (716) 436-4037

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Micro-Tec, Inc. 6076 Busch Boulevard, Suite 3 Columbus, Ohio 43029 (614) 888-9761/62

Micro-Tec 19 Alpha Park Highland Heights, Ohio 44143 (216) 461-0191 TWX: 810-427-2972

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\*Applications Engineer Available

# Telecommunications Circuits

A new catalog of microprocessors and integrated circuits designed for telecommunications applications, is now available from National.

The booklet contains descriptions, data, and applications notes, and diagrams of twelve different subsystems product lines that are of particular importance to manufacturers and users of modern telecommunications systems equipment.

The booklet is available without charge from National Semiconductor, 2900 Semiconductor Drive, Santa Clara, California 95051, and from National's local sales offices.

# TRANSLATION PLEASE!

Occasionally we get letters or COMPUTE orders where the address is difficult to read. When we translate these to the envelope labels with your library requests or orders they are returned because the postal service cannot find you. If at all possible please use your mailing label on all correspondence to the user group, print legibly or type your name and address. Thanks a lot.

# SCHEDULE OF MICROPROCESSOR RESIDENT TRAINING PROGRAMS

	EASTERN TRAINING CENTER	WESTERN TRAINING CENTER
MICROPROCESSOR FUNDAMENTALS	SEPTEMBER 19-22 OCTOBER 17-20 JANUARY 9-12 FEBRUARY 6-9 APRIL 3-6 MAY 1-4	AUGUST 22-25 SEPTEMBER 19-22 OCTOBER 17-20 FEBRUARY 6-9 MARCH 6-9 APRIL 3-6
SC/MP APPLICATIONS	AUGUST 1-4 SEPTEMBER 26-29 OCTOBER 24-27 JANUARY 16-19 FEBRUARY 13-16 APRIL 10-13 MAY 8-11	SEPTEMBER 1 SEPTEMBER 26-29
PACE APPLICATIONS	AUGUST 8-11 OCTOBER 3-6 OCTOBER 31- NOVEMBER 3 JANUARY 23-26 FEBRUARY 20-23 APRIL 17-20 MAY 15-18	AUGUST 8-11 SEPTEMBER 5-8 OCTOBER 3-6 OCTOBER 31- NOVEMBER 3 FEBRUARY 20-23 APRIL 17-20 MAY 8-11
ADVANCED PROGRAMMING	OCTOBER 10–13 FEBRUARY 27 – MARCH 2	NOVEMBER 7-10
8080/PERIPHERALS	AUGUST 22-25 DECEMBER 5-8	JANUARY 30- FEBRUARY 2

MARCH 27-30

MAY 22-25

# POWER TRANSISTOR DATA BOOK

A new data book and power catalog that details more than one hundred discrete power semiconductor products is now available from National.

This is the first catalog to describe National's complete line of power transistors, which include four plastic packages: TO-126, TO-202, TO-220 and the innovative 92 Plus package, as well as the standard (metal) TO-3 package.

The book provides access to all specifications, and is crossindexed with part number to process conversion for all the devices. The reference guide allows the engineer to pinpoint the voltage current and package he needs in the simplest way.

The 152 page data book is available from National Semiconductor Corporation, Marketing Services, 2900 Semiconductor Drive, Santa Clara, California 95051, \$3.00 postpaid.

# HEXADECIMAL TO DECIMAL DISPLACEMENT TABLE

-HEX DEC HEX	-HEX DEC HEX	-HEX DEC HEX	-HEX DEC HEX
FF 01 01	DF 33 21	BF 65 41	9F 97 61
FE 02 02	DE 34 22	BE 66 42	9E 98 62
FD 03 03	DD 35 23	BD 67 43	9D 99 63
FC 04 04	DC 36 24	BC 68 44	9C 100 64
FB 05 05	DB 37 25	BB 69 45	9B 101 65
FA 06 06	DA 38 26	BA 70 46	9A 102 66
F9 07 07	D9 39 27	B9 71 47	99 103 67
F8 08 08	D8 40 28	B8 72 48	98 104 68
F7 09 09	D7 41 29	B7 73 49	97 105 69
F6 10 0A	D6 42 2A	B6 74 4A	96 106 6A
F5 11 0B	D5 43 2B	B5 75 4B	95 107 6B
F4 12 0C	D4 44 2C	B4 76 4C	94 108 6C
F3 13 0D	D3 45 2D	B3 77 4D	93 1 <b>0</b> 9 6D
F2 14 0E	D2 46 2E	B2 78 4E	92 110 6E
F1 15 0F	D1 47 2F	B1 79 4F	91 111 6F
F0 16 10	D0 48 30	B0 80 50	90 112 70
EF 17 11	CF 49 31	AF 81 51	8F 113 71
EE 18 12	CE 50 32	AE 82 52	8E 114 72
ED 19 13	CD 51 33	AD 83 53	8D 115 73
EC 20 14	CC 52 34	AC 84 54	8C 116 74
EB 21 15	CB 53 35	AB 85 55	8B 117 75
EA 22 16	CA 54 36	AA 86 56	8A 118 76
E9 23 17	C9 55 37	A9 87 57	89 119 77
E8 24 18	C8 56 38	A8 88 58	88 120 78
E7 25 19	C7 57 39	A7 89 59	87 121 79
E6 26 1A	C6 58 3A	A6 90 5A	86 122 7A
E5 27 1B	C5 59 3B	A5 91 5B	85 123 7B
E4 28 1C	C4 60 3C	A4 92 5C	84 124 7C
E3 29 1D	C3 61 3D	A3 93 5D	83 125 7D
E2 30 1E	C2 62 3E	A2 94 5E	82 126 7E
E1 31 1F	C1 63 3F	A1 95 5F	81 127 7F
E0 32 20	C0 64 40	A0 96 60	80 128 80

We would like to thank whoever sent in the above table; however, we lost the name and address. Sorry about that.

BULK RATE U.S. POSTAGE PAID PERMIT NO. 317 SUNNYVALE, CALIF

# SC/MP II COMPATIBILITY

There was a short article in the May 1977 issue of COMPUTE announcing the SC/MP-II Microprocessor Chip. The article stated that the SC/MP and SC/MP-II chips are software pinout compatible. This is not entirely true. The two chips are software compatible except for timing delays. Since SC/MP-II runs much faster than SC/MP, any timing delays in a SC/MP program must be modified before the program will run correctly on a SC/MP-II. SC/MP and SC/MP-II have the same pinouts except the power pins. The differences are as follows:

S	C/MP	SC/N	1P-11
Pin	Signals	Pin	Signals
20	+5(V <sub>SS</sub> )	20	GND
40	-7(V <sub>GG</sub> )	40	+5(V <sub>CC</sub> )

In addition the active input level for the following signals has changed from active low to active high:

	SC/MP			SC/MP-I	l
Pin	Signal	Active	Pin	Signal	Active
3	ENIN	low	3	ENIN	high
4	ENOUT	low	4	ENOUT	high
5	BREQ	low	5	BREQ	high

# Microprocessor Consultants

# ABLER DATA SERVICES, INC.

740 Garvens Avenue Brookfield, WI 53005 (414) 786-2448

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10357 Kinsman Road Newbury, OH 44065 (216) 564-1152

# CYBERTRONICS INC. MICROPROCESSOR SYSTEMS & COMPONENTS

312 Production Ct., Louisville, KY. 40299, (502) 499-1551

# DANYL CORPORATION

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# **INTERPHASE ASSOCIATES**

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# MICROCOMPUTER CONCEPTS, INC.

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# MICROPROCESSOR CORPORATION OF AMERICA

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