

M980 PROM Programmer

M980 PROM Programmer

User's Manual Update

M980 DATA REVISION

Periodically the M980 User's Manual will be revised to reflect new or updated technical information. New pages may also be added.

The pages listed below have been revised. The old pages of the same number should be discarded and replaced by these new pages (Rev A).

REPLACEMENT PAGES

Title Page	Rev A
Contents	Page v Rev A & vi Rev A
Figures	Page vii Rev A & viii Rev A
Section 2	Page 2-1 Rev A & 2-2 Rev A
Section 3	Page 3-7 Rev A & 3-8 Rev A
Section 4	Page 4-1 Rev A & 4-2 Rev A
Section 6	Page 6-5 Rev A, 6-6 Rev A, 6-9 Rev A, 6-10 Rev A 6-11 Rev A & 6-12 Rev A
Section 7	Page 7-5 Rev A & 7-6 Rev A, 7-13 Rev A, 7-14 Rev A, 7-15 Rev A, 7-16 Rev A, 7-23 Rev A, 7-33 Rev A, 7-34 Rev A, 7-35 Rev A, 7-36 Rev A, 7-37 Rev A & 7-38 Rev A
Section 9	Page 9-1 Rev A, 9-2 Rev A, 9-3 Rev A & 9-4 Rev A
Section 10	Page 10-3 Rev A & 10-4 Rev A
Section 13	Page 13-1 Rev A & 13-2 Rev A
Section 17	Page 17-1 Rev A, 17-2 Rev A, 17-3 Rev A, 17-4 Rev A, 17-13 Rev A & 17-14 Rev A
Section 18	Page 18-1 Rev A, 18-2 Rev A, 18-3 Rev A, 18-4 Rev A, 18-7 Rev A, 18-8 Rev A, 18-13 Rev A, 18-14 Rev A, 18-15 Rev A, 18-16 Rev A, 18-21 Rev A, 18-22 Rev A, 18-23 Rev A, 18-24 Rev A, 18-33 Rev A, 18-34 Rev A, 18-37 Rev A, 18-38 Rev A, 18-45 Rev A, 18-46 Rev A, 18-47 Rev A, 18-48 Rev A, 18-49 Rev A, 18-50 Rev A, 18-51 Rev A & 18-52
Section 19	Page 19-1 Rev A & 19-2 Rev A

Contents

	Page		Page
SECTION 1—Purpose and Main Features	1-1	Duplicating a PROM from a Master PROM	5-8
Description	1-1	Comparing a Copy PROM with a Master PROM.....	5-10
Features.....	1-1	Performing a Checksum on a Master PROM.....	5-12
Operational Modes.....	1-2	Performing a Checksum on a Copy PROM	5-14
Personality Modules.....	1-2	Performing a Blank Check on a Master PROM.....	5-16
Optional Accessories	1-2	Performing a Blank Check on a Copy PROM	5-18
Physical Specifications	1-3	Performing an Illegal Bit Check on a Copy PROM from the Master PROM	5-20
SECTION 2—Operating Panel Description	2-1	SECTION 6—Buffer Operations To/From a Copy or Master PROM	6-1
Panel	2-1	Description	6-1
Panel Displays, Indicators and Controls.....	2-2	Duplicating the RAM Buffer from a Master PROM.....	6-2
Hexadecimal Notation.....	2-3	Comparing the RAM Buffer with a Master PROM.....	6-4
SECTION 3—Personality Module Description	3-1	Duplicating the RAM Buffer into a Copy PROM.....	6-6
Personality Module Types.....	3-1	Comparing the RAM Buffer to a Copy PROM	6-8
Dedicated Modules	3-1	Performing an Illegal Bit Check on a Copy PROM from the Buffer	6-10
Generic Modules	3-2	SECTION 7—Additional Buffer Operations	7-1
Dedicated Gang Modules.....	3-4	Description	7-1
Generic Gang Modules.....	3-5	Programming the RAM Buffer using the M980 Keyboard.....	7-2
5V MOS Generic Module	3-6	Reading the RAM Buffer using the M980 Keyboard	7-4
Special Personality Modules	3-7	Performing a Read/Modify on the RAM Buffer	7-6
PROM Handling	3-7	Performing a Checksum on the M980 RAM Buffer	7-8
ZIF Sockets	3-7	Buffer Edit Functions	7-10
SECTION 4—Address Field Definition	4-1	Buffer Edit—Set Word Size	7-11
Full Address Operation	4-1	Buffer Edit—Invert (Complement)	7-12
Partial Address Operation.....	4-1	Buffer Edit—Fill Buffer	7-14
Clear Key Operations	4-2	Buffer Edit—Insert	7-16
SECTION 5—Copy and Master Socket Operations	5-1	Buffer Edit—Delete	7-20
Description	5-1	Buffer Edit—Block Move.....	7-24
Master and Copy Socket Modes	5-1	Buffer Edit—Nibble Swap	7-28
Audio/Manufacturing Toggle Switches	5-1	Buffer Edit—Hex Pack.....	7-30
Master/Buffer/Copy Source Destination Toggle Switches	5-2	Buffer Edit—Hex Unpack	7-32
Programming a PROM.....	5-2		
Reading a Copy PROM in the COPY Socket.....	5-4		
Reading a Master PROM in the MASTER Socket	5-6		

Contents

(Continued)

	Page		Page
Buffer Edit—RAM Split.....	7-34	SECTION 14—M980 Interface Software	
Buffer Edit—RAM Interleave.....	7-36	Selection	14-1
SECTION 8—Buffer Applications	8-1	Selecting Type and Format.....	14-1
Description	8-1	Interface Format Numbers	14-3
Example 1	8-1	Pro-Log and Industry Format Description	14-4
Example 2	8-1	SECTION 15—9811 Paper Tape Reader	15-1
SECTION 9—Manufacturing Mode	9-1	9811 Paper Tape Reader	15-1
Description	9-1	Parallel Interface Connector.....	15-1
Automatic Sequencing Operation	9-2	Controls	15-2
Single Operation.....	9-4	Indicators.....	15-2
SECTION 10—Engineering Auto-Sequencing		Formats	15-2
Mode	10-1	Operating Sequences	15-4
Description	10-1	Error Indication	15-5
Buffer to Copy Operation	10-2	SECTION 16—9812-02 TTY Interface	16-1
Master to Copy Operation.....	10-4	9812 Auto-Baud TTY.....	16-1
SECTION 11—Failure to Program	11-1	Controls and Indicators.....	16-1
Fusible PROMs.....	11-1	Paper Tape Format	16-2
UV Erasable PROMs	11-1	Keyboard Commands	16-2
Example of Error during Duplication	11-2	Operating Modes	16-3
PM9005A and PM9053A Modules.....	11-3	Operating Sequences	16-3
PM9051A, PM9060A, PM9075A and PM9076A		TTY Errors.....	16-4
Modules	11-3	Options and Modifications	16-4
SECTION 12—Error Indications and		Removing TTY Housing	16-5
Operation Codes	12-1	Current Loop—Without Elapsed Time	
Error Indications	12-1	Meter	16-7
Operation Codes	12-1	Current Loop—With Elapsed Time Meter.....	16-9
SECTION 13—Self-Test Operations	13-1	Full Duplex Option	16-10
Description	13-1	Remote Reader Control.....	16-10
Keyboard Self-Test Selection.....	13-1	Manual Reader Operation.....	16-11
Toggle Switch Test	13-1	Auto Reader Operation	16-12
Keyboard (Keyswitch) Test	13-1	SECTION 17—9814 Computer Interface	17-1
Display Test	13-1	Master or Slave Operation	17-1
RAM Buffer Test.....	13-2	Summary of Operation	17-4
		9814 Interfacing	17-6
		Signal Definitions	17-8
		Pin 114 Applications Note.....	17-12

Contents

(Continued)

	Page		Page
SECTION 18—Communication Interface	18-1	Motorola Format ("L" List)	18-29
9818 RS-232-C Communications Interface		MOS Technology Format Description.....	18-31
(General)	18-1	M980 RS-232-C Remote Control	18-33
Functional Description.....	18-1	Description	18-33
M304 Panel Description	18-1	Duplicate Function.....	18-33
DTE and DCE Operation and Connection	18-2	Remote Control Operation	18-34
Simple Hook-up for DTE and DCE	18-4	Typical Remote Load and Program.....	18-34
Character Structure	18-4	RS-232-C Interface Application Notes	18-35
ASCII Code Assignments	18-5	Intel MDS 200 Series.....	18-35
How to Select the Interface and Formats.....	18-6	Tektronix 8002A MDL	18-38
Downloading.....	18-8	Tektronix 8550	18-39
Uploading	18-8	AMC Systems 8 and 29.....	18-41
Pro-Log Format Descriptions	18-11	Motorola EXORciser II	18-42
RS-232-C Format Descriptions	18-11	Motorola EXORmacs	18-44
4-Bit Data Programming	18-11	CP/M-Based Systems	18-44
"L" List	18-13	64K Wraparound Feature of the M980 RAM	
"M" List	18-14	Buffer	18-45
"S" List	18-15	M304 Adapter	18-47
"N" List.....	18-16	Parity and Stop Bits	18-47
"X" List.....	18-17	Signal Discipline.....	18-49
"P" Program	18-18	Electrical Specifications	18-49
"CR/LF" Program	18-19	Mechanical Specifications	18-49
Industrial Format Descriptions	18-21	Environmental Specifications.....	18-49
Description	18-21	SECTION 19—9103A UV Erase Light	19-1
4-Bit Data Programming	18-22	Description	19-1
Intel-Hex Format Description	18-22	Physical Characteristics	19-1
Intel #10 Format Selection	18-24	Controls	19-1
Intel #11 Format Selection	18-24	Operating Instructions.....	19-1
Intel #12 Format Selection	18-25	Lamp Characteristics	19-2
Intel #13 Format Selection	18-25	Power Requirements	19-2
Tek-Hex Format Description	18-25	ASCII Code Assignments and Error	
Tek-Hex Format Selection	18-27	Indications	Inside Back Cover
Motorola Format Description ("S" Record)	18-27		

Figures

Figure		Page	Figure		Page
1-1	M980 PROM Programmer	1-1	15-5	Binary Tape Format	15-3
1-2	M980 Operating Modes	1-2	15-6	MDS Format	15-3
2-1	M980 Operating Panel	2-1	16-1	M980 with TTY	16-1
2-1	M980 Operating Panel	2-1	16-2	Operating Modes	16-3
2-2	Conversion Table (Hex/Binary/Decimal)	2-3	16-3	Top View—TTY with Housing Removed	16-5
2-3	Conversion Table (Hex/Binary/Decimal)	2-3	16-4	TTY Interface Circuit	16-6
3-1	Dedicated Module	3-1	16-5	Current Loop Option (Situation 1)	16-7
3-2	Installation and Removal of Personality Module	3-2	16-6	Side View—TTY with Housing Removed	16-8
3-3	Generic Module	3-2	16-7	Current Loop Option (Situation 2)	16-9
3-4	Base Module	3-3	16-8	TTY Half-Duplex Option	16-10
3-5	Pinout Adapter	3-3	16-9	TTY Full-Duplex Option	16-10
3-6	Configurator	3-3	16-10	TTY Modification (Manual Reader)	16-11
3-7	Dedicated Gang Module	3-4	16-11	TTY Modification (Auto Reader)	16-12
3-8	Generic Gang Module and Gang Configurators	3-5	17-1	Computer Interface	17-1
3-9	ZIF Socket	3-6	17-2	9814 Format Selection	17-1
3-10	PM9080 5V MOS Generic Module	3-7	17-3	M980 Configured as a Slave Unit	17-2
4-1	PROM Size Field Definition	4-1	17-4	M980 Configured as a Master Controller	17-3
6-1	Buffer Operations (To/From Copy or Master PROM)	6-1	17-5	Data Signals for Address Definition	17-4
7-1	Buffer Operations via Hex Keyboard	7-1	17-6	Connector Interface Pin List for M980 Slave Unit	17-7
7-2	Buffer Edit—Set Word Size	7-10	17-7	Connector Interface Pin List for M980 Master Controller	17-7
7-3	Illustration of Edit Insert	7-18	17-8	Data Transfer Waveforms	17-9
7-4	Illustration of Delete Operation	7-22	17-9	Initialization	17-10
7-5	Illustration of Buffer Block Move Operations	7-26	17-10	Mode Select	17-10
7-6	Illustration of Nibble Swap	7-29	17-11	Address Definition	17-10
7-7	Illustration of Hex Pack	7-31	17-12	Read	17-11
7-8	Illustration of Hex Unpack	7-33	17-13	Write	17-11
7-9	Illustration of RAM Split	7-35	17-14	PIN 114 Parallel Interface System	17-12
7-10	Illustration of RAM Interleave	7-37	17-15	PIN 114 Connected to a Pro-Log PROM Programmer	17-13
15-1	M301 Paper Tape Reader	15-1	17-16	PIN 114 System Interconnect	17-13
15-2	Paper Tape Reader Interface	15-1	17-17	RC50-6 Keying	17-14
15-3	ASCII Hex Format	15-2	17-18	Pin 114 Bit and Port Assignments	17-14
15-4	ASCII BNPF	15-2			

Figures

(Continued)

Figure	Page	Figure	Page
18-1 M304 RS-232-C Communications Adapter	18-1	18-13 Character Format.....	18-48
18-2 M304 Switch Settings and Signal Paths	18-3	18-14 Jumper Locations and Character Variations Using Jumper.....	18-48
18-3 Hook-Up for DTE and DCE	18-4	18-15 Signal Discipline.....	18-49
18-4 ASCII Code Assignments	18-5	18-16 Terminal/Modem/I/O Specifications	18-50
18-5 Address Offset Download.....	18-9	18-17 M304 I/O Specifications.....	18-50
18-6 Address Offset Upload	18-9	18-18 M304 Schematic	18-51
18-7 M304/MDS Interconnect	18-35	18-19 M304 Assembly	18-52
18-8 Serial CH1 Lines and Jumpers	18-36	19-1 9103A (mounted in case)	19-1
18-9 Connecting to MDS	18-38	19-2 9103A UV Erase Light.....	19-1
18-10 M980/8002 Interconnect	18-39	19-3 Recommended PROM Arrangement and Erase Times	19-2
18-11 M980/8550 Interconnect	18-40		
18-12 M980/EXORcisor II Interconnect	18-42		

SECTION 1

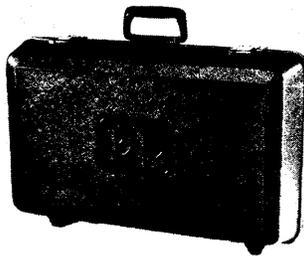
Purpose and Main Features

DESCRIPTION

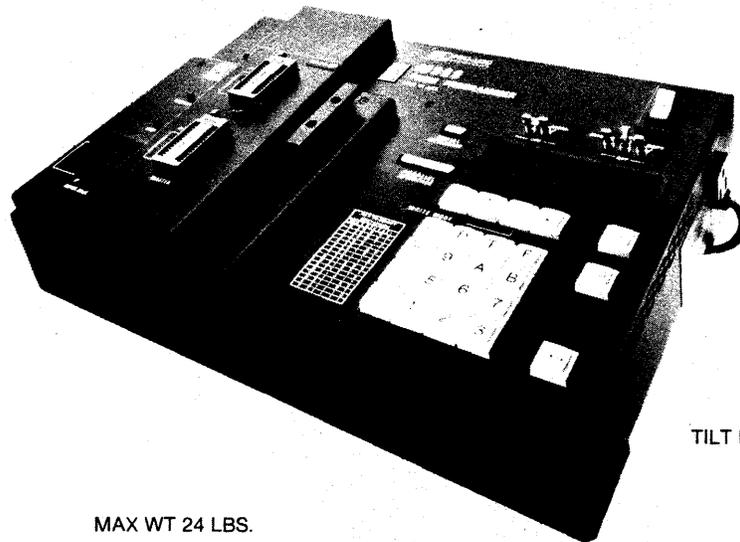
The M980 PROM Programmer (Figure 1-1) is a compact, portable microprocessor-based Control Unit that utilizes a series of plug-in Personality Modules to program, copy and test bipolar and MOS PROMs and other programmable devices. There are essentially six types of personality modules designed for use with the M980: Dedicated, Generic, Dedicated Gang, Generic Gang, 5V MOS Generic and Special. The M980 also easily interfaces with a variety of external sources including computers, development systems, paper tape readers and TTYs. The functional operating panel contains all of the controls, indicators and displays necessary for ease of keyboard operation plus integral connectors for remote control options. Various key-selectable data formats, Pro-Log as well as industry-compatible, are available for the many communication modes. The M980 features a Buffer Memory which allows data manipulation prior to PROM programming. It is highly efficient for many applications from design engineering to field service, and is ideally suited to the manufacturing environment.

FEATURES

- Program, compare, read and duplicate more than 450 different devices, including PROMs, PALs, and microprocessors containing programmable memory
- Perform blank checks, six-digit checksums, and illegal-bit checks
- Edit data in the CMOS RAM buffer memory, including move, insert, delete, and nibble swap
- Retain data in the CMOS RAM buffer for 7 days with power off
- Interface with computers, development systems, paper-tape readers and TTYs
- Utilize visible and audible prompting to ensure proper programming operations
- Use the manufacturing mode for single keystroke duplicating
- Select built-in self-test functions
- Operate with a safe, UL-listed product



ATTACHE CARRYING CASE



TILT BAR

MAX WT 24 LBS.

Figure 1-1. The M980 PROM Programmer

OPERATIONAL MODES

The M980 features three main operating modes: Manual, Automatic and Manufacturing (see Figure 1-2).

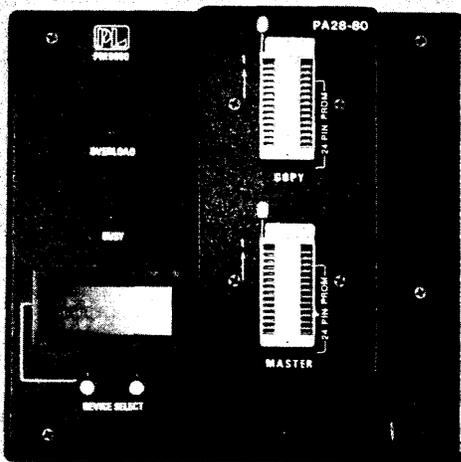
M980 MODES		
MANUAL	AUTOMATIC	MANUFACTURING
Read (see Sect. 5-5)	Compare (see Sect. 5)	Auto (see Sect. 9)
Program (see Sect. 5)	Duplicate (see Sect. 5)	Blank Check (see Sect. 5)
Read/Modify (see Sect. 5) (Buffer only)	Auto (see Sect. 9)	Duplicate (see Sect. 5)
	Blank Check (see Sect. 5) (Copy and Master only)	Compare (see Sect. 5)
	Illegal Bit Check (see Sect. 5)	
	Checksum (see Sect. 5)	
	Buffer Edit Options (see Sect. 7)	
	Self-test (see Sect. 13)	

All modes have repeat capabilities.

Figure 1-2. M980 Operating Modes

PERSONALITY MODULES

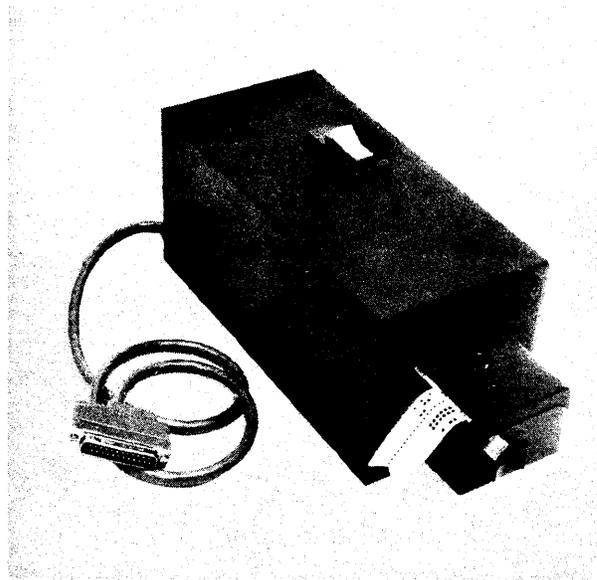
These plug-in modules include the circuitry for timing, voltages and currents necessary to program a PROM when the module is coupled with the M980. Each of the six categories of modules offer alternatives for specific programming applications. These modules also include individual Zero Insertion Force PROM Sockets for Master and Copy PROMs and control switches as required to allow special functions (see Section 3 for detailed description).



OPTIONAL ACCESSORIES

The M980 software for the following optional accessories is factory installed. This equipment has been designed to configure the programmer to a variety of external sources.

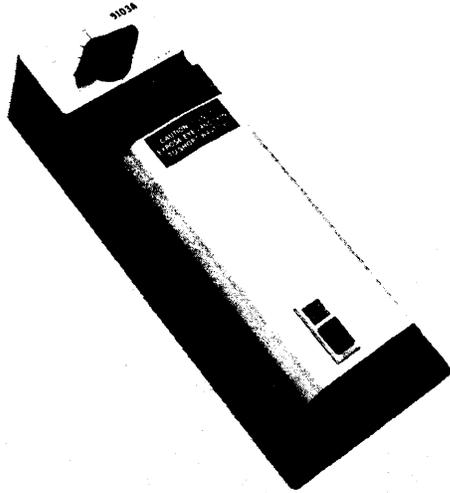
M301 Paper Tape Reader: Combines with 9811 software in the M980 to allow Duplicate and Compare operations from paper tape. Multiple Formats (see Section 15 for detailed description).



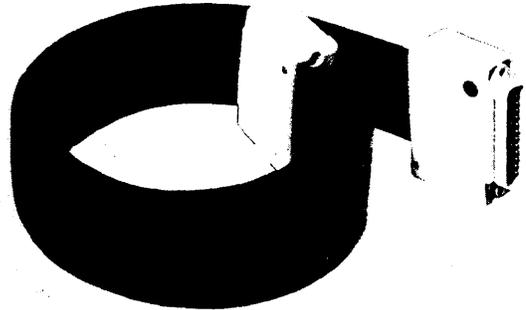
M304 RS-232-C Adapter: Combines with 9818 software in the M980 to allow Program and List operations via the RS-232-C interface. Multiple formats (see Section 18 for detailed description).



9103A UV Erase Light System: Ultra-violet light source with timer for erasing MOS PROMs (see Section 19 for detailed description).



RC18 Cable: 25 wire cable with lead male and female connectors. For use with 9814 or 9818 computer interfaces.



RC12 TTY Cable: Combines with 9812-2 software to allow Read, Program, Duplicate, and Compare operations from ASR33-type machines. The cable provides three circuit connections, using six wires to allow:

- Data to TTY
- Reader Control to TTY, 15V DC neutral loop

PHYSICAL SPECIFICATIONS

Dimensions: 23x12x6.5 inch — housed in a high-impact carrying case.

Weight: 24 lbs — maximum weight with personality module and erase light.

Power: Factory wired for either 117V 50-60Hz, or 220V 50-60Hz (100V 50Hz optional). Maximum power: 100W.



SECTION 2

Operating Panel Description

PANEL

The M980 Operating Panel (see Figure 2-1) contains the controls, indicators, and displays necessary for ease of panel operation, plus integral connectors for remote control operations. The keyboard utilizes hex-

adecimal notation, and a convenient HEX to BINARY conversion table is located adjacent to the keyboard to assist the operator in programming operations. Figure 2-1 shows the panel with a dedicated personality module inserted.

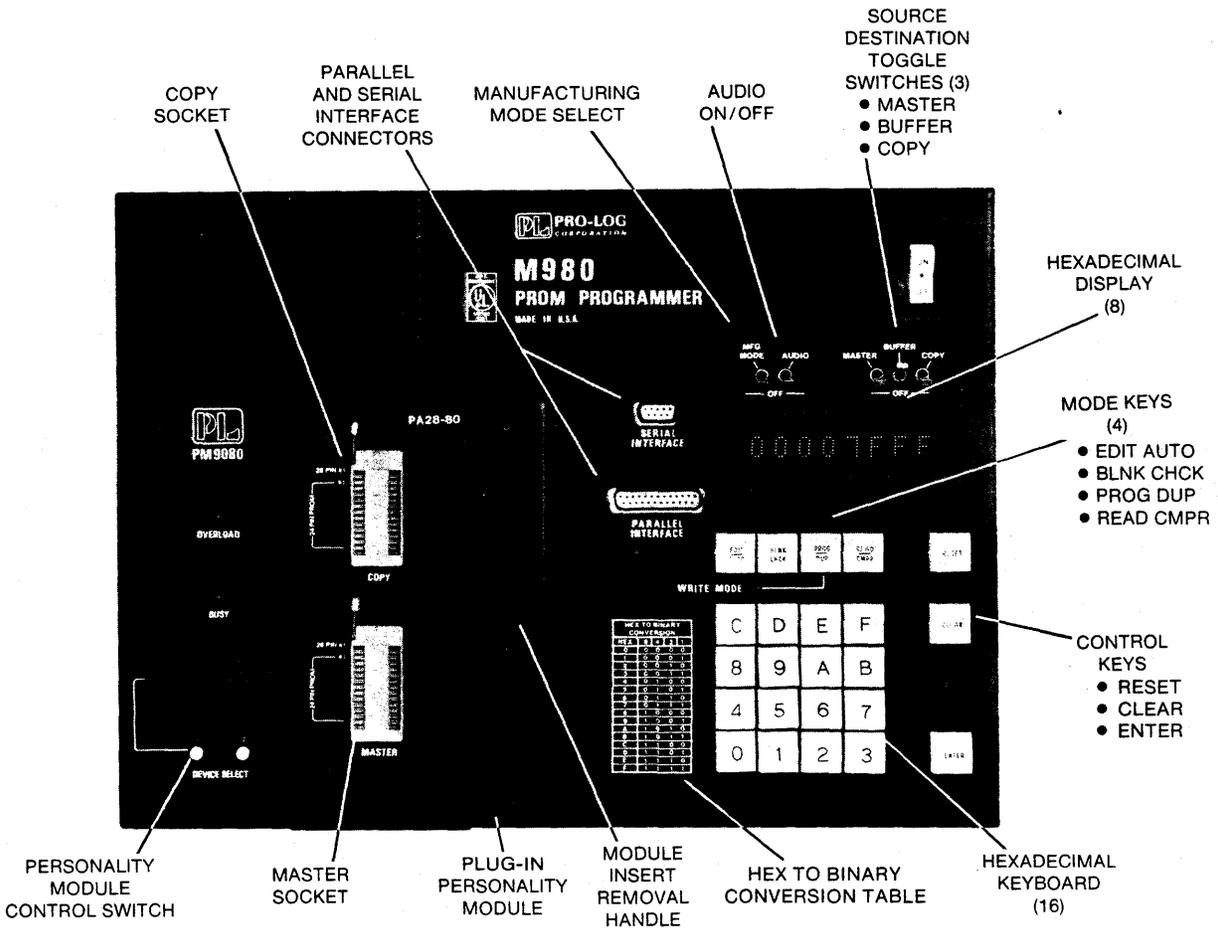


Figure 2-1. M980 Operating Panel

PANEL DISPLAYS, INDICATORS AND CONTROLS

Displays and Indicators

Write Mode LED: An individual indicator located above the keyboard which lights during a write operation.

Hexadecimal Display: An 8-digit character display capable of showing the hex characters 0-9, A, B, C, D, E, F. This display is located above the keyboard and is used to indicate address, error, option selection, operation and data information.

Binary Data Display: Located on some Personality Modules. It displays data depending on the mode.

Source Destination Toggle Switches (down = off; up = on)

MANUFACTURING Mode: Locks out hex keyboard and CLEAR key entries. Allows only Automatic (AUTO), Blank Check (BLNK CHCK), Duplicate (DUP), and Compare (CMPR) operations.

AUDIO: Activates a tone generator located inside the M980 unit. This tone generator will then produce audio tones when an error occurs or an operation is finished.

MASTER/BUFFER/COPY: A single switch ON will indicate the Destination on which the operation is being performed. Two switches ON will indicate the Source and Destination for Duplicate and Compare operations. The left-most switch is the Source and the right-most is the Destination. No switches or all switches ON will result in an error "E0" code displayed, and a chirping of the tone generator.

Control Keys

RESET: A control key that cancels operation in progress, without altering the RAM Buffer. RESET clears the hex display.

CLEAR: A multi-function key used to clear data entries manually, decrement the address in the Read mode, or abort from an error in Duplicate and Program operations. See Section 4 for further information.

ENTER: A key used to initiate or repeat operations; also used to increment the address in the Read and Program modes.

Programmer Mode Keys (Active after Power ON or RESET)

READ/CMPR: A dual-function key. When two toggle switches (MASTER/BUFFER/COPY) are ON, this key acts to select the Compare mode in which the source contents are compared, one location at a time, against the destination contents. When only one toggle switch is ON, the Read mode is selected. In the Read mode a non-volatile read is made of the Destination selected, one location at a time. In the Read mode, and when the BUFFER toggle switch is ON, a Read/Modify may be performed.

PROG/DUP: A dual-function key. When two toggle switches (MASTER/BUFFER/COPY) are ON, this key acts to select the Duplicate mode in which the source contents are copied into the destination. When only one toggle switch is ON the Program mode is selected. In the Program mode, data is written into either the Buffer or Copy PROM.

BLNK CHCK: A dual-function key. If one switch is ON (MASTER or COPY), a check of the PROM for the unprogrammed state will be performed. If any bit in the PROM is found to be in the programmed state, an error will be indicated. When used with the MASTER socket, the Blank Check mode may safely be used for incoming inspection of new PROMs, with no danger of accidental programming. If two switches are ON (MASTER and COPY or BUFFER and COPY), an illegal bit check will be performed on the Copy PROM. The Illegal Bit Check will determine from the erased state of the PROM if the data in the Copy PROM can be successfully overwritten. This dual function does not apply to gang modules. If an attempt is made to Illegal Bit Check with a gang module an "E0" will be displayed. During the IBC operation, no attempt will be made to actually write data to the Copy PROM. Check PROM manufacturers specifications before overwriting any PROM.

EDIT/AUTO: A dual-function key used to select automatic sequencing of the Blank Check, Duplicate, and Compare modes. Two toggle switches (MASTER/BUFFER/COPY) must be in the ON position. Also used to select Buffer Edit functions when only the Buffer switch is in the ON position.

Hexadecimal keyboard: This keyboard has several dual-purpose switches. In addition to normal data entry, the keys are used to select modes for interface selection (see Section 14). Key C is used to select the Checksum mode. In this mode, a checksum may be made over any defined address field on the Master or Copy PROM or the Buffer.

Hexadecimal Notation

The M980 uses hexadecimal notation to represent the PROM binary address and data. Hexadecimal notation is a convenient operator language which reduces data handling by representing 16 combinations of four bits with a single character for each combination. The character set for displaying hexadecimal consists of the characters 0 through 9 to represent the binary combinations 0 through 9 and the characters A, B, C, D, E, and F to represent the number combinations 10 through 15 (see Figure 2-2).

HEXADECIMAL CHARACTERS	BINARY BITS 8 4 2 1	DECIMAL - CHARACTERS
0	0 0 0 0	0
1	0 0 0 1	1
2	0 0 1 0	2
3	0 0 1 1	3
4	0 1 0 0	4
5	0 1 0 1	5
6	0 1 1 0	6
7	0 1 1 1	7
8	1 0 0 0	8
9	1 0 0 1	9
A	1 0 1 0	10
B	1 0 1 1	11
C	1 1 0 0	12
D	1 1 0 1	13
E	1 1 1 0	14
F	1 1 1 1	15

Figure 2-2. Conversion Table

As an extension of this technique, all 256 combinations of 8 bits can be represented by two hexadecimal characters, as shown in the following examples (see Figure 2-3).

HEXADECIMAL CHARACTERS	BINARY BITS	DECIMAL CHARACTERS
00	0000 0000	0
01	0000 0001	1
3E	0011 1110	62
42	0100 0010	66
E1	1110 0001	225
FF	1111 1111	255

Figure 2-3. Conversion Table

All 4,096 combinations of 12 bits can be represented by three hexadecimal characters. This technique can be extended indefinitely by adding one hexadecimal character for each four bits of information.

SECTION 3

Personality Module Description

PERSONALITY MODULE TYPES

Six types of plug-in personality modules are available for use with the M980 Programmer.

- **Dedicated Module:** configured to program one or more non-generic bipolar and MOS PROMs with identical pinouts
- **Generic Module:** programs a specific manufacturers' PROM using pinout adapters and configurators to accommodate different PROM sizes, bit structures, and pin arrangements
- **Dedicated Gang Module:** programs multiple PROMs (usually eight) simultaneously
- **Generic Gang Module:** uses configurators to simultaneously program like PROMs (usually eight) of a generic family
- **5V MOS Generic Module:** programs families of PROMS from various manufacturers whose devices have similar pinouts and programming algorithms
- **Special Module:** programs *PALs™.

The M980 includes provisions for allowing a module to assume control of the programmer. The PM9080 generic personality module is an example of this feature.

In every case, the personality module interface with the control unit provides the specific voltages required to program and read a particular PROM, automatically accommodating the various interface options integral to the control unit.

Each module is designed to plug into a control unit, using the three proven and reliable "D" type connectors. Each module has one or more COPY sockets and one MASTER socket. In order to protect the master PROM, programming voltages are never applied to the MASTER socket.

Newer modules feature cold sockets (power off) during PROM insertion or removal.

*PAL™ is a Trade Mark of Monolithic Memories Inc.

DEDICATED MODULES

Dedicated modules (see Figure 3-1) are configured to program one or several PROMs with identical pinouts. In some modules, a switch is used to permit one module to program two PROMs of the same family (e.g., 256x4 and 512x4), when the pinouts are compatible. In some cases, the switch is used to set the operating conditions to satisfy multiple manufacturers' products.

The COPY socket is located on the upper half of the module mounting plate: Pin 1 is located adjacent to the locking lever on the Zero Insertion Force (ZIF) socket. Binary lights are located to the left of the COPY socket on some personality modules and display the contents of the COPY socket. Either four or eight LEDs are used, depending on the configuration of the PROM to be programmed. The MASTER socket is located on the lower half of the module mounting plate; its ZIF socket is indexed in the same manner as the COPY socket.

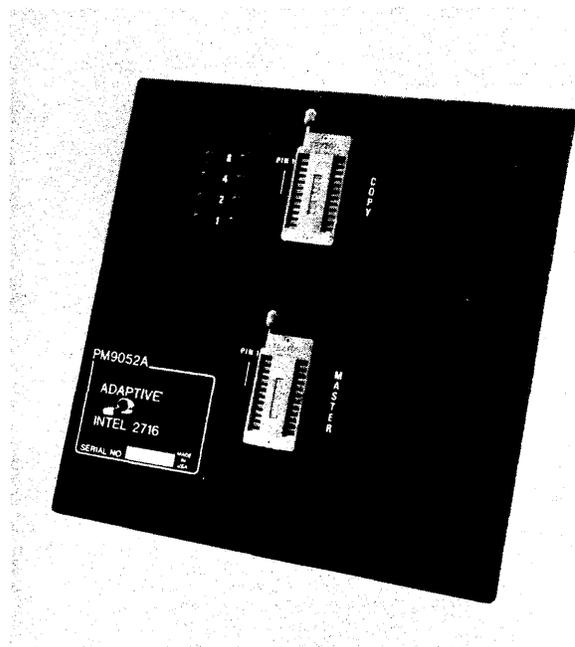


Figure 3-1. Dedicated Module

Personality Module Description

The handle affixed to the personality module plate is designed to assist in insertion and removal of the module from the control unit, by being mounted coaxially with the "D" type connectors. Removal of the module is accomplished with a direct upwards pull or slight back-and-forth motion (see Figure 3-2). To insert the module, push downward with a slight back-and-forth motion, being careful to ensure that the "D" type connection shells are properly mated before applying force to seat the module. When properly seated, the module plate lies flat against the top of the unit.

Certain dedicated modules have special features or functions, and therefore have special operating instructions. These operating instructions are provided with each module.

NOTE

Insert or remove personality module only when M980 power is OFF.



Figure 3-2. Installation and Removal of Personality Module

GENERIC MODULES

Generic modules (see Figure 3-3) are designed to program all PROM types of a particular manufacturer. Adapters are used to conform to specific pinouts and configurators used to allow the control unit to automatically accommodate different sizes and types of PROMs (e.g., 512x4, or 1024x8). The polarity of unprogrammed PROM locations and the PROM type (bipolar or MOS) are also contained in the configurator (refer to the Pro-Log Price List/Short Form Catalog or the Personality Module Wall Chart for specific pinout adapter and configurator types for particular PROM types).

Signals are passed from the base module (see Figure 3-4) to the pinout adapter (see Figure 3-5) via two 25-pin "D" type connectors; the same type used to connect the personality module to the control unit. The configurator (see Figure 3-6) is mounted via a ZIF socket located on the bottom right of the module mounting plate. The configurator must be mounted as shown in Figure 3-3 for the module to function properly. It should also be the proper size and type (e.g., 2048x8(H) for 2716).

With the proper pinout adapter and configurator installed, the generic module functions the same as a dedicated module of the same type. Additional pinout adapters and configurators are constantly being added to accommodate the ever-broadening line of PROMs being manufactured.

Those modules having special features or requiring special operating techniques are furnished with special operating instructions.

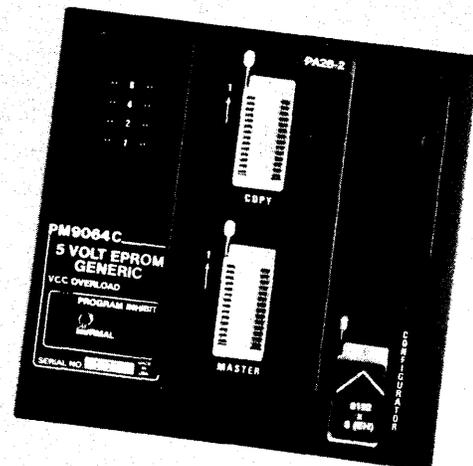


Figure 3-3. Generic Module

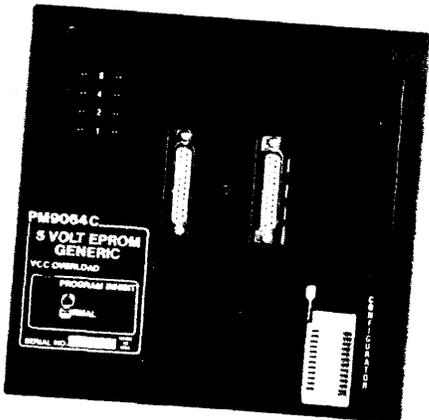


Figure 3-4. Base Module



Figure 3-6. Configurator

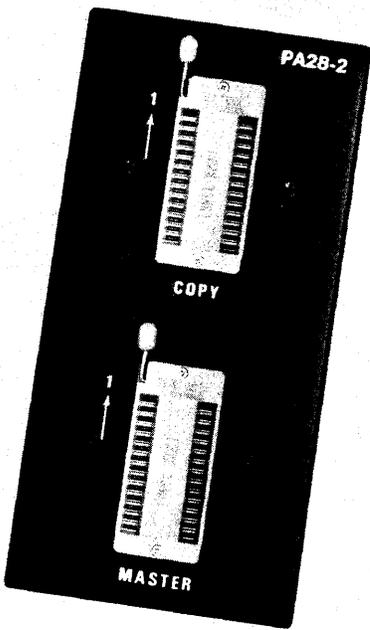


Figure 3-5. Pinout Adapter

DEDICATED GANG MODULES

Dedicated gang modules (see Figure 3-7) are designed to program multiple PROMs simultaneously. The operation of each is tailored to the PROM being programmed, and each has its own special operating instructions.

NOTE

The M980 Control Unit performs the blank check, duplicate, and compare functions on four or eight parts¹ at one time. If one or more of the sockets being operated on is left empty, a FAIL indication occurs at the completion of the function². For further failure instructions, see the operating instructions for that particular personality module.

¹Some gang personality modules (e.g., PM9061A) may duplicate two banks of four PROMS.

²If the PROM to be programmed is normally FF (all ones) in the unprogrammed state, the BLNK CHCK mode does not fail on an empty socket. In the AUTO mode, a PROM that fails to program does not cause a failure indication until CMPR operation is completed.

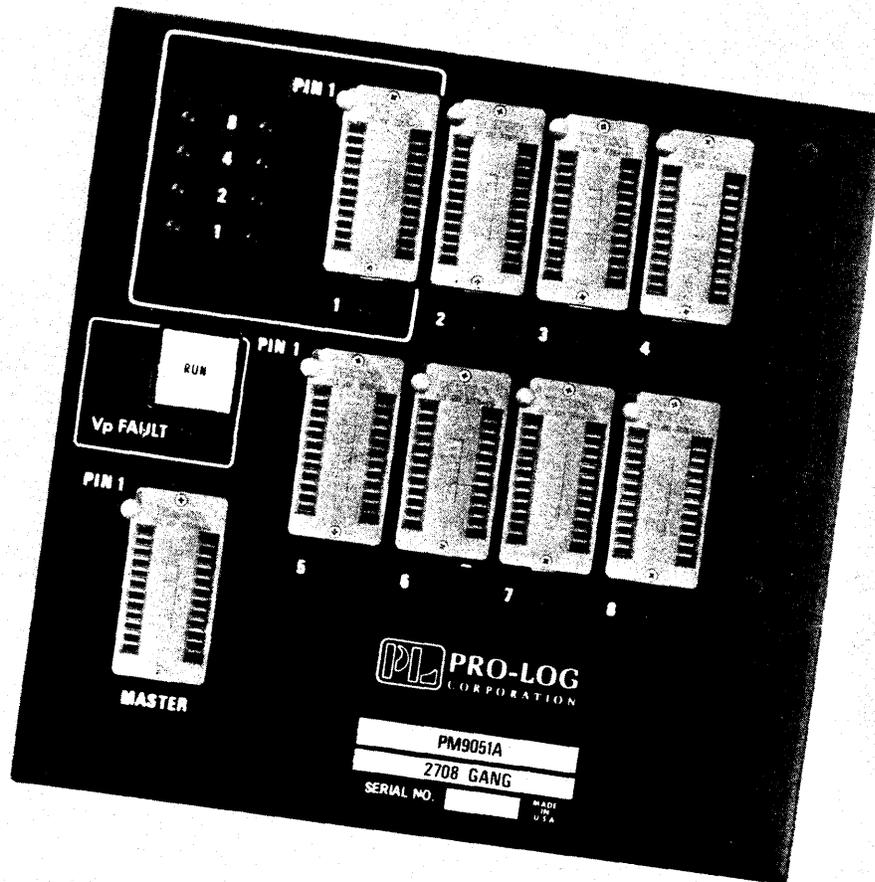


Figure 3-7. Dedicated Gang Module

GENERIC GANG MODULES

Generic gang modules (see Figure 3-8) are capable of simultaneously programming multiple PROMS from a generic family. Programming algorithms and PROM pinouts are reconfigured by inserting the appropriate 40-pin gang configurator (GC). These modules are available in a 24- and a 24/28-pin version.

NOTE

Generic gang modules will function only in the M980 and M910A master control units.

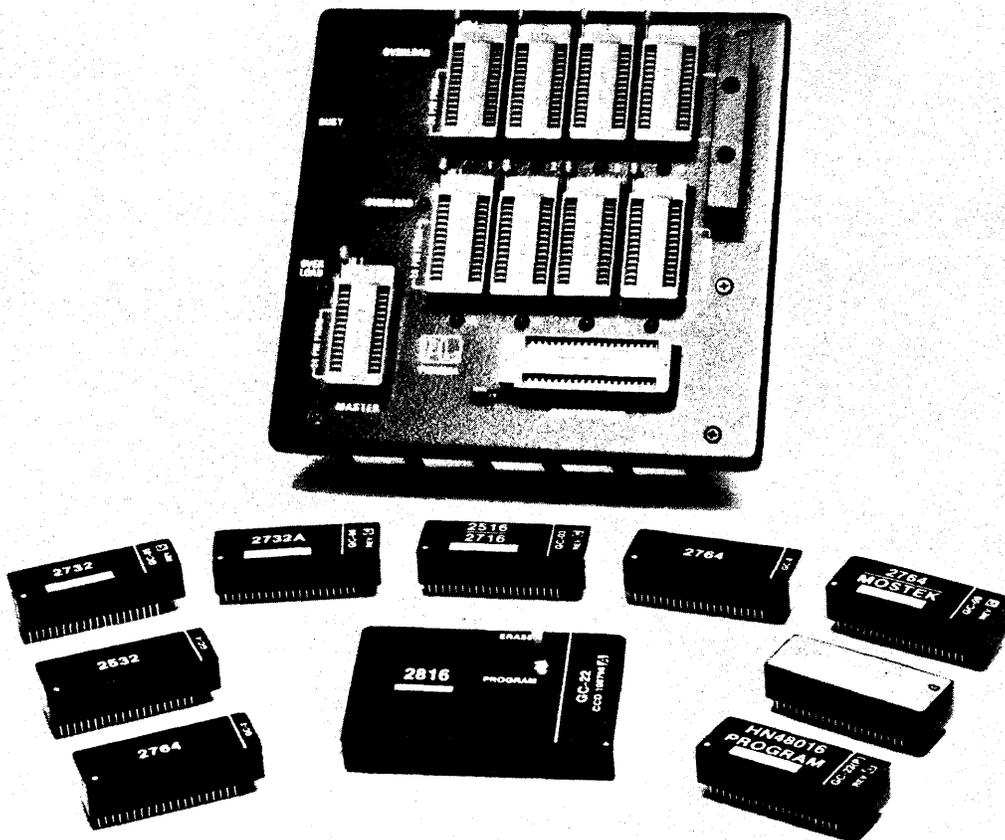


Figure 3-8. Generic Gang Module and Gang Configurators

5V MOS GENERIC MODULE

The PM9080 Module (see Figure 3-9) programs many similar 5V MOS device families from several manufacturers. The manufacturers' programming algorithms are very similar, but the pin assignments and the number of pins vary. The PM9080 uses plug-in pinout adapters to accommodate the varying pin assignments and number of pins for each device.

WARNING

Use only the appropriate pinout adapter as shown in PM9080 User's Manual, Appendix A, Device Selection Guide. Insertion of a pinout adapter other than those listed may damage the PM9080 and will void the Pro-Log warranty.

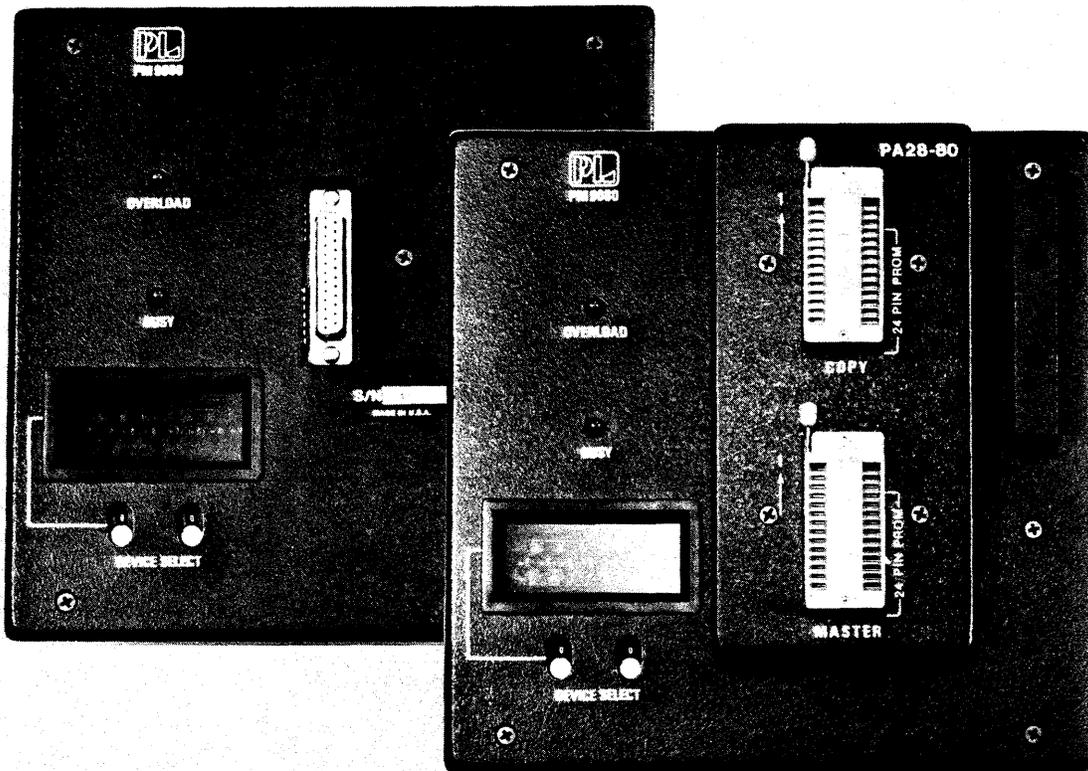


Figure 3-9 PM9080 5V MOS Generic Module

SPECIAL PERSONALITY MODULES

The M980 was designed to be compatible with all Personality Modules produced by Pro-Log. However, many of the software routines within the M980 Control Unit have been streamlined, and new modes of operation designed. As a result, some modules operate differently in the M980 than in other Series 90 programmers. Those differences are described here.

PM9005A Module

This module has two modes of operation: Block and Normal. When in Block Mode, all operations of the M980 are as described in the manual. In Normal Mode, programming does not occur unless data is entered for location 3FF. Therefore, all operations that involve programming the PROM must take this into account.

It is suggested that for ease of operation, use only the Normal Mode when copying the entire PROM.

In Engineering Auto-Sequencing Mode (see Section 10) the Last Address must be 3FF.

In any programming mode, should errors be detected by the module, a special display sequence is begun. For further details refer to Section 11, Failure to Program Operations.

PM9051A Module

The PM9051A is a gang 2708 module and requires data to be entered for location 3FF in order for programming to take place. For ease of operation, all programming and duplication operations should use a Last Address of 3FF.

In the Engineering Auto-Sequence Mode (see Section 10) the Last Address must be 3FF. In any programming mode, should errors be detected by the module, a special display sequence is begun. For further details refer to Section 11, Failure to Program Operations.

PM9053A Module

In any programming mode, should errors be detected by the module, a special display sequence is begun. For further details refer to Section 11, Failure to Program Operations.

PM9060A Module

The PM9060A is a TMS2716 Gang Module and requires data to be entered for location 7FF in order for programming to take place. For ease of operation, all programming and duplication operations should use the Last Address of 7FF.

In the Engineering Auto-Sequencing Mode (see Section 10) the Last Address must be 7FF. In any programming mode, should errors be detected by the module, a special display sequence is begun. For further details refer to Section 11, Failure to Program Operations.

PROM Handling

PROMs can be separated into two major categories: MOS and Bipolar. The MOS PROMs include all EPROMs and some CMOS fusible-link PROMs. Care should be taken when handling MOS devices, as most of them are susceptible to damage due to static charges. When not plugged in, keep the PROMs on a pad of conductive foam.

Pro-Log has pioneered the two-socket approach, where the MASTER socket is never subjected to programming voltages, and so the chances of ruining a master PROM are minimal.

ZIF Sockets

All Pro-Log Personality Modules utilize Zero Insertion Force (ZIF) sockets (see Figure 3-10) for both Master and Copy sockets. These sockets are activated by a handle, located adjacent to pin 1 of the socket. When the handle is raised or in the up position, the contacts are open, and the PROM may be inserted. Lowering the handle engages the contacts and locks the PROM in place.

In sockets subjected to severe environmental conditions or after extensive use, the contacts may become corroded or bent. Periodic inspection of the sockets is suggested. In case they are worn, the design of the modules permits replacement of individual sockets. (Contact Pro-Log Customer Support if this is the case.)

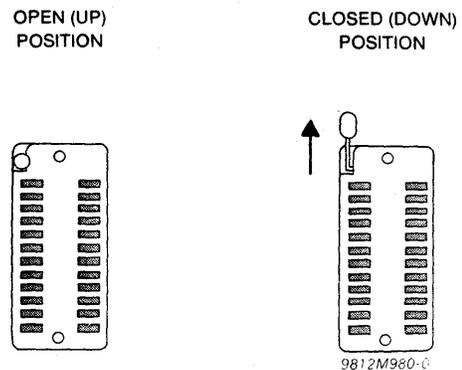


Figure 3-10. ZIF Socket

SECTION 4

Address Field Definition

All keyboard operations with the exception of the Manufacturing mode and some of the remote control options allow the operator to select a partial address field. If the operator does not select a partial field, the full address range will be used. The M980 refers to the Personality Module for Master and Copy PROM size.

Full Address Operation

Whenever a mode is selected, the hexadecimal display indicates the full PROM size to the operator by automatically displaying the First Address and the Last Address. The First Address is always zeros and the Last Address is always ones, represented in hexadecimal notation. The hexadecimal values for the First and Last Addresses of all PROMs are given in Figure 4-1.

PROM SIZE	HEXADECIMAL FULL PROM FIELD ADDRESS	
	FIRST ADDRESS	LAST ADDRESS
16 by X	0	F
32 by X	00	1F
64 by X	00	3F
128 by X	00	7F
256 by X	00	FF
512 by X	000	1FF
1024 by X	000	3FF
2048 by X	000	7FF
4096 by X	000	FFF
8192 by X	0000	1FFF
16384 by X	0000	3FFF
32768 by X	0000	7FFF
65536 by X	0000	FFFF

Figure 4-1. PROM Size Field Definition

The full address field indicates to the operator that all addresses of the PROM will be operated on. The operator may accept the full address or select a partial address.

Partial Address Operation

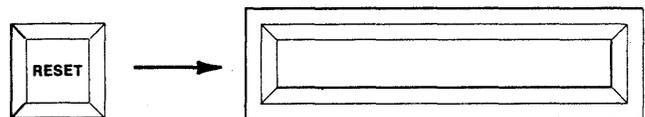
The operator has the option of changing the full address to a partial field before initiating the operation. A partial field may be as small as a single location and as large as the full address field.

When the First Address and Last Address appear in the hex display, the operator can redefine the field by keying in a Start Address and End Address. The Start and End Addresses define the new field to be operated on. If the Start and End Addresses are equal, a single location will be operated on.

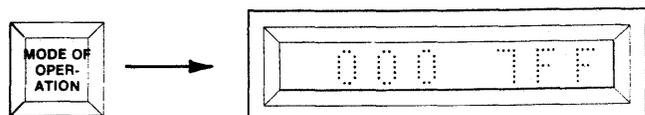
The M980 can recall the previous operation Start and End Addresses by not depressing RESET between operations. After completing an operation, depress the next mode key and the previous Start and End Addresses are recalled. The operator may now perform another operation on the same address field.

EXAMPLE: Keyboard Strokes for an Operation over a Limited Field (for a 2Kx8 PROM)

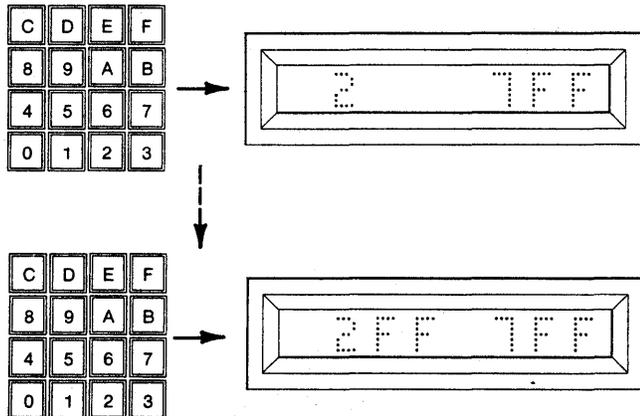
1. Depress RESET. The 8 hex displays will be blank.



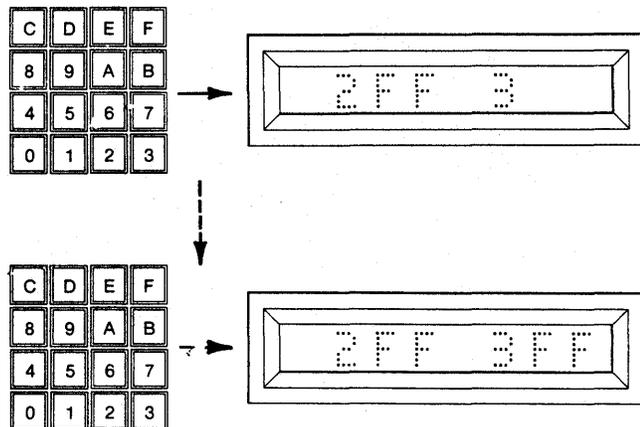
2. Depress the desired Mode key. The First and Last Addresses of the Copy PROM will be displayed.
3. If the entire address range is to be operated on, depress ENTER and the First and Last Addresses shown will be accepted as the Start and End Address for the operation. If a limited field is desired, continue.



- Using the hex keyboard, key in a new Start Address, MSD first. When the first key is depressed, the left-most displays will be blanked and the character corresponding to the key depressed will be displayed. Continue to key in the necessary characters to fill the Start Address displays.



- If a new End Address is needed, use the keyboard to key in a new End Address. When the next key is depressed, the right-most displays will be blanked and the character corresponding to the key depressed will be displayed. Continue until the entire address is keyed in. Depress ENTER and the displayed addresses will be accepted as the Start and End Addresses.



CLEAR KEY OPERATIONS

In the M980, the Clear operation is defined as: An operation that removes the present condition and allows a correction of that condition to be implemented without resetting all of the previous operations.

The CLEAR key on the M980 has several functions, depending upon the mode of the M980. In keyboard entry situations, it allows the correction of hex keyboard entries. In the Read mode, it allows recall of the previous address and data (decrement). Finally, it is used to abort Duplicate or Program modes upon an error indication, without changing any of the previous operation of sequences.

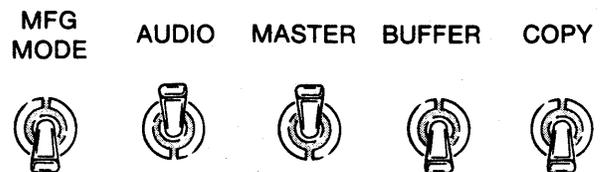
The CLEAR key is active to clear the displays after a hex key is used to key in information and before the ENTER key is depressed. In this mode, after the hex character is displayed, the CLEAR key may be used to clear that character and any characters to the left, one character for each depression of the CLEAR key (see the following example for a step-by-step explanation).

In the Read mode the CLEAR key is active to decrement the address. By depressing the CLEAR key, the previous address and its corresponding data is displayed.

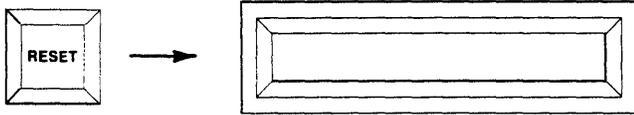
In the Duplicate and Program modes, the CLEAR key can be used to abort the mode when an error is indicated. When the error is displayed, the depression of CLEAR automatically aborts the operation and displays "F" for Finished. The previous Start and End Addresses of the operation are still intact in the M980's memory. By depressing the ENTER key, a repeat of the operation may be implemented, starting with the address field definition. For more information on procedures during a programming failure, see Section 11.

Example of CLEAR Key Operation in Read Mode

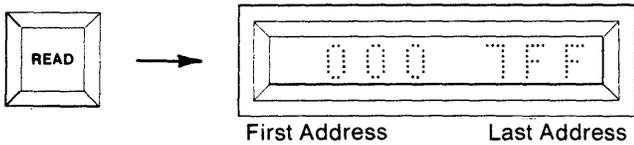
- Insert Personality Module and select the switches as shown. AUDIO switch is optional. Insert the PROM to be read into the MASTER socket of the Personality Module.



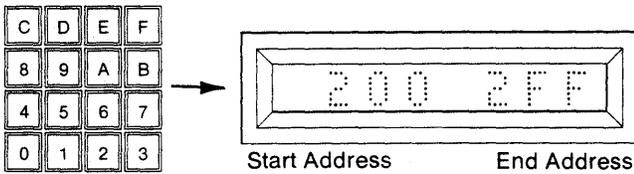
2. Depress RESET. The 8 hex displays are blank.



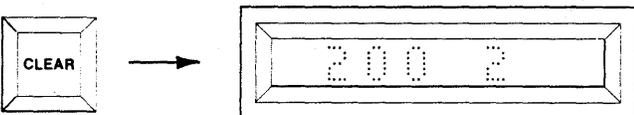
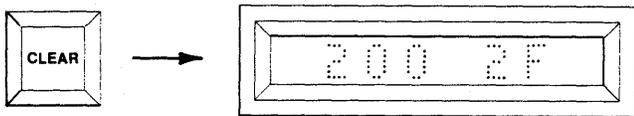
3. Depress READ. The First and Last Addresses of the Master are displayed.



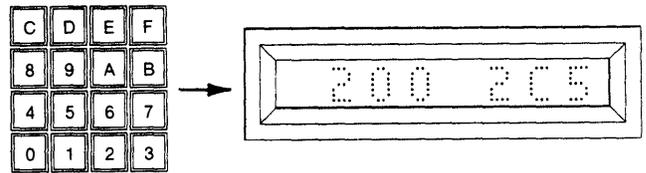
4. To Read the entire contents of the Master PROM, starting with the First Address, depress ENTER. To Read a limited address field use the hex keyboard to key in a new Start and End Address, MSD first. If an incorrect character is keyed, use the CLEAR key to correct it.



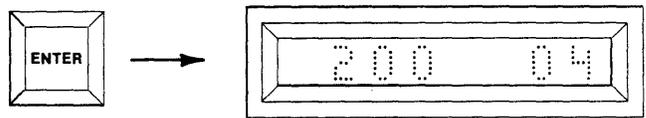
5. Depress the CLEAR key twice. The right-most two characters are cleared. Depressing the CLEAR key additional times will clear correspondingly more digits.



6. Use the hex keyboard to key in a revised address.



7. Depressing ENTER will cause the operation to proceed over the revised range.



SECTION 5

Copy and Master Socket Operations

DESCRIPTION

This section describes those modes involving the MASTER and COPY sockets. For a description of the modes involving the Buffer, see Section 6.

The COPY socket is used to program PROMs and other devices such as PALs. A PROM should not be put into the COPY socket unless it is to be programmed. A Copy PROM may be programmed from the keyboard, Master PROM, or Buffer. The Copy PROM can be read to the display one location at a time and it can be compared automatically with the Master PROM or Buffer. Checksum, Blank Check or Illegal Bit Check can be performed on the Copy PROM.

The MASTER socket is used to provide input from a Master PROM for writing to either the Copy PROM or Buffer. Checksum or Blank Check can be performed on the Master PROM.

MASTER and COPY Socket Modes

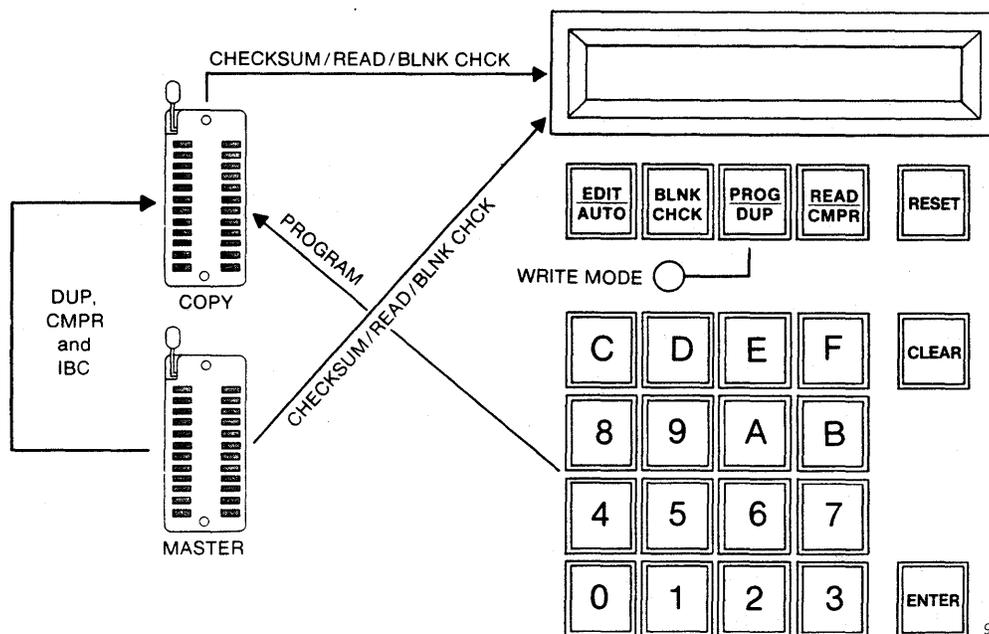
RESET: Halts all operations. The RESET key is an overriding hardware input to the M980 that halts all operations and returns the programmer to the idle state. RESET can be used to stop any automatic operation. RESET does not affect the Buffer contents.

CLEAR: Corrects miskeyed address/data, decrements address in READ, aborts from Duplicate, Compare, and Program modes after failure. The CLEAR key is active to clear the displays only at those times when a hex key is used to key in address or data information. After the hex character is displayed, the CLEAR key may be used to clear that character and any characters to the left of the first character cleared. For additional uses of the CLEAR key, see Section 4.

AUDIO/MANUFACTURING Toggle Switches

MANUFACTURING Mode. When ON, this toggle switch will reconfigure the M980 into a manufacturing PROM Programmer. When in the OFF position, the M980 becomes a multifunctional and versatile tool for programming any type of programmable device. See Section 9 for Manufacturing Mode operations.

AUDIO. This toggle switch activates a tone generator located inside the M980 Unit. When any error occurs, a warbling tone will be generated for approximately 4 seconds. When any operation is finished successfully, a steady tone will be generated for approximately 4 seconds. An operator error in mode selection will cause a high-pitched tone for 4 seconds.



9812M980-1

MASTER/BUFFER/COPY Source Destination Toggle Switches

If only one toggle switch is in the ON position, it becomes the Destination of the operation. If two toggle switches are in the ON position, the left-most switch becomes the Source and the right-most switch becomes the Destination. (If three switches are ON/OFF, and ENTER is depressed, an error code "EO" will be indicated in the display, and the warbling tone will sound.)

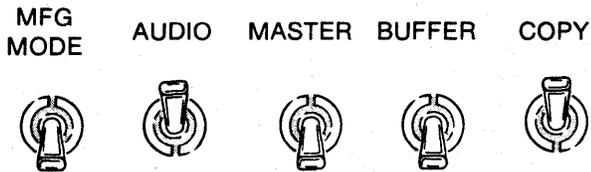
MASTER. When only this toggle switch is selected, the MASTER socket becomes the Destination. With two switches selected, the MASTER socket becomes the Source.

BUFFER. When this toggle switch is selected, the Buffer becomes the Source if the COPY switch is ON. At all other times the Buffer becomes the Destination.

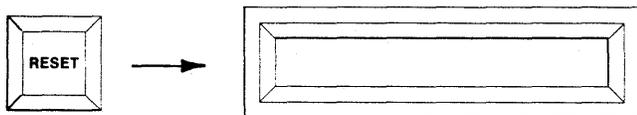
COPY. When this toggle switch is selected, the COPY socket becomes the Destination.

Programming a PROM using the M980 Keyboard (example shown is for a 2Kx8 PROM)

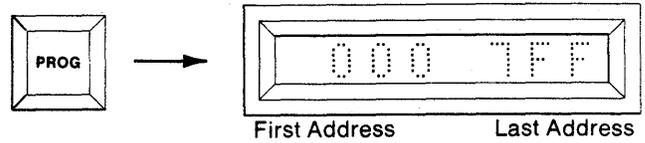
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the PROM to be written into in the COPY socket. The Audio switch is optional.



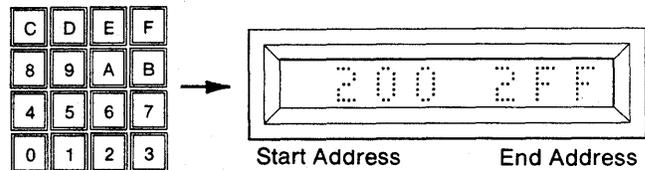
2. Depress RESET. The 8 hex displays are blank.



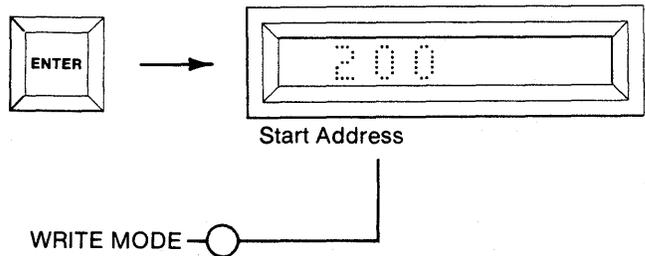
3. Depress PROG. The First and Last Addresses of the Copy PROM will be displayed.



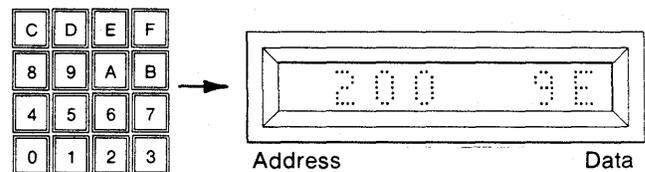
4. To operate over the entire contents of the Copy PROM, starting with the First Address, go to step 5. To operate over a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



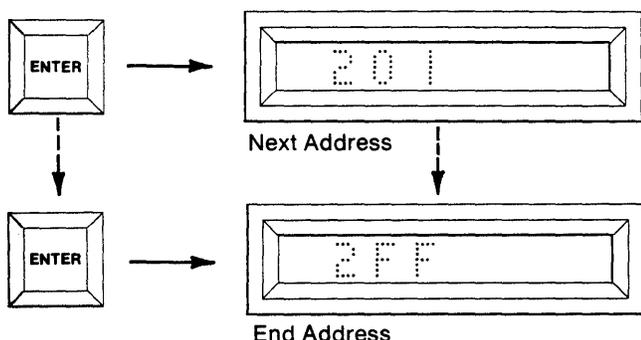
5. Depress ENTER. The displayed addresses will be accepted as the Start and End Addresses for the operation. The display will show the Start Address in the left-most displays. The Write Mode LED is lit.



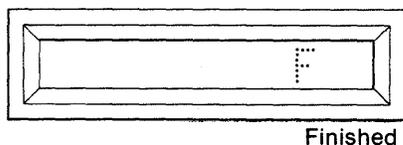
6. To program the address displayed, key in the desired data, MSD first, using the CLEAR key to correct mistakes. To step over a location continue to step 7.



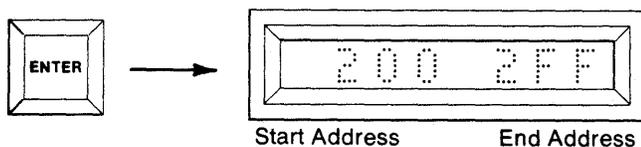
7. Depress ENTER to initiate programming of the displayed data, or to step over an address without altering it. The next sequential address will be displayed. Repeat steps 6 and 7 for each address. If an address cannot be programmed with the data displayed, the M980 will not increment the address, and the error tone will sound, if Audio switch is ON. See Failure to Program Operations, Section 11.



8. When the End Address is displayed and step 6 and/or 7 are initiated, an "F" will appear to indicate that the Program mode has been performed over the entire Start and End Address fields.



9. To repeat the Read mode without resetting, depress the ENTER key when the "F" appears. The previous Start and End Addresses will be displayed. Continue with step 4 and/or 5.

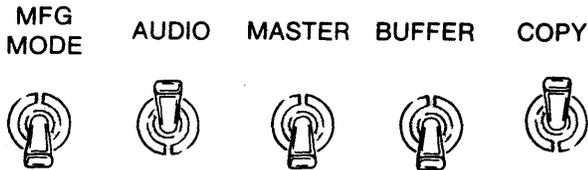


Summary of Programming a PROM using the M980 Keyboard

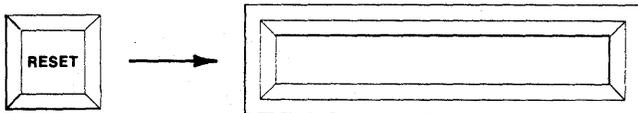
1. Insert Personality Module, PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (OFF), COPY (ON).
2. Depress RESET. Displays are blank.
3. Depress PROG/DUP. First and Last Addresses are shown.
4. Optional. Redefine Start and End Addresses via the hex keyboard.
5. Depress ENTER. Address shown accepted. Start Address displayed.
6. Optional. Key in data to be programmed.
7. Depress ENTER. This will program previously keyed data or step over the displayed address. Repeat for every address.
8. Last Address reached and "F" is displayed to indicate Finished.
9. Optional. Depress ENTER to show previous Start and End Addresses, and to return to step 4 and/or 5.

**Reading a Copy PROM in the COPY Socket
(example shown is for a 2Kx8 PROM)**

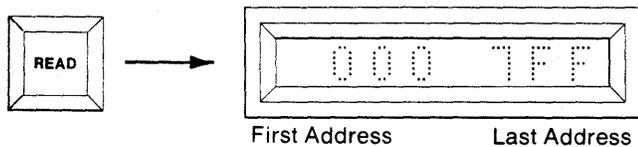
1. Insert Personality Module and select switches as shown. Insert the PROM to be read into the COPY socket of the Personality Module. The AUDIO switch is optional.



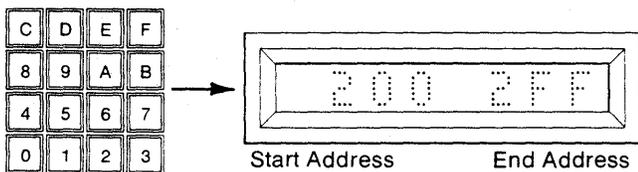
2. Depress RESET. The 8 hex displays are blank.



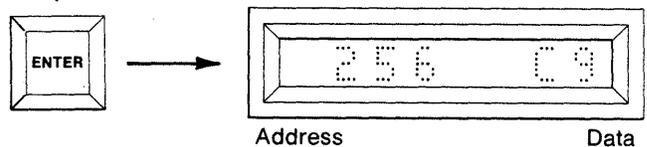
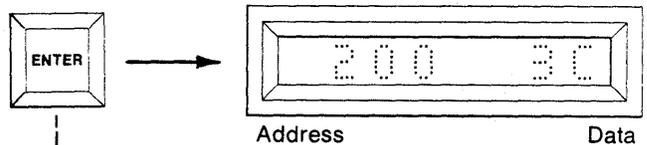
3. Depress READ. The 8 hex displays show the First and Last Addresses of the Copy PROM.



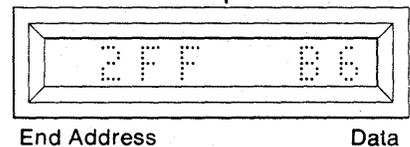
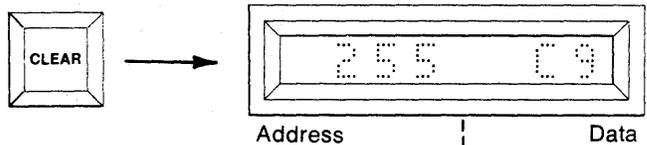
4. To Read the entire contents of the Copy PROM, starting with the First Address, go to step 5. To Read a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



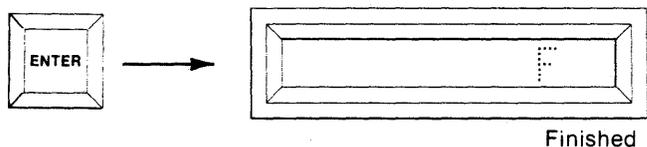
5. Depress ENTER. The displayed addresses will be accepted as the Start and End Addresses for the operation. The display will show the Start Address in the left-most displays. The data located at that address will be displayed in the right-most displays. Repeat step 5 and the next sequential address and data will be displayed. Repeat until the End Address is reached, Reset occurs, OR



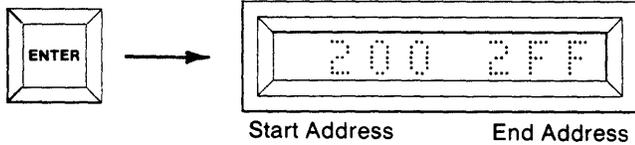
6. Depress the CLEAR key during the Read operation. The address will be decremented and the data at that address will be displayed. The M980 can decrement past the defined Start Address. Wrap-around will occur if an all-zero address is reached and decremented again.



7. When the End Address is reached, its data displayed, and ENTER is depressed, an "F" will appear in the display to indicate Finished.



8. To repeat the Read mode without resetting, depress the ENTER key when the "F" appears. The previous Start and End Addresses will be displayed. Continue with step 4 and/or 5.

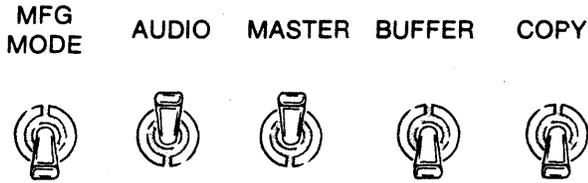


Summary of Reading a Copy PROM in the COPY Socket

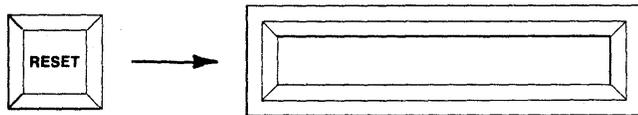
1. Insert Personality Module, PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (OFF), COPY (ON).
2. Depress RESET. Displays are blank.
3. Depress READ/CMPR. First and Last Addresses are shown.
4. Optional. Redefine Start and End Addresses via the hex keyboard.
5. Depress ENTER. The Start Address and its corresponding data are displayed. Repeat for each sequential address OR
6. Optional. Depress CLEAR to decrement the address and show its data.
7. End address is reached and ENTER is depressed. An "F" is displayed for Finished.
8. Optional. Depress ENTER to show previous Start and End Addresses, and to return to step 4 and/or 5.

Reading a Master PROM in the MASTER Socket (example shown is for a 2kx8 PROM)

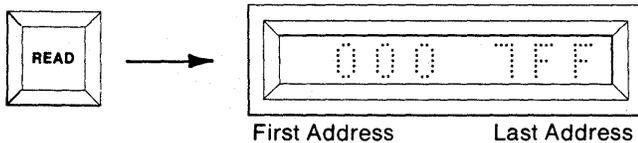
1. Insert Personality Module and select switches as shown. Insert the device to be read into the MASTER socket of the Personality Module. The AUDIO switch is optional.



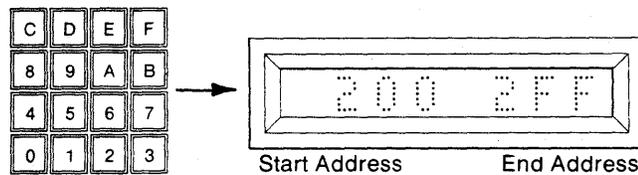
2. Depress RESET. The 8 hex displays are blank.



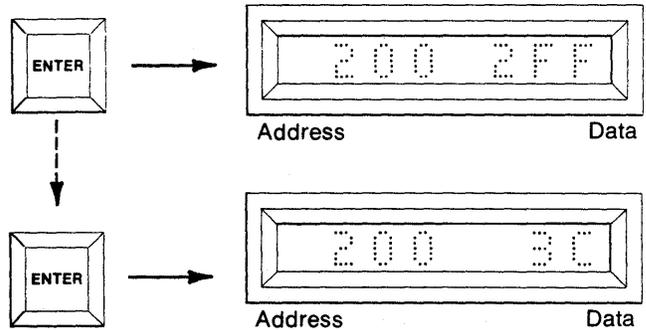
3. Depress READ. The 8 hex displays show the First and Last Addresses of the Master PROM.



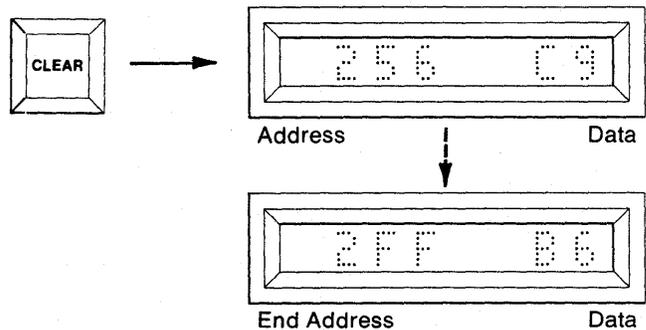
4. To Read the entire contents of the Master PROM, starting with its First Address, go to step 5. To Read a limited address field, use the hex keyboard to key in a new Start Address, MSD first. Repeat for End Address.



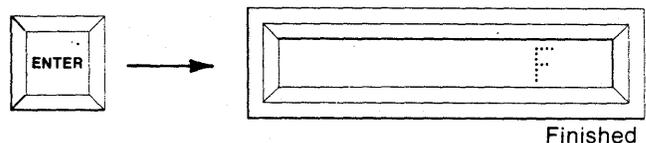
5. Depress ENTER. The M980 will accept the displayed data as the Start and End Addresses for the operation. The display will show the Start Address in the left-most displays. The data located at that address will be displayed in the right-most displays. Repeat step 5 and the next sequential address and data will be displayed. Repeat until the End Address is reached, Reset occurs, OR



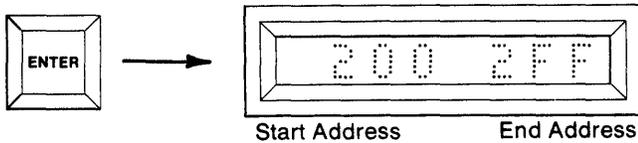
6. Depress the CLEAR key during the Read operation. The address will be decremented and the data at that address will be displayed. The M980 can decrement past the defined Start Address. Wrap-around will occur if an all-zero address is reached and decremented again.



7. When the End Address is reached, its data displayed, and ENTER is depressed, an 'F' will appear in the display to indicate Finished.



8. To repeat the Read mode without resetting, depress the ENTER key when the "F" appears. The previous Start and End Addresses will be displayed. Continue with step 4 and/or 5.

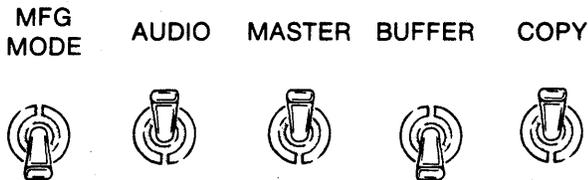


Summary of Reading the Master PROM in the Master Socket

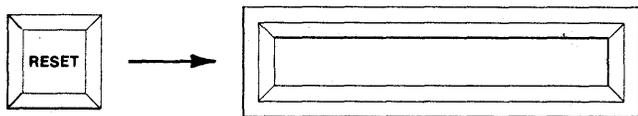
1. Insert Personality Module, PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (OFF), COPY (OFF).
2. Depress RESET. Displays are blank.
3. Depress READ. First and Last Addresses are shown.
4. Optional. Redefine Start and End Addresses.
5. Depress ENTER. The Start Address and its corresponding data are displayed. Repeat each sequential address OR
6. Optional. Depress CLEAR to decrement the address and show its data.
7. End Address is reached and ENTER is depressed. An "F" is displayed to indicate Finished.
8. Optional. Depress ENTER to show previous Start and End Addresses, and to return to step 4 and/or 5.

**Duplicating a PROM from a Master PROM
(example shown is for a 2Kx8 PROM)**

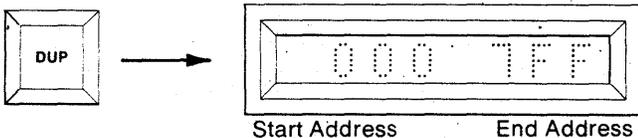
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the PROM to be used as Master in the MASTER socket. Insert the PROM to be written into in the COPY socket. The AUDIO switch is optional.



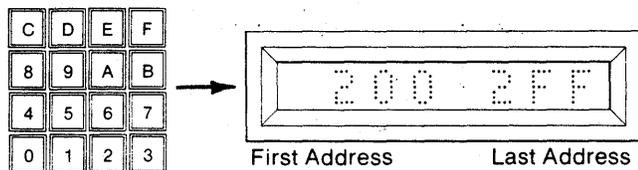
2. Depress RESET. The 8 hex displays are blank.



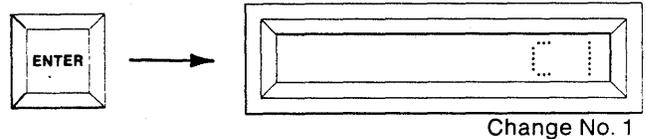
3. Depress DUP. The First and Last Addresses of the Master and Copy PROM will be displayed.



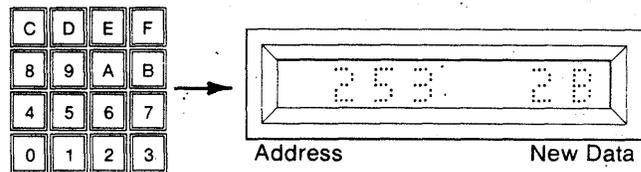
4. To Duplicate the entire contents of the Master PROM into the Copy PROM, starting with the First Address, go to step 5. To Duplicate over a limited field, use the hex keyboard to key in a new Starting and Ending Address, MSD first.



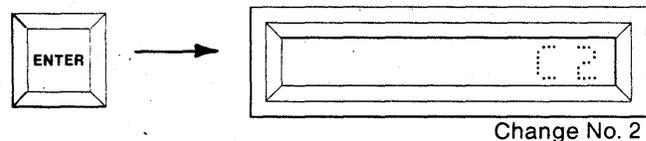
5. Depress ENTER. The displayed addresses will be accepted as the Start and End Addresses for the operation. "C1" will be displayed to indicate Change #1. If there is no reason to change any of the data being duplicated, go to step 8.



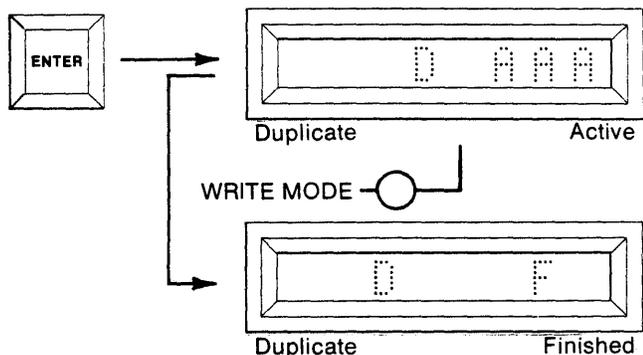
6. New data may now be substituted for up to eight addresses in the defined address field. Using the hex keyboard, key in the address at which you wish to substitute data. The address will be displayed in the left-most displays. Now key in the data to be substituted. The data will be displayed in the right-most displays. If an incorrect character is keyed in, use the CLEAR key to correct it.



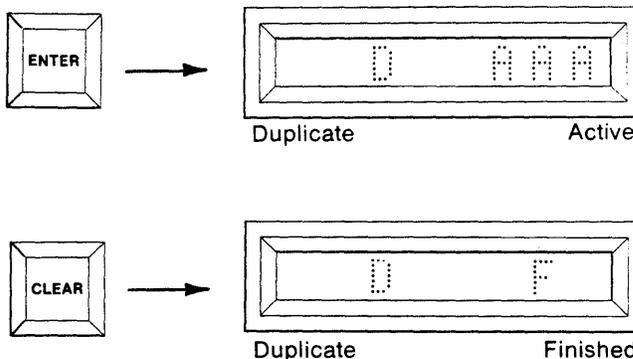
7. Depress ENTER. The change will be stored in scratch pad RAM and the next change will be displayed (C2, C3, C4, ...C8). Repeat step 6 for up to 8 changes or go to step 8. Step 8 will start automatically after the eighth change is keyed in and ENTER is depressed.



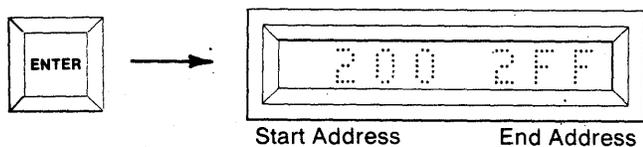
8. Depress ENTER. The display will show "D AAA" to indicate that the Duplicate (D) mode is Active (AAA). The Write Mode LED is lit. When the Duplicate mode is finished "D F" will be displayed. The Write Mode LED is extinguished.



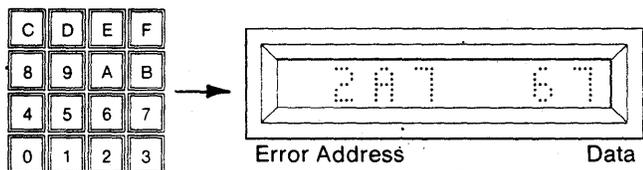
11. Depress ENTER to resume the Duplicate operation and to return to step 8, OR depress CLEAR to abort to Duplicate Finished. See Failure to Program Operations, Section 11.



9. To repeat the Duplicate mode without resetting, depress ENTER again. This will display the previous Start and End Address and return you to step 4 and/or 5. After step 5, the change code will indicate the number of changes entered previously, plus one. Additional changes may now be entered if desired.



10. If an error should occur, the address and the data of the Master PROM where the error occurred will be displayed. Depressing key C will show the copy data at that address. Depressing key A will show the master data again.



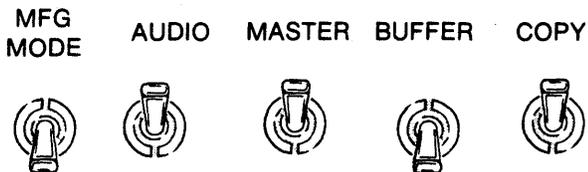
Summary of Duplicating a PROM from a Master PROM

1. Insert Personality Module, Master and Copy PROMs, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (OFF), COPY (ON).
2. Depress RESET. Displays are blank.
3. Depress PROG/DUP. First and Last Addresses are displayed.
4. Optional. Key in new Start and/or End Addresses.
5. Depress ENTER. C1 is displayed asking for change #1. If no changes go to step 8.
6. Optional. Key in substitution address and data.
7. Depress ENTER. C2, C3, C4, ...C8, will be displayed asking for more changes. Repeat step 6 for more changes or go to step 8.
8. Depress Enter. "D AAA" will be displayed for DUP ACTIVE. "D F" will be displayed for Dup Finished.
9. Optional. Depress ENTER to recall Start and End Addresses and go to step 4 and/or 5 if you wish to repeat the Duplicate mode.
10. If an error should occur the address and data of the error will be displayed. Key A will show master data and Key C will show copy data.
11. Optional. Depress ENTER to continue with DUP after an error or depress CLEAR to abort to Dup Finished, without losing original address limits and changes.

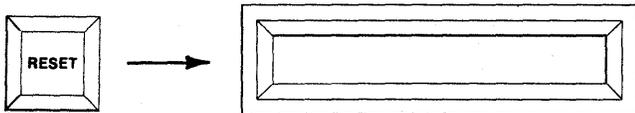
COPY and MASTER Socket Operations

Comparing a Copy PROM with a Master PROM (example shown is for a 2Kx8 PROM)

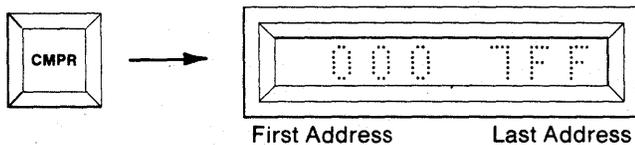
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the PROM to be used as Master in the MASTER socket. Insert the PROM to be written into the COPY socket. The AUDIO switch is optional.



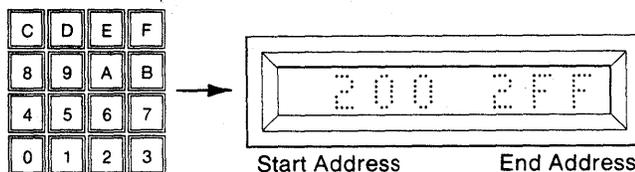
2. Depress RESET. The 8 hex displays are blank.



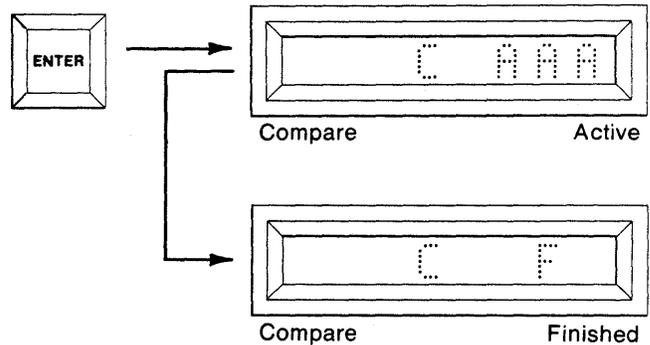
3. Depress CMPR. The First and Last Addresses of the Master and Copy PROMs will be displayed.



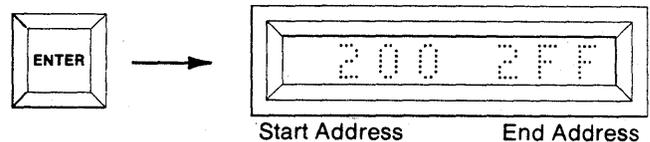
4. To Compare the entire contents of the Master PROM against the Copy PROM, starting with the First Address, go to step 5. To Compare a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



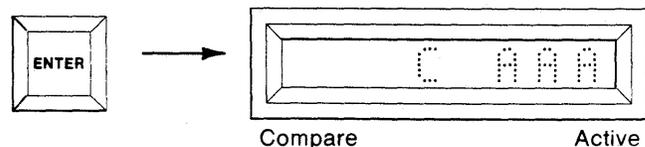
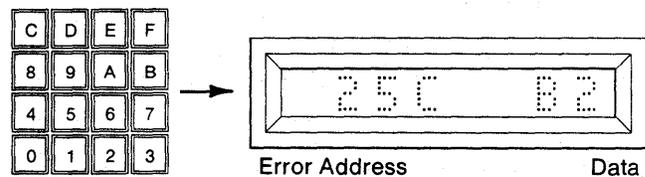
5. Depress ENTER. The displayed addresses will be accepted as the Start and End Addresses for the operation. "C AAA" will be displayed to indicate Compare (C) Active (AAA). When the Compare mode is finished, "C F" will be displayed for Compare (C) Finished (F).



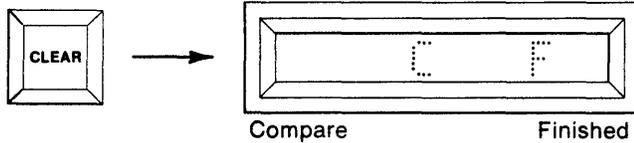
6. To repeat the Compare mode after "C F" is displayed, depress ENTER. The previous Start and End Addresses will be displayed. Continue with step 4 and/or 5.



7. If a non-compare occurs, the address and data of the Master PROM where the non-compare occurred will be displayed. Key C will display the copy data and key A will display the master data.



8. Depress ENTER to continue with the Compare operation and to return back to step 4 and/or 5, OR depress CLEAR to abort to Compare Finished.



Summary of Comparing a Copy PROM with a Master PROM

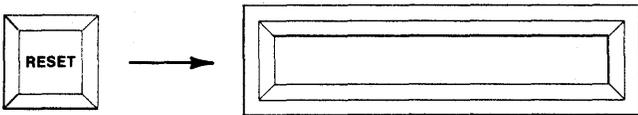
1. Insert Personality Module, Master and Copy PROMs, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (OFF), COPY (ON).
2. Depress RESET. The hex displays are blank.
3. Depress READ/CMPR. First and Last Addresses are displayed.
4. Optional. Key in new Start and/or End Addresses.
5. Depress ENTER. "C AAA" is displayed. When finished "C F" is displayed.
6. Optional. Depress ENTER to repeat operation over previously selected address field.
7. If a non-compare occurs the address and data of the Master PROM are displayed. Key C displays copy data and key A displays master data.
8. Optional. Depress ENTER to continue Comparing or depress CLEAR to abort to Compare Finished, without losing original address limits.

Performing a Checksum on a Master PROM (example shown is for a 2Kx8 PROM)

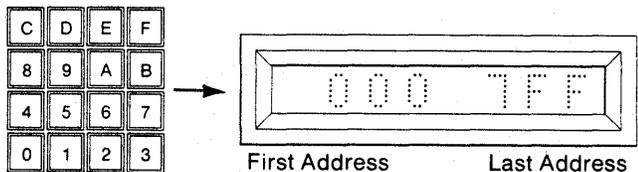
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the PROM to be used as Master PROM in the MASTER socket. The AUDIO switch is optional.



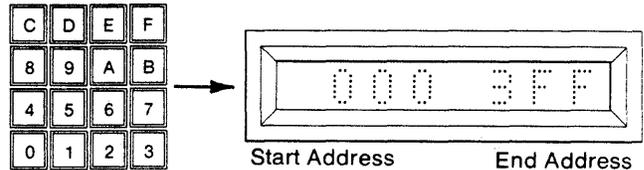
2. Depress RESET. The 8 hex displays are blank.



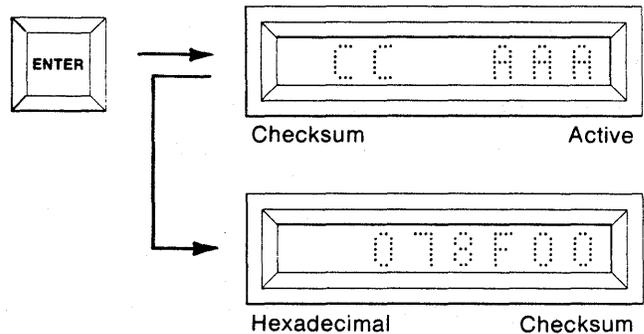
3. Depress Key C. The Start and End Addresses of the Master PROM will be displayed.



4. To Checksum the entire contents of the Master PROM, starting with the Start Address, go to step 5. To Checksum over a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



5. Depress ENTER. The M980 will accept the displayed data as the Start and End Addresses for the operation. The display will show "CC AAA" to indicate Checksum (CC) Active (AAA). When the Checksum is complete, the six digit hex equivalent will be displayed with the MSD's that are not used indicating 0's.



Summary of Performing a Checksum on a Master PROM

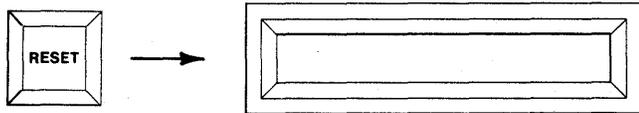
1. Insert Personality Module, Master PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (OFF), COPY (OFF).
2. Depress RESET. Displays are blank.
3. Depress key C. First and Last Addresses are displayed.
4. Optional. Redefine Start and End Addresses.
5. Depress ENTER. "CC AAA" is displayed while active. Hexadecimal Checksum is displayed when finished.

Performing a Checksum on a Copy PROM (example shown is for a 2Kx8 PROM)

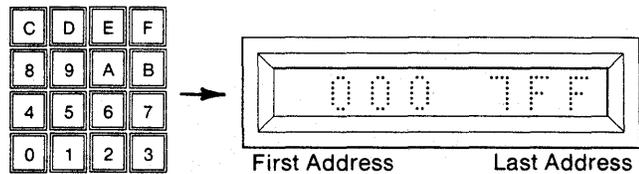
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the Copy PROM into the COPY socket of the Personality Module. The AUDIO switch is optional.



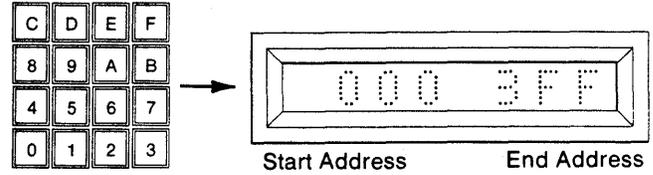
2. Depress RESET. The 8 hex displays are blank.



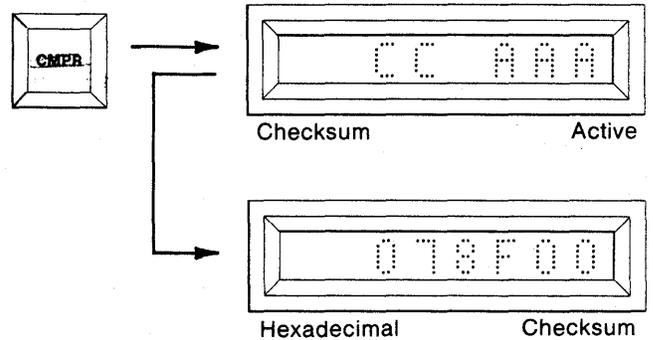
3. Depress KEY C. The First and Last Addresses of the Copy PROM will be displayed.



4. To Checksum the entire contents of the Copy PROM, starting with the First Address, go to step 5. To Checksum over a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



5. Depress ENTER. The M980 will accept the displayed data as the Start and End Addresses for the operation. The display will show "CC AAA" to indicate Checksum (CC) Active (AAA). When the Checksum is complete, the six digit hex equivalent will be displayed.

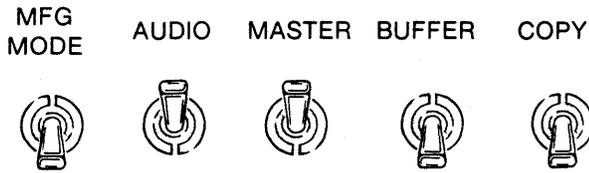


Summary of Performing a Checksum on a Copy PROM

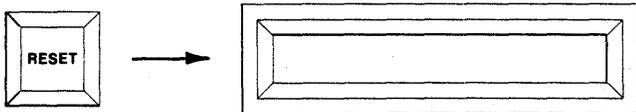
1. Insert Personality Module, Copy PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (OFF), COPY (ON).
2. Depress RESET. Displays are blank.
3. Depress key C. First and Last Addresses are displayed.
4. Optional. Redefine Start and End Addresses.
5. Depress ENTER. "CC AAA" is displayed while active. Hexadecimal Checksum is displayed when finished.

Performing a Blank Check on a Master PROM (example shown is for a 2Kx8 PROM)

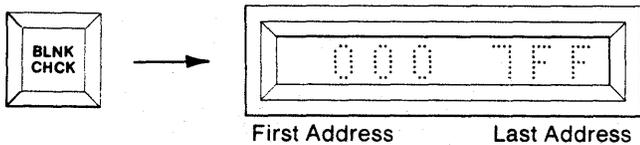
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the PROM to be Blank Checked into the MASTER socket. The AUDIO switch is optional.



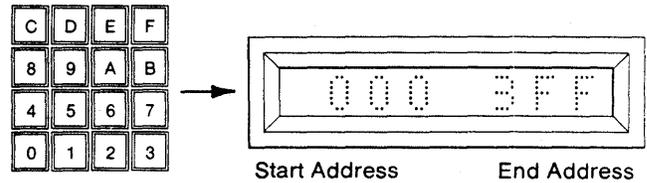
2. Depress RESET. The 8 hex displays are blank.



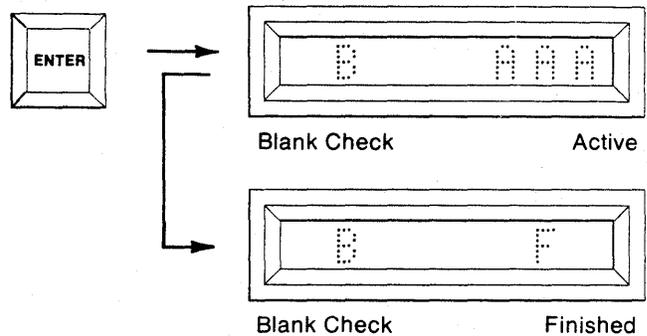
3. Depress BLNK CHCK. The First and Last Addresses of the Master PROM will be displayed.



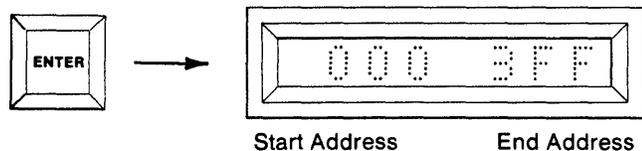
4. To Blank Check the entire contents of the Master PROM, starting with the first location, go to step 5. To Blank Check a limited field, continue. Use the hex keyboard to key in a new Start Address, MSD first. Repeat for the Ending Address.



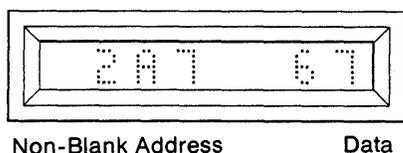
5. Depress ENTER. The M980 will accept the displayed data as the Start and End Addresses for the operation. The display will show "B AAA" to indicate Blank Check (B) Active (AAA). "B F" will be displayed for Blank Check Finished.



6. To repeat the Blank Check operation, depress ENTER when "B F" appears. The previous Start and End Addresses will be displayed and you may continue with step 4 and/or 5.



7. If a non-blank address is found, the address and data are displayed. Return to step 5 to continue or RESET.

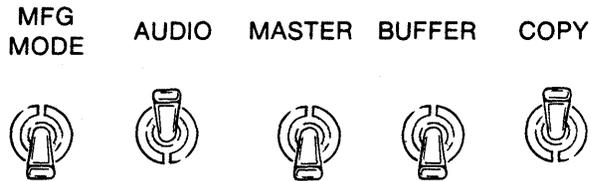


Summary of Performing a Blank Check on a Master PROM

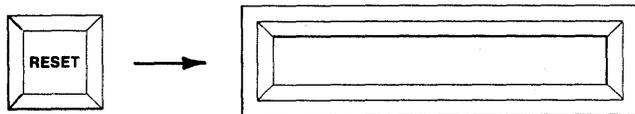
1. Insert Personality Module, Master PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (OFF), COPY (OFF).
2. Depress RESET. Displays are blank.
3. Depress BLNK CHCK. First and Last Addresses of Master PROM are displayed.
4. Optional. Redefine Start and End Addresses.
5. Depress ENTER. "B AAA" is displayed while active. "B F" displayed for Blank Check Finished.
6. Optional. Depress Enter to repeat Blank Check and go to step 4 and/or 5.
7. If non-blank address is found, it will be displayed. Return to step 5 to continue or RESET.

**Performing a Blank Check on a Copy PROM
(example shown is for a 2Kx8 PROM)**

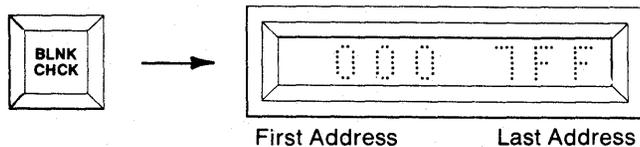
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the Copy PROM to be Blank Checked into the COPY Socket. The AUDIO switch is optional.



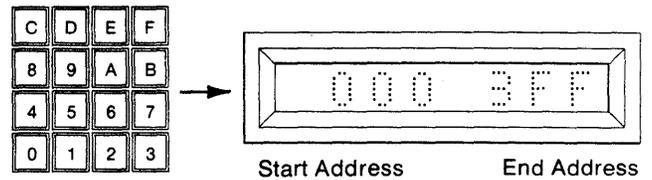
2. Depress RESET. The 8 hex displays are blank.



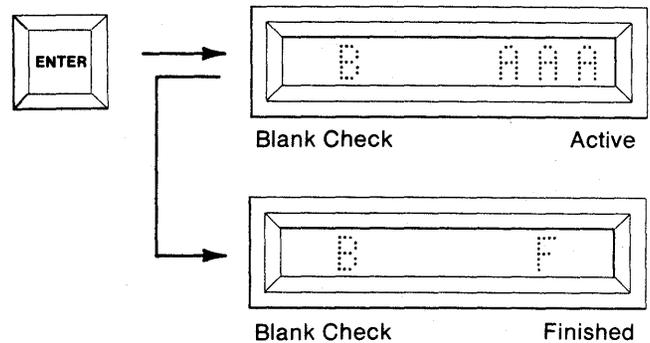
3. Depress BLNK CHCK. The First and Last Addresses of the Copy PROM will be displayed.



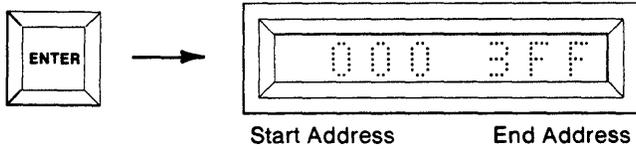
4. To Blank Check the entire contents of the Copy PROM, starting with the first location, go to step 5. To Blank Check a limited field, continue. Use the hex keyboard to key in a new Start Address, MSD first. Repeat for the End Address.



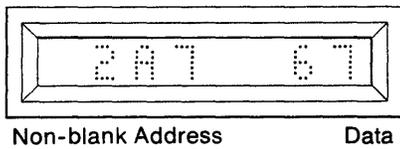
5. Depress ENTER. The M980 will accept the displayed data as the Start and End Addresses for the operation. The display will show "B AAA" to indicate Blank Check (B) Active (AAA). "B F" will be displayed for Blank Check Finished.



- To repeat the Blank Check operation, depress ENTER when "B F" appears. The previous Start and End Address will be displayed and you may continue with step 4 and/or 5.



- If a non-blank address is found, the address and data will be displayed. Return to step 5 to continue or RESET.



Summary of Performing a Blank Check on a Copy PROM

- Insert Personality Module, Copy PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (OFF), COPY (ON).
- Depress RESET. Displays are blank.
- Depress BLNK CHCK. First and Last Addresses of Copy PROM are displayed.
- Optional. Redefine Start and End Addresses.
- Depress ENTER. "B AAA" is displayed while active. "B F" displayed for Blank Check Finished.
- Optional. Depress ENTER to repeat Blank Check and go to step 4 and/or 5.
- If non-blank address is found, it will be displayed. Return to step 5 to continue or RESET.

Performing an Illegal Bit Check on Copy PROM from the Master PROM (example shown is for a 2Kx8 PROM)

The Illegal Bit Check operation checks for the possibility of overwriting the PROM in the copy socket over the defined field with data from the master PROM. Illegal Bit Check determines the erased state of the PROM under consideration from the lookup table in the personality module. If the copy PROM has a non-erased location that has an erased state to be written, an error condition will occur. No attempt will be made to actually write data to the copy PROM during Illegal Bit Check.

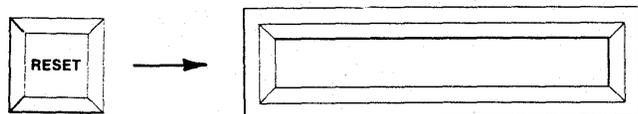
NOTE

Illegal Bit Check does not apply to gang modules. If attempted, an "EO" will be displayed.

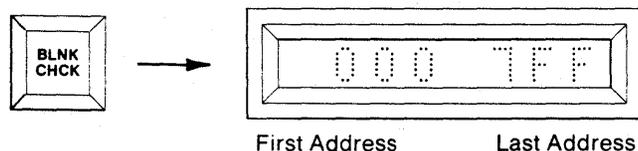
1. Select switches as shown.



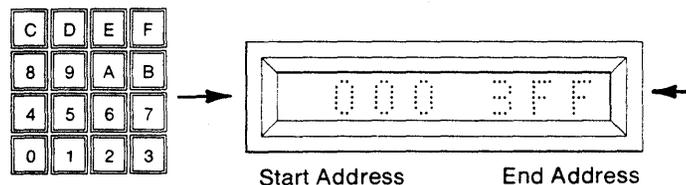
2. Depress RESET. The 8 hex displays are blank.



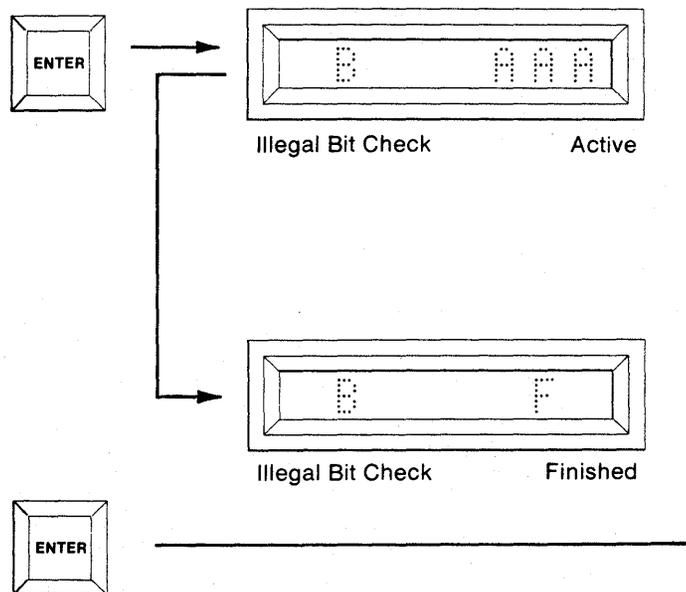
3. Press BLNK CHCK. The first and last addresses of the Copy PROM will be displayed.



4. To perform an Illegal Bit Check (IBC) over displayed field, go to step 5. To change address field, use keyboard to enter new Start and End Addresses. See SECTION 3 for more details. Use CLEAR key for corrections. When the complete field is defined, go on to the next step.

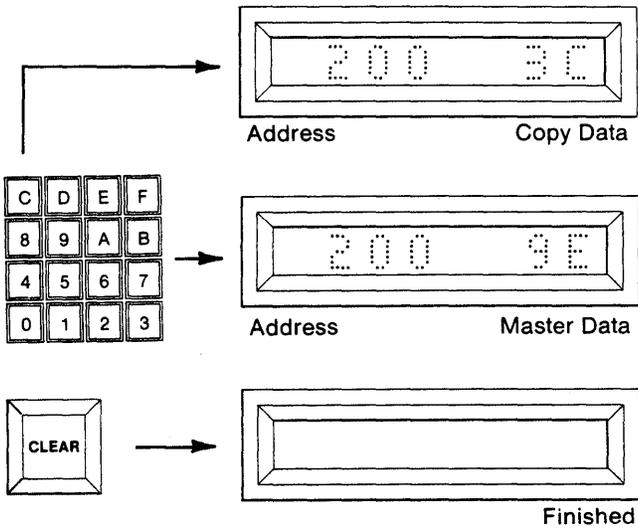


5. Depress ENTER. The M980 will accept the Start/End Address displayed as the field over which the Illegal Bit Check will be performed. "B AAA" shows that IBC is active. "B F" shows that IBC has been completed.



6. To repeat IBC operation, depress ENTER after "B F" appears. The previous Start/End Address will be displayed. Continue at step 4.

7. The Illegal Bit Check is performed at sequential addresses beginning with the Start Address. If a location is found that can't be overwritten, that address is shown along with the Master data. Depress key "C" on the hex keyboard to display Copy data. Depress key "A" to restore Master data. Depress ENTER to continue IBC operation or CLEAR to force finish. Then depress ENTER to continue at Step 4.



Summary of Illegal Bit Checking a Copy PROM from a Master PROM

1. Insert Personality Module, Master and Copy PROMs, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (OFF), COPY (ON).
2. Depress RESET The hex displays are blank.
3. Depress BLNK CHCK. First and Last Addresses are displayed.
4. Optional. Key in new Start and/or End Address.
5. Depress ENTER. "B AAA" is displayed. When finished "B F" is displayed.
6. Optional. Depress ENTER to repeat operation over previously selected address field.
7. If an illegal condition occurs, the address and data of the Master PROM are displayed. Key C displays copy data and key A displays master data.
8. Optional. Depress ENTER to continue Illegal Bit Check or depress CLEAR to abort to IBC Finished, without losing original address limits.

SECTION 6

Buffer Operations to/from a Copy or Master Prom

DESCRIPTION

The CMOS RAM Buffer of the M980 provides a workspace (8Kx8 standard, 16Kx8 and 32Kx8 optional) where PROM code can be accumulated and manipulated prior to programming a blank PROM. The Buffer can be loaded from the M980 keyboard, Master PROM, or the remote interfaces 9811, 9812, 9814, and 9818. The M980 features Data Displacement during Buffer input and output operations, and enables edit functions to change that data. The M980 power may be switched OFF for at least one week without losing Buffer data. It is recommended that the Buffer be cleared to the erased state of the PROM type used prior to loading valid data into the Buffer. See Fill Buffer Operations in Section 7. RESET does not affect the Buffer contents.

The following operations are described in detail to allow the user to perform this transfer of data. These operations may also be used to transfer parts of several different PROMs into the Buffer and to transfer their total sum into one PROM (see Figure 6-1).

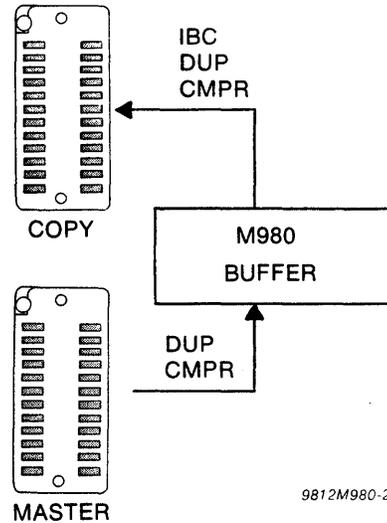
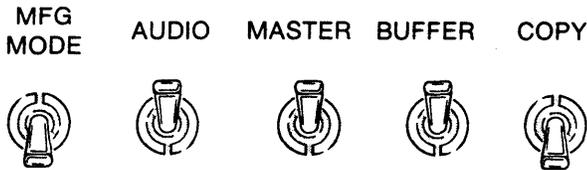


Figure 6-1. Buffer Operations
(to/from Copy or Master Prom)

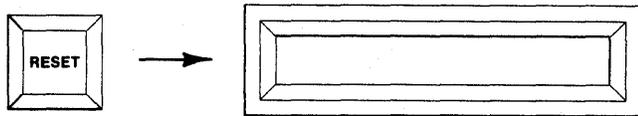
Buffer Operations To/From a Copy or Master PROM

Duplicating the RAM Buffer from a Master PROM (example shown is for a 16Kx8 RAM Buffer and a 2Kx8 Master PROM)

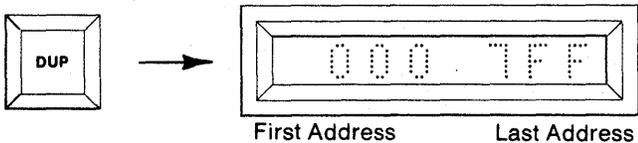
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the PROM into the MASTER socket. The RAM Buffer may be filled with any data prior to this operation by using "Fill Buffer" a Buffer Edit operation described in Section 7. The AUDIO switch is optional.



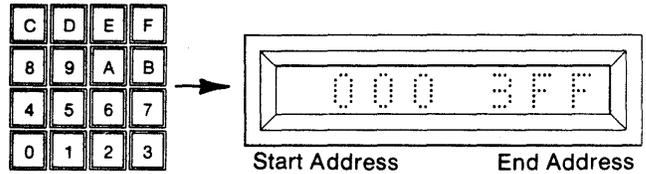
2. Depress RESET. The 8 hex displays are blank.



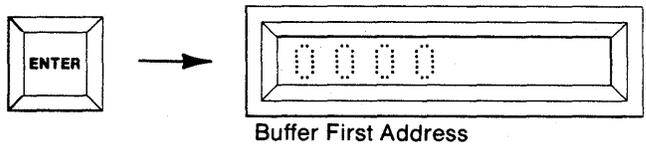
3. Depress DUP. The First and Last Addresses of the Master PROM are displayed.



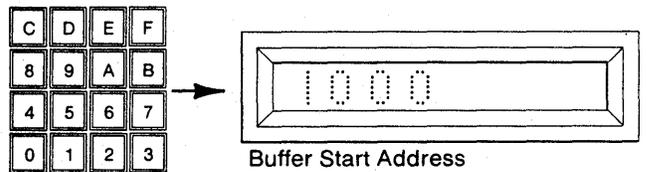
4. To Duplicate the entire contents of the Master PROM into the Buffer go to step 5. To Duplicate over a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



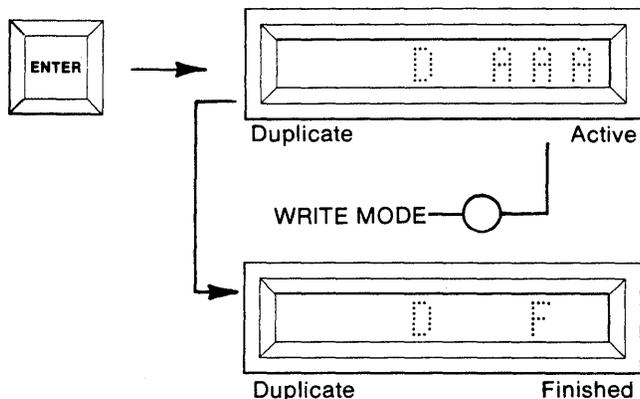
5. Depress ENTER. The M980 accepts the displayed data as the Start and End Addresses for the operation. The display shows "0000" which is the First Address of the RAM Buffer.



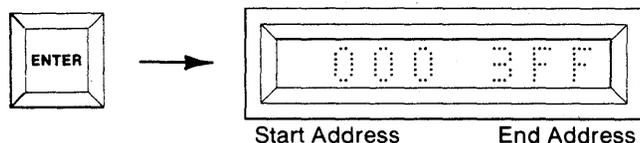
6. If you wish the Duplicate operation to start at the first location of the RAM Buffer, continue to step 7. To redefine the Start Address of the Buffer, use the hex keyboard to key in a new Start Address, MSD first.



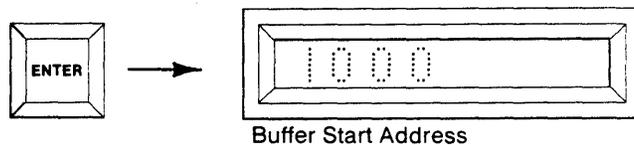
7. Depress ENTER. The displayed Start Address for the RAM Buffer is accepted by the M980. "D AAA" is displayed to indicate Duplicate (D) Active (AAA). Write Mode LED is lit. The M980 starts duplicating from the Master Start Address into the Start Address of the RAM Buffer. This continues until the end address of the Master is reached. When finished the display shows "D F."



8. To repeat the Duplicate operation without resetting, depress ENTER. The hex display shows the previous Start and End Addresses used. You may now redefine the Start and End Addresses as in step 4 or you may depress ENTER again and the previous Buffer Start Address is displayed.



9. It is possible now to redefine the Buffer Start Address as in step 6, or depress ENTER to start the Duplicate function as in step 7.



Summary of Duplicating the RAM Buffer from a Master PROM

1. Insert Personality Module, Master PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (ON), COPY (OFF).
2. Depress RESET. Displays are blank.
3. Depress DUP. First and Last Addresses of Master PROM are displayed.
4. Optional. Redefine Start and End Addresses of the Master.
5. Depress ENTER. Start Address of RAM Buffer is displayed.
6. Optional. Redefine the Buffer Start Address.
7. Depress ENTER. "D AAA" is displayed for DUP Active. "D F" is displayed when finished.
8. Optional. Depress ENTER to repeat Master, Start and End Address.
9. Optional. Depress ENTER to repeat Buffer Start Address, beginning of Duplicate operation.

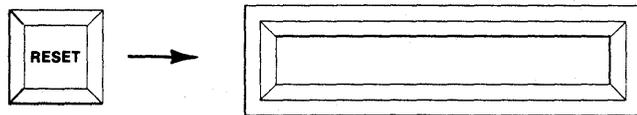
Buffer Operations To/From a Copy or Master PROM

Comparing the RAM Buffer with a Master PROM (example shown is for a 16Kx8 RAM Buffer and a 2Kx8 Master PROM)

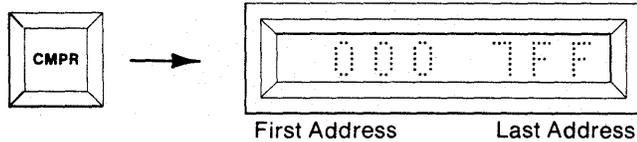
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the Master PROM into the MASTER socket. The AUDIO switch is optional.



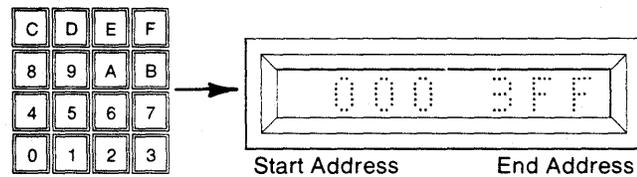
2. Depress RESET. The 8 hex displays are blank.



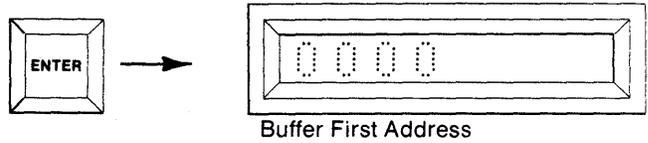
3. Depress CMPR. The 8 hex displays show the First and Last Addresses of the Master PROM.



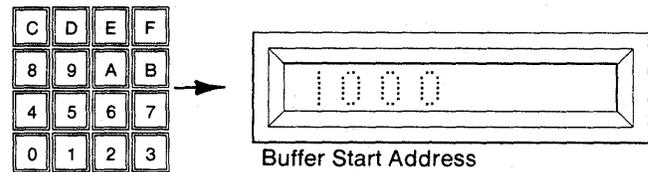
4. If the entire contents of the Master PROM are to be Compared with the Buffer go to step 5. To compare a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



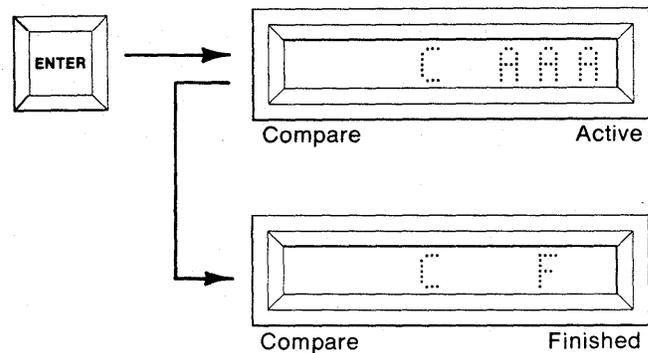
5. Depress ENTER. The M980 accepts the displayed data as the Start and End Addresses for the operation. The display shows "0000" which is the First Address of the RAM Buffer.



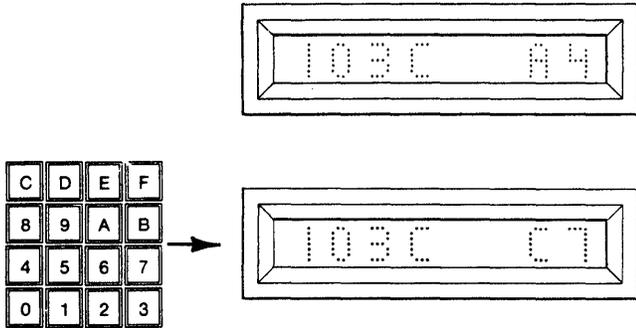
6. To have the compare operation begin at the first location of the RAM Buffer, continue to step 7. To redefine the Start Address of the Buffer, use the hex keyboard to key in a new Start Address, MSD first.



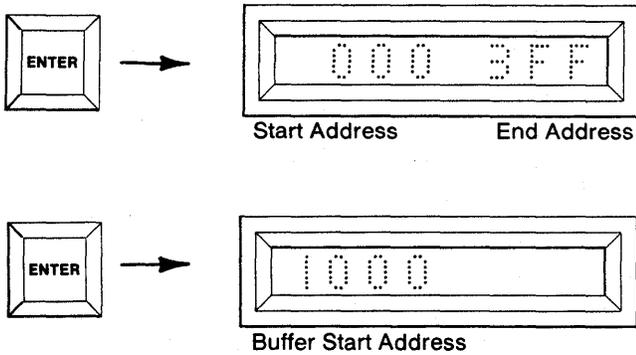
7. Depress ENTER. The displayed Start Address for the RAM Buffer is accepted by the M980. "C AAA" is displayed to indicate Compare (C) Active (AAA). The M980 starts Comparing from the Master PROM Start Address with the Start Address of the RAM Buffer. This continues until the End Address of the Master PROM is reached. When finished the display shows "C F".



8. If a non-compare occurs, the address and data of the Master location is displayed. By depressing key B, the Buffer address and data may be seen. Depress ENTER to continue, or CLEAR to abort.



9. To repeat the Compare operation without resetting, depress ENTER. The hex display shows the previous Start and End addresses used. Now redefine the Start and End Addresses as in step 4 or depress ENTER again and the previous Buffer Start Address is displayed. It is possible to redefine the Buffer Start Address as in step 6 and/or go to step 7.



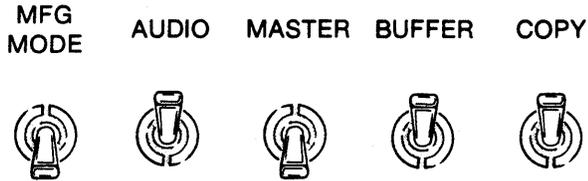
Summary of Comparing the RAM Buffer with a Master PROM

1. Insert Personality Module, Master PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (ON), BUFFER (ON), COPY (OFF).
2. Depress RESET. Displays are blank.
3. Depress CMPR. First and Last Addresses of Master PROM are displayed.
4. Optional. Redefine Start and End Addresses of the Master PROM.
5. Depress ENTER. Start Address of RAM Buffer is displayed.
6. Optional. Redefine the Buffer Start Address.
7. Depress ENTER. "C AAA" is displayed for CMPR Active. "C F" is displayed when finished.
8. Error displayed if non-compare occurs.
9. Optional. Depress ENTER to repeat Compare operation.

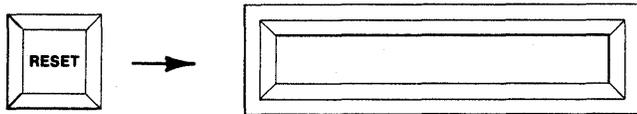
Buffer Operations To/From a Copy or Master PROM

Duplicating the RAM Buffer into a Copy PROM (example shown is for a 16Kx8 RAM Buffer and a 2Kx8 Copy PROM)

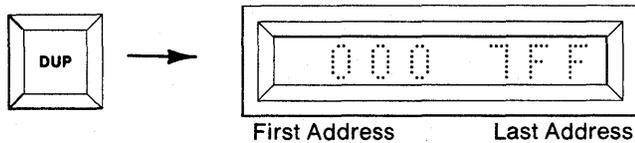
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the Copy PROM into the Copy socket. The AUDIO switch is optional.



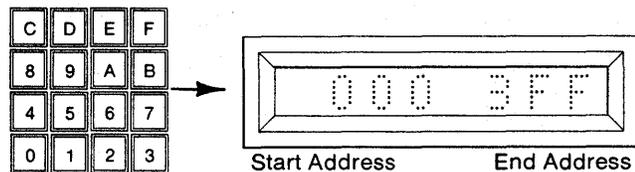
2. Depress RESET. The 8 hex displays are blank.



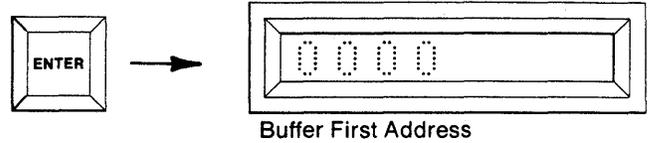
3. Depress DUP. The First and Last Addresses of the Copy PROM are displayed.



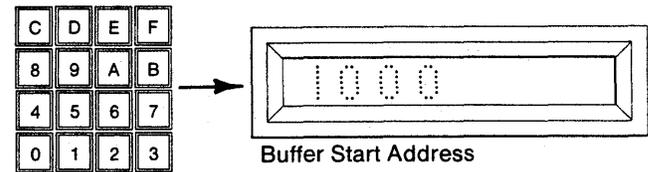
4. To Duplicate the entire contents of the Copy PROM from the Buffer go to step 5. To Duplicate over a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



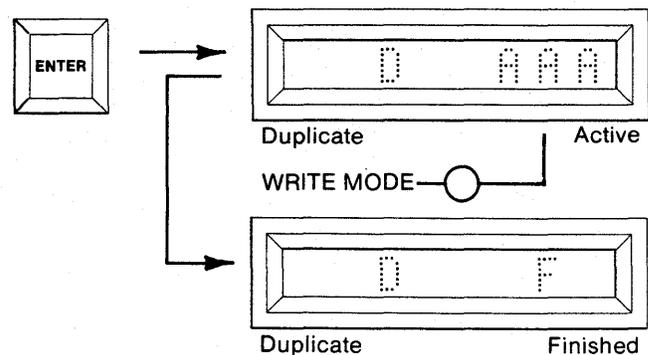
5. Depress ENTER. The M980 accepts the displayed data as the Start and End Addresses for the operation. The display shows "0000" which is the First Address of the RAM Buffer.



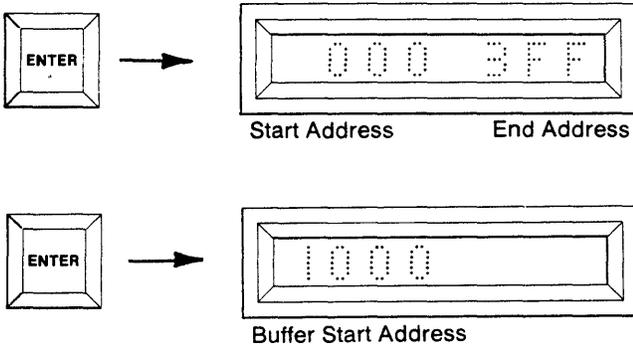
6. To have the Duplicate operation start at the first location of the RAM Buffer, continue to step 7. To redefine the Start Address of the Buffer, use the hex keyboard to key in a new Start Address, MSD first.



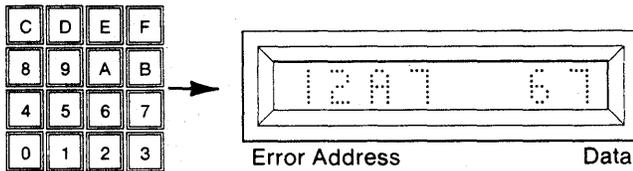
7. Depress ENTER. The displayed Start Address for the RAM Buffer is accepted by the M980. "D AAA" is displayed to indicate Duplicate (D) Active (AAA). The write mode LED is lit. The M980 starts duplicating to the Copy PROM's Start Address from the Start Address of the RAM Buffer. This continues until the End Address of the Copy PROM is reached. When finished the display shows "D F".



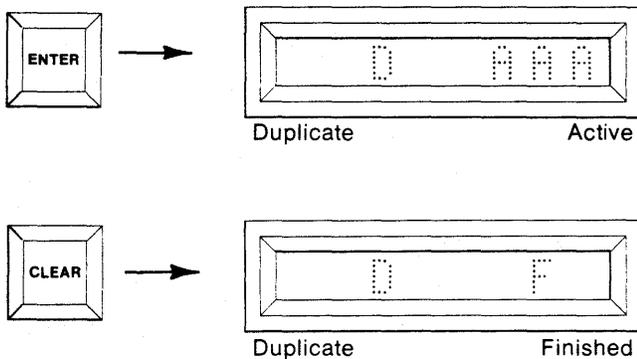
- To repeat the Duplicate operation without resetting, depress ENTER. The hex display shows the previous Start and End Addresses used. Now redefine the Start and End Addresses as in step 4 or depress ENTER again and the previous Buffer Start Address is displayed. It is possible to redefine the Buffer Start Address as in step 6 and/or go to step 7.



- If an error should occur, the address and the data of the Buffer where the error occurred are displayed. Depressing key C shows the copy data and address. Depressing key B shows the Buffer data again (see Section 8).



- Depress ENTER to resume duplication and to return to step 8, or depress CLEAR to abort to Duplicate Finished ("D F"). See Failure to Program Operations in Section 11.



Summary of Duplicating the RAM Buffer into a Copy PROM

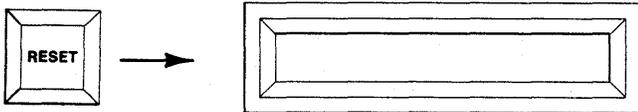
- Insert Personality Module, Copy PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (ON).
- Depress RESET. Displays are blank.
- Depress DUP. First and Last Addresses of Copy PROM are displayed.
- Optional. Key in Start and End Addresses.
- Depress ENTER. First Address of the Buffer is displayed.
- Optional. Key in the new Buffer Start Address.
- Depress ENTER. "D AAA" is displayed for Duplicate Active. "D F" is displayed when Finished.
- Optional. Depress ENTER to repeat the start and End Addresses of the Copy PROM. Depress ENTER again to repeat the Start Address of the Buffer. Return to step 7 to continue the Duplicate operation.
- If an error occurs, the address and data of the error are displayed. Depress key C to view copy address and data; depress key B to view Buffer address and data.
- Optional. Depress ENTER to continue with the Duplicate operation or depress CLEAR to abort to Dup Finished.

**Comparing the RAM Buffer to a Copy PROM
(example shown is for a 16Kx8 RAM Buffer
and a 2Kx8 Copy PROM)**

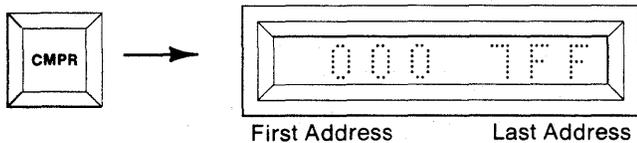
1. Select the switches as shown. Insert the appropriate Personality Module. Insert the Copy PROM in the COPY socket. The AUDIO switch is optional.



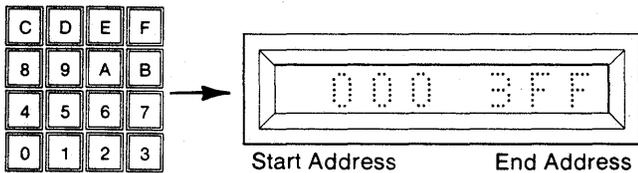
2. Depress RESET. The 8 hex displays are blank.



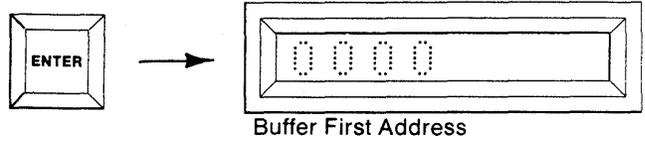
3. Depress CMPR. The 8 hex displays show the First and Last Addresses of the Copy PROM.



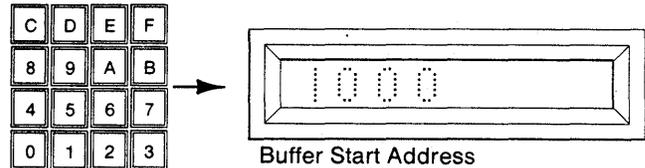
4. To Compare the entire contents of the Copy PROM with the Buffer, go to step 5. To Compare a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



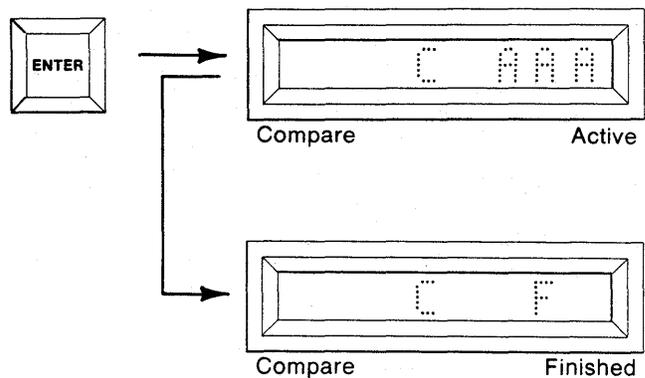
5. Depress ENTER. The M980 accepts the displayed data as the Start and End Addresses for the operation. The display shows "0000" which is the First Address of the RAM Buffer.



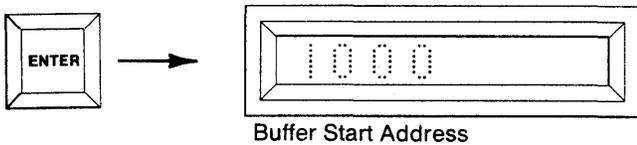
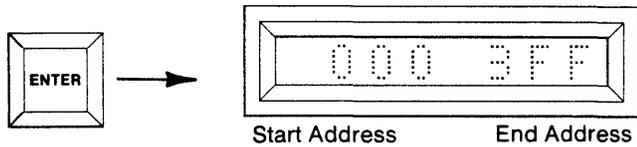
6. To have the Compare operation start with the first location of the RAM Buffer, continue to step 7. To redefine the Start Address of the Buffer, use the hex keyboard to key in a new Start Address, MSD first.



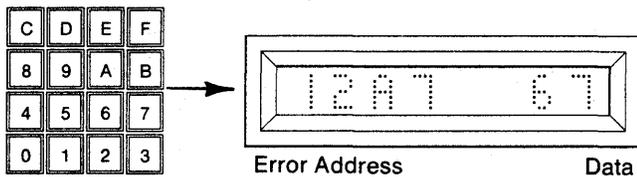
7. Depress ENTER. The displayed Start Address for the RAM Buffer is accepted by the M980. "C AAA" is displayed to indicate Compare (C) Active (AAA). The M980 begins comparing the Start Address of the Buffer with the Start Address of the Copy PROM. This continues until the End Address of the Copy PROM is reached. When finished the display shows "C F".



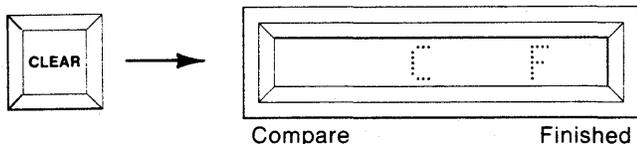
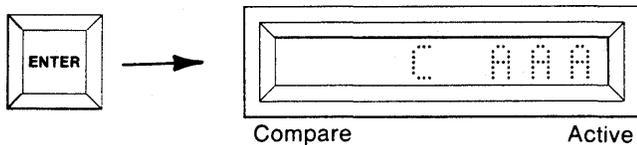
8. To repeat the Compare operation without resetting, depress ENTER. The hex display shows the previous Start and End Addresses used. Now redefine the Start and End Addresses as in step 4 OR depress ENTER again and the previous Buffer Start Address is displayed. It is possible to redefine the Buffer Start Address as in step 6 and/or go to step 7.



9. If an error should occur, the address and the data of the Buffer where the error occurred are displayed. Depressing key C shows the copy data and address. Depressing key B shows the Buffer data and address again (see Section 8).



10. Depress ENTER to resume Compare operations and to return to step 8 or depress CLEAR to abort to Compare Finished. See Failure to Program Operations in Section 11.



Summary of Comparing the RAM Buffer with a Copy PROM

1. Insert Personality Module, Copy PROM, and select switches: MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (ON).
2. Depress RESET. All displays are blank.
3. Depress CMPR. First and Last Addresses of the Copy PROM are displayed.
4. Optional. Key in the new Start and End Addresses.
5. Depress ENTER. The First Address of the Buffer is displayed.
6. Optional. Key in the new Buffer Start Address.
7. Depress ENTER. "C AAA" is displayed for Compare Active. "C F" is displayed when finished.
8. Optional. Depress ENTER to repeat the Start and End Addresses of the Copy PROM. Depress ENTER again to repeat the Start Address of the Buffer. Go to step 7 to continue the Compare operation.
9. If an error occurs, the address and data of the error are displayed. Depress key C to view copy data and key B to view Buffer data.
10. Optional. Depress ENTER to continue with the Compare operation or depress CLEAR to abort to Compare Finished.

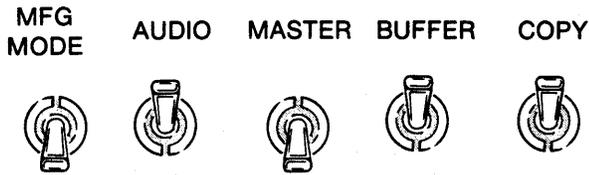
Performing an Illegal Bit Check on a Copy PROM from the Buffer (example shown is for a 16Kx8 RAM Buffer and a 2Kx8 Copy PROM)

The Illegal Bit Check operation checks for the possibility of overwriting the PROM in the copy socket over the defined field with data from the buffer. Illegal Bit Check determines the erased state of the PROM under consideration from the lookup table in the personality module. If the copy PROM has a nonerased location that has an erased state to be written, an error condition will occur. No attempt will be made to actually write data to the copy PROM during illegal bit check.

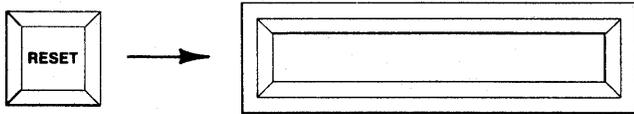
NOTE

Illegal Bit Check does not apply to Gang Modules. If attempted, an "EO" will be displayed.

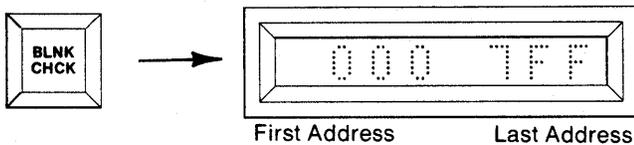
1. Select switches as shown.



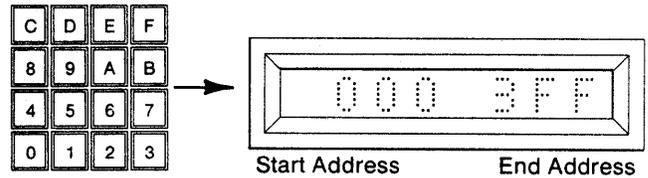
2. Depress RESET. The 8 hex displays are blank.



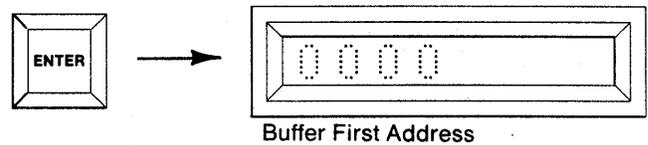
3. Press BLNK CHCK. The first and last addresses of the Copy PROM will be displayed.



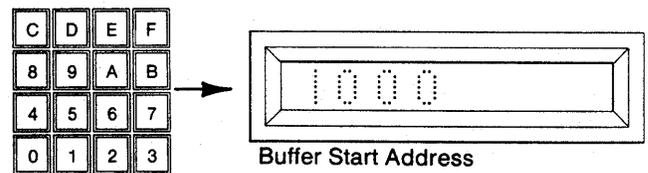
4. To perform Illegal Bit Check over displayed field, go to step 5. To change address field, use keyboard to enter new Start and End Address. See Section 3 for more details. Use CLEAR key for corrections. When the complete field is defined, go on to the next step.



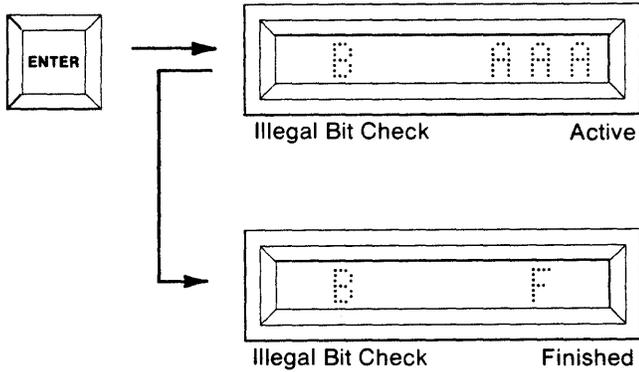
5. Depress ENTER. The M980 will accept the Start/End Address displayed as the field over which the IBC will be performed. The display shows "0000", the first address of the RAM Buffer.



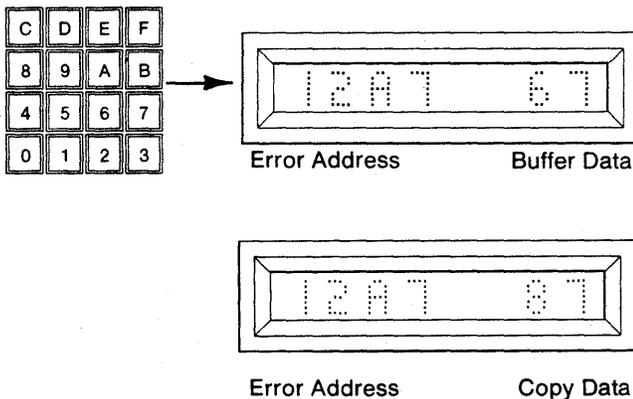
6. To have the IBC begin at the Buffer location shown, go to step 7. To redefine the Start Address of the Buffer, use hex keyboard to key in new Buffer Start Address, MSD first. Use CLEAR key if corrections are needed.



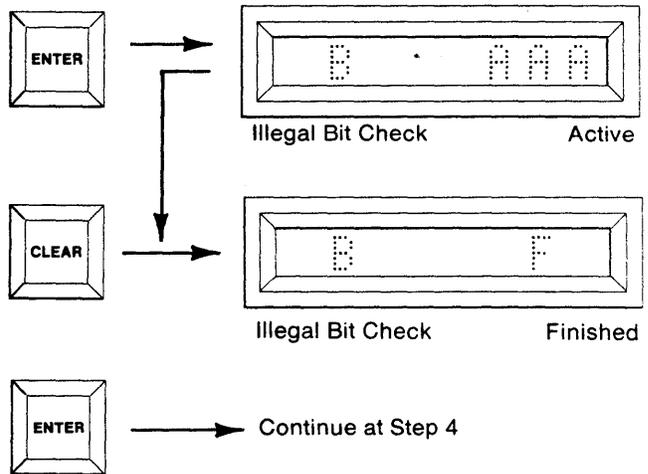
7. Depress ENTER. The displayed Start Address for the RAM Buffer is accepted. "B AAA" is displayed to show that the IBC is being performed over the addresses accepted. The M980 performs the IBC between the Start Address of the copy PROM and the Start Address of the Buffer in sequential order. When finished, the display shows "B F."



8. If the Illegal Bit Check finds a location that can't be overwritten, the address and data of the Buffer at that location is shown. Depressing key "C" shows the corresponding location of the Copy PROM address and data. Pressing key "B" will restore Buffer address and data to the display.



9. Depress ENTER to continue IBC, or CLEAR to force finish ("B F"), then depress ENTER to return to step 4.



Summary of Illegal Bit Checking the RAM Buffer to a Copy PROM

1. Insert Personality Module, Copy PROM, and select switches; MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON) COPY (ON).
2. Depress RESET. All displays are blank.
3. Depress BLNK CHCK. First and Last Addresses of the Copy PROM are displayed.
4. Optional. Key in the new Start and End Addresses.
5. Depress ENTER. The First Address of the Buffer is displayed.
6. Optional. Key in the new Buffer Start Address.
7. Depress ENTER. "B AAA" is displayed for IBC Active. "B F" is displayed when finished.
8. Optional. Depress ENTER to repeat the Start and End Addresses of the Copy PROM. Depress ENTER again to repeat the Start Address of the Buffer. Go to step 7 to continue the IBC operation.
9. If an illegal condition occurs, the address and data of the error are displayed. Depress Key C to view copy data and Key B to view Buffer data.
10. Optional. Depress ENTER to continue with the IBC operation or depress CLEAR to abort to IBC Finished.

SECTION 7

Additional Buffer Operations

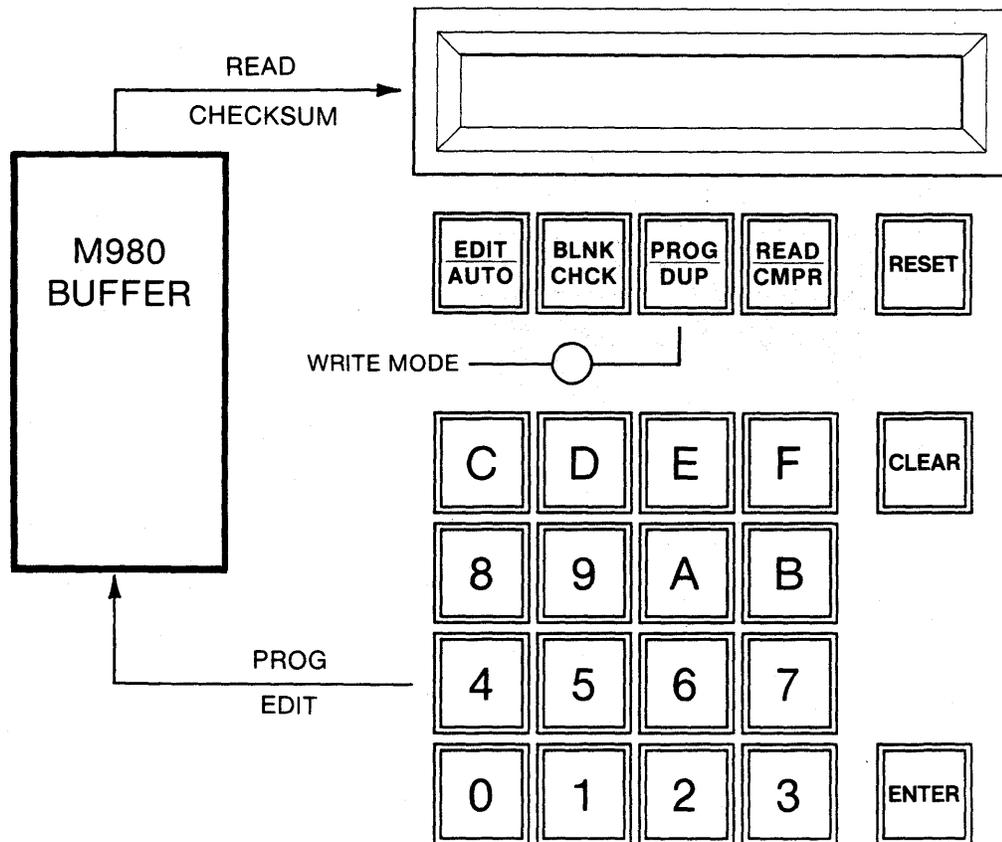
DESCRIPTION

The CMOS RAM Buffer of the M980 provides a workspace (8Kx8 standard, 16Kx8 and 32Kx8 optional) where PROM code can be accumulated and manipulated prior to programming a blank PROM. The Buffer can be loaded from the M980 keyboard, Master PROM, or the remote interfaces 9811, 9812, 9814, and 9818. The M980 features Data Displacement during Buffer input and output operations, and enables edit functions to change that data. The M980 power may be switched OFF for at least one week without losing Buffer data. It is recommended that the Buffer be cleared to the erased state of the PROM type used prior to loading

valid data into the Buffer. See Fill Buffer Operation. RESET does not affect the Buffer contents.

The M980 Buffer Edit operations are selected via the hex keyboard after RESET and the EDIT key are depressed. In its present configuration the M980 RAM Buffer is seen as an 8-bit Buffer when performing Invert, Insert, Delete, and Fill Buffer operations. The Nibble Swap, Hex Pack, and Hex Unpack operations are provided for 4-bit manipulation.

Only the Buffer is involved in the following operations; it is not mandatory that a Personality Module be installed, a warning "E4" is displayed; this can be overridden by continuing with the operation.

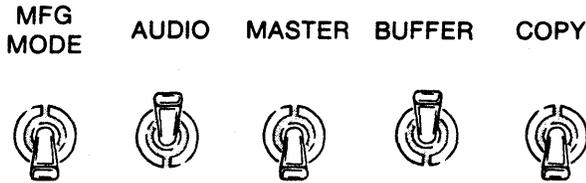


9812M980-1

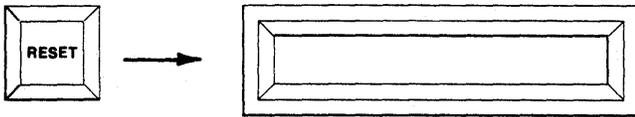
Figure 7-1. Buffer Operations via Hex Keyboard

Programming the RAM Buffer using the M980 Keyboard (example shown is for 8Kx8 RAM Buffer)

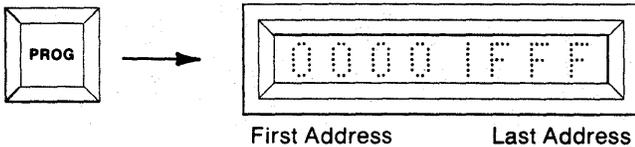
1. Select the switches as shown. The AUDIO switch is optional.



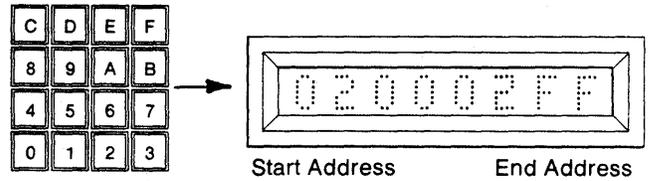
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. You may now continue.



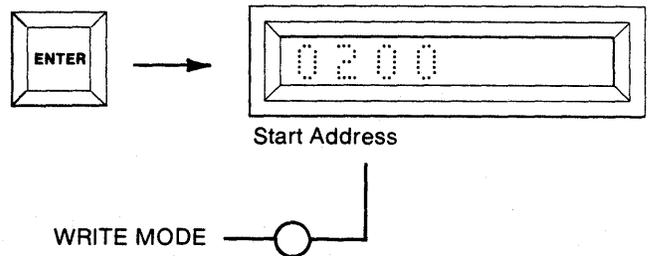
3. Depress PROG. The 8 hex displays should show the First and Last Addresses of the RAM Buffer.



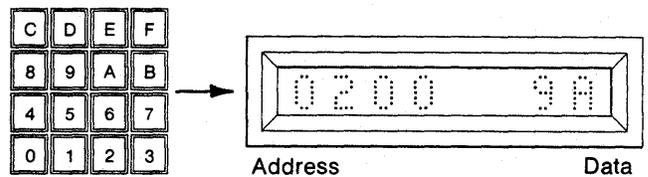
4. To Program the entire contents of the RAM Buffer, starting with the First Address, go to step 5. To Program a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



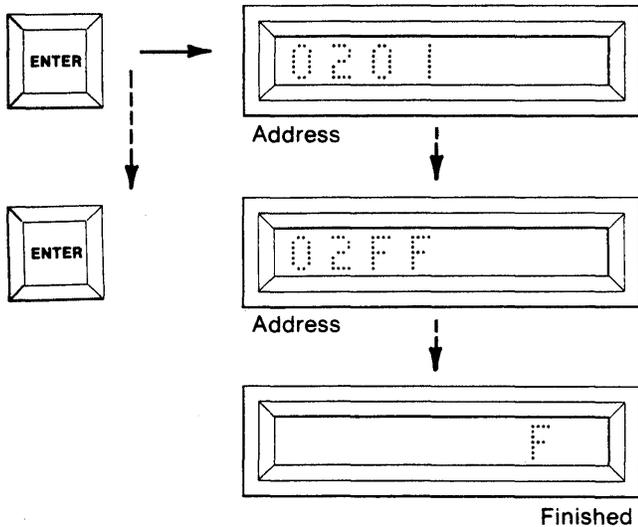
5. Depress ENTER. The M980 accepts the displayed data as the Start and End Addresses for the operation. The display shows the Start Address in the left-most display. The Write Mode LED is lit.



6. To Program the address displayed, key in the desired data, MSD first, using the CLEAR key to correct mistakes. To step over a location, continue to step 7.

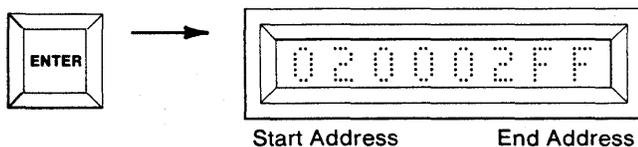


7. Depress ENTER to initiate Programming of the displayed data, or to step over an address without altering it. The next sequential address is displayed. Repeat steps 6 and/or 7 for each address.



8. When the End Address is displayed and steps 6 and/or 7 are initiated, an "F" appears to indicate that the Program mode has been performed over the specified Address field.

9. To repeat the Program operation without resetting, depress ENTER when "F" is displayed. This displays the Start and End Address field previously used (identical to step 4). The Start and End Address field can be redefined or you can continue with the displayed Start and End Addresses.



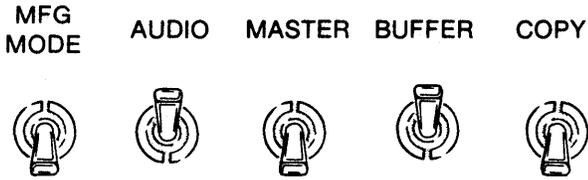
Summary of Programming the RAM Buffer using the M980 Keyboard

1. Set select switches: MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress PROG. First and Last Addresses are displayed.
4. Optional. Redefine the the Start and End Addresses via the hex keyboard.
5. Depress ENTER. The address shown is accepted and the Start Address is displayed.
6. Optional. Key in the data to be programmed.
7. Depress ENTER. This programs the previously keyed data or step over the displayed address. Repeat for every address.
8. The End Address is reached and "F" is displayed to indicate Finished.
9. Depress ENTER to return to step 4 if desired.

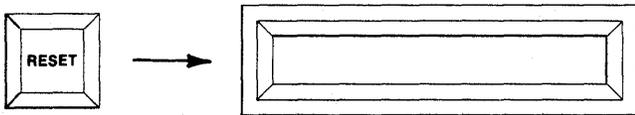
Additional Buffer Operations

Reading the RAM Buffer using the M980 Keyboard (example shown is for an 8Kx8 RAM Buffer)

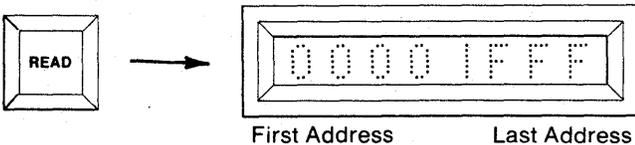
1. Select the switches as shown. The AUDIO switch is optional.



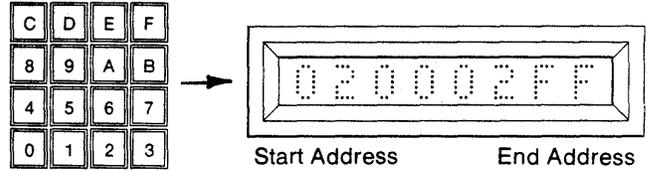
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. You may now continue.



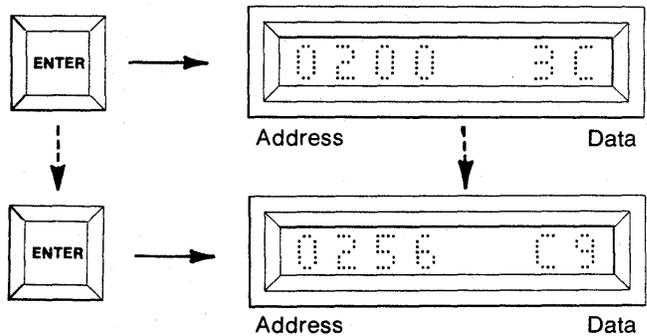
3. Depress READ. The 8 hex displays show the First and Last Addresses of the RAM Buffer.



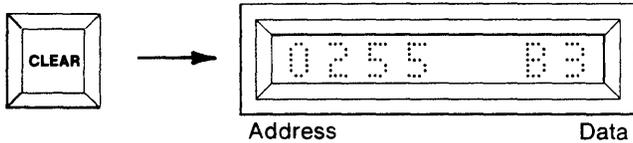
4. To Read the entire contents of the RAM Buffer, starting with the First Address, go to step 5. To Read a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



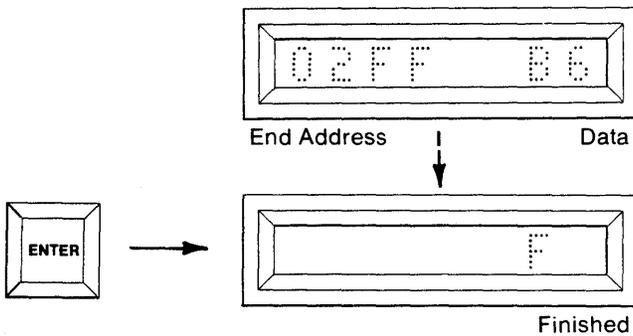
5. Depress ENTER. The M980 accepts the displayed data as the Start and End Addresses for the operation. The display shows the Start Address in the left-most display. The data located at that address is displayed in the right-most display. Repeat step 5 and the next sequential address and data are displayed. Repeat until the End Address is reached, RESET occurs, OR



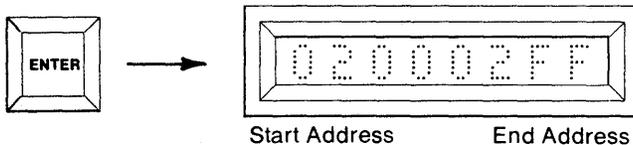
6. By Depressing CLEAR during the Read operation the addresses are decremented and the data at that address is displayed. The M980 can decrement past the defined Start Address.



7. When the End Address is reached, its data displayed, and ENTER is depressed, an "F" is displayed to indicate Finished.



8. To repeat the Read mode without resetting, depress ENTER when the "F" appears. The previous Start and End Addresses are displayed. Continue with step 4 and/or 5.



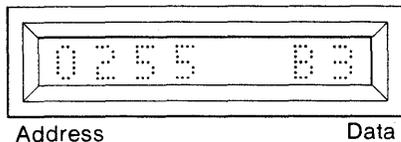
Summary of Reading the RAM Buffer using the M980 Keyboard

1. Set select switches: MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. Displays are blank.
3. Depress READ. First and Last Addresses are displayed.
4. Optional. Redefine the Start and End Addresses.
5. Depress ENTER. The Start Address and its corresponding data are displayed. Repeat for each sequential address OR
6. Optional. Depress CLEAR to decrement the address and display its data.
7. End Address is reached and ENTER is depressed. An "F" is displayed to indicate Finished.
8. Optional. Depress ENTER to show the previous Start and End Addresses and return to step 4 and/or 5.

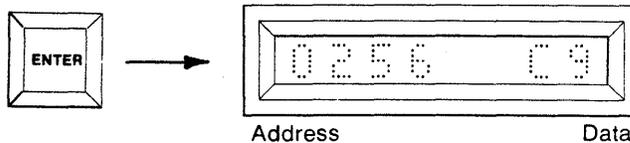
Additional Buffer Operations

Performing a Read/Modify on the RAM Buffer (example shown is for an 8Kx8 RAM Buffer)

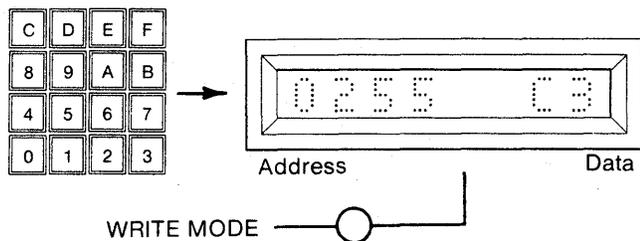
1. Repeat steps 1 through 5 of the Read Buffer operation (page 7-5) until the desired address is reached.



3. Depress ENTER. The data displayed is written into the RAM Buffer at the displayed address. The next sequential address and data are displayed. The Write Mode LED is extinguished. Continue until the End Address is reached.



2. The display now shows the address and data of the location to be modified. Enter new data by using the hex keyboard, MSD first, until the data displays are filled with the desired data. As soon as a hex key is depressed, the Write Mode LED is lit.

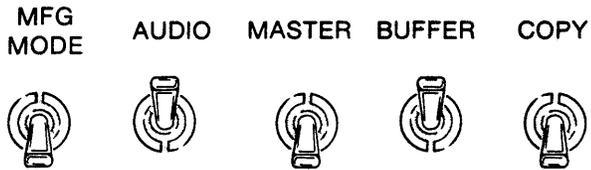


(Operations Continued Next Page)

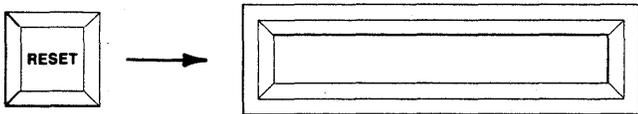
Additional Buffer Operations

Performing a Checksum on the M980 RAM Buffer (example shown is for an 8Kx8 RAM Buffer)

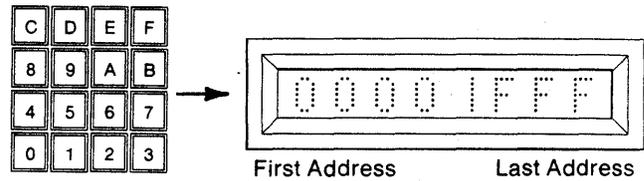
1. Select the switches as shown. The AUDIO switch is optional.



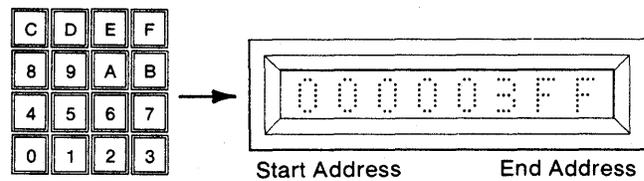
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. You may now continue.



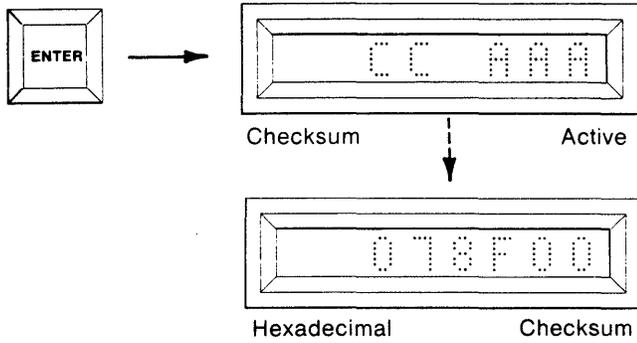
3. Depress key C. The First and Last Addresses of the RAM Buffer are displayed.



4. To Checksum the entire contents of the RAM Buffer, starting with the First Address, go to step 5. To Checksum a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



5. Depress ENTER. The M980 accepts the displayed data as the Start and End Addresses for the operation. The display shows "CC AAA" to indicate Checksum (CC) Active (AAA). When the Checksum is complete, the six digit hex equivalent is displayed.



Summary of Performing a Checksum on the RAM Buffer

1. Set select switches: MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress key C. First and Last Addresses are displayed.
4. Optional. Redefine the Start and End Addresses.
5. Depress ENTER. "CC AAA" is displayed while active. Hexadecimal Checksum is displayed when finished.

BUFFER EDIT FUNCTIONS

Buffer Edit functions are provided for manipulating Buffer data into a more useful form. Currently, there are eleven Buffer Edit modes, summarized below (see Figure 7-2). The word length of the Buffer is always 8 bits in the Edit mode.

The Set Word Size mode configures the Buffer word length for 4, 8, 12 or 16 bits. When the RESET key is depressed, the Buffer word length defaults to the Personality Module word size. If no Personality Module is installed, then the defaulted word size is 8 bit. Programming and Reading of the Buffer is dependent on the word size setting.

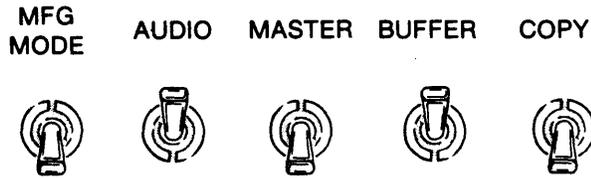
HEX KEY CODE	EDIT MODE	DESCRIPTION
00	SET WORD SIZE	Set Buffer word size to 4, 8, 12 or 16 bits.
01	INVERT	Complement a data field.
02	FILL BUFFER	Load Buffer field with specific data byte.
03	INSERT	Insert a block of data into a specified address field.
04	DELETE	Delete a block of data and close within a specified address field.
05	BLOCK MOVE	Move a block of data from one address field to another address field.
06	NIBBLE SWAP	Exchange upper and lower hex digits within an address field.
07	HEX PACK	Combine unpacked digits from two defined address fields.
08	HEX UNPACK	Separate packed digits to form two unpacked address fields.
11	RAM SPLIT	Separate one WORD (16 bit) field into two BYTE (8 bit) fields.
12	RAM INTERLEAVE	Combine two BYTE (8 bit) fields into one WORD (16 bit) field.

Figure 7-2. Buffer Edit—Set Word Size

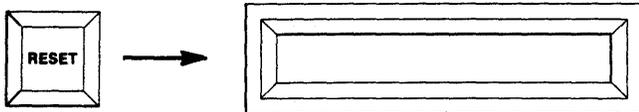
Buffer Edit—Set Word Size

Example: Read the Buffer with 4 bit word lengths.

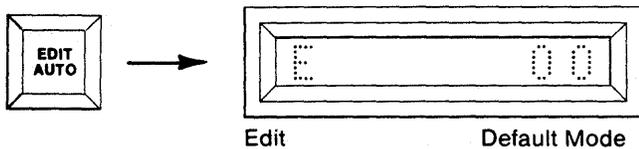
1. Select the switches as shown. The AUDIO switch is optional.



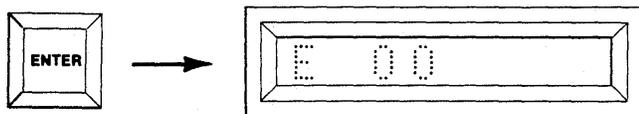
2. Depress RESET. The 8 hex displays are blank.



3. Depress EDIT. "E 00" is displayed to indicate Edit mode 00.

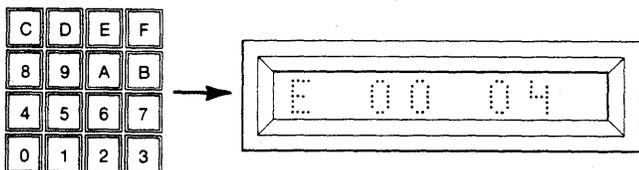


4. Depress ENTER. The display shows "E 00" to indicate Edit Word Size.

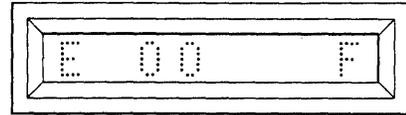


5. Use the hex keyboard to key in the desired word size 4, 8, 12 or 16 bit.

- Hex key 1 04
- Hex key 2 08
- Hex key 3 12
- Hex key 4 16



6. Depress the ENTER key. The previously selected word size is now accepted. A steady tone sounds if the AUDIO switch is ON. The "F" indicates finished.



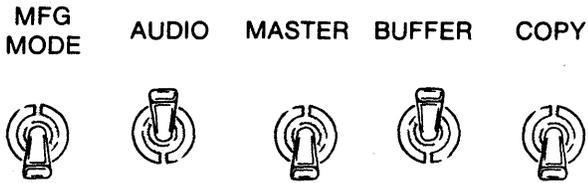
Summary: Read the Buffer with 4-bit Lengths

1. Set Select Switches: MFG MODE (OFF); AUDIO (optional ON/OFF); MASTER (OFF); BUFFER (ON); COPY (OFF).
2. Depress RESET. All displays blank.
3. Depress EDIT. "E00" displays to indicate Edit Mode 00.
4. Depress ENTER. "E 00" displayed to indicate Edit Set Word Size.
5. Use keyboard to key in desired word size.
6. Depress ENTER. Word size accepted, tone sounds if AUDIO (ON), "F" indicates finished.

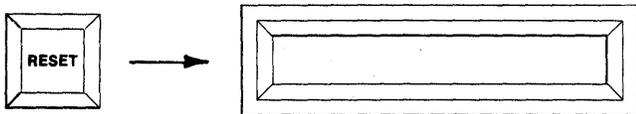
Additional Buffer Operations

Buffer Edit — Invert (Complement)
 (example shown is for a 2K block of data in an 8Kx8 RAM Buffer)

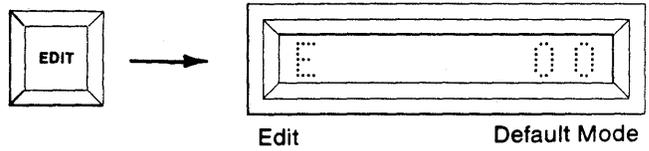
1. Select the switches as shown. The AUDIO switch is optional.



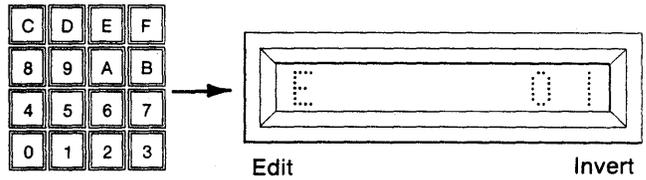
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. Now continue to step 3.



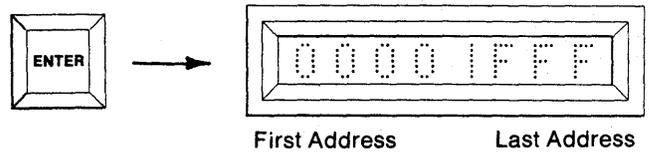
3. Depress EDIT. "E 00" is displayed to indicate Edit mode 00.



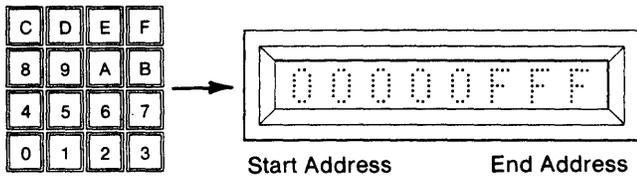
4. Using the hex keyboard, key in "01" to select Invert mode.



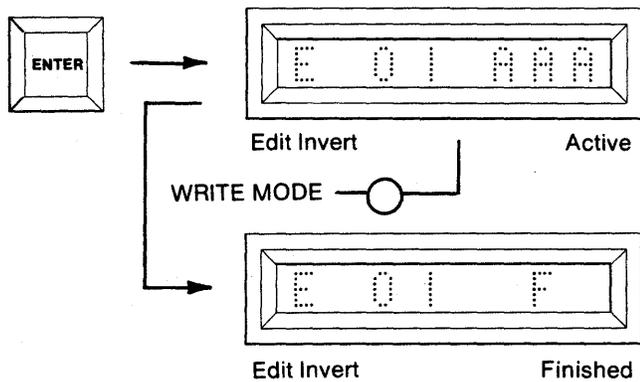
5. Depress ENTER. Invert Mode is accepted and the First and Last Addresses of the Buffer are displayed.



- To perform the Invert operation over the entire contents of the Buffer, starting with the First Address, go to step 7. To Invert a limited field, use the hex keyboard to key in a new Start and End Address field, MSD first.



- Depress ENTER. The displayed address is accepted as the Start and End Addresses for the operation. "E 01 AAA" is displayed to indicate Edit Invert Active. The Write Mode LED is lit. Upon completion of Mode of operation, "E01 F" is displayed to indicate Finished. A steady tone sounds if the AUDIO switch is ON. The Write Mode LED is extinguished.



Summary of Buffer Edit-Invert (Complement)

- Set select switches: MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
- Depress RESET. All displays are blank.
- Depress EDIT. Display indicates "E 00".
- Key in 01 using the hex keyboard
- Depress ENTER. First and Last RAM Buffer Addresses are displayed.
- Optional. Redefine the Start and End Addresses via the hex keyboard
- Depress ENTER. Data in the RAM Buffer is inverted over the defined Start and Ending addresses.

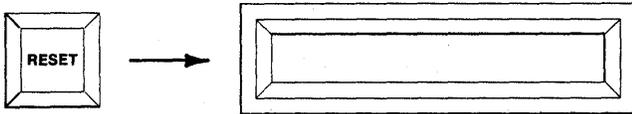
Additional Buffer Operations

Buffer Edit—Fill Buffer (example shown is for a 2K block of data in an 8Kx8 RAM Buffer)

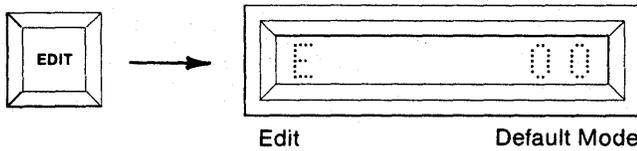
1. Select the switches as shown. The AUDIO switch is optional.



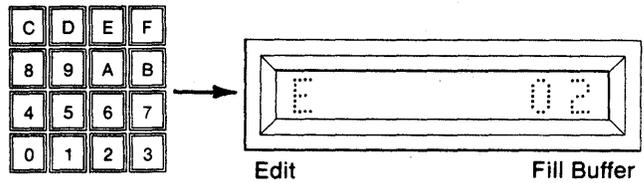
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. Now continue to step 3.



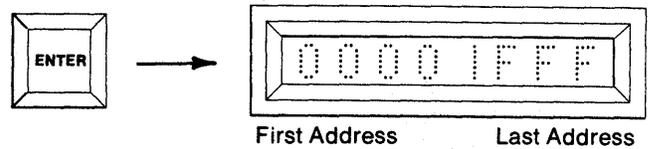
3. Depress EDIT. "E 00" is displayed to indicate Edit Mode 00.



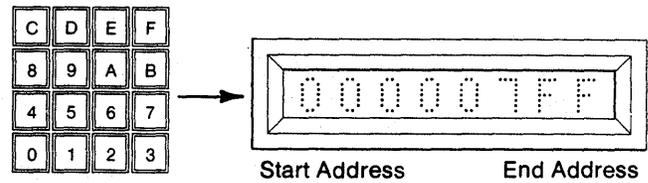
4. Using the hex keyboard, key in "02" to select Fill Buffer Mode.



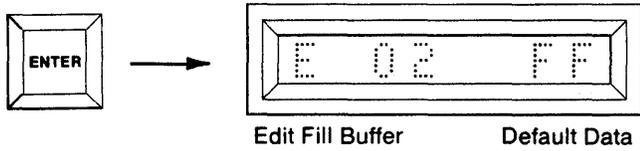
5. Depress ENTER. The Fill Buffer Mode is accepted and the First and Last Addresses of the Buffer are displayed.



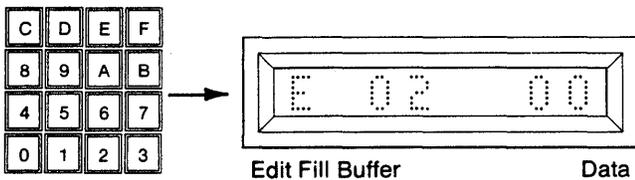
6. To perform the Fill Buffer operation over the entire contents of the Buffer, go to step 7. To operate over a limited field, use the hex keyboard to key in a new Start and End Address field, MSD first.



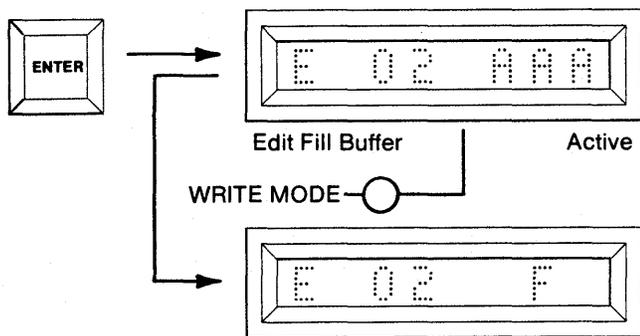
7. Depress ENTER. The display shows "E 02 FF" to indicate the Edit Fill Buffer Mode and the data to be loaded into the Buffer as default data.



8. Use the hex keyboard to key in new data or default to FF.



9. Depress ENTER. (Write Mode LED is lit.) The data is accepted and replaced with "AAA" to indicate Edit Fill Buffer Active. The Write Mode LED is lit. Upon completion of the operation, the "AAA" is replaced with "F" to indicate Finished. A steady tone sounds if the AUDIO switch is ON. The Write Mode LED is extinguished.



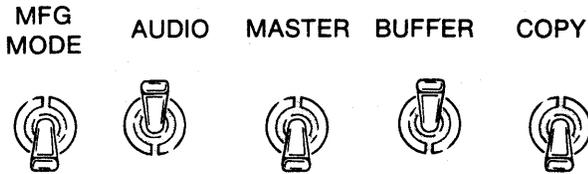
Summary of Buffer Edit-Fill Buffer

1. Set select switches: MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 02 using the hex keyboard.
5. Depress ENTER. First and Last RAM Buffer Addresses are displayed.
6. Optional. Redefine the Start and End Addresses via the hex keyboard.
7. Depress ENTER. "E 02 FF" is displayed.
8. Optional. Redefine the data to be loaded into all RAM Buffer locations. Default data is FF.
9. Depress ENTER. The RAM Buffer is filled with the same data over the defined Start and Ending Addresses.

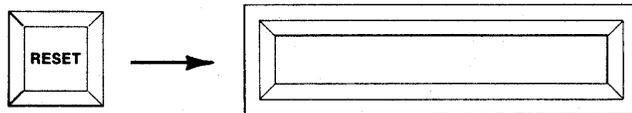
Buffer Edit — Insert (example shown is for an 8Kx8 RAM Buffer)

In the Insert Mode of operation up to 32 eight bit data bytes may be inserted. The operation can be defined to operate over any defined Buffer address field. The Start Address should always be the first location at which an insertion is made. If a Buffer address field is not given the entire Buffer is operated on. The same number of locations inserted will be lost from the end of the defined Buffer address. All insertions must be sequential, starting with the First Address of the defined Buffer address (see Figure 7-3). The example shown is over the defined Buffer address field of 1000 to 10FF. Figure 7-3 shows the insertion of three data bytes at locations 1000, 1001, and 1002. In this case locations 10FD, 10FE, and 10FF are lost from the end of the Buffer address field.

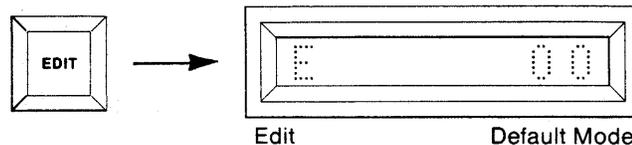
1. Select the switches as shown. The AUDIO switch is optional.



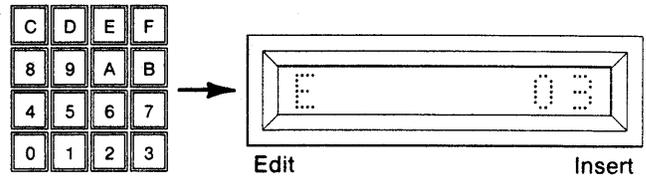
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. Now continue to step 3.



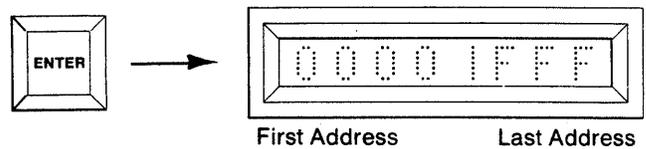
3. Depress EDIT. "E 00" is displayed to indicate Edit Mode 00.



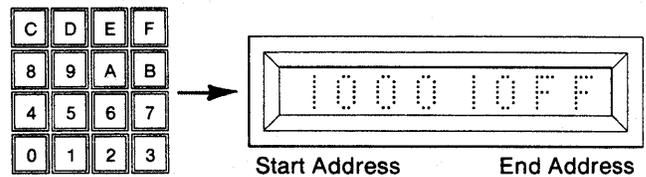
4. Using the hex keyboard, key in "03" to select the Insert Mode.



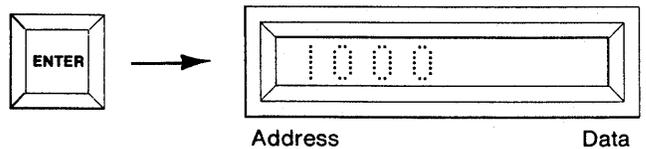
5. Depress ENTER. Insert is accepted and the First and Last Addresses of the Buffer are displayed.



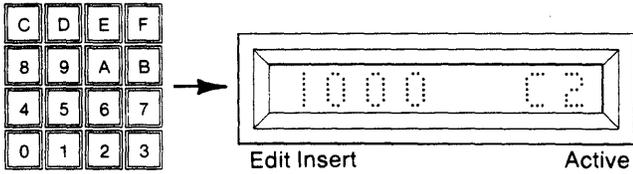
6. Use the hex keyboard to key in a new Start and End Address field, MSD first. It is not possible to insert over the full address range of the Buffer without creating wraparound. If this is tried, the M980 will display an "E3" during step 9.



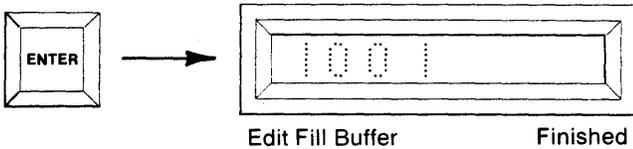
7. Depress ENTER. The Start and End Addresses are accepted. The display shows the block Start Address.



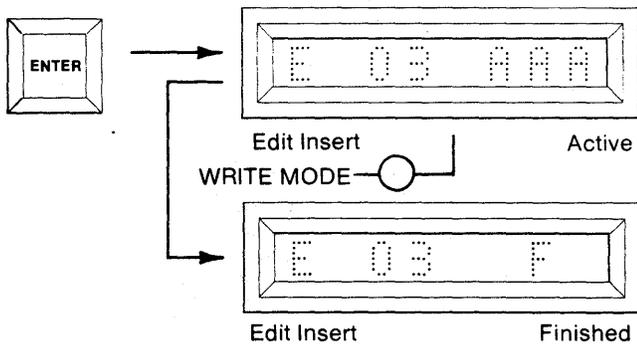
8. Use the keyboard to key in the new data to be inserted.



9. Depress ENTER. The address and data are accepted. The next sequential address is displayed. If more insertions are desired, repeat steps 8 and 9 for up to 32 insertions OR



10. Depress ENTER. The display shows "E 03 AAA" to indicate Edit Insert Active. The write Mode LED is lit. Upon completion of the operation the "AAA" is replaced with "F" to indicate Finished. A steady tone sounds if the AUDIO switch is ON. The Write Mode LED is extinguished.



NOTE

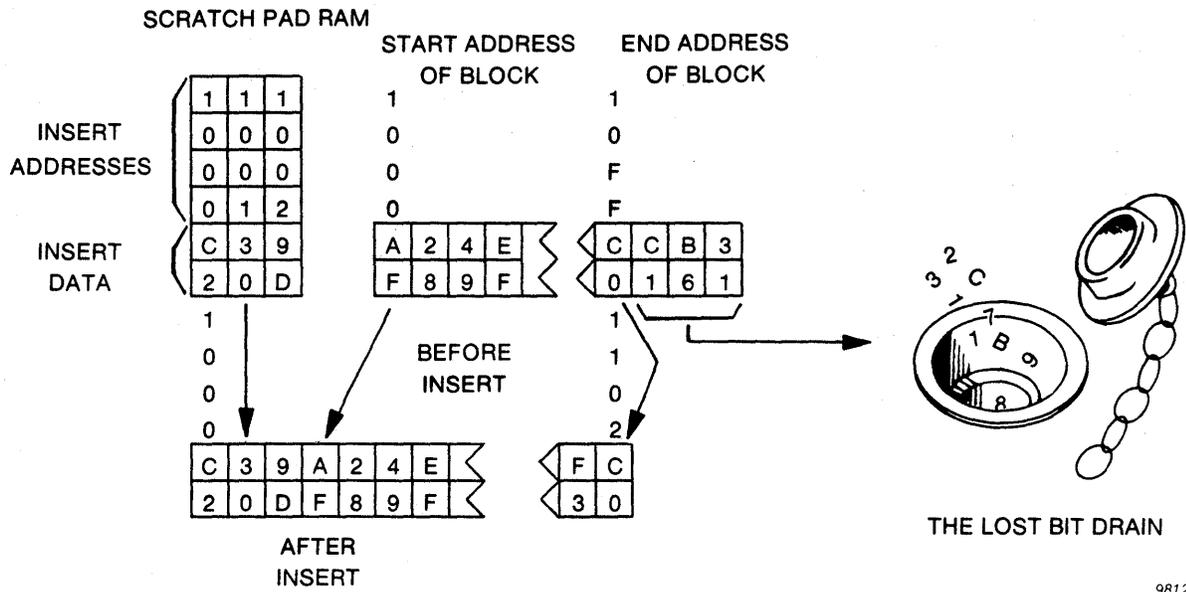
Depending on size of block to be inserted, the operation may require as much as 60 seconds to perform.

CAUTION

When inserting data into RAM, the same number of data bytes inserted will be lost from the end of the address locations immediately following the defined block. Define your block end address accordingly.

Summary of Buffer Edit-Insert

1. Set select switches: MFG MODE (OFF), AUDIO (optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 03 using the HEX keyboard.
5. Depress ENTER. First and Last RAM Buffer Addresses are displayed.
6. Key in a new Start and End address field. The Start address is the first address at which data is to be inserted.
7. Depress ENTER. The Start address is displayed.
8. Enter data to be inserted at this address via the HEX keyboard.
9. Depress ENTER. The next sequential address is displayed.
10. Optional. Repeat steps 8 and 9 for up to 32 insertions or
11. Depress ENTER. The data previously keyed in will be inserted at the address indicated.



9812M980-4

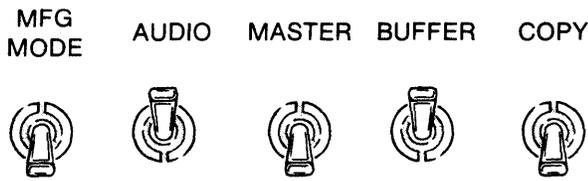
Figure 7-3. Illustration of Edit Insert

(Operations Continued Next Page)

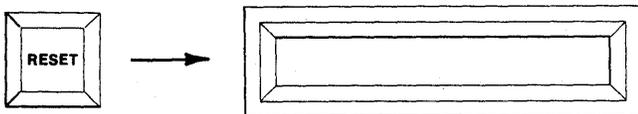
Buffer Edit — Delete (example shown is for an 8kx8 RAM Buffer)

When deleting information, the data locations vacated when all data is moved up are filled with a user-defined value. The example shown is for deleting locations 1000 through 100F and operating over a block of 256 locations (1000-10FF). The data used to fill in the vacated locations is 00 (See Figure 7-4).

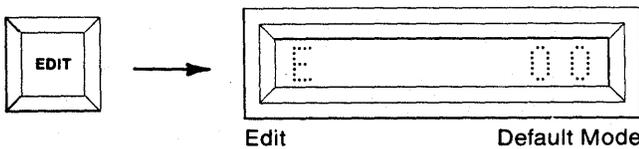
1. Select the switches as shown. The AUDIO switch is optional.



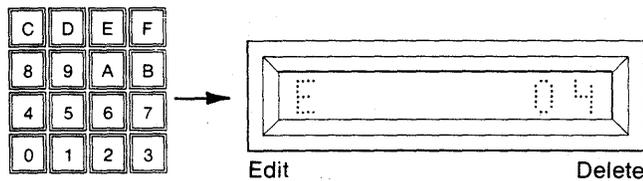
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. Now continue to step 3.



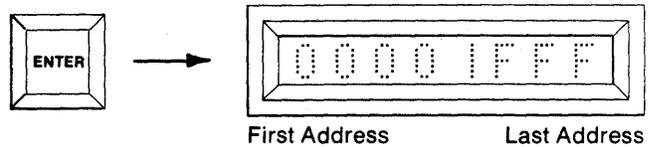
3. Depress EDIT. "E 00" is displayed to indicate Edit Mode 00.



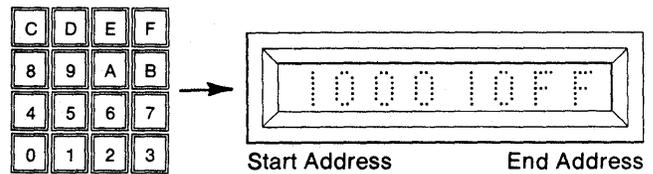
4. Using the hex keyboard, key in "04" to select the Delete operation.



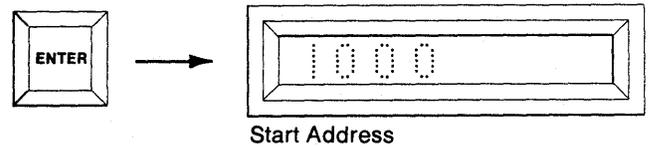
5. Depress ENTER. The Delete Mode is accepted and the First and Last Addresses of the Buffer are displayed.



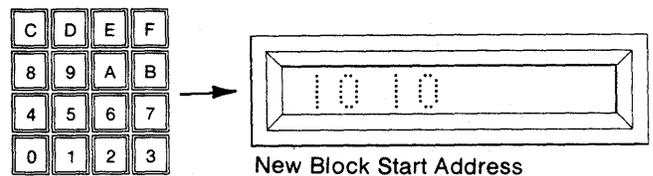
6. Using the hex keyboard, key in the Start and End Address limits of the data block to be affected or default to the entire Buffer. The Start Address should be the First Address at which data is to be deleted.



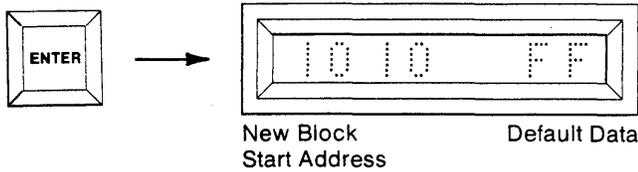
7. Depress ENTER. The Start and End Addresses of the block are accepted and the Start Address of the block is displayed.



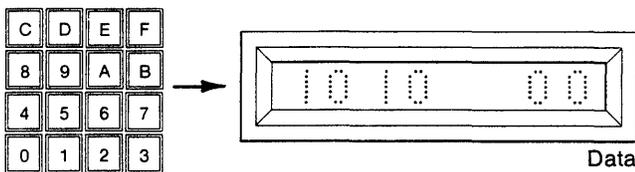
8. Use the keyboard to key in the desired Start Address of the block to be moved up. See Figure 7-3 for additional explanation.



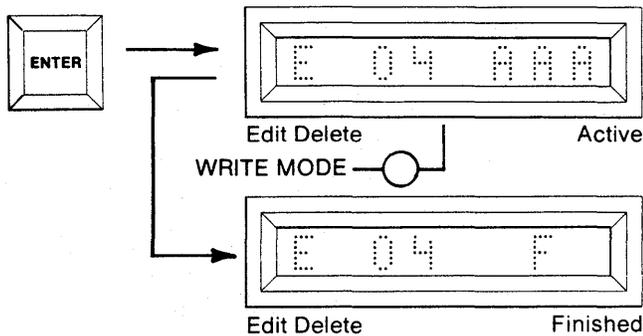
9. Depress ENTER. The default data to fill the vacated location(s) is displayed.



10. If desired, use the keyboard to key in other data to be used to fill vacated locations.



11. Depress ENTER. The previous data is accepted and the display shows "E 04 AAA" to indicate Edit Delete Active. The Write Mode LED is lit. The M980 deletes all of the data between the block Start Address and the address keyed in step 8. It then fills all of the vacated locations with the data in the display prior to step 11. Upon completion of the operation, the "AAA" in the display is replaced with "F" to indicate Finished. A steady tone sounds if the AUDIO switch is ON. The Write Mode LED is extinguished.



NOTE

Depending upon the size of the block to be deleted, this operation may take up to 60 seconds to perform.

Summary of Buffer Edit—Delete

1. Set select switches: MFG (OFF), AUDIO (Optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 04 using the hex keyboard.
5. Depress ENTER. First and last RAM Buffer addresses are displayed.
6. Key in the start and end address of the data block to remain unaffected.
7. Depress ENTER. Key in the new start address for this block.
8. Depress ENTER. Key in the new data to replace the vacated address or default to FFH.
9. Depress ENTER. The data in the block defined in step #6 is moved to start at the address defined in step #7. The locations vacated by this move are filled with the data defined by step #8.

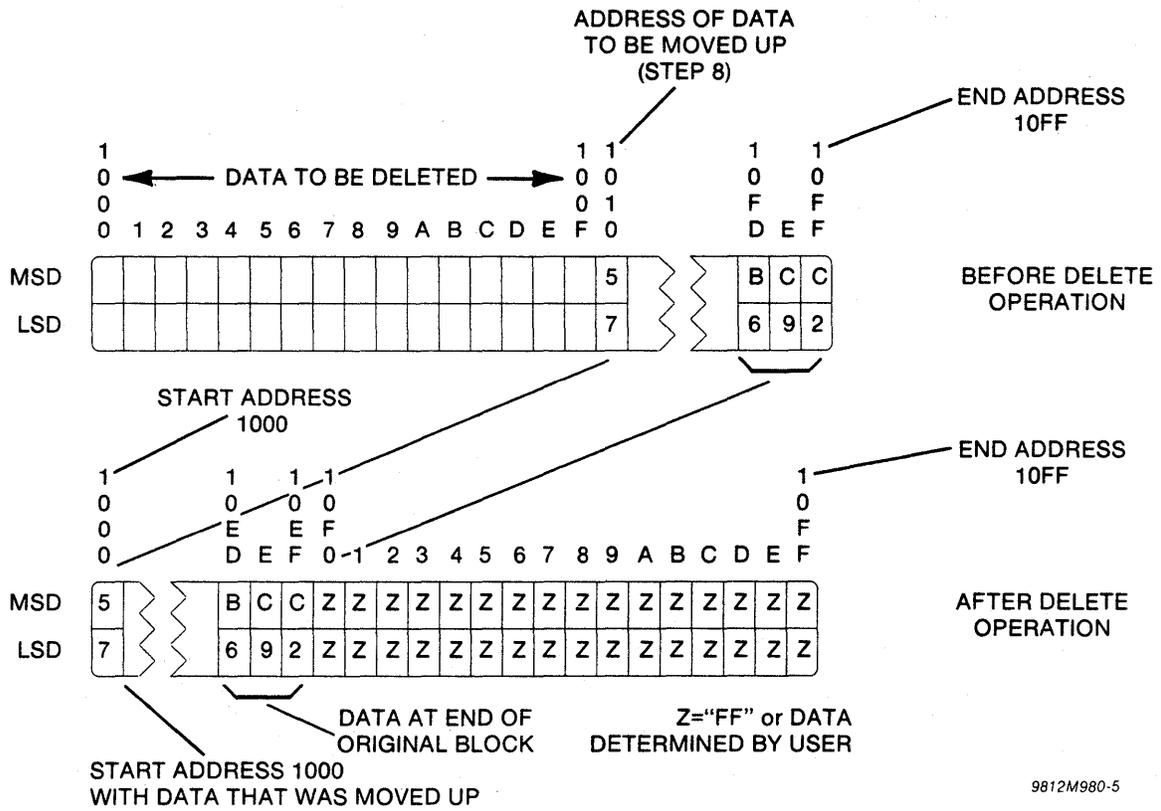


Figure 7-4. Illustration of Delete Operation

(Operations Continued Next Page)

Buffer Edit — Block Move (example shown is for an 8Kx8 RAM Buffer)

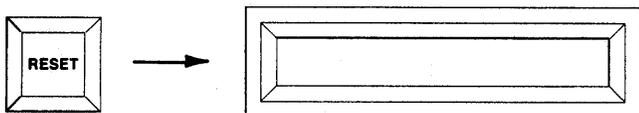
When Block Moving data, the original data is left intact unless overlapping occurs. The example shown in Figure 7-5 is for moving address locations 1000 through 12FF to addresses 1800 through 1AFF.

1. Select the switches as shown. The AUDIO switch is optional.

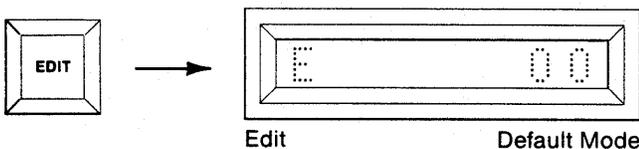
MFG MODE AUDIO MASTER BUFFER COPY



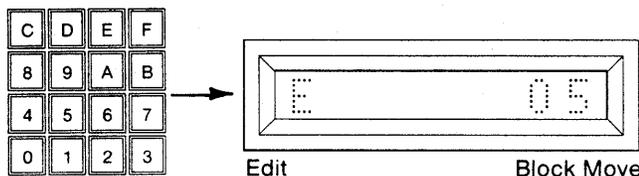
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. Now continue to step 3.



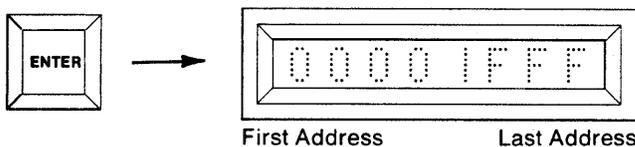
3. Depress EDIT. "E 00" is displayed to indicate Edit Mode 00.



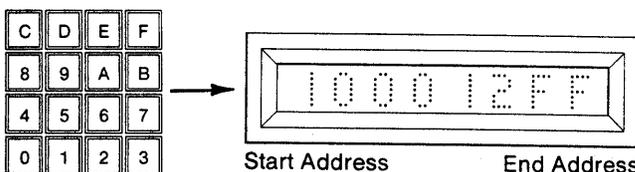
4. Using the hex keyboard, key in "05" to select Block Move Mode.



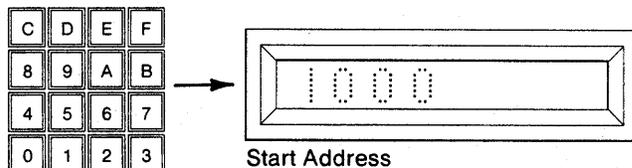
5. Depress ENTER. Block Move is accepted and the First and Last Addresses of the Buffer are displayed.



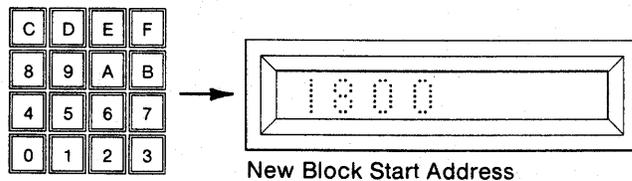
6. Use the hex keyboard to key in the Start and End Addresses of the block to be moved.



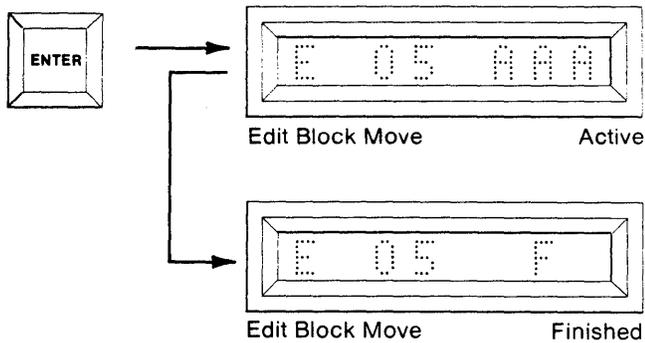
7. Depress ENTER. The Start and End Addresses are accepted and the Start Address of the block is displayed.



8. Use the hex keyboard to key in the address at which the new block starts.



9. Depress ENTER. The new block Start Address is accepted and "E 05 AAA" is displayed to indicate Edit Block Move Active. The Write Mode LED is lit. Upon completion of the operation, the "AAA" is replaced with "F" to indicate Finished. A steady tone sounds if the AUDIO switch is ON, and the Write Mode LED is extinguished.



NOTE

Depending upon the size of the block to be moved, this operation may take up to 60 seconds to program.

Summary of Buffer Edit—Block Move

1. Set select switches: MFG (OFF), AUDIO (Optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 05 using the hex keyboard.
5. Depress ENTER. First and last RAM Buffer addresses are displayed.
6. Key in the start and end address for the block of data to be moved.
7. Depress ENTER. Key in the new start address for this block.
8. Depress ENTER. The data block defined in step #6 is moved to start at the address defined in step #7.

Additional Buffer Operations

A) Block Move forward without overlapping. Both areas finish with block data.

B) Block Move forward with overlapping. New block overwrites original.

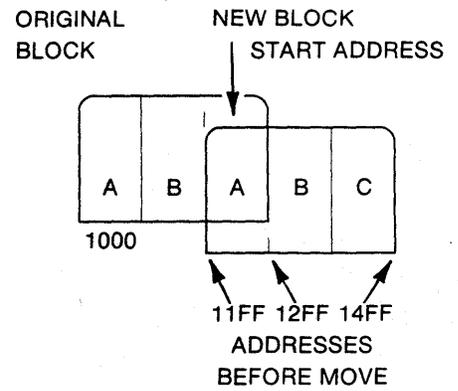
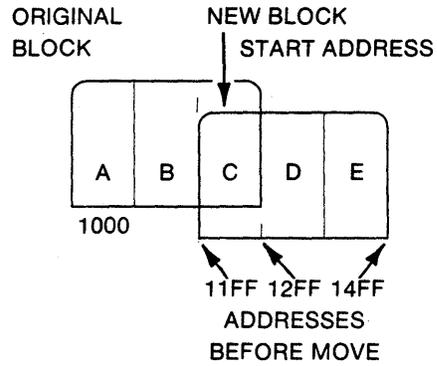
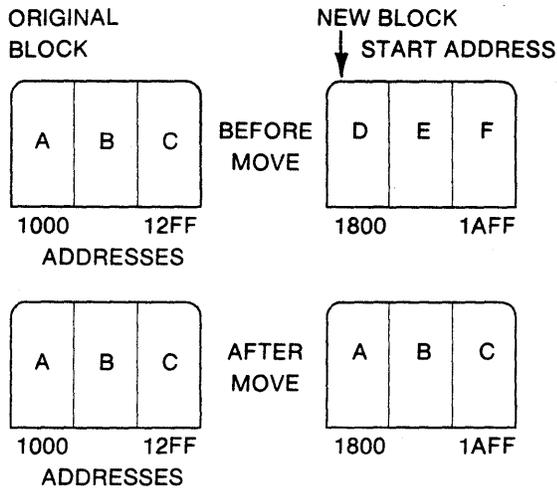
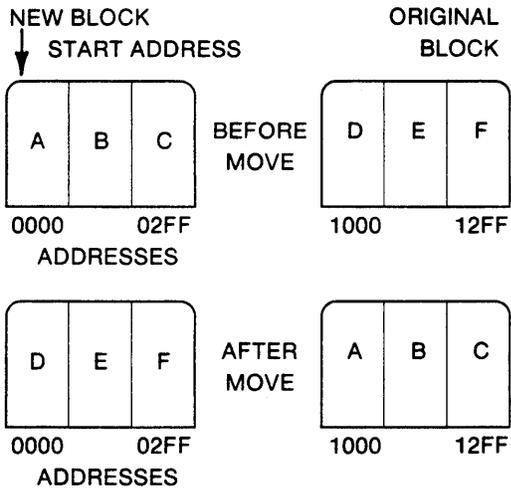


Figure 7-5. Illustrations of Buffer Block Move Operations
(In the examples, each internal lettered block is equal to 256 locations.)

C) Block Move backwards without overlapping. Both areas finish with block data.



D) Block Move backwards with overlapping. New block overwrites original.

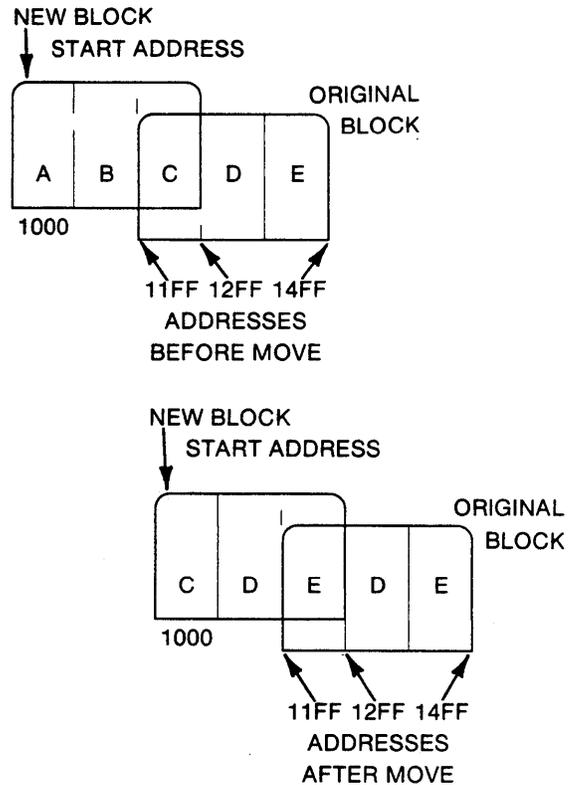
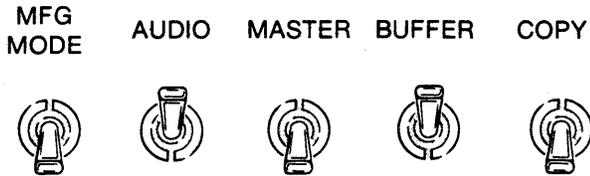


Figure 7-5 (continued). Illustrations of Buffer Block Move Operations
(In the examples, each internal lettered block is equal to 256 locations.)

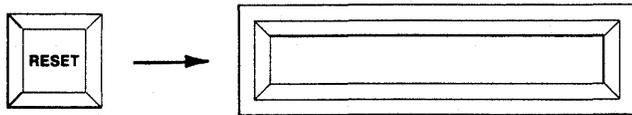
Buffer Edit — Nibble Swap (example shown is for an 8Kx8 RAM Buffer)

In the Nibble Swap operation, the MSD of each 8-bit Buffer location is swapped with the LSD of the same location (see Figure 7-6).

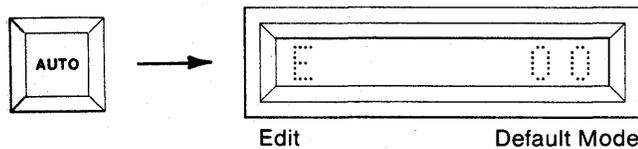
1. Select the switches as shown. The AUDIO switch is optional.



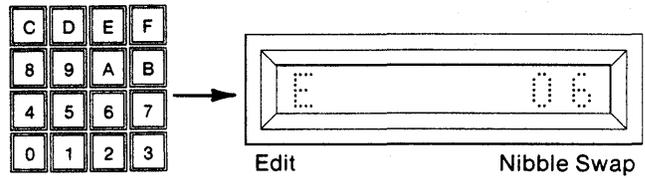
2. Depress RESET. The 8 hex displays are blank. A Personality Module is not necessary. "E4" is displayed if a Personality Module is not present. A warbling tone will sound if the AUDIO switch is ON. Now continue to step 3.



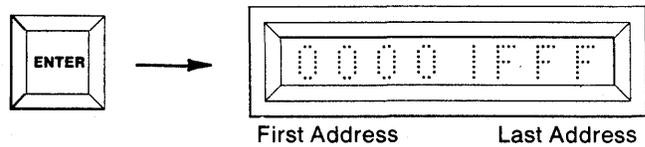
3. Depress EDIT. "E 00" is displayed to indicate Edit Mode 00.



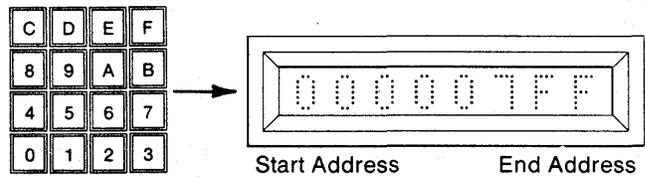
4. Using the hex keyboard, key in "06" to select Nibble Swap Mode.



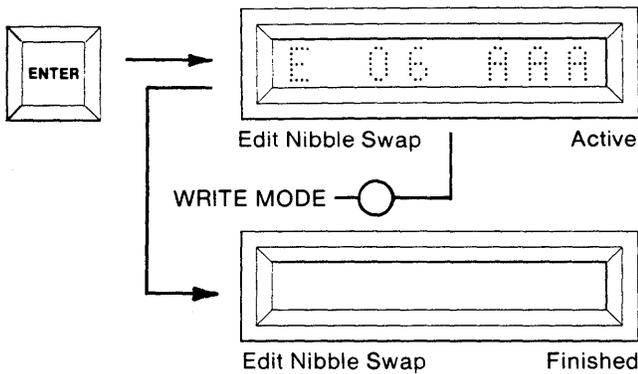
5. Depress ENTER. Nibble Swap is accepted and the First and Last Addresses of the Buffer are displayed.



6. To Nibble Swap the entire contents of the Buffer, go to step 7. To Nibble Swap a limited field, use the hex keyboard to key in new Start and End Addresses.



7. Depress ENTER. The Start and End Addresses are accepted and "E 06 AAA" is displayed to indicate Edit Nibble Swap Active. The Write Mode LED is lit. Upon completion of the operation, the "AAA" is replaced with "F" to indicate Finished. A steady tone sounds if the AUDIO switch is ON. The Write Mode LED is extinguished.



Summary of Buffer Edit—Nibble Swap

1. Set select switches: MFG (OFF), AUDIO (Optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 06 using the hex keyboard.
5. Depress ENTER. The default start and end addresses for the RAM Buffer installed are displayed.
6. Optional. Key in a new address field to be split.
7. Depress ENTER. The data in the addresses defined in steps #5 or #6 will be split. All even address bytes will be placed in the third quarter of the RAM Buffer and all odd address bytes will be placed in the fourth quarter.

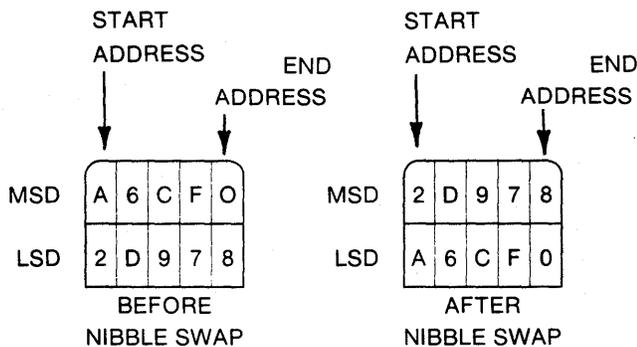


Figure 7-6. Illustration of Nibble Swap

Buffer Edit — Hex Pack

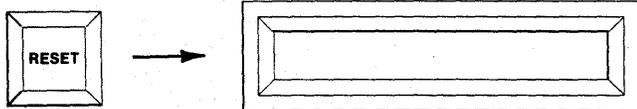
An 8 bit byte of data may be expressed as two hexadecimal digits. For example, 01100111 is expressed in hexadecimal notation as 67. If both hexadecimal digits have meaning, then the 8 bit data byte is referred to as being in a Packed form. When the least significant hexadecimal digit has meaning and the most significant digit is treated as "don't care", the 8 bit data byte is referred to as being in the Unpacked form.

In the Hex Pack mode of operation, the Buffer Start/End Addresses of the least significant digit field and the Start Address of the most significant digit field are selected. When the Hex Pack operation is complete, the Buffer address field defined for the least significant digit will contain the Hex Packed data. The most significant digit address field remains unaltered (see Figure 7-7).

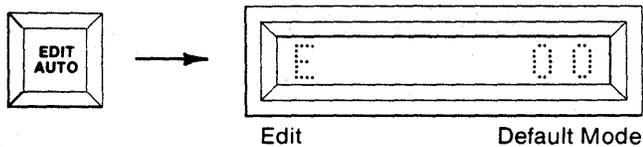
1. Select the switches as shown. The AUDIO switch is optional.



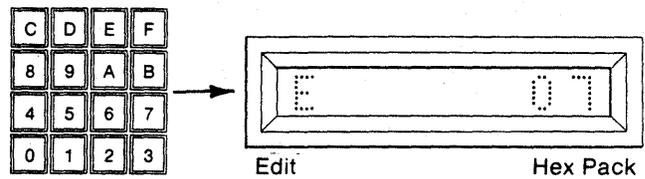
2. Depress RESET. The 8 hex displays are blank.



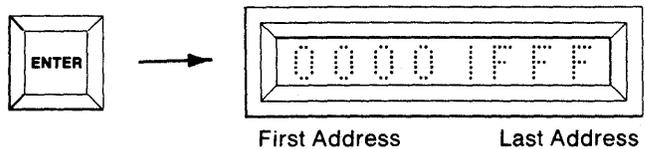
3. Depress EDIT. "E 00" is displayed to indicate Edit mode 00.



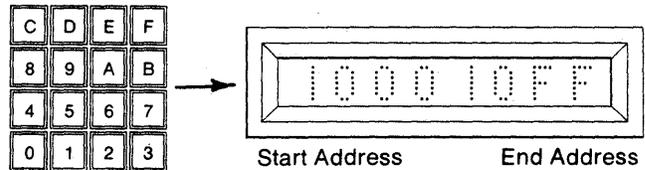
4. Using the hex keyboard, key in "07" to select the Hex Pack mode.



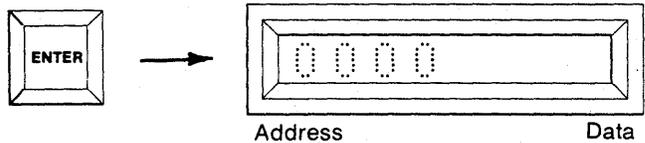
5. Depress ENTER. Hex Pack is accepted and the First and Last Addresses of the Buffer are displayed.



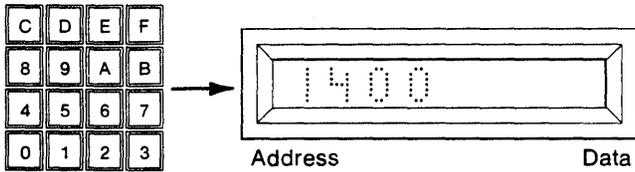
6. Use the hex keyboard to key a Start and End Address for the least significant digit of the Packed field. Use the CLEAR key to clear miskeyed characters. See Section 4 for further information.



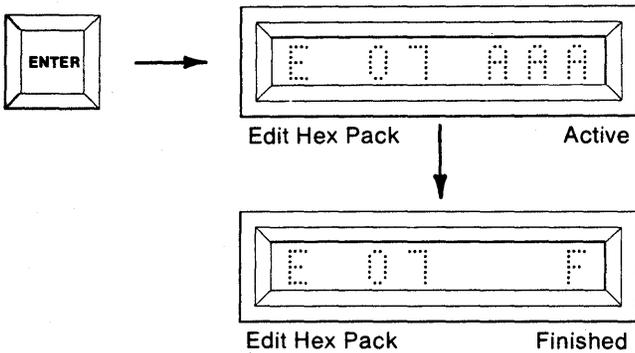
7. Depress ENTER. The Start and End Addresses are accepted. The display shows the Start Address for the second field containing the most significant digit which is to be Packed.



8. Use the hex keyboard to key the second field Start Address. Use the CLEAR key to clear miskeyed characters.

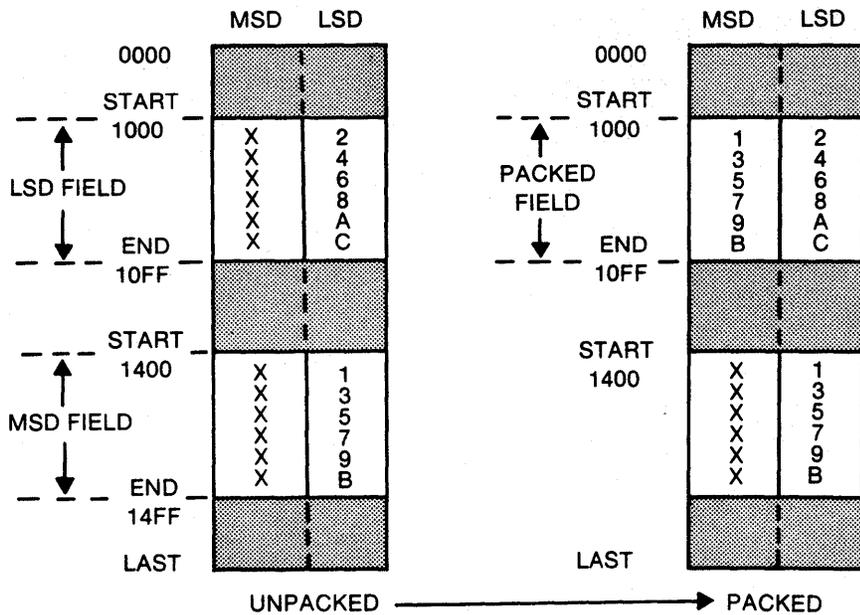


9. Depress ENTER. The Write mode LED is ON. The display shows "E 07 AAA" to indicate Edit Hex Pack Active. Upon completion of the operation, the "AAA" is replaced with an "F" to indicate Finished. A steady tone sounds if the AUDIO switch is ON. The Write mode LED is switched OFF.



Summary of Buffer Edit—Hex Pack

1. Set select switches: MFG (OFF), AUDIO (Optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 07 using the hex keyboard.
5. Depress ENTER. First and last RAM Buffer addresses are displayed.
6. Key in the start and ending address of the RAM Buffer data block containing the LSD.
7. Depress ENTER. Key in the starting address of the RAM Buffer data block containing the MSD.
8. Depress ENTER. The MSD in the second block is programmed into the MSD in the first block.



9812M980-6

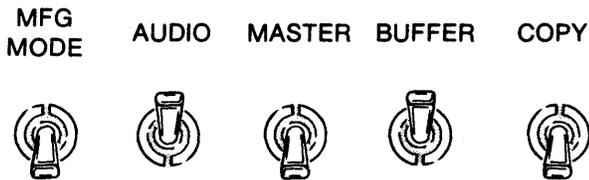
Figure 7-7. Illustration of Hex Pack

Additional Buffer Operations

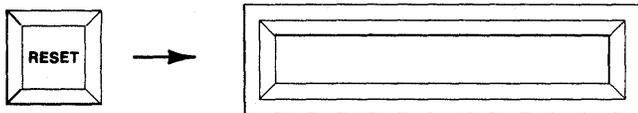
Buffer Edit — Hex Unpack

In the Hex Unpack mode of operation, the Buffer address field is defined for the data block to be unpacked. A Start Address is then defined for the beginning of the Buffer address field where the most significant digit in unpacked form is stored. The least significant digit is stored in the unpacked form in the same address field as that of the data block that is unpacked (see Figure 7-8).

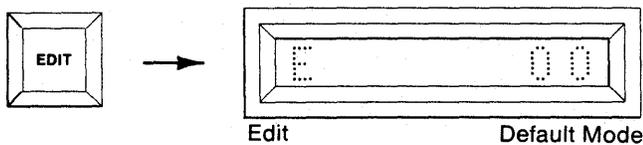
1. Select the switches as shown. The AUDIO switch is optional.



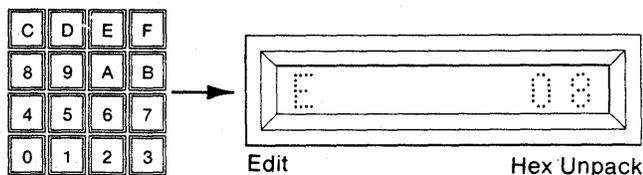
2. Depress RESET. The 8 hex displays are blank.



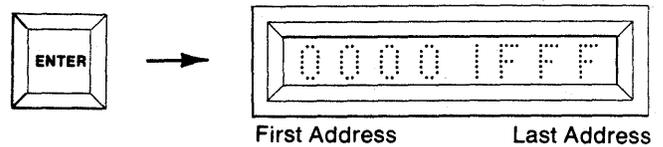
3. Depress EDIT. "E 00" is displayed to indicate Edit mode 00.



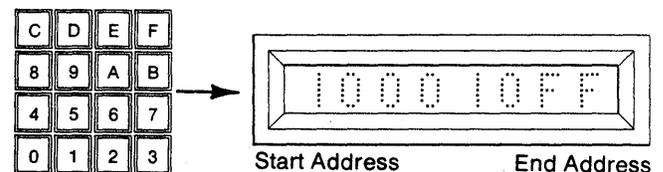
4. Using the hex keyboard, key in "08" to select the Hex Unpack mode.



5. Depress ENTER. Hex Unpack is accepted and the First and Last Addresses of the Buffer are displayed.



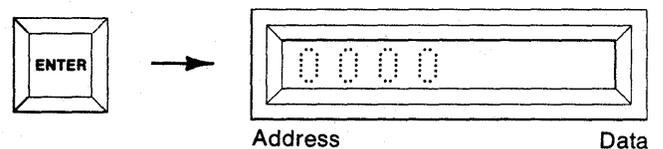
6. Use the hex keyboard to begin a Start and End Address field for the block of data to be Unpacked. Use the CLEAR key to clear miskeyed characters. See Section 4 for further information.



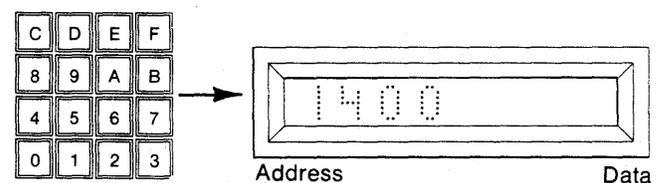
NOTE

Keyed-in field must reside within first half of the total RAM Buffer.

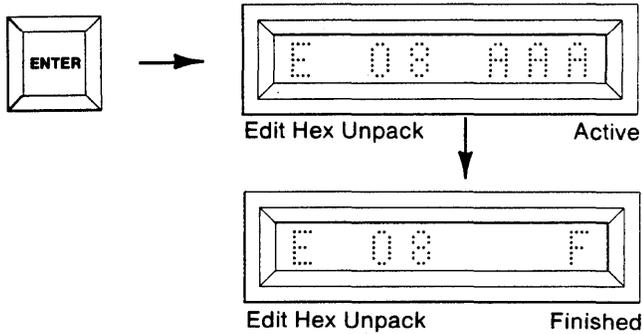
7. Depress ENTER. The Start and End Addresses are accepted. The display shows the Start Address for the second field where the most significant digit in Unpacked form is stored.



8. Use the hex keyboard to key the second field Start Address. Use the CLEAR key to clear miskeyed characters.



9. Depress ENTER. The Write mode LED is ON. The display shows "E 08 AAA" to indicate Edit Hex Pack Active. Upon completion of the operation, the "AAA" is replaced with an "F" to indicate finished. A steady tone sounds if the AUDIO switch is ON. The Write mode LED is switched OFF.



Summary of Buffer Edit—Hex Unpack

1. Set select switches: MFG (OFF), AUDIO (Optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 08 using the hex keyboard.
5. Depress ENTER. First and last RAM Buffer addresses are displayed.
6. Key in the starting and ending addresses of the RAM Buffer data block to be unpacked.
7. Depress ENTER. Key in the starting address of RAM Buffer data block that will contain the MSD of the unpacked data.
8. Depress ENTER. The MSD contained in the RAM Buffer block defined in step #6 is loaded into the RAM Buffer starting at the address defined in step #7.

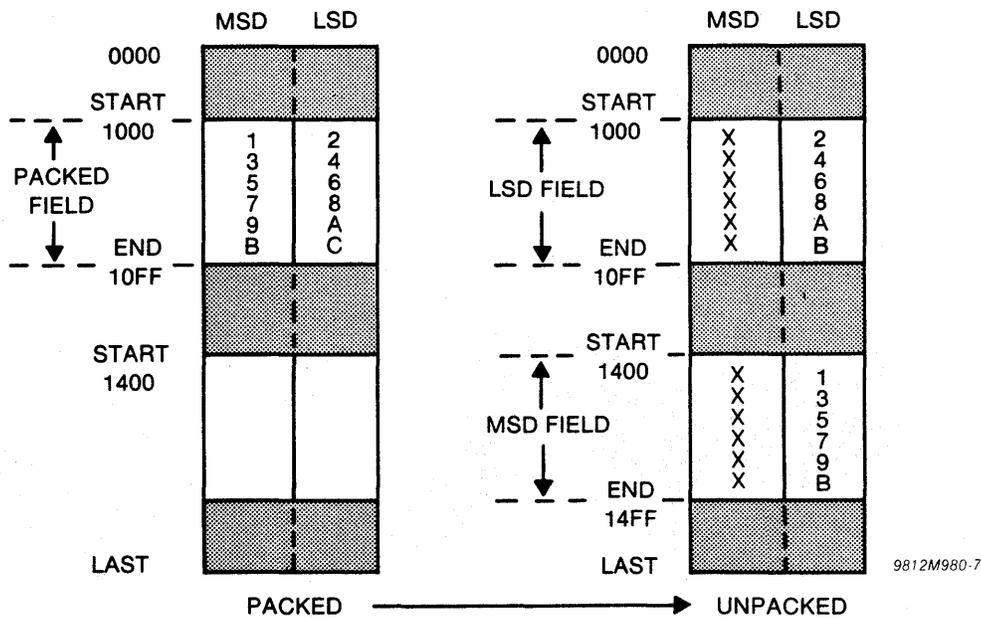
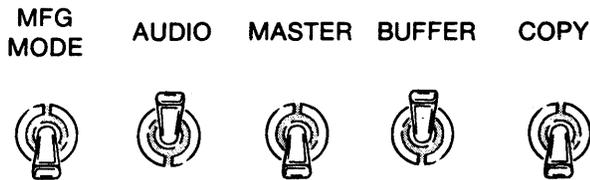


Figure 7-8. Illustration of Hex Unpack

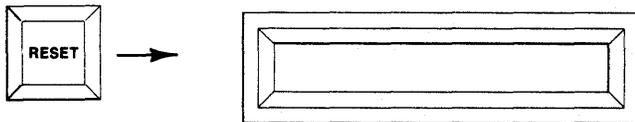
Buffer Edit — RAM Split

The RAM Split allows data stored anywhere in the first half of the RAM Buffer to be divided into two separate blocks. The two blocks always start at exactly half and three-quarters of the total RAM Buffer, respectively. The block starting at half of the total RAM contains the data originally resident at the start address and every other address in the block that is split. The block starting at three-quarters of the total RAM contains the start address plus 1, and every other address in the block that is split (see Figure 7-9).

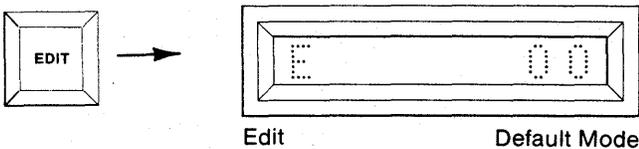
1. Select the switches as shown.



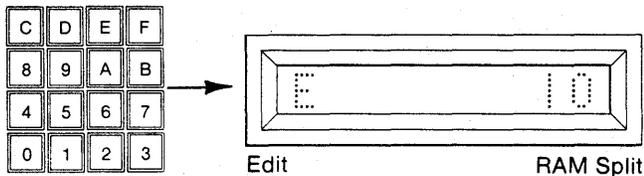
2. Depress RESET: The 8 hex displays are blank.



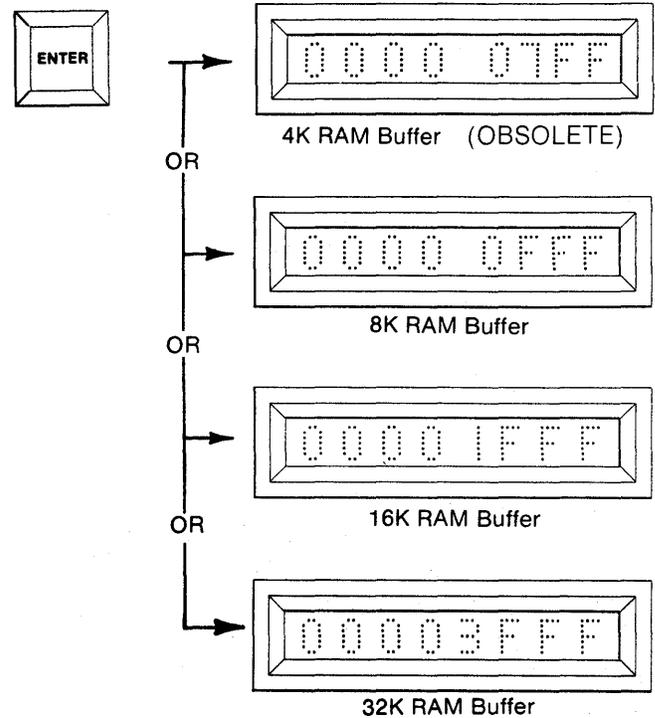
3. Depress EDIT: "E 00" is displayed to indicate Edit mode.



4. Using the hex keyboard, key in "10" to select the RAM Split mode.



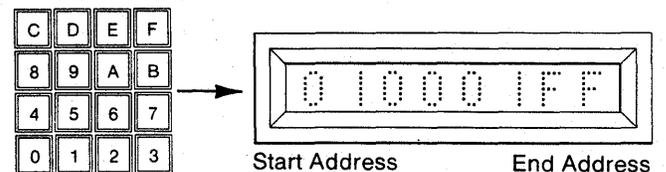
5. Depress ENTER. Display shows the Default start and end Addresses of the RAM data field to be split (Default size is one half of Buffer size).

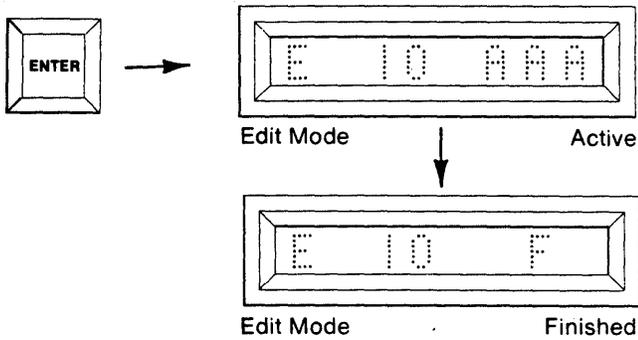


6. Accept Default field by pressing ENTER, or redefine using hex keyboard; then press ENTER to accept new field.

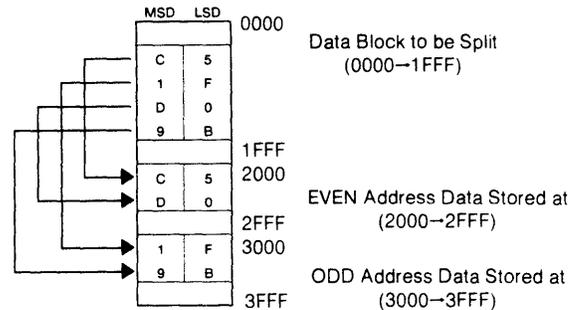
NOTE

Keyed-in field must reside within first half of the total RAM Buffer.





c. 16K BUFFER EXAMPLE: (DEFAULT SIZE)



9812M980 9

7. When RAM Split operation is complete, the display indicates "F" for finished.

d. 32K BUFFER EXAMPLE (DEFAULT SIZE)

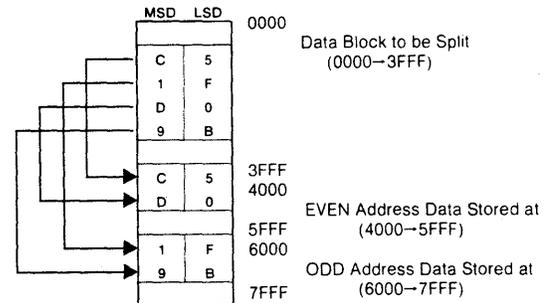
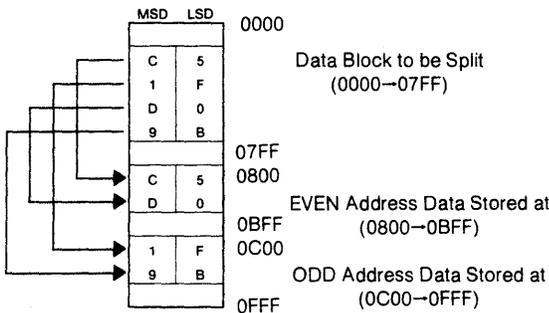


Figure 7-9 (continued).

a. 4K BUFFER EXAMPLE: (DEFAULT SIZE) (OBSOLETE)



b. 8K BUFFER EXAMPLE: (DEFAULT SIZE)

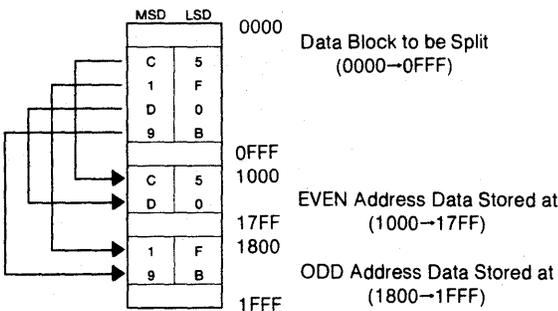


Figure 7-9. Illustration of RAM Split

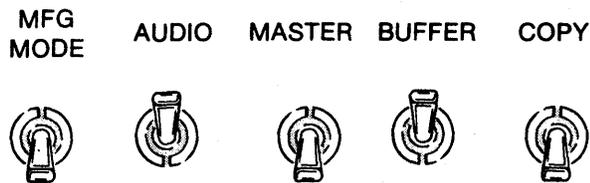
Summary of Buffer Edit—RAM Split

1. Set select switches: MFG (OFF), AUDIO (Optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 10 using the hex keyboard.
5. Depress ENTER. The default start and end addresses for the RAM Buffer installed are displayed.
6. Optional. Key in a new address field to be split.
7. Depress ENTER. The data in the addresses defined in steps #5 or #6 will be split. All even address bytes will be placed in the third quarter of the RAM Buffer and all odd address bytes will be placed in the fourth quarter.

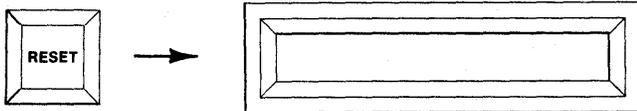
Buffer Edit — RAM Interleave

The RAM Interleave allows data stored in two separate blocks to be alternately stored in a defined area in the first half of the RAM Buffer. The two blocks always start at exactly half and three-quarters of the total RAM Buffer, respectively. The block starting at half of the total RAM contains the start address and every other address in the block to be interleaved. The block starting at three-quarters of the total RAM contains the start address plus 1, and every other address in the block to be interleaved (see Figure 7-10).

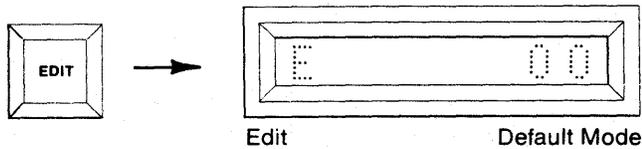
1. Select the switches as shown.



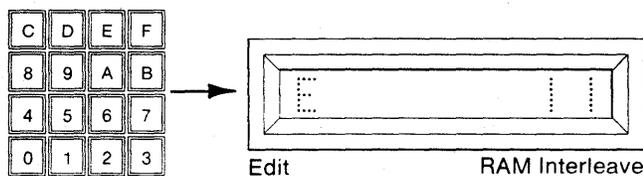
2. Depress RESET: The 8 hex displays are blank.



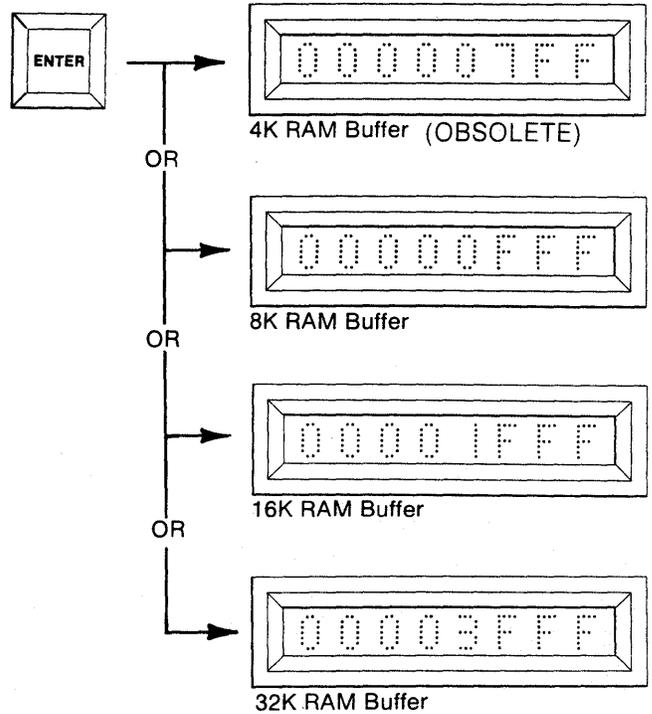
3. Depress EDIT: "E 00" is displayed to indicate Edit mode.



4. Using the hex keyboard, key in "11" to select the RAM Split mode.

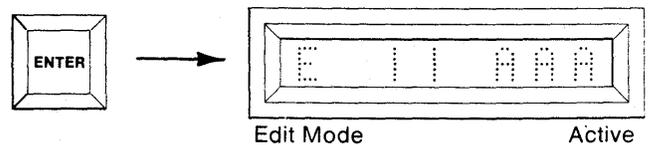
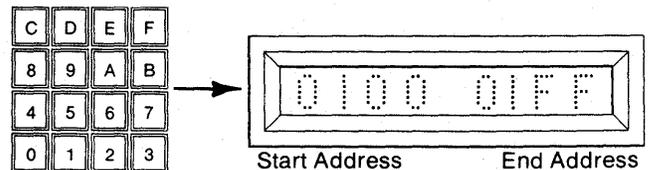


5. Depress ENTER. Display shows the Default start and end Addresses of the RAM Buffer where the data will be stored (Default size is one half of Buffer size).

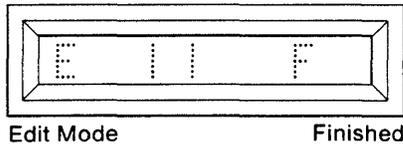


6. Accept Default field by pressing ENTER, or redefine using hex keyboard; then press ENTER to accept new field.

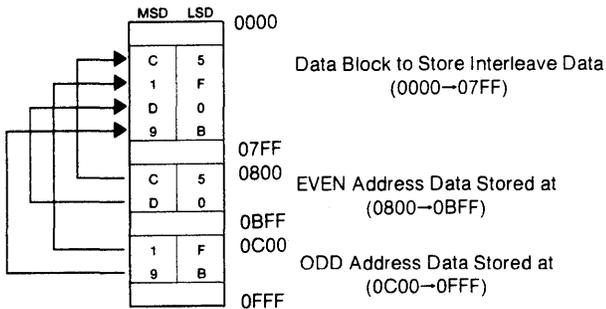
NOTE
Keyed-in field must reside within first half of the total RAM Buffer.



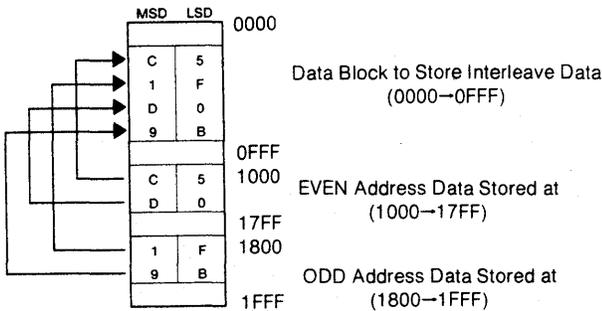
7. When RAM Split operation is complete, the display indicates "F" for finished.



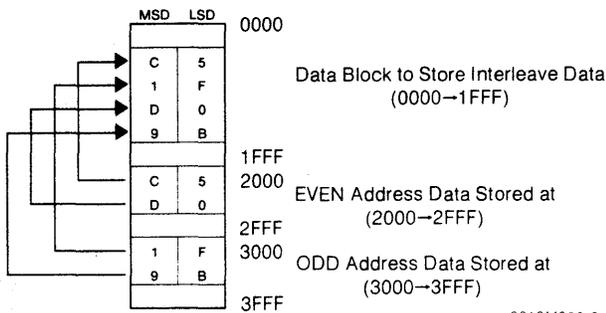
a. 4K BUFFER EXAMPLE: (DEFAULT SIZE) (OBSOLETE)



b. 8K BUFFER EXAMPLE: (DEFAULT SIZE)

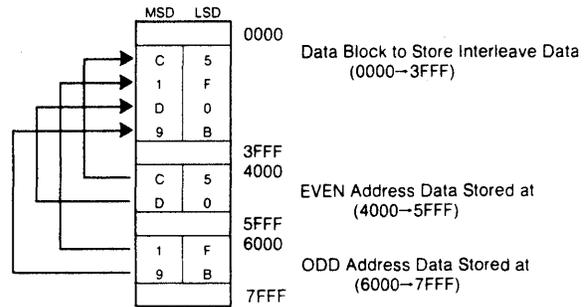


c. 16K BUFFER EXAMPLE: (DEFAULT SIZE)



9812M980-8

d. 32K BUFFER EXAMPLE (DEFAULT SIZE)



Summary of Buffer Edit—RAM Interleave

1. Set select switches: MFG (OFF), AUDIO (Optional ON/OFF), MASTER (OFF), BUFFER (ON), COPY (OFF).
2. Depress RESET. All displays are blank.
3. Depress EDIT. Display indicates "E 00".
4. Key in 11 using the hex keyboard.
5. Depress ENTER. The default start and end addresses for the RAM Buffer installed are displayed.
6. Optional. Key in a new address field to contain the interleaved data.
7. Depress ENTER. The data in the third quarter is loaded into the even addresses and data in the fourth quarter is loaded into the odd addresses of the RAM Buffer address field defined in steps #5 and #6.

Figure 7-10. Illustration of RAM Interleave

SECTION 8

BUFFER APPLICATIONS

DESCRIPTION

The CMOS Buffer included in the M980 PROM Programmer allows useful data retention characteristics—its battery back-up retains data for a minimum of seven days with power removed from the M980. Thus, Personality Modules may be exchanged without RAM Buffer data loss, permitting the exchange of data between different types of PROMs without resorting to paper tape or other alternative storage media. The M980 editing features (see Section 7) permit 8-bit data to be programmed into two 4-bit PROMs with ease. Further expansion of the concept, to 16-bit PROMs, is also provided.

The applications presented in this section are indicative of the utility of these features.

EXAMPLE 1

A 74S471 PROM (256x8) is to replace two 74S287 PROMs (256x4 each). Configure the control unit for a 74S287 and perform the following steps.

1. Insert the first 74S287 into the Master socket. This PROM's data will become the most significant nibbles in each location of the 74S471.
2. Duplicate the contents of the first 74S287 into the RAM Buffer (see Section 6 "Duplicating the RAM Buffer from a Master PROM").
3. Perform the Nibble Swap edit operation on the first 256 bytes of the RAM Buffer (0000 through 00FF). This will place the contents of the first PROM into the high order nibbles of each RAM location (see Section 7 "Buffer Edit—Nibble Swap").
4. Insert the second 74S287 into the Master socket. This PROM's data will become the least significant nibbles in each location of the 74S471.
5. Duplicate the contents of the second 74S287 into the RAM Buffer (see Section 6 "Duplicating the RAM Buffer from a Master PROM").
6. Turn the control unit's POWER OFF.
7. Reconfigure the control unit to program a 74S471.
8. Turn the control unit's POWER ON.
9. Insert the 74S471 into the Copy Socket.
10. Duplicate the contents of the RAM Buffer into the 74S471 (see Section 6 "Duplicating the Ram Buffer into a Copy PROM").

The 74S471 now contains the first 74S287 in its high order nibbles and the second 74S287 in its low order nibbles.

EXAMPLE 2

A 2732A PROM (4Kx8) is to replace four 2708's (1Kx8 each). Configure the control unit for a 2708 EPROM and perform the following steps.

1. Insert the first 2708 into the Master socket. This PROM's data will reside in the first 1K bytes of the 2732.
2. Duplicate the contents of the first 2708 into the RAM Buffer starting with address 0000H (see Section 6 "Duplicating the RAM Buffer from a Master PROM").
3. Replace the first 2708 with the second 2708.
4. Duplicate the contents of the second 2708 into the RAM Buffer starting with address 0400H.
5. Replace the second 2708 with the third 2708.
6. Duplicate the contents of the third 2708 into the RAM Buffer starting with address 0800H.
7. Replace the third 2708 with the fourth 2708.
8. Duplicate the contents of the fourth 2708 into the RAM Buffer starting with address 0C00H.
9. Turn the control unit's POWER OFF.
10. Reconfigure the control unit to program a 2732.
11. Turn the control unit's POWER ON.
12. Insert an unprogrammed 2732 into the Copy Socket.
13. Duplicate the contents of the RAM Buffer into the 2732. (see Section 6 "Duplicating the RAM Buffer into a Copy PROM").

SECTION 9

Manufacturing Mode

DESCRIPTION

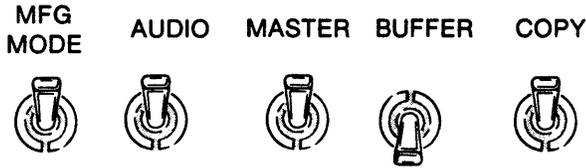
The Manufacturing Mode is a mode which operates with minimum operator interaction. To achieve this operating simplicity, the mode is restricted to:

1. Master-to-Copy operations only
2. Full PROM field only

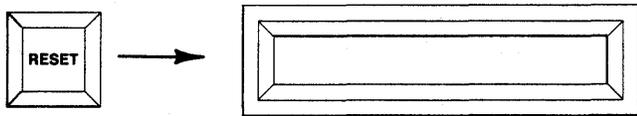
In the Manufacturing Mode, the M980 can operate in one of four sub-modes: Blank Check, Duplicate, Compare, or Automatic (a mode which sequences automatically through the other operations). The AUDIO tone, selected by a toggle switch, is optional.

**Manufacturing Mode —
Automatic Sequencing Operation**

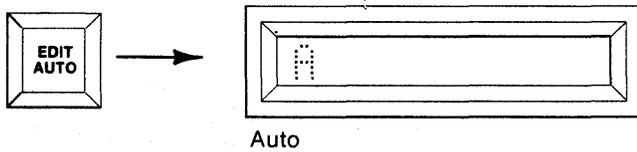
1. Insert the appropriate Personality Module and select switches as shown. Insert the PROM to be used as the Master PROM into the MASTER socket and the PROM to be copied in the COPY socket.



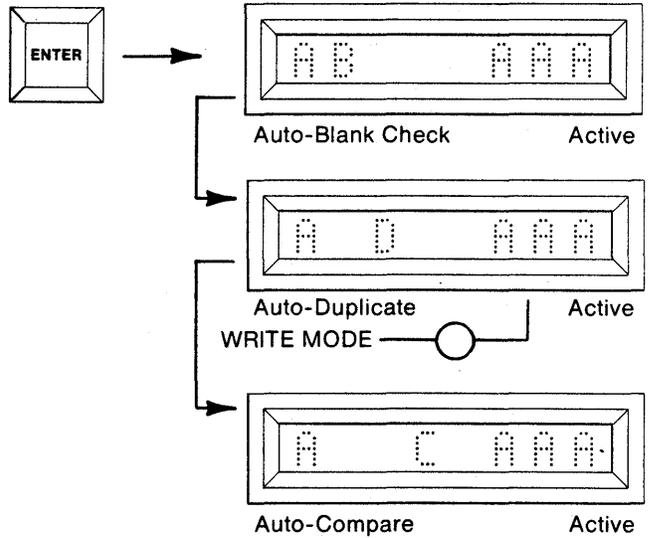
2. Depress RESET. The 8 hex displays are blank.



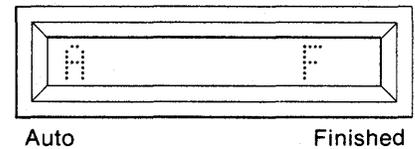
3. Depress AUTO. An "A" appears in the display.



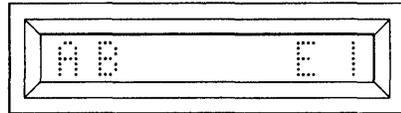
4. Depress ENTER. This initiates an automatic sequence progressing from: Blank Check to Duplicate (Write Mode LED lit) to Compare.



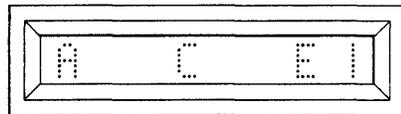
5. Upon the successful conclusion of the operation an "F" is displayed replacing the "AAA". A steady tone sounds if the AUDIO switch is ON.



6. If an error is detected, the M980 halts and displays the operation code "B" (Blank Check) or "C" (Compare) and "E1" to denote Error. A warbling tone sounds if the AUDIO toggle switch is in the ON position.



Auto-Blank Check



Auto-Compare

Error

NOTE

All modules that program the 2708 and TMS2716 (PM9005A, PM9053A, PM9051A, and PM9060A) respond differently. Refer to Section 11, Failure to Program Operations. Also, Gang Modules for PROMs other than the 2708 or TMS2716 continue through to the end of the operation before halting.

7. To repeat the entire sequence with new Copy PROM, return to step 4.

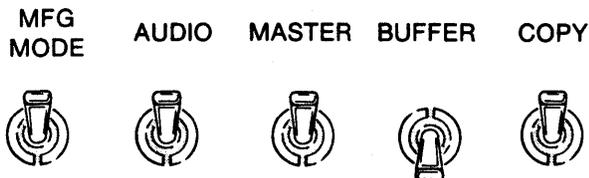
Summary of Automatic Sequencing Operation

1. Insert Personality Module, PROM to be programmed, PROM to be copied, and select switches as follows; MFG MODE (ON), AUDIO (optional), MASTER (ON), BUFFER (OFF), COPY (ON).
2. Depress RESET. Display is blank.
3. Depress AUTO. "A" is displayed.
4. Depress ENTER. Automatic sequencing commences. The display shows "AB AAA", "AD AAA", "AC AAA".
5. When complete, "A F" is displayed.
6. If an error is detected "B" or "C" and "E1" are displayed.
7. Optional. Load new Copy PROM. Depress ENTER to repeat Blank Check to Duplicate to Compare operation.

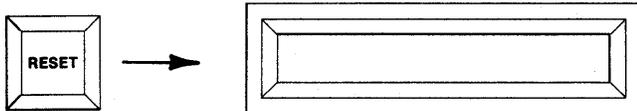
Manufacturing Mode

Manufacturing Mode — Single Operation (Blank Check, Duplicate, Compare)

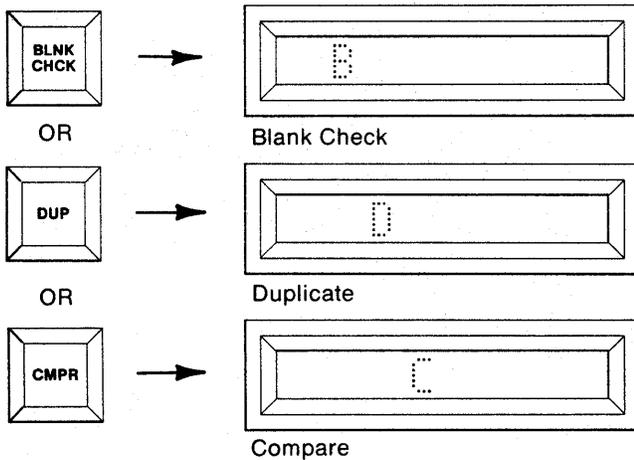
1. Insert the appropriate Personality Module and select switches as shown. Insert the PROM to be used as the Master PROM into the MASTER socket and the PROM to be copied into the COPY socket.



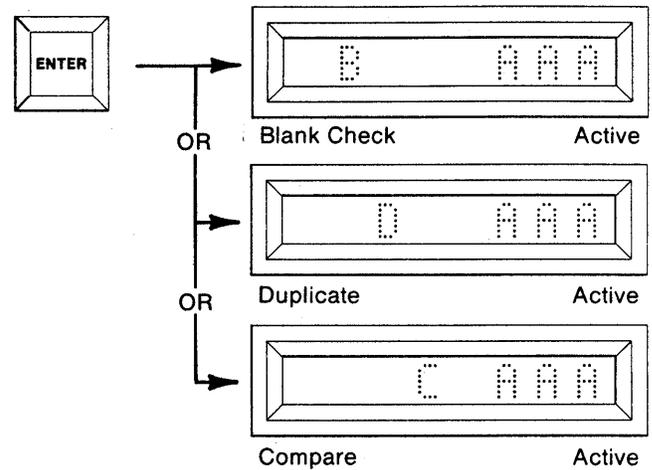
2. Depress RESET. The 8 hex displays are blank.



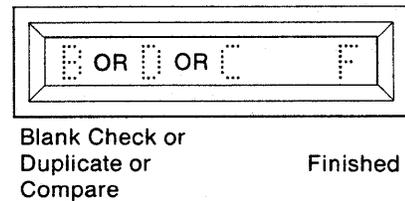
3. Depress BLNK CHCK(Blank Check), DUP(Duplicate) or CMPR(Compare). A "B", "D", or "C" is displayed to indicate the mode key depressed.



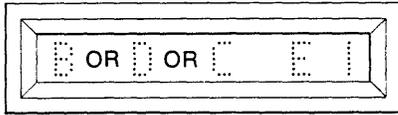
4. Depress ENTER. The operation automatically begins and "AAA" is displayed in the right-most display to indicate Active.



5. Upon the successful conclusion of the operation an "F" is displayed replacing the "AAA". A steady tone sounds if the AUDIO switch is ON.



6. To repeat the entire sequence, return to step 4.
7. If an error is detected, the M980 halts and displays the operation code "B", "D" or "C" and "E1" to denote Error. A warbling tone sounds if the AUDIO toggle switch is in the ON position.



Blank Check or
Duplicate or
Compare

Error

Summary of Single Operation

1. Insert Personality Module, PROM to be programmed, PROM to be copied, and select switches as follows; MFG MODE (ON), AUDIO (optional), MASTER (ON), BUFFER (OFF), COPY (ON).
2. Depress RESET. Display is blank.
3. Depress BLNK CHCK, DUP, or CMPR. The display shows "B", "D", or "C".
4. Depress ENTER. The display shows "B AAA", "D AAA", "C AAA".
5. When complete, "A F" is displayed.
6. Optional. Depress ENTER to repeat the operation.
7. If an error is detected "B", "D", or "C" and "E1" are displayed.

SECTION 10

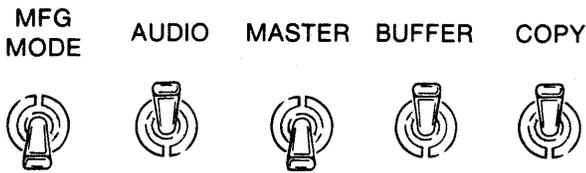
Engineering Auto-Sequencing Mode

DESCRIPTION

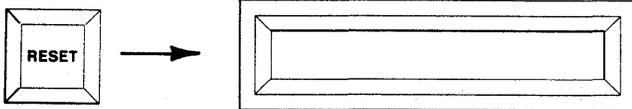
The Engineering Automatic sequencing Mode provides the convenience of the Manufacturing Mode without the restrictions on data source and address field size. As in the other operational modes the use of the AUDIO tone is optional. Some gang modules may vary from these operations. See the individual operating instructions.

Engineering Auto-Sequence Mode—Buffer to Copy Operation (example shown is for 2Kx8 PROM)

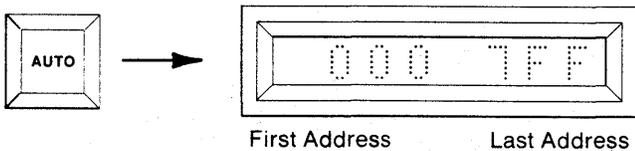
1. Insert the appropriate Personality Module and select switches as shown. Insert the PROM to be copied in the COPY socket.



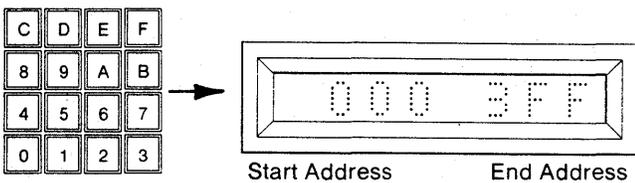
2. Depress RESET. The 8 hex displays are blank.



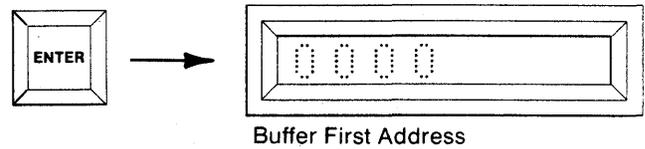
3. Depress AUTO. The displays show the First and Last Addresses of the Copy PROM.



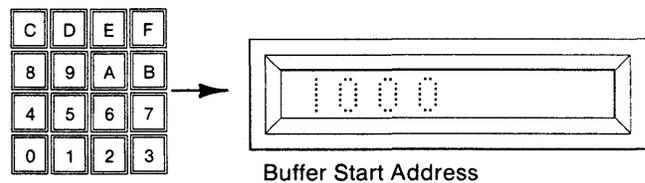
4. To Program the entire contents of the Copy PROM go to step 5. To operate over a limited field use the hex keyboard to key in a new Start and End Address, MSD first.



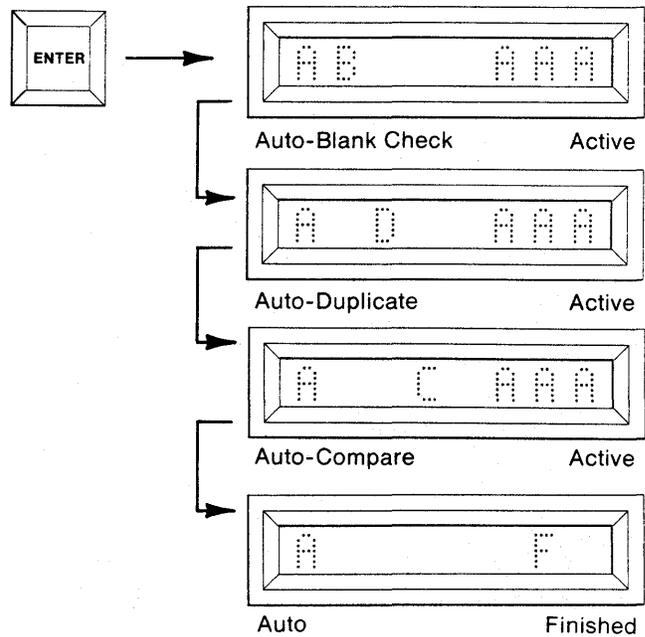
5. Depress ENTER. "0000" is displayed to indicate the default Buffer First Address.



6. If a different Buffer Start Address is desired, use the keyboard to key in a new Start Address. Otherwise, proceed to step 7.

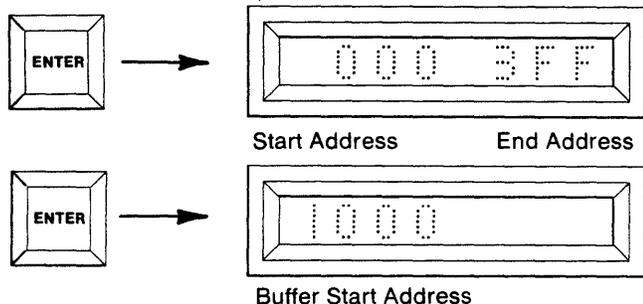


7. Depress ENTER. The displayed Buffer Start Address is accepted and Automatic Sequencing begins.

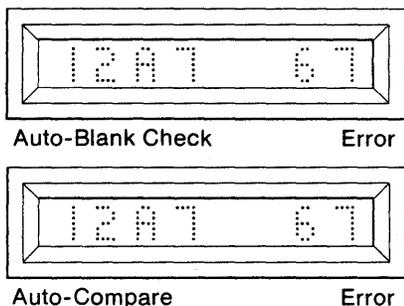


8. Upon completion of the sequence, an "F" replaces the "AAA" to indicate Finished. A steady tone sounds if the AUDIO switch is ON.

9. Depress ENTER to repeat the operation. The previous Start and End Addresses of the Copy PROM are displayed. Now continue with step 4. Each depression of ENTER recalls the next previous address.



10. If an error is detected, the Buffer address and data are displayed. Gang modules respond differently at this point. A warbling tone sounds if the AUDIO switch is ON. Depress Key C to display the copy address and data.



NOTE

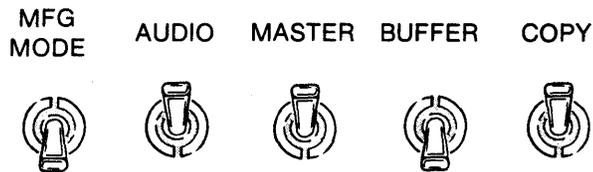
All modules that program the 2708 and TMS2716 (PM9005A, PM9053A, PM9051A, and PM9060A) respond differently. Refer to Section 11, Failure to Program Operations. Also, Gang Modules for PROMs other than the 2708 or TMS2716 continue through to the end of the operation before halting.

Summary of Buffer to Copy Operation

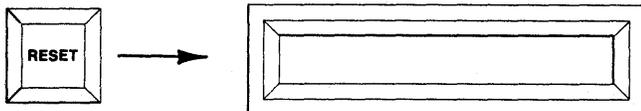
1. Insert Personality Module, PROM to be programmed, and select switches as follows; MFG MODE (OFF), AUDIO (optional), MASTER (OFF), BUFFER (ON), COPY (ON).
2. Depress RESET. Display is blank.
3. Depress AUTO. The First and Last Addresses of the Copy PROM are displayed.
4. Key in new Start and End Addresses if desired.
5. Depress ENTER. The First Address of the Buffer is displayed.
6. Key in a new Buffer Start Address if desired.
7. Depress ENTER. The Auto sequencing begins. The display shows "AB AAA", "AD AAA", or "AC AAA".
8. When complete the "AAA" is replaced with "F" to indicate Finished.
9. Optional. Depress ENTER to repeat the operation and return to step 4.
10. If an error is detected, the address and data are displayed.

Engineering Auto-Sequence Mode Master to Copy Operation (example shown is for a 2Kx8 PROM)

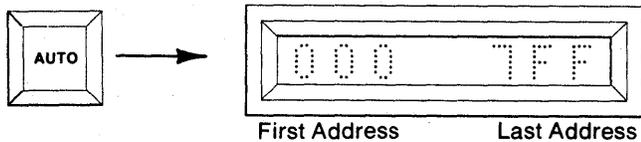
1. Insert the appropriate Personality Module and select switches as shown. Insert the PROM to be copied into the Copy socket.



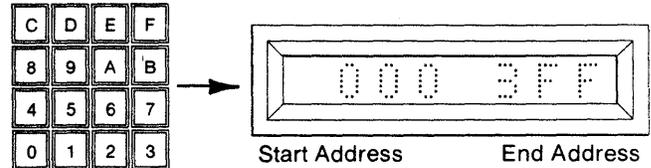
2. Depress RESET. The 8 hex displays are blank.



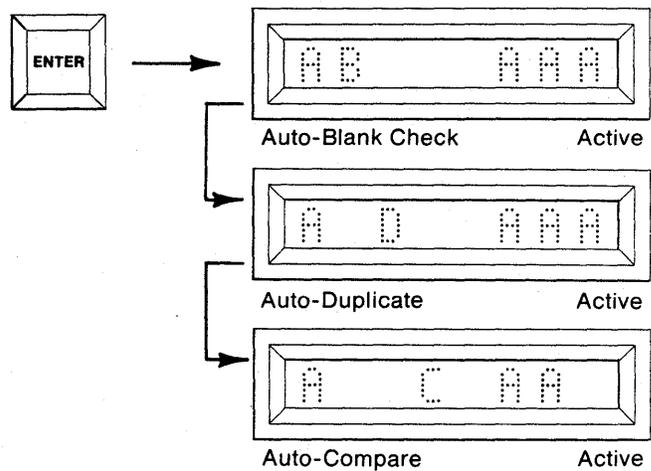
3. Depress AUTO. The displays show the First and Last Addresses of the Copy PROM.



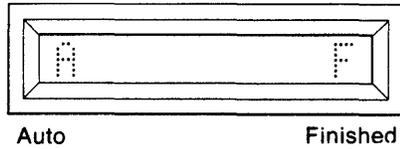
4. To Duplicate the entire contents of the Copy PROM, go to step 5. To Duplicate a limited field, use the hex keyboard to key in a new Start and End Address, MSD first.



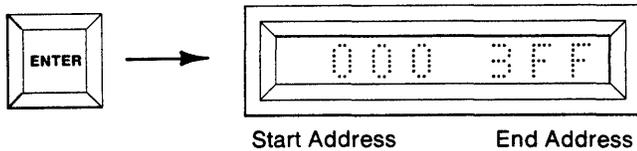
5. Depress ENTER. This initiates the Auto-Sequencing operation.



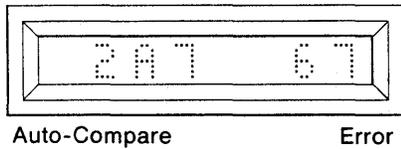
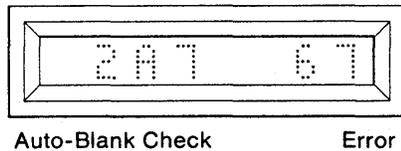
6. Upon completion of the sequence, an "F" replaces the "AAA" to indicate Finished. A steady tone sounds if the AUDIO switch is ON.



7. Depress ENTER to repeat the Automatic Mode without resetting. This displays the previous Start and End Addresses and returns to step 4 and/or 5.



8. If an error is detected, the M980 halts and displays the Master address and data. A warbling tone sounds if the AUDIO switch is ON. Depress Key C to display the Copy address and data.



NOTE

All modules that program the 2708 and TMS2716 (PM9005A, PM9053A, PM9051A, and PM9060A) respond differently. Refer to Section 11, Failure to Program Operations. Also, Gang Modules for PROMs other than the 2708 or TMS2716 continue through to the end of the operation before halting.

Summary of Master to Copy Operation

1. Insert Personality Module, PROM to be programmed, PROM to be copied, select switches as follows; MFG MODE (OFF), AUDIO (optional), MASTER (ON), BUFFER (OFF), COPY (ON).
2. Depress RESET. Display is blank.
3. Depress AUTO. First and Last Addresses of the Master/Copy are shown.
4. Depress ENTER. The display will show "AB AAA", "AD AAA", "AC AAA".
5. When complete, the "AAA" will be replaced with "F".
6. To repeat, depress ENTER. You are now back to step 4. The M980 halts and displays the address and data to indicate an error.

SECTION 11

Failure to Program Operations

FUSIBLE PROMS:

As it attempts to program the bad location, the M980 typically takes less than a second before indicating error, although delays of up to 12 seconds are possible. With many bipolar PROMs the operator may retry the failed location by depressing ENTER (check PROM manufacturers specifications to determine whether re-try is permissible). The display will then indicate the next sequential address if re-try is successful, or "AAA" is displayed if in DUP mode. If unsuccessful, the error indication is displayed again. To step over the failed location, the operator may depress the CLEAR key and an "F" will appear for Finished. The operator may now reselect the mode and redefine the address field, using the address after the failed location as a Start Address. In the Duplicate mode the operator may examine data in the corresponding address in Master PROM, Buffer, or Copy PROM by depressing key A to see Master PROM data, key B to see Buffer data, or key C to see Copy PROM data (refer to the example shown below).

UV ERASABLE PROMS:

Following an unsuccessful attempt at programming a location, the operator may step over a failed location by depressing the ENTER key. In the Duplicate mode the operator may see what is in the corresponding address in the Master PROM, Buffer, or Copy PROM by depressing key A to see Master data, key B to see Buffer data, or key C to see Copy PROM data.

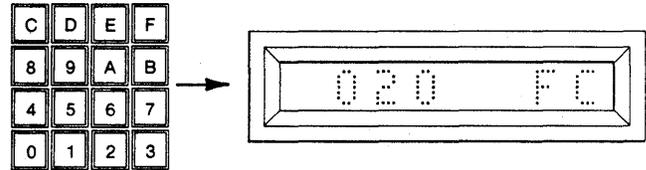
To step to the end of the operation, the operator may depress the CLEAR key and an "F" appears to indicate Finished. However, some Personality Modules have special software routines that prevent this operation. They include the PM9005A, PM9053A, PM9051A and PM9060A. For these modules it is necessary to depress RESET to abort a duplication process. The display for these PROMs also differs from the normal display (refer to their respective Failure Instructions at the end of this section).

Failure to Program

NOTE

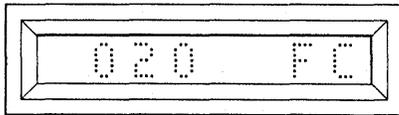
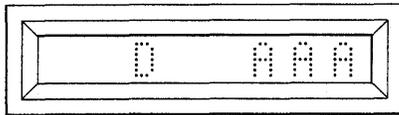
Do not try to reprogram a failed UV Erasable PROM without complete erasure since this will result in a marginal data condition.

3. The operator may examine the Master PROM data by depressing key A, OR

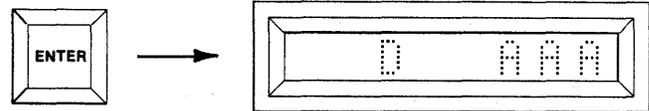


Example: Example of Error During Duplication

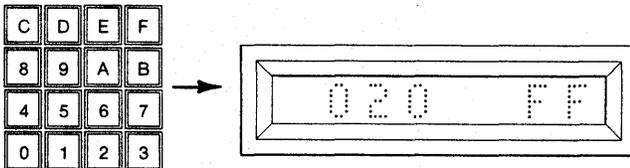
1. An error occurs in address 020. The M980 halts and displays the address and the source (Master) data for that address. (Example: "FC")



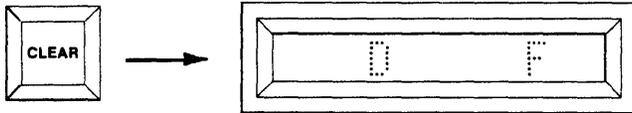
4. Depress ENTER to bypass the location (for UV and some bipolar PROMs). The M980 steps over the failed location and tries the next sequential location. For bipolar PROMs, depressing ENTER will retry to program the same location again. If the re-try or next location fail to program, the previous steps may be followed.



2. The operator may now examine the Copy PROM data by depressing key C. (Example "FF")



5. The operator may abort the operation (without pressing RESET, to re-enter the mode and address information) by depressing the CLEAR key. This causes the M980 to step to the end of the operation, displaying an "F" for Finished.



All 2708 and TMS2716 Modules show a programming count of 00-99 when programming. After the 99th pass the program carried by these modules performs a complete Compare operation independent of the M980. The display is blanked for Gang Personality Modules while the module performs its own Compare.

PM9005A AND PM9053A MODULES

The address and data for the earliest failed location are displayed. Since this operation is independent of the M980, a tone does not sound, regardless of the position of the AUDIO switch. Depressing ENTER sequences to the next failed location. In either Manufacturing or Engineering Auto Sequencing mode, the operator may have to depress ENTER many times in order to reach the point where the automatic sequence resumes. It is therefore suggested that the operator abort these operations by pressing RESET with this module.

PM9051A, PM9060A, PM9075A AND PM9076A MODULES

Any error results in a display of "E"; a tone will not sound. Depressing ENTER causes the M980 to display "F" (or continue in Manufacturing or Engineering Auto Sequence). The LEDs below each COPY socket or the Gang Module indicate which PROM has failed (on = fail; off = pass).

SECTION 12

Error Indications and Operation Modes

ERROR INDICATIONS (Also see inside back cover)

CODE	EXPLANATION
E0	Set-up error. The Source, Destination, or MFG toggle switches are not in the proper position, e.g. a non-valid operation such as program MASTER.
E1	Data error. A failure to Blank Check, Program, Compare.
E2	No option. Option selected does not exist.
E3	Address error. Performing an operation and the address given cannot be complied with. Example: Duplicate Master to Buffer. If you try to move a 2K program into the last 1K of Buffer, this error indication will appear prior to attempting the operation.
E4	No Personality Module. A Personality Module is not installed. Buffer operation may continue.
E5	Option Interface not ready. Option selected, but when checked, the interface is not properly hooked up. Example: 9818 RS-232-C adapter installed but ON-LINE/OFF-LINE switch is in the OFF-LINE position.
E6	Communication CHECKSUM error. When using one of the interfaces, in which the checksum of each line is sent over the interface, and the checksum does not match, this error will be displayed. An example: Intel Format RS-232-C.
E7	Remote control error indication: Response to the QXN command.
E8	Personality Module Overload Failure (see individual operating instruction).
E9	Invalid Buffer Data during PM9080 Update.
EA	Programming Error in updating PM9080 PROMs.

OPERATION CODES

CODE (DISPLAY)	EXPLANATION
A - - - - -	Auto Mode Selected.
A B - - - A A A	Auto Blank Check Active.
A B - - - E 1	Auto Blank Check Error (MFG Mode only).
A - - C - A A A	Auto Compare Active.
A - - C - E 1	Auto Compare Error (MFG Mode only).
A - D - - A A A	Auto Duplicate Active.
A - D - - E 1	Auto Duplicate Error (MFG Mode only).
A - - - - F -	Auto Mode Finished.
- B - - - - -	Blank Check Selected.
- B - - - A A A	Blank Check Active.
- B - - - E 1	Blank Check Error (MFG Mode only).
- B - - - F -	Blank Check Finished.
- - - C - - -	Compare Selected.
- - - C - A A A	Compare Active.
- - - C - - E 1	Compare Error (MFG Mode only).
- - - C - - F -	Compare Finished.
- - D - - - -	Duplicate Selected.
- - D - - A A A	Duplicate Active.
- - D - - E 1	Duplicate Error (MFG Mode only).
- - D - - F -	Duplicate Finished.

Note: A hyphen (-) denotes a blank display.

Error and Operation Codes

OPERATION CODES (cont.)

CODE (DISPLAY)	EXPLANATION
E - - - - - 0 0	Edit Reset Default Mode. Word Size.
E 0 0 - - - - -	Edit Word Size Selected.
E 0 0 - - - 0 4	Edit Word Size 4 bit.
E 0 0 - - - 0 8	Edit Word Size 8 bit.
E 0 0 - - - 1 2	Edit Word Size 12 bit.
E 0 0 - - - 1 6	Edit Word Size 16 bit.
E 0 0 - - - F -	Edit Word Size Finished.
E - - - - - 0 1	Edit Invert Mode Selected.
E 0 1 - - A A A	Edit Invert Mode Active.
E 0 1 - - - F -	Edit Invert Mode Finished.
E - - - - - 0 2	Edit Fill Buffer Mode Selected.
E 0 2 - - A A A	Edit Fill Buffer Mode Active.
E 0 2 - - - F -	Edit Fill Buffer Mode Finished.
E - - - - - 0 3	Edit Insert Selected.
E 0 3 - - A A A	Edit Insert Active.
E 0 3 - - - F -	Edit Insert Finished.
E - - - - - 0 4	Edit Delete Selected.
E 0 4 - - A A A	Edit Delete Active.
E 0 4 - - - F -	Edit Delete Finished.
E - - - - - 0 5	Edit Block Mode Selected.
E 0 5 - - A A A	Edit Block Mode Active.
E 0 5 - - - F -	Edit Block Mode Finished.
E - - - - - 0 6	Edit Nibble Swap Selected.
E 0 6 - - A A A	Edit Nibble Swap Active.
E 0 6 - - - F -	Edit Nibble Swap Finished.
E - - - - - 0 7	Edit Hex Pack Selected.
E 0 7 - - A A A	Edit Hex Pack Active.
E 0 7 - - - F -	Edit Hex Pack Finished.
E - - - - - 0 8	Edit Hex Unpack Selected.
E 0 8 - - A A A	Edit Hex Unpack Active.
E 0 8 - - - F -	Edit Hex Unpack Finished.
E - - - - - 1 0	Edit RAM Split Selected.
E 1 0 - - A A A	Edit RAM Split Active.
E 1 0 - - - F -	Edit RAM Split Finished.
E - - - - - 1 1	Edit RAM Interleave Selected.
E 1 1 - - A A A	Edit RAM Interleave Active.
E 1 1 - - - F -	Edit RAM Interleave Finished.
- - - - - F -	Finished.
9 8 1 1 - - d d	Paper Tape Reader Interface Selected.
9 8 1 2 - - d d	TTY Interface Selected.
9 8 1 4 - - d d	Parallel I/O Interface Selected.
9 8 1 8 - - d d	RS-232-C Interface Selected.
0 - d d - A A A	Interface Option "dd" Output Active (see Section 15).
- - d d - A A A	No Zero or One indicates Active Idle.
D - d d - A A A	Remote Control Active.
1 - d d - A A A	Interface Option "dd" Input Active (see Section 15).

Note: A hyphen (-) denotes a blank display.

SECTION 13

Self Test Operations

DESCRIPTION

During normal operation of the M980, if malfunctions occur, they are easily detected. This section describes tests which may be used for confidence testing or for troubleshooting. They are:

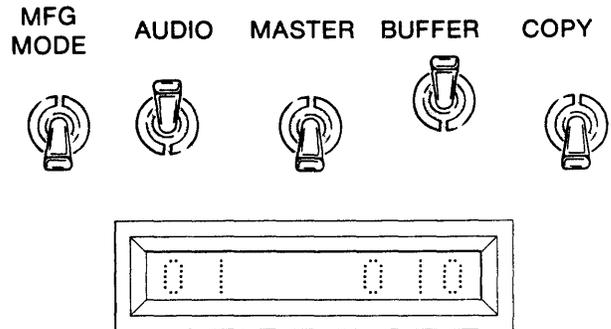
- Keyboard Test
- Display Test
- Toggle Switch Test
- Ram Buffer Test

Keyboard Self-Test Selection

These test routines are located in software and are designed to interact with the user to test various hardware sections of the M980. The basic functioning of the keyboard involves strobing of the X-Y matrix formed by the keyboard switches. All tests are initiated in the same manner. While depressing any hex key, depress and release the RESET key. The hex key depressed (down) is displayed in all of the hex displays until released. When the key is released, the Self-Test mode is active. Display shows 0 0 0 0.

Toggle Switch Test

Depressing Key 1 initiates the Toggle Switch Test, where the display corresponding to each toggle switch reflects the position of the switch (0 = down; 1 = up).



Depress CLEAR to return to Self-Test Selection and to display alternating 0's.

Keyboard (Keyswitch) Test

Depressing key 2 enters the Keyboard Test. As this test begins, the displays are blank. Any hex key depressed is shown in the display and shifts from left to right, as additional keys are depressed and released. The function keys will respond as follows: EDIT/AUTO = 4; BLNK CHCK = 5; PROG/DUP = 6; READ/CMPR = 7; and ENTER = 0. When depressed the CLEAR key terminates this test and returns the M980 to the Self-Test Selection.

Display Test

Depressing Key 0 causes the Display Test to begin. In this test, all 8 displays cycle from 0 through F and repeat, allowing the operator to determine if any display segment, character, or display is not operating properly. When depressed, the CLEAR key terminates this test and returns the M980 to the Self-Test Selection.

(Operations Continued Next Page)

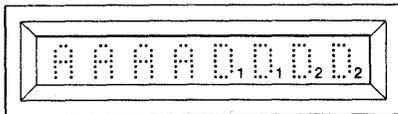
RAM Buffer Test

When this test is performed, all existing data in the Buffer is altered (time for this test is ~ 5 min. for 16K). Depressing key 3 enters the RAM Buffer Test. The display will show the full buffer address range. Depress enter. The displays show "B DD AAA" while the test is in progress. The M980 writes all 0's into the Buffer and checks that the RAMs will accept the data. The next test writes alternating 1's into specified blocks and checks that block for data retention and all other blocks to make sure no other RAMs have the pattern.

When finished with data test (Display B DD AAA), an address test is initiated (Display B AA AAA), which tests the chip address lines for shorts and opens.

When Finished, the displays indicate "B AA F", then 0 0 0 0. The audio tone will sound when finished if selected.

If an error is found, the M980 indicates the address of the error, the data written to that location, and the data read back from that location in the following manner.



- "AAAA" = Address of failure.
- "D₁" = Data written to that address.
- "D₂" = Data read back from that address.

An error during the address test is shown.

- A¹A¹A¹A¹ = Correct address.
- A²A²A²A² = Incorrect address.

Depressing ENTER will continue the RAM Buffer Test, displaying "B DD AAA".

Depressing CLEAR will terminate this test and return the M980 to the Self-Test Selection.

Section 14

M980 Interface

Software Selection

SELECTING TYPE AND FORMAT

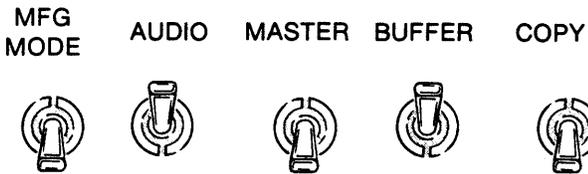
The M980 contains several software packages to interface the M980 to peripheral equipment. This interface may be directly from the M980 (example: 9812 TTY or 9814 Parallel I/O) or via additional hardware (example: 9811 with M301 Paper Tape Reader, or 9818 with M304 RS-232-C adapter).

The 9812 TTY Interface uses the 9 Pin "D" type connector located on the front panel to interface directly to TTY machines (ASR-33). The 9814 parallel I/O uses the 25 Pin "D" type connector to interface to intelligent equipment via a TTL Parallel I/O handshake interface. This TTL connector is used to drive and read from the M301 Paper Tape Reader or M304 RS-232-C adapter.

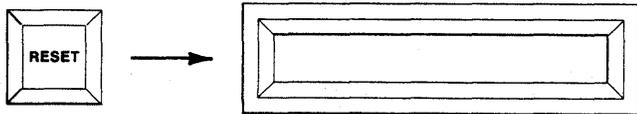
The M980 interface type and format are selected via the hex keyboard. After RESET, the depression of keys 1, 2, 4, and 8 selects either the 9811, 9812, 9814 or 9818 software routines. The interface type selected is displayed in the left-most displays. In the right-most displays a default format number is displayed. The user may elect to use the default format or choose any one of the formats listed at the end of this section (see Sections 15 through 18 for detailed descriptions of the various formats available for each interface).

The following is a step-by-step example of the key strokes required for selecting a format:

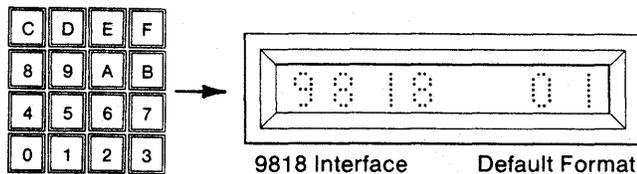
1. Select the switches as shown. Connect and activate the interface to be selected. The 9811 is activated by connecting the M301, turning ON the M301 Power and the Reader head. The 9812 is activated by plugging in the RC12 TTY cable or jumpering Pin 2 to Pin 8 on the 9-pin "D" type connector. The 9814 is activated by pulling interlock low on the 25-pin "D" type connector. The 9818 is activated by plugging in the M304, pulling DTR or CTS high, turning M304 ON-LINE and/or Modem ON (see appropriate section for more detailed information).



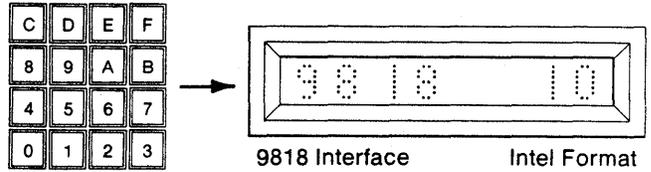
2. Depress RESET. The 8 hex displays are blank.



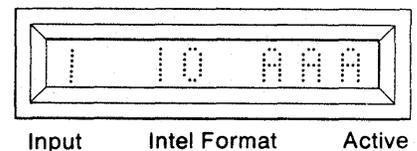
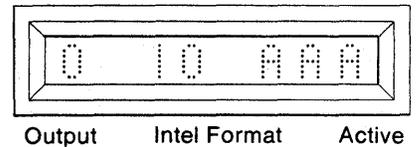
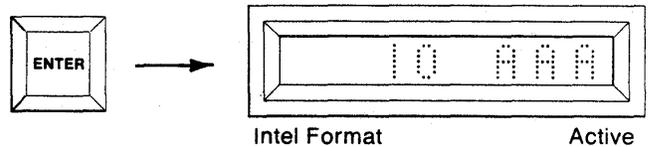
3. Depress 1 for 9811, 2 for 9812, 4 for 9814, or 8 for 9818 (Example is for 9818 RS-232-C.) The interface selected is displayed in the left-most displays and "01" is displayed in the right-most displays.



4. If the default format is desired, go to step 5. If a new format is required, use the hex keyboard to key in a new format number (see format number listing at the end of this section).

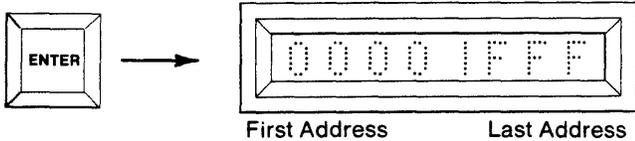


5. Depress ENTER. The displayed format will be accepted. The display will show the format number and "AAA" for active. The interface is now active to receive information remotely. When remotely interfacing with the M980, any output of data will be indicated by a "0" in the left-most display. Any input of data will be indicated by a "1" in the left-most display. Upon completion, the "0" or "1" will be removed from the display. The interface and format will remain active until the M980 is reset. In formats that use checksums, an "E6" error will disable the format until ENTER is depressed.

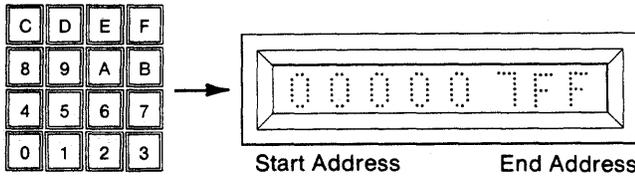


6. For some formats — those not requiring that the address information be sent over the interface — the user may elect to define the Buffer address limits via the hex keyboard. If local address field definition is desired, continue.

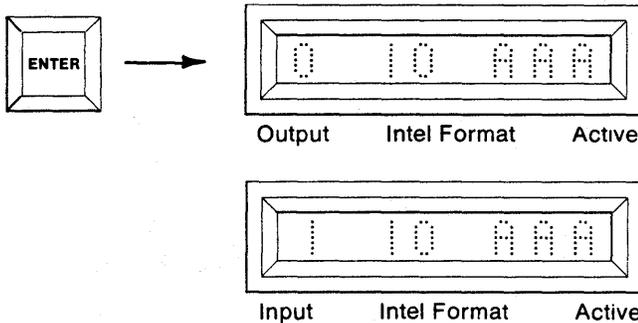
7. Depress ENTER. The First and Last Addresses of the Buffer are displayed.



8. If the entire contents of the Buffer are to be operated on, go to step 9. For a limited field, use the hex keyboard to key in a new Start and End Address field for the operation.



9. Depress ENTER. This initiates the format selected over the indicated address range. A zero or 1 is displayed in the left-most display to indicate output or input as described in step 5.



INTERFACE FORMAT NUMBERS

9811 PAPER TAPE READER	
NUMBER	DESCRIPTION
00	ASCII Hex Local — Duplicate
01	ASCII Hex Local — Compare
02	BNPF Local — Duplicate
03	BNPF Local — Compare
04	BINARY Local — Duplicate
05	BINARY Local — Compare
06	INTEL MDS — Duplicate
07	INTEL MDS — Compare

9812 TTY	
NUMBER	DESCRIPTION
02	Data Only — Remote Duplicate, List, Program, Compare

9814 PARALLEL I/O	
NUMBER	DESCRIPTION
00	Parallel — Remote Read, Program (Slave)
01	Parallel — Master Write
02	Parallel — Master Read

PRO-LOG AND INDUSTRY FORMAT DESCRIPTION

KEY SELECT	REMOTE CODE	9818 RS-232-C PRO-LOG FORMAT DESCRIPTION
9818-00	P	M980 accepts ASCII hexadecimal characters as data to be written to the buffer. Each ASCII character represents 4 bits of data. Non-hexadecimal characters sent between characters are discarded.
9818-01	S	M980 lists selected buffer field in ASCII hexadecimal characters formatted in 256-byte data blocks. Each data block is preceded by a header to separate columns, and each data line is preceded by the line starting address. Each line consists of 16 data bytes separated by spaces. Output operation halts after each block. A "SPACE" received via the interface or the ENTER key on the M980 causes the next block to be sent. Operation terminates when the end address is reached, when the M980 is reset, or when any character other than "SPACE" is received via the interface.
9818-02	L	M980 lists selected buffer field in ASCII hexadecimal characters formatted in 16-byte lines. Each line consists of 16 data bytes separated by spaces. Each line is followed by a carriage return and line feed. Output operation runs continuously until the end address is reached.
9818-03	M	M980 lists selected buffer field in ASCII hexadecimal characters formatted in 256-byte data blocks. Format and operation are identical to those of the 9818-01, except that output operation does not stop with each block but runs until the end address is reached.
9818-04	N	M980 lists selected buffer field in ASCII hexadecimal characters. Data is output in a continuous stream, without any control characters, from the start address to the end address.
9818-05	X	M980 lists selected buffer field in ASCII hexadecimal characters formatted in 16-byte lines. Each line consists of 16 data bytes separated by spaces. Each line is followed by a carriage return and a line feed. M980 outputs one line each time an XON character is received. Operation terminates when the end address is received.
9818-06	—	M980 sends a carriage return to initiate data transfer and then waits to receive ASCII hexadecimal characters as data to be written to the buffer.
INDUSTRY FORMATS		
9818-10		Intel HEX basic — M980 sends or receives data in the Intel HEX block format, without any special control operations. This version is compatible with Intel HEX files based by systems other than MDS. For example, CPM-based systems can write UFN-HEX files to the M980 buffer, via TYPE UFN.HEXtP, or read and write HEX files using the peripheral interchange program (PIP).
9818-11		Intel HEX with "ACK" or "NAK" response to checksum — M980 sends or receives data in the Intel HEX block format. In the receive mode, the M980 sends an "ACK" to acknowledge a correct checksum, and a "NAK" to acknowledge an incorrect checksum. This feature is intended to assist communication over a remote link, e.g., through a modem.
9818-12		Intel-Hex with "CONTROL Z" end-of-file terminator—M980 sends or receives data in the Intel HEX block format. In the local LIST operation, a "CONTROL Z" character is sent after the end-of-file record is sent; this is required by the Intel MDS to terminate the copy mode.
9818-13		Intel Extended (8086).
9818-14		TEK-HEX—can be used with the Tektronix 8001, and 8002 systems via the built-in commands of RHEX and WHEX.
9818-15		Motorola S2 (68000)—can be used with Motorola EXORmacs.
9818-16		Motorola S1—can be used with Motorola EXORcisor.
9818-18		MOS Technology

SECTION 15

9811, PAPER TAPE READER

9811, PAPER TAPE READER

The M980 9811 provides an interface with the M301 Paper Tape Reader (PTR).

With the M301 PTR (see Figure 15-1), the M980 can input data at a rate greater than 100 characters per second for use in the Duplicate or Compare Modes.

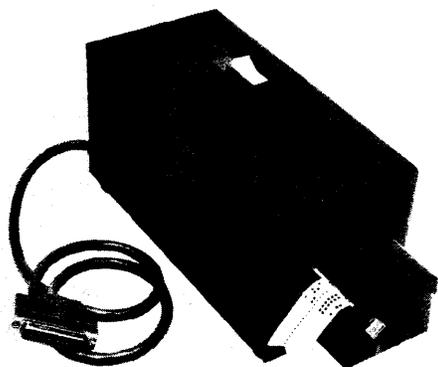


Figure 15-1. M301 Paper Tape Reader

PAPER TAPE CONNECTOR (PARALLEL INTERFACE)

The M301 PTR connects to the M980 programmer via the 25-pin "D"-type connector located in the center of the programmer control panel.

The connector provides four drive lines for reader stepping control, eight data lines, one sprocket line, and logic power connections (see Figure 15-2).

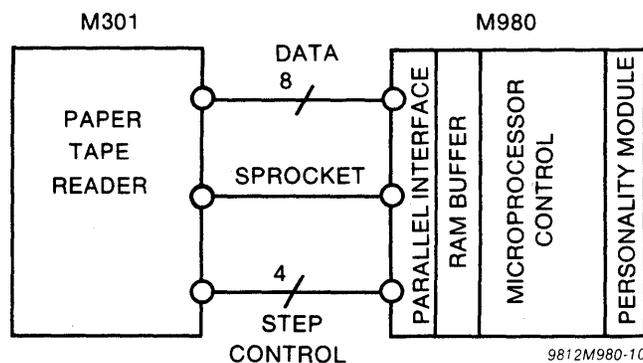


Figure 15-2. Paper Tape Reader Interface

PAPER TAPE CONTROLS

The M301 reader has two switches, **READER POWER** and **READER ENABLE**.

READER POWER Switch: A rocker switch on the top side of the reader chassis; it controls the power supply for the reader stepping motor.

READER ENABLE Switch: A rocker switch on the front of the reader mechanism; it enables the light source for the photo-reader in the ON position.

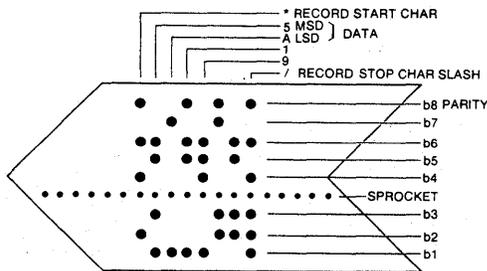
KEY 1: Interface selection key that puts the system into the PTR operating sequence. Active after Power ON or RESET.

PAPER TAPE INDICATOR

Reader Ready: A red indicator located on the reader mechanism. Indicates reader ready condition.

PAPER TAPE FORMATS

ASCII hex format (9811—00/01) requires 8-level, ASCII data coding where only the hexadecimal characters represent data to be operated on (see Figure 15-3).



9812M980-11

Figure 15-3. ASCII HEX Format

Address: Address information must not be on the tape. The M980 keeps sequential address count for each location operated on.

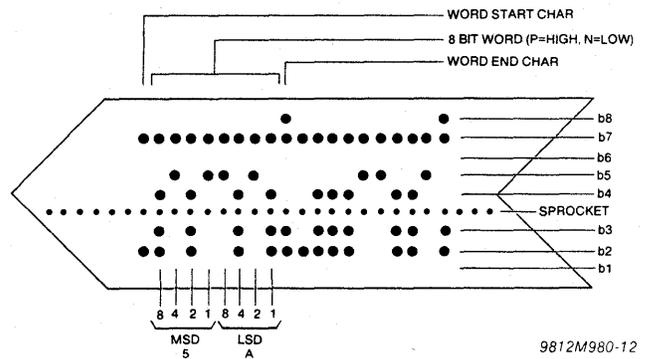
8-Bit Data: Each 8-bit location to be operated on requires two sequential ASCII hex characters on the tape. Non-hex characters are allowed and ignored but must not occur between the two hex data characters to be programmed.

4-Bit Data: Each ASCII hex character on the tape is loaded to the lower half of the Buffer; the upper half is unaffected.

Start Character: The ASCII character asterisk (*) must occur as the start character at the beginning of the data stream. Header information is allowed on the paper tape if it precedes the asterisk start character.

End Character: The Tape Read operation can be terminated by the ASCII character slash (/).

ASCII BNPf format (9811—02/03) requires 8-level ASCII data coding where the characters B, N, P, and F are used to encode and control binary data words. Other characters are allowed on the tape but must not occur within the data word (see Figure 15-4).



9812M980-12

Figure 15-4. ASCII BNPf

Address: Address information must not be on the tape. The M980 keeps sequential address count for each location operated on.

8-Bit Data: Eight ASCII P's or N's preceded by a B and followed by an F.

4-Bit Data: Four ASCII P's or N's preceded by a B and followed by an F.

Binary tape format (9811—04/05) requires 8-level, binary characters on punched tape (see Figure 15-5).

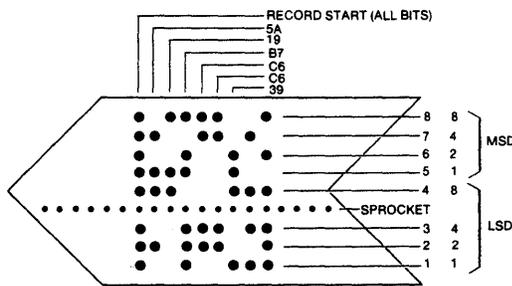


Figure 15-5. Binary Tape Format

9812M980-13

Address: Address information must not be on tape. The M980 keeps sequential address count for each location operated on.

8-Bit Data: Each 8-bit location is represented by an 8-bit binary character on tape. All binary combinations are legal for data.

4-Bit Data: Only the lower four bits are stored; the upper half of the Buffer is unaffected.

Start Character: The ASCII character "delete" must occur at the beginning of the data stream. Header information is allowed on the paper tape if it precedes the "Delete" character. (Note that "delete" is all holes punched.)

End Character: There is no ending character; the reader continues until the end of the defined field, even if blank tape is installed.

Intel MDS format (9811—06/07) provides an interface to the Pro-Log M301 PTR for reading MDS format paper tapes (see Figure 15-6).

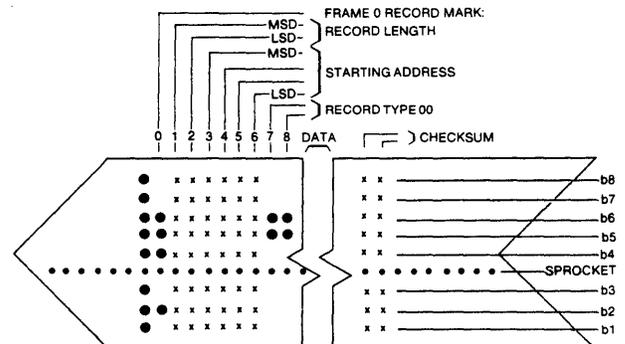


Figure 15-6. MDS Format

9812M980-14

MDS - ASCII HEX format requires 8-level, ASCII data coding where only the hexadecimal characters represent data to be operated on.

Address: Starting at the tape-defined address, the M980 keeps sequential address count for each location operated on until byte count is exhausted, at which time a new line is searched for. If a Compare error occurs, RAM address and tape data are displayed until ENTER key is depressed, at which time comparing continues.

8-Bit Data: Each 8-bit location to be operated on requires two sequential ASCII hex characters on tape. Non-hex characters are allowed and ignored but must occur as a start character at the beginning of the block stream. Header information is allowed on the paper tape, if it precedes the start character.

Frame 0

Record Mark = ASCII colon (:) marks the start of a record block.

Frames 1 and 2

Frame 1 = High Order Digit

Frame 2 = Low Order Digit

Record length in hexadecimal count of data bytes in this record block.

Frames 3 through 6 - Load Address

Frame 3 = High Order Digit

Frame 6 = Low Order Digit

The first data byte will load at this address; next byte in ascending order, etc.

Frames 7 and 8 - Record Type

At this time, all record types are 00. This field may be used for future expansion.

Frames 9 Upwards

These are for data digits. Each pair represents one 8-bit data byte in hexadecimal.

Final 2 Frames

These are the checksum. The checksum is the negative of the sum of all 8-bit bytes in the record evaluated module 256. The sum of all bytes in the record added to the checksum should be zero.

PAPER TAPE OPERATING SEQUENCES

(9811—00 through 05 only)

DUPLICATE operating sequence: In the Duplicate operations (00, 02 or 04) data from the paper tape is programmed into the RAM Buffer in the following sequence:

1. Mount the paper tape, with the pattern to be programmed, on the M301 reader. Note that the tape is loaded with the Bit 1 (b1) row of holes closest to the unit, and feeds from left to right.
2. Turn the Reader Power and Reader Enable switches ON.
3. Depress RESET, the displays are blank.
4. Depress Key 1, "9811—00" is displayed.
5. Key in new format (02 or 04) if desired.
6. Depress ENTER, the First and Last Addresses of the Buffer are displayed.
7. Key in new Start and End Addresses for operation, using the hex keyboard.

8. Depress ENTER, the display indicates "1 FF AAA" for Input-Format-Active.
9. When completed, the display shows "9811—FF" for paper tape format. NOTE: FF = default format "00" or format keyed in during step 5. After "9811—FF" is displayed, a new format can be keyed in (example: Compare "01").

COMPARE operating sequence: In the Compare operations (01, 03 or 05) data from the paper tape is compared with the RAM Buffer in the following sequence:

1. Mount the paper tape with the pattern to be programmed on the M301 reader. Note that the tape is loaded with the Bit 1 (b1) row of holes closest to the unit, and feeds from left to right.
2. Turn the Reader Power and Reader Enable switches ON.
3. Depress RESET, the displays are blank.
4. Depress Key 1, "9811—00" is displayed.
5. Key in new format (01, 03 or 05) if desired.
6. Depress ENTER, the First and Last Addresses of the Buffer are displayed.
7. Key in new Start and End Addresses for operation using the hex keyboard.
8. Depress ENTER, the display indicates "0 FF AAA" for Output-Format-Active.
9. When completed, the display shows "9811—FF" for Paper Tape Format. NOTE: FF = default format 00 or format keyed in during step 5.

If a Compare error occurs, RAM address and tape data are displayed until the ENTER key is depressed, at which time comparing continues.

PAPER TAPE OPERATING SEQUENCES

(9811—06 and 07)

DUPLICATE operating sequence: In the Duplicate operation (06), data from the paper tape is programmed into the RAM Buffer in the following sequence:

1. Mount the paper tape with the pattern to be programmed on the M301 reader. Note that the tape is loaded with the Bit 1 (b1) row of holes closest to the unit, and feeds from left to right.
2. Turn the Reader Power and Reader Enable switches ON.
3. Depress RESET, the displays are blank.
4. Depress Key 1, "9811—00" is displayed.
5. Key in "06" using the hex keyboard.
6. Depress ENTER, the display indicates "1 06 AAA" for Input-Intel MDS-Active.
7. When completed, the display shows "9811—06." NOTE: When "9811—06" is displayed, a new format may be keyed in (example: Compare "07").

COMPARE operating sequence: In the Compare operation (07) data from the paper tape is compared with the RAM Buffer in the following sequence:

1. Mount the paper tape, with the pattern to be programmed on the M301 reader. Note that the tape is loaded with the Bit 1 (b1) row of holes closest to the unit, and feeds from left to right.
2. Turn the Reader Power and Reader Enable switches ON.
3. Depress RESET, the displays are blank.
4. Depress Key 1, "9811—00" is displayed.
5. Key in "07" using the hex keyboard.
6. Depress ENTER, the display indicates "0 07 AAA" for Output-INTEL MDS-Active.
7. When completed, the display shows "9811—07."
NOTE: When "9811—07" is displayed, a new format may be keyed in.

ERROR INDICATION

If a Checksum error should occur during Duplicate operation, an "E6" is displayed. A warbling tone sounds if the Audio switch is ON.

If a Compare error occurs, RAM address and tape data are displayed until ENTER key is depressed, at which time comparing continues.

SECTION 16

9812-02 TTY INTERFACE

9812 AUTO-BAUD TTY

The 9812 to the M980 PROM programmer provides an ASCII-HEX coded TTY interface with automatic baud rate selection from 1 to 300 baud (see Figure 16-1).

Auto-Baud

- Data Rate Range: 1 to 300 baud
- Auto-baud sense character: CARRIAGE RETURN, or any character with an odd hex code (B, D, F, H, 1, 3, 5, etc.)

Electrical Interface (Serial Interface Connector)

- Keyboard input: Polar, 20mA; input resistance 5.1k Ω ; open circuit voltage (pins 5 and 9 to pin 4); 18.2V maximum.

- Printer output: Polar, 20mA; output resistance 220 ohms; output current forcing compliance voltage +5.8V maximum.

- Relay Driver: connector pin 1 supplies -12.4V to relay coil; connector pin 6 sinks up to 60 mA maximum relay coil current.

TTY CONTROLS AND INDICATORS

Mode Switch:

A three position rotary switch located in the lower right of the TTY keyboard.

- LOCAL position allows local TTY control.
- OFF position disables the TTY.
- LINE position allows remote control of the TTY and is the setting for operating with the M980.



Figure 16-1. M980 with TTY

Reader Control Switch

A multi-position switch located on the TTY paper tape reader. Manual and automatic readers have different controls.

Manual Reader: A three-position lever switch.

- ON is the reader on position.
- OFF is the reader off position.
- FREE is the position for loading and unloading paper tape.

Auto Reader: A four-position lever switch.

- MANUAL START is a momentary contact to start the reader in Local.
- AUTO is the normal position for remote operation.
- MANUAL STOP is a momentary contact to stop the reader in Local.
- FREE is the position for loading and unloading paper tape.

Punch Controls: Four push-buttons located on the punch.

- ON enables the punch.
- OFF disables the punch.
- RELEASE disengages the punch drive for tape loading.
- BACK SPACE moves tape backward one character.

TTY PAPER TAPE FORMAT (9812-02)

Requires 8 level ASCII data coding where the hexadecimal characters represent data to be operated on. When a tape is generated in the LIST mode the actual format becomes: data, space, data, space ... with sixteen locations followed by a Carriage Return and Line Feed.

Address: Address information must not be on the tape. The M980 keeps sequential address count for each location operated on.

8-Bit Data: Each 8-bit location to be operated on requires two sequential ASCII hex characters on tape. Non-hex characters are allowed and ignored but must not occur between the two hex data characters to be programmed.

4-Bit Data: Each 4-bit location to be operated on requires one ASCII hex character on tape. Non-hex characters are allowed and ignored.

End Character: The data stream can be terminated by the ASCII character slash (/) if less than a full PROM is to be operated on.

TTY KEYBOARD COMMANDS

Commands to the M980 from the TTY keyboard consist of a 4-digit hex Start Address, followed (without spaces) by a 4-digit hex End Address, followed by a single letter command which designates an operation (see Figure 16-2).

The Start and End Addresses define the portion of the RAM Buffer to be operated on. This may be as small as one location, in which case the Start and End Address are the same; or as large as the entire Buffer.

After the user types the desired Start and End Address, the M980 types a space and waits for one of the following single letter operation codes:

- L - List (M980 — TTY)
- P - Program (TTY — M980)
- D - Duplicate (Tape — M980)
- C - Compare (Tape — M980)
- T - Tape Punch (M980 — Punch)

The M980 can operate without a Personality Module installed. The PROM data width (generally 4 bits or 8 bits) is defined by the Personality Module, which in turn defines the width of the RAM Buffer.

If no Personality Module is installed, the data width is 8 bits. If a 4-bit Personality Module is installed, the M980 regards one Buffer location as a 4-bit word, which is the equivalent of one hex character. Thus the M980 prints and accepts one hex character per Buffer location with 4-bit Personality Modules. The four least significant Buffer bits are used at each location.

8-bit Personality Modules establish an 8-bit data width (one byte) for the Buffer. Thus the M980 prints, and accepts two hex characters per Buffer location when an 8-bit Personality Module is installed.

TTY KEY	MODE	9812-02 OPERATION
L	LIST	Prints the content of the Buffer from the Start address to the End Address. Sixteen Buffer locations are printed on each line, with the content of each location separated by a space. Leading spaces are inserted on the first line to maintain the hex address orientation of the printout. Buffer memory pages are separated by a blank line.
P	PROGRAM	Loads the Buffer from the Start Address to the End Address with hex data typed from the TTY keyboard. The current Buffer Address is printed by the M980, followed by a Space. The user then types the hex data to be loaded into the Buffer, and the M980 responds with Carriage Return-Line Feed and proceeds to the next Address.
D	DUPLICATE	Loads the Buffer with ASCII-hex data from a paper tape. The M980 recognizes all ASCII-hex characters as data and stores them sequentially beginning at the Start Address and finishing when End Address or a slash (/) is reached. Non-hex characters are ignored.
C	COMPARE	Compares Buffer content to paper tape ASCII-HEX data. The tape data is compared Address by Address to the data in the Buffer beginning at the Start Address and finishing at the End Address or a slash (/) is reached.
T	TAPE PUNCH	This Mode is similar to LIST but is used with the Tape Punch turned ON. A 64-character leader and a second * (Asterisk) precedes the data printout, which is followed by additional leader. Tape memory pages are separated by 16 null Characters to improve readability of the paper tape.

Figure 16-2. Operating Modes

TTY OPERATING SEQUENCES (DATA ONLY) 9812-02

The TTY takes control of the M980 whenever the following sequence is followed:

1. Connect TTY machine to 9 Pin "D"-type connector as shown on Figure 16-1.
2. Depress RESET on M980, the 8 hex displays are blank.
3. Depress Key 2, 9812-02 is displayed.
4. Depress ENTER, the display shows "A 02 AAA" for Auto-Baud.
5. Send CR from TTY. The M980 responds with a CR, LF, and displays "02 AAA".

At this point, the user has established contact with the M980 and has selected the Format and Baud rate.

LIST OPERATING SEQUENCE:

1. Type in the hex characters that define the Starting and Ending Addresses of the field to be listed, from the TTY keyboard.
2. The TTY responds with a Space (SP).
3. Type in an "L" (upper case). The TTY does a CR, LF, and begins to automatically list the Buffer contents over the previously defined Address field. The display shows "0 02 AAA" to indicate Output-02 Format-Active. If it is desired to punch a tape, the Punch should not be turned ON after the entry of the last character in the field definition. This ensures that the field information will not be on the tape where it would be interpreted as valid data.
5. When the TTY reaches the end of the field, it does a Space (SP), Slash (/), CR, LF.

EXAMPLE of 9812-02 List:

```
00000013 L
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
10 11 12 13 /
```

PROGRAM OPERATING SEQUENCE:

1. Type in hex characters that define the Starting and Ending Addresses of the field to be programmed from the TTY keyboard.
2. The TTY responds with a Space (SP).
3. Type in a "P" (upper case). The TTY does a CR, LF, and prints the First Address and another Space (SP).
4. Type in the data to be programmed, MSD first, the M980 responds with a CR, LF, and prints the next sequential Address.
5. When the End Address is reached, the TTY does a Space (SP), Slash (/), CR, LF.

EXAMPLE of 9812-02 Program:

```
01000106 P
 0100 00
 0101 01
 0102 02
 0103 03
 0104 04
 0105 05
 0106 06 /
```

DUPLICATE OPERATING SEQUENCE:

1. Load the paper tape to be duplicated on the TTY Paper Tape Reader.
2. Place the Paper Tape Reader Control Switch in the AUTO position.
3. Type in the hex characters that define the Starting and Ending Addresses for the field to be Duplicated from the TTY keyboard. The TTY responds with a Space (SP).
4. Type the letter "D" (upper case) on the TTY keyboard. The reader begins to read the data information. The M980 automatically increments the Address. (If the TTY is not equipped with a modification for Tape Reader Control, it must be manually started at this point.)
5. The Duplicate operation ends with the TTY printing a Slash (/), CR, LF.

EXAMPLE of 9812-02 Duplicate:

```
000003FF D/
```

COMPARE OPERATING SEQUENCE:

1. Load the paper tape to be compared to the Buffer.
2. Place the Paper Tape Reader Control Switch in the AUTO position.
3. Type in the hex characters that define the Starting and Ending Addresses for the field to be compared from the TTY keyboard. The TTY responds with a Space (SP).

4. Type the letter "C" (upper case) from the TTY keyboard. The Reader begins to read the data information and compares it to the data in the Buffer, one Address at a time from Start to End (if the TTY is not equipped with a modification for reader tape control, the Reader should be manually started). The M980 automatically increments the Address. If the data on the tape and the Buffer data do not compare, the TTY prints the Buffer Address and data. The Compare operation does not stop on non-compare.
5. The Compare operation ends with the TTY printing a Slash (/), CR, LF.

EXAMPLE of 9812-02 Compare:

```
000007FF C
0100 D9      Location 0100 does not compare with
/           the tape.
           Data shown is from Buffer.
```

TTY ERRORS

If a Duplicate or Compare error occurs, and the Paper Tape Reader modification is not installed, the tape continues to step and the M980 displays the address and data of the tape. The tape runs until the end and the M980 ignores any information past the error location.

"E5" is displayed if the TTY cable is not connected when the Interface is selected.

"E6" is displayed if the Baud rate of the CR sent is below 1 Baud (possibly a shorted cable) or above 300 Baud.

Any non-hex character sent during the address field definition will cause the M980 to respond with a ?, CR, LF. The address field may now be redefined.

Any non-hex character sent during the data transmission causes the M980 to respond with a CR, LF, and reprint the Current Address to be programmed, and a Space (SP).

TTY OPTIONS AND MODIFICATIONS

The TTY Interface requires the following options and modification in the Teletype Unit:

1. 20mA Current Loop Option.
2. Full Duplex Option.
3. Remote Reader Control modifications.

The 20mA Current Loop and the Full Duplex Connection are options available on the Teletype Unit. The Remote Reader Control requires the addition of a 12 to 15 volt DC relay capable of switching the high voltage reader circuit inside the TTY (see Figure 16-4).

A number of mini-computers specify a similar interface; thus, many teletypes already have the required configuration. Detailed instructions for modifying a TTY to this configuration are given in the following paragraphs.

REMOVING THE TTY HOUSING

It is necessary to remove the TTY housing to inspect or modify the TTY options.

1. Unplug the TTY from any power source.
2. Remove the roll of TTY printer paper from its cradle.
3. Remove the manual paper feed knob by pulling firmly.
4. Remove the Mode select knob located on the right front by pulling firmly.
5. Remove the metal trim panel behind the Mode select knob by prying downward.
6. Remove the 4 screws under the metal trim panel.
7. Remove the screw on the left side of the paper tape reader housing.
8. Remove the four knurled knobs along the lower rear edge of the housing.
9. Lift upward on the housing to remove, being careful of the controls on the Paper Tape Reader as they clear their openings in the housing (see Figures 16-3 and 16-6).

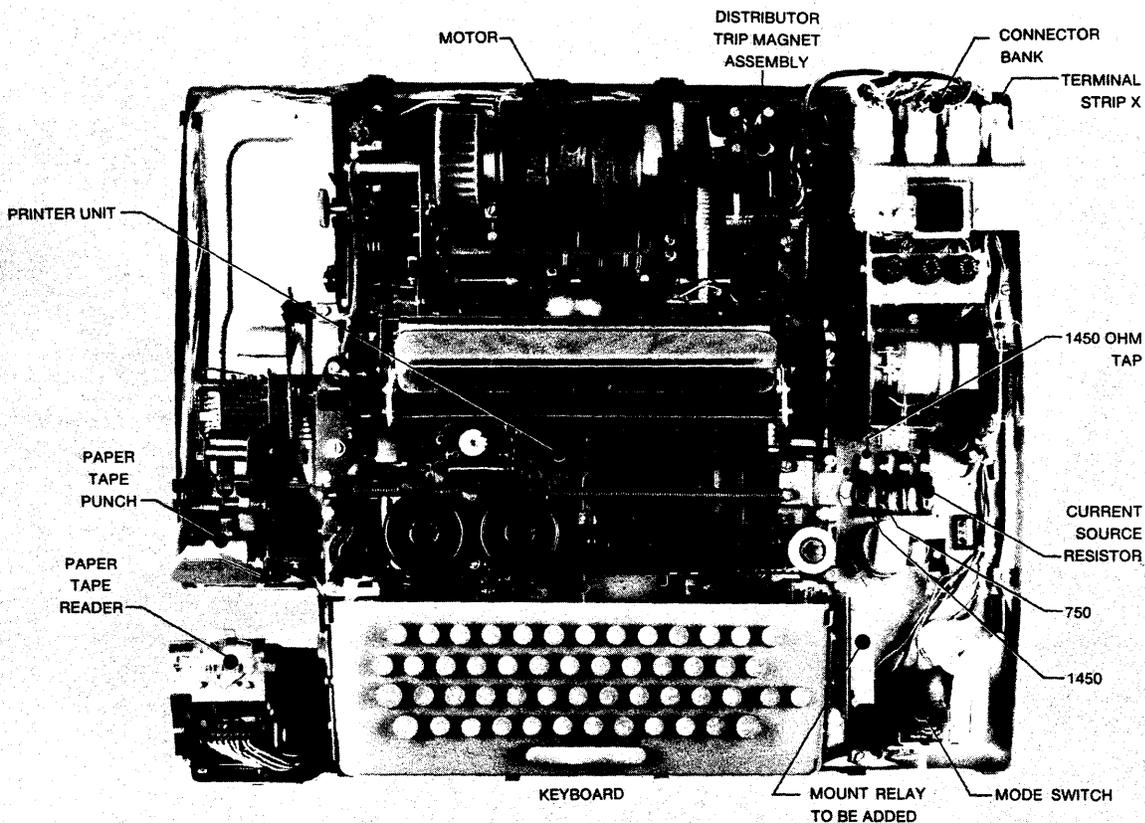
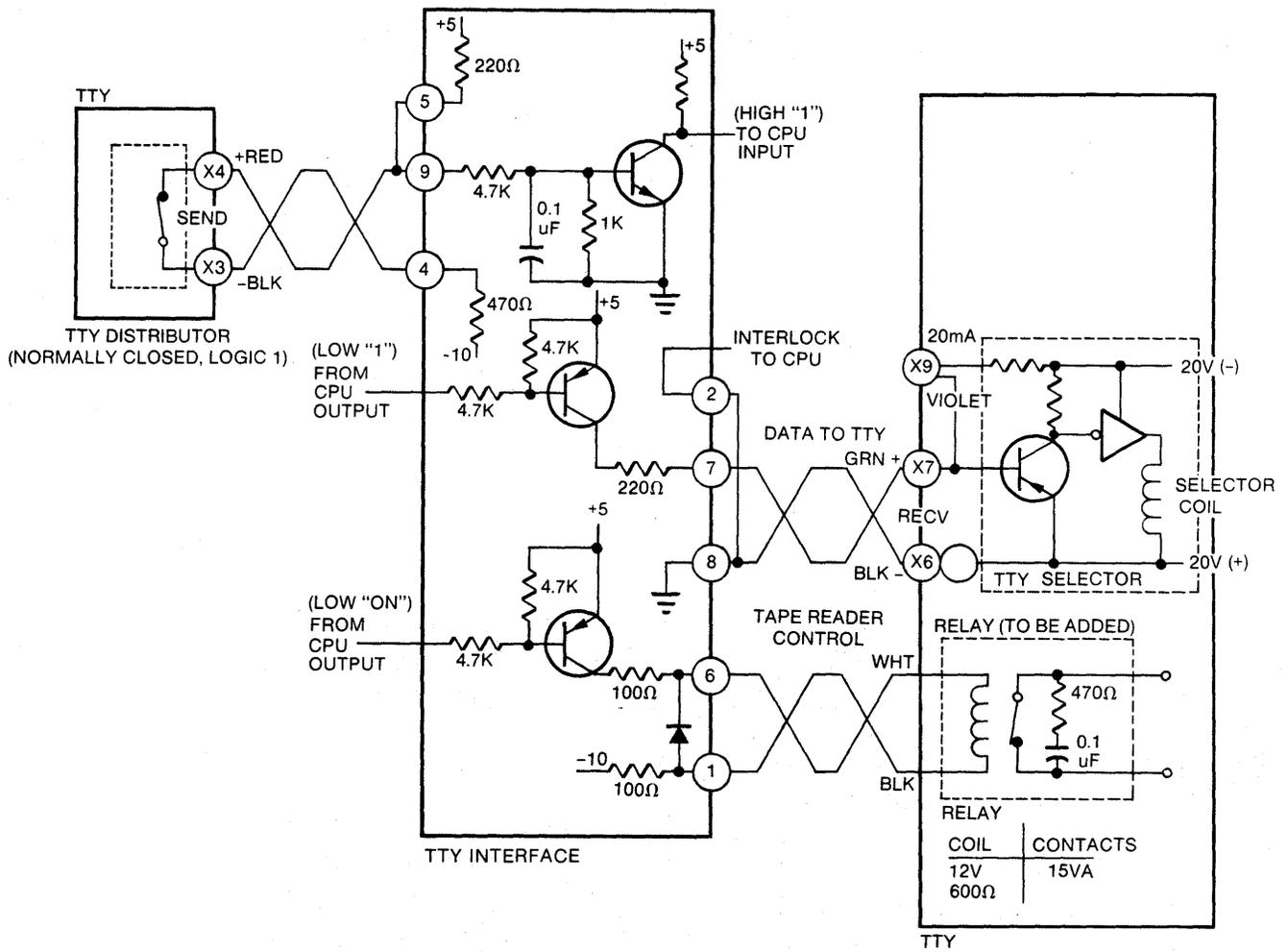


Figure 16-3. Top View - TTY with Housing Removed



9812M980-15

Figure 16-4. TTY Interface Circuit

Current Loop Option

The TTY Send and Receive Current Loop can be optionally selected to work from either 20mA or 60mA. When the selection is made, both the Internal Current Source and the Selector Drive Current Bias must be modified to be compatible (see Figure 16-5 and 16-7).

Internal Current Source

The Internal Current Source is set to 20mA by putting the blue wire on the 1450 ohm tap of Power Resistor R1 located on the right side of the TTY.

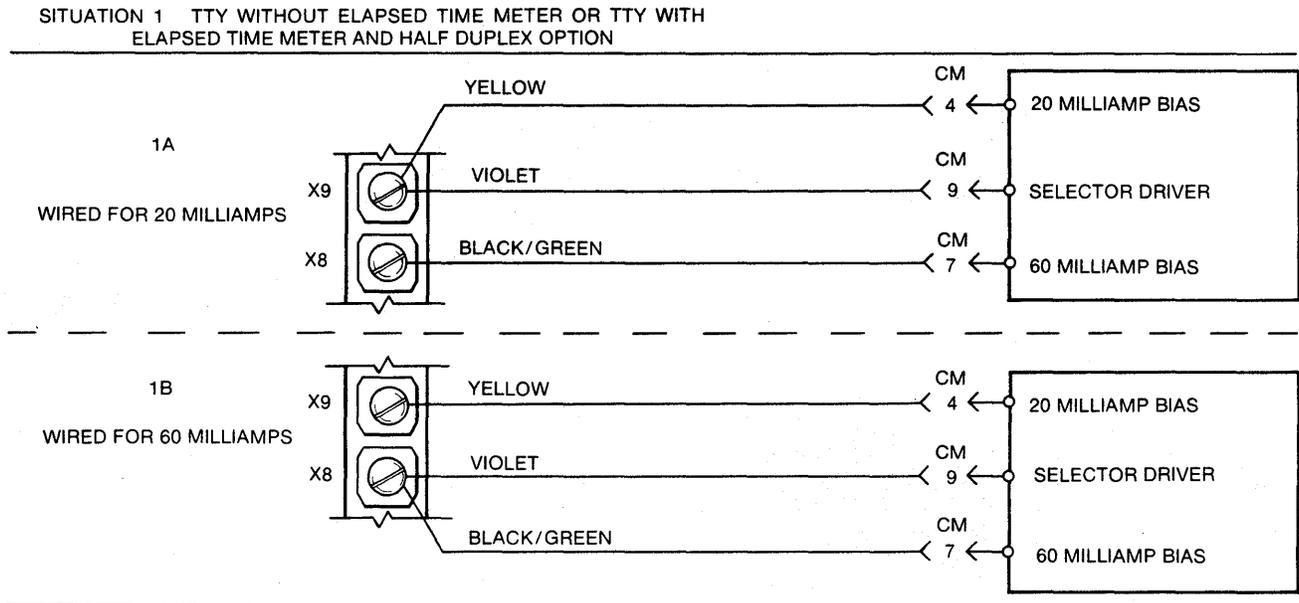
Selector Drive Current Bias

The Selector Drive Current Bias is set to 20mA by optional wiring on Terminal Strip X located below the Connector Bank in the right rear corner of the TTY. In making this change various wiring configurations may be encountered as shown in Figure 16-5 depending on whether the unit has an Elapsed Time Meter.

TTY Without Elapsed Time Meter

If wired as 1A: Do nothing; this is the correct connection for 20mA without an Elapsed Time Meter.

If wired as 1B: Remove the violet wire from Terminal X8 and move it to X9 with the yellow wire.



9812M980-16

Figure 16-5. Current Loop Option (Situation 1)

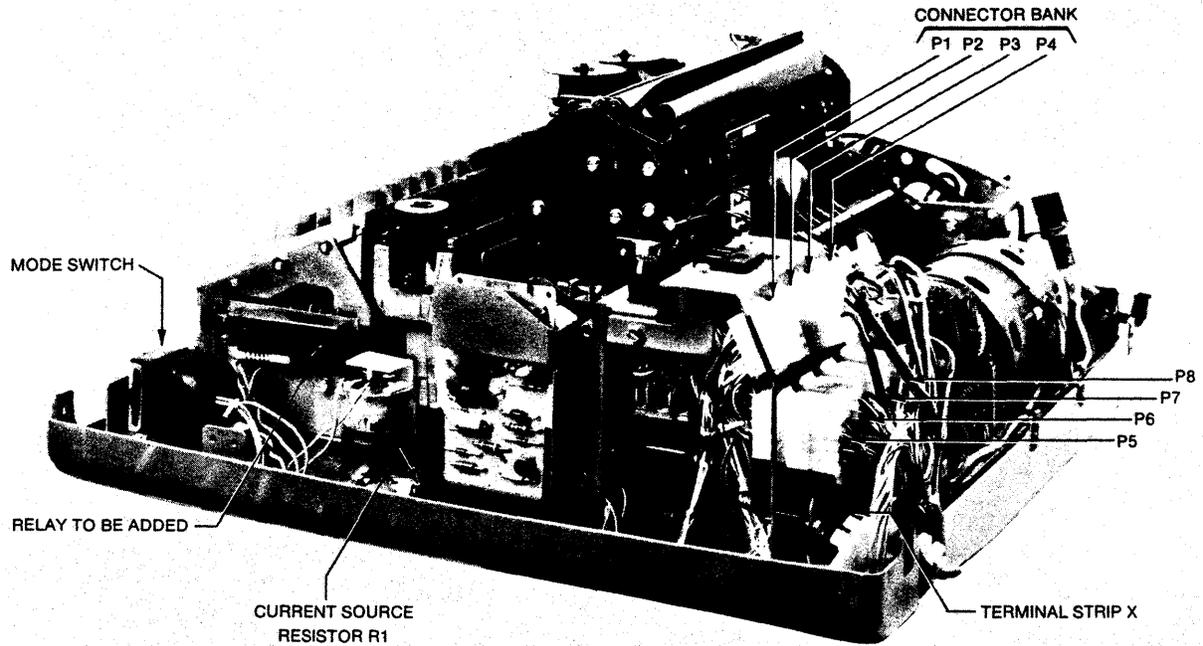
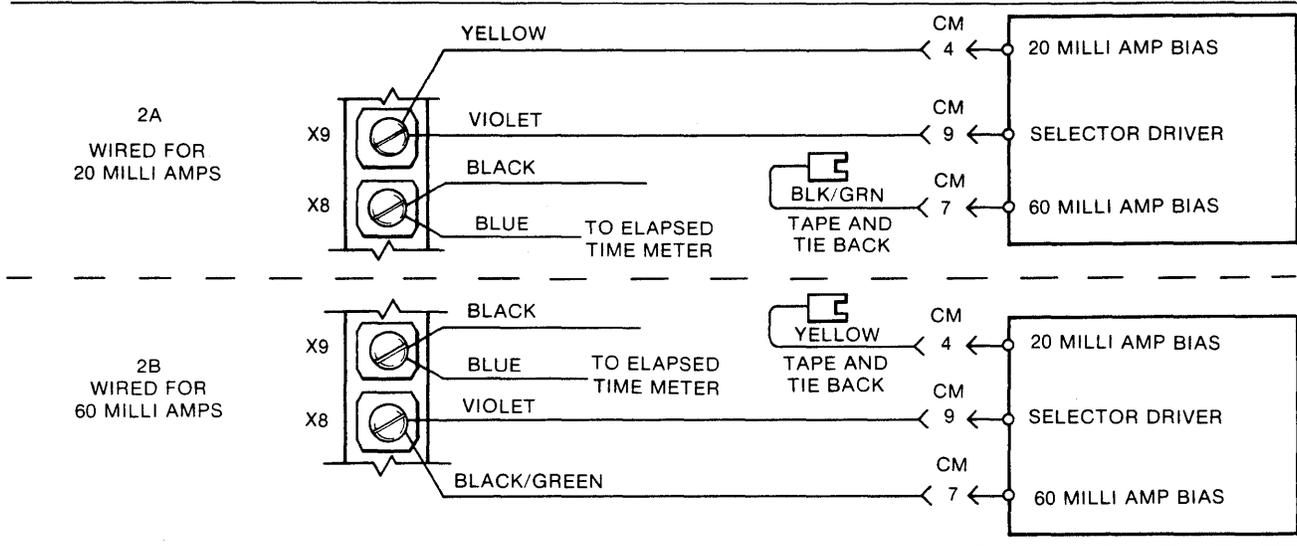


Figure 16-6. Side View—TTY with Housing Removed

SITUATION 2 TTY WITH ELAPSED TIME METER AND FULL DUPLEX



9812M980-17

Figure 16-7. Current Loop Option (Situation 2)

TTY With Elapsed Time Meter

A TTY with an Elapsed Time Meter may be wired as 1A, 1B, 2A or 2B. To modify for 20mA:

If wired as 1A: Remove the black/green wire from Terminal X8, tape the exposed end and tie back into the wire bundle. Locate a black wire and a blue wire on Terminal X5. Move both wires from X5 to X8.

If wired as 1B: Remove the violet wire from Terminal X8 and move it to X9. Remove the black/green wire from X8, tape the exposed end and tie back into the wire bundle. Locate a black wire and a blue wire connected on X5. Move both wires from X5 to X8.

If wired as 2A: Do nothing; this is the correct connection for 20mA with an Elapsed Time Meter.

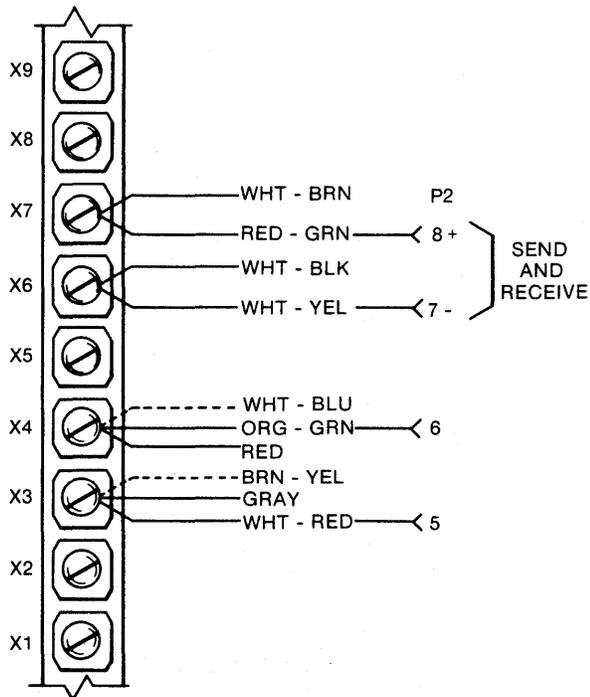
If wired as 2B: Remove the black wire and blue wire from X9. Remove the violet wire and black/green wire from X8. Connect the black wire and blue wire to X8. Connect the violet wire to X9. Locate the yellow wire taped back into the wire bundle. Connect the yellow wire to X9. Tape the exposed end of the black/green wire and tie back into wire bundle.

Full Duplex Option

The Full Duplex Option is wired into the TTY on Terminal Strip X located below the Connector Bank in the right rear corner of the unit.

If the TTY is wired for Half-Duplex, Terminal Strip X should appear as in Figure 16-8.

If the TTY is wired for Full-Duplex, Terminal Strip X should appear as in Figure 16-9.

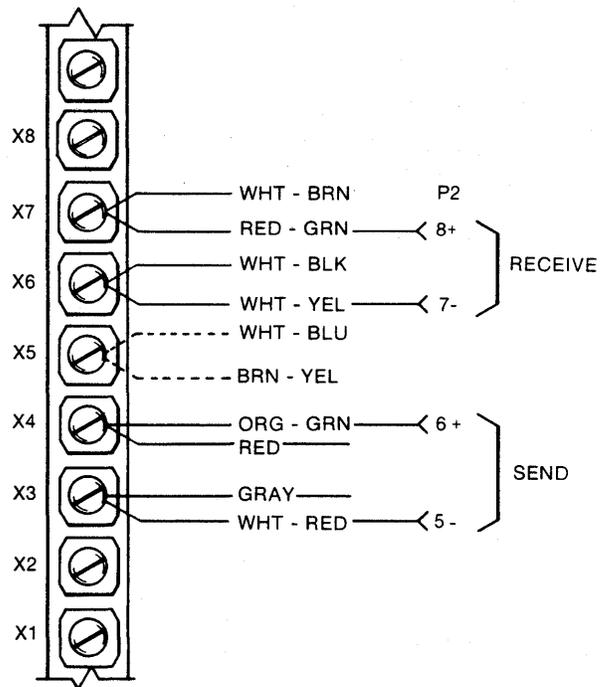


9812M980-18

Figure 16-8. TTY Half-Duplex Option

To convert from Half-Duplex to Full-Duplex:

1. Confirm that screw lug X5 has no wires connected. If there is a black wire and a blue wire on X5, an Elapsed Time Meter is installed. Refer to the Current Loop Option for instructions on moving the black wire and blue wire from X5 to X8.
2. Move the white/blue wire from screw lug X4 to X5.
3. Move the brown/yellow wire from screw lug X3 to X5.



9812M980-19

Figure 16-9. TTY Full-Duplex Option

Remote TTY Reader Control

The wiring of standard teletype does not allow the TTY Paper Tape Reader to be used remotely as a stand-alone input device. By modifying the distributor trip circuit for remote operation, the TTY Reader can be advanced one character at a time for total reader control.

TTY circuits operate from 115 VAC or 48 VDC requiring remote logic control circuits to be relay-buffered. Two basic reader circuits will be encountered in TTY reader modification: Manual and Automatic. The Manual and Automatic Readers are identified by the Reader Control switch located on the Paper Tape Reader. The Manual Reader has a three-position switch labeled ON, OFF, FREE. The Automatic Reader has a four-position switch labeled MANUAL START, AUTO, MANUAL STOP, FREE.

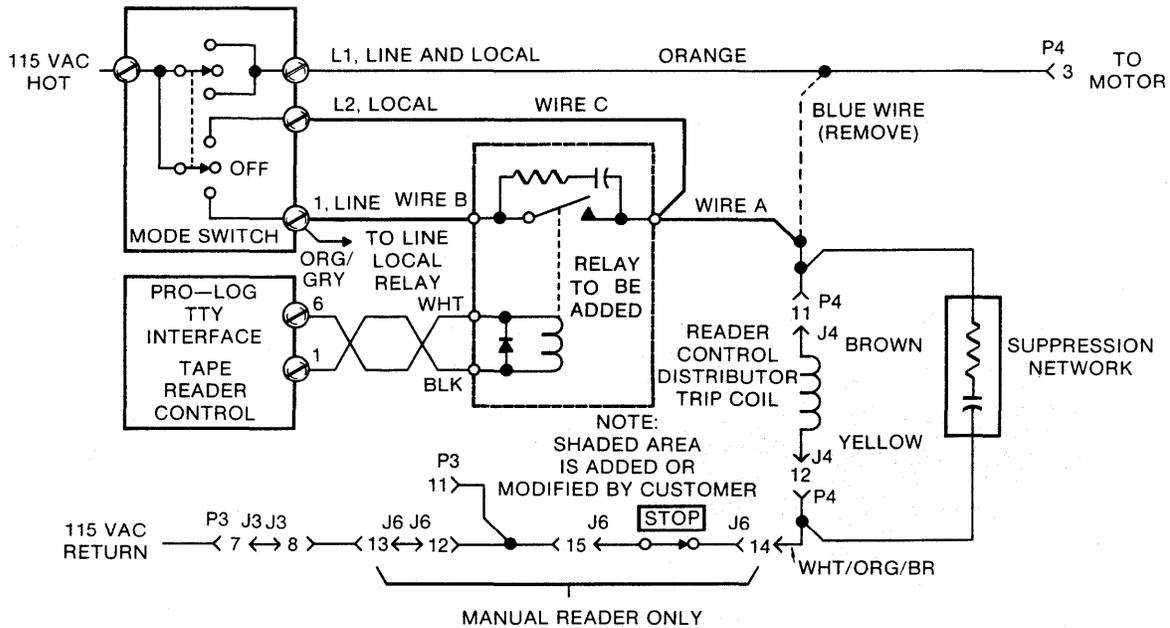
Manual Reader Operation

The 115 VAC Manual Reader Circuit is operated in either the Line or Local Modes by the ON-OFF switch located on the Reader.

The Manual Reader Circuit can be controlled remotely by adding a Relay to control the reader trip coil in the Line Mode. Modifying the reader circuit as shown in Figure 16-10 allows normal operation in the Local Mode and remote control in the Line Mode.

Manual Reader Modification

1. Locate Plug P4.
Locate the blue wire connection P4 pin 3 and P4 pin 11.
Locate the orange wire on screw lug L1 of the Mode switch.
Locate the L2 of the Mode switch (no wires).
Locate the orange/gray wire on screw lug 1 of the Mode switch.
If the wire colors do not agree, do not proceed with this modification unless the connections can be verified to agree with those of Figure 16-10.
2. Cut the blue wire near P4 pin 3.
3. Splice wire A from the new Relay to the portion of the blue wire still connected to P4 pin 11.
4. Connect wire B to screw lug L1 of the Mode switch.
5. Connect wire C to screw lug L2 of the Mode switch.



9812M980-20

Figure 16-10. TTY Modification (Manual Reader)

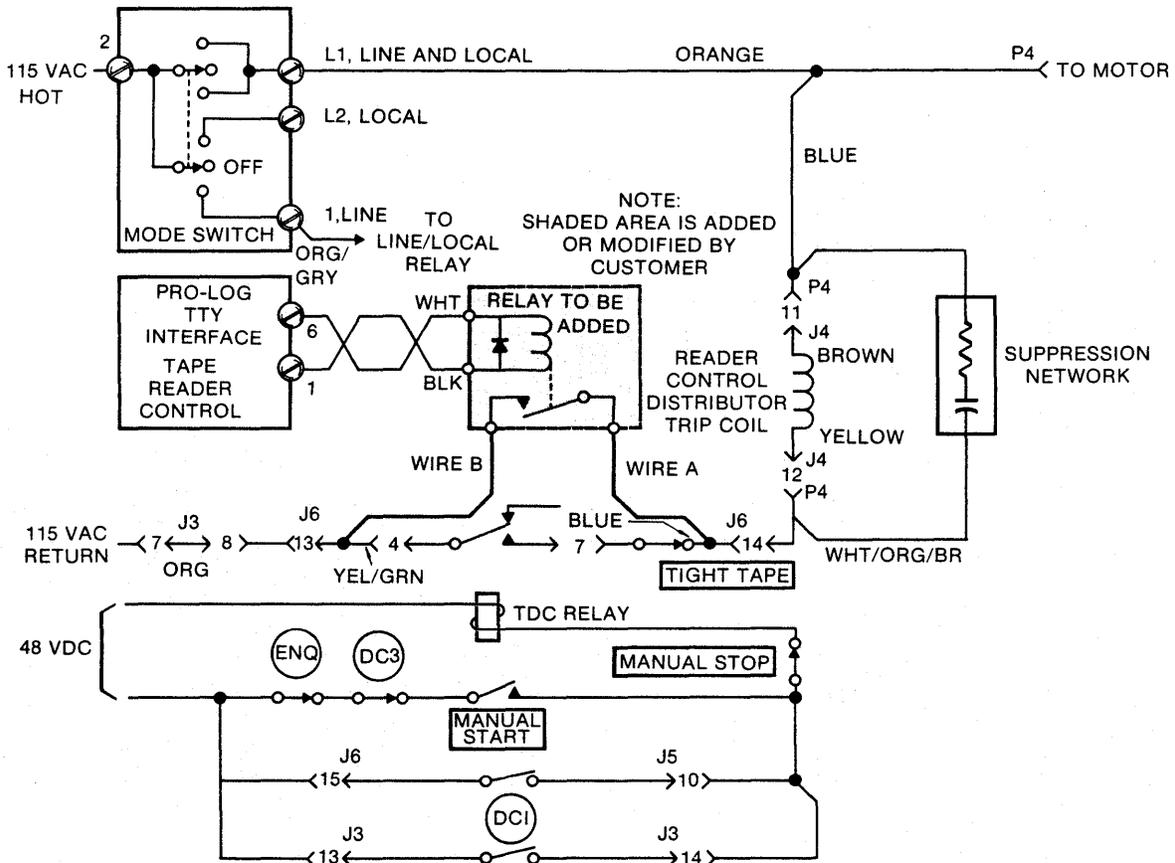
Auto Reader Operation

The 115 VAC Automatic Reader Circuit is normally open due to the TDC Relay contact. The 48 VDC TDC Relay can be operated by the momentary Manual Start switch on the Reader or by the DC1 data function. Once the TDC Relay operates, it holds itself energized until the momentary Manual Stop switch on the Reader is activated. The DC3 and ENQ data functions will also stop the Reader.

The Automatic Reader circuit can be controlled remotely by adding a Relay to control a contact closure in parallel across the TDC Relay contact as shown in Figure 16-11.

Auto Reader Modification

1. Locate jack J6 connected to plug P6.
Locate the yellow/green wire at J6-13.
Locate the blue wire at J6-14.
If the wire colors do not agree, do not proceed with this modification unless the connection can be verified to agree with those of Figure 16-11.
2. Connect wire A from the new Relay to the blue wire at J6-14.
3. Connect wire B from the new Relay to the yellow/green wire at J6-13.



9812M980-21

Figure 16-11. TTY Modification (Auto Reader)

SECTION 17

9814, COMPUTER INTERFACE

The 9814 computer interface (Figure 17-1) provides an 8-bit parallel data path for transferring data to or from a computer and to or from the M980 RAM Buffer.

Master or Slave Operation

The M980, through its parallel interface, can be configured as a Master Controller or a Slave Unit to a remote computer. The configuration is controlled by the cable interconnection and the keyboard selected formats of the M980 are shown in Figure 17-2.

FORMAT	CONFIGURATION
9814-00	Slave Unit (default format)
9814-01	Master Controller write to Slave Unit
9814-02	Master Controller read from Slave Unit

Figure 17-2. 9814 Format Selection

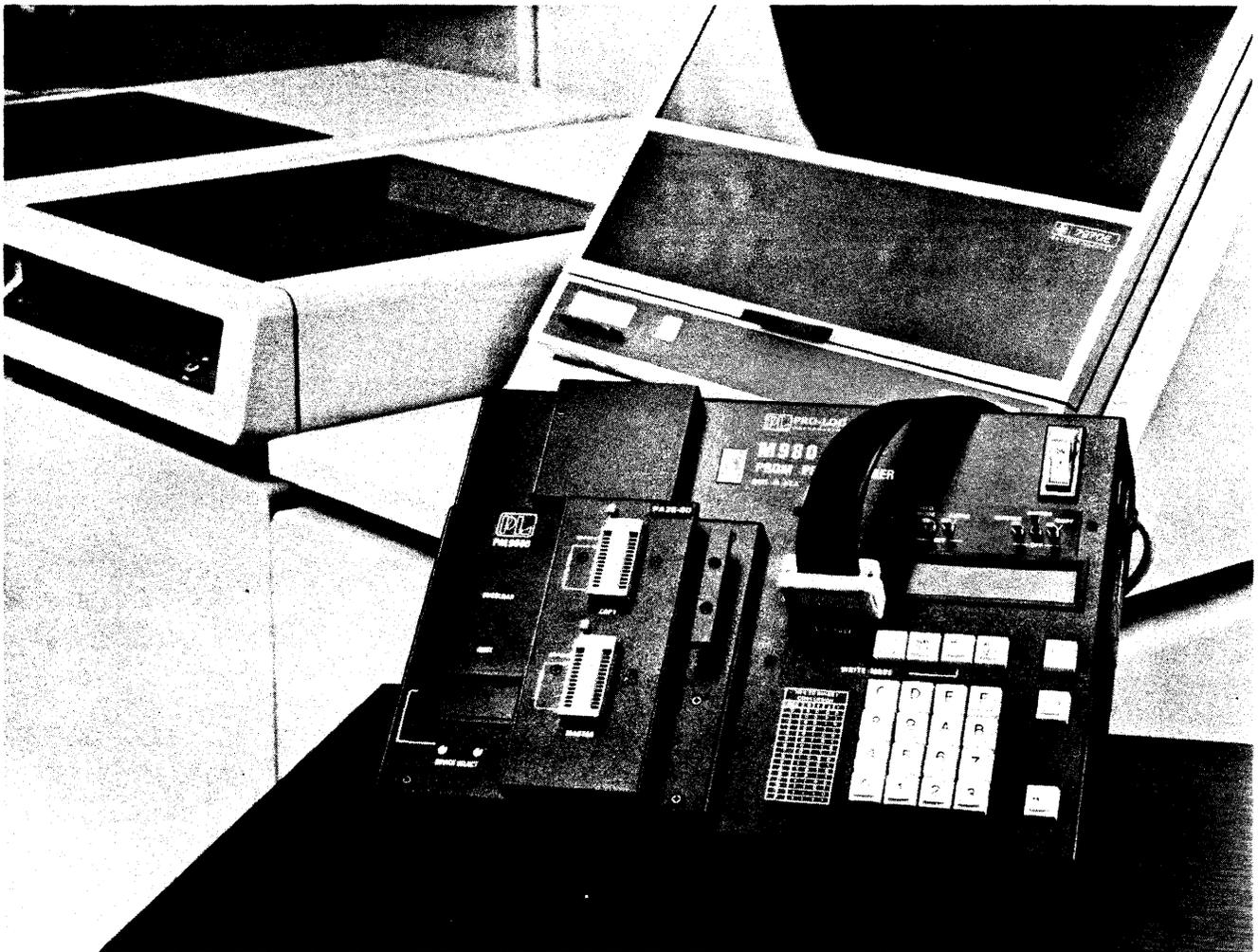
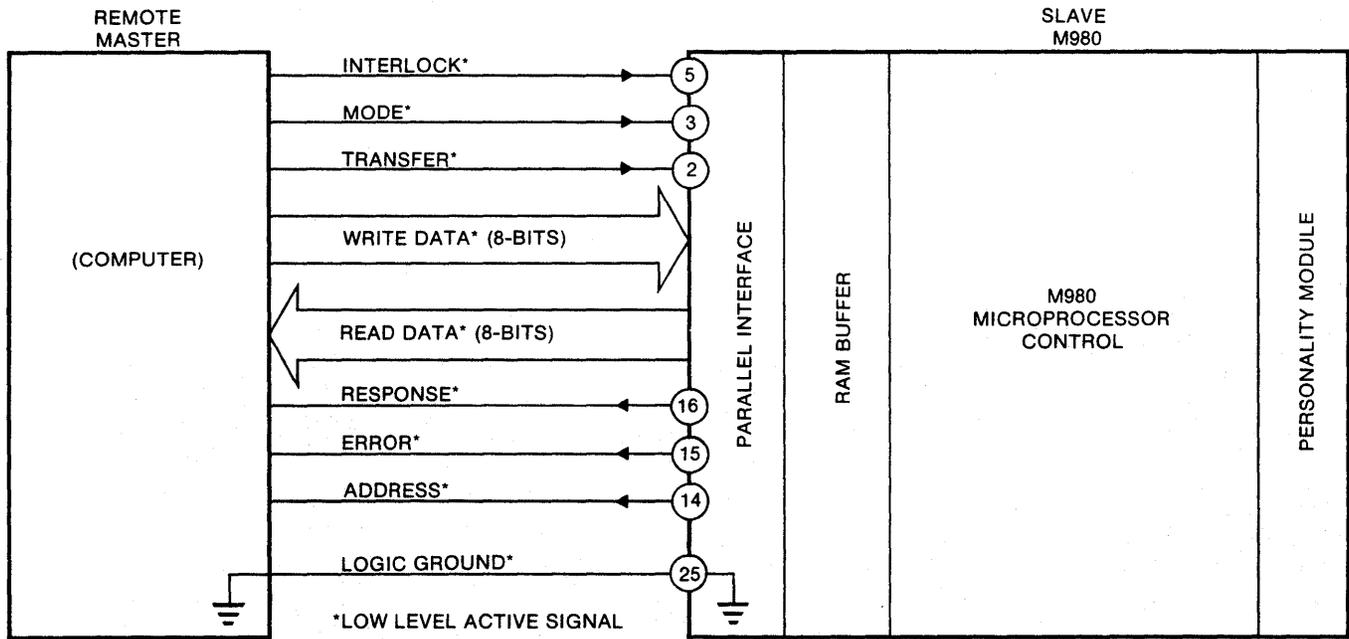


Figure 17-1. Computer Interface

9814-00, M980 Slave Unit Operation

The default format 9814-00 configures the M980 as a Slave Unit (see Figure 17-3), allowing a remote Master Controller to either write data to the M980 Buffer or read data from the M980 Buffer. This configuration puts the remote computer in command of the M980.

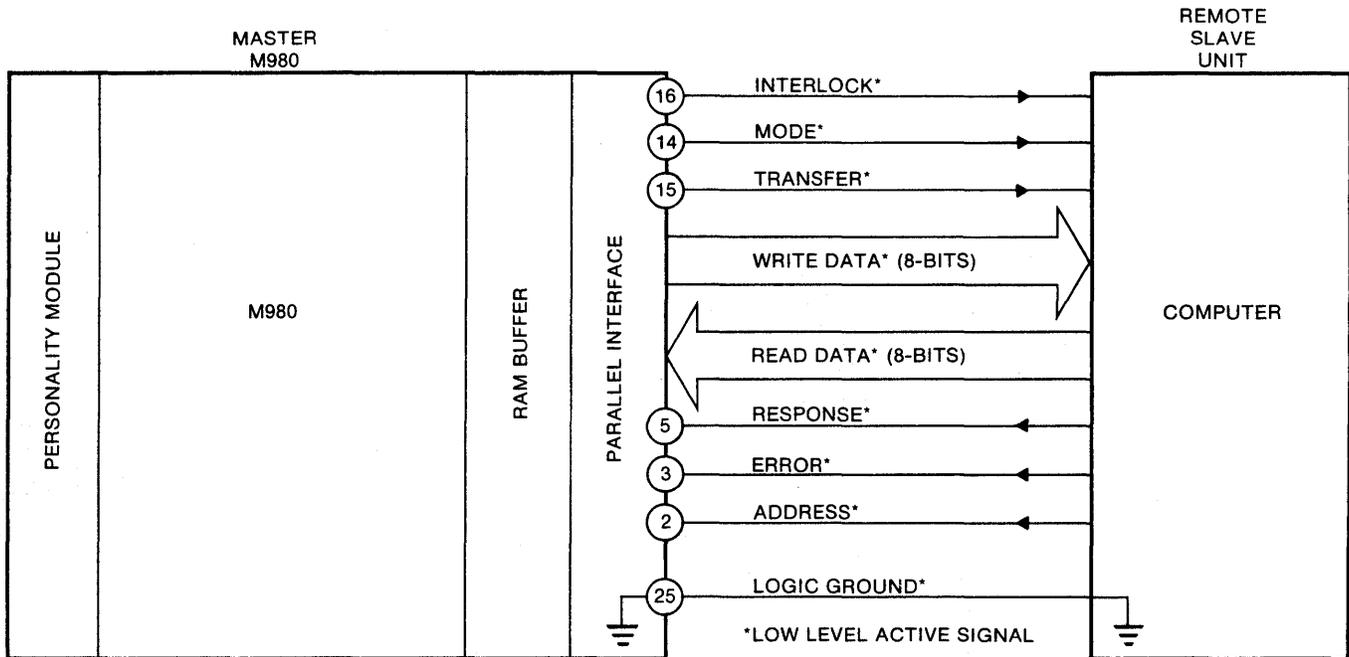


9812M980-22

Figure 17-3. M980 Configured as a Slave Unit

9814-01 and 9814-02, M980 Master Controller Operation

Master formats 9814-01 and 9814-02 allow the M980 to be configured as a Master Controller (see Figure 17-4), to send data from its Buffer to a remote Slave Unit or to receive data into its Buffer from a remote Slave Unit. This configuration puts the M980 in command of the remote computer.



9812M980-23

Figure 17-4. M980 Configured as a Master Controller

SUMMARY OF OPERATION

The Master Controller sends a Start Address and an End Address to the Slave Unit to define the field size for the M980 Buffer memory. When address field definition is completed, the Master Controller selects either the Write or Read Mode and initiates the data transfer between the M980 Buffer and the remote computer. Eight bits of data are transferred for each address location.

When the complete field of data has been transferred, the M980 Slave Unit resets to the address field definition for the next operation. The M980 Master Controller returns to select another format or repeat the same format.

Address Field Definition

The eight hexadecimal address characters needed to define the RAM Buffer Start and End Address are contained in the lower four bits of the first eight bytes sent to the control unit. The upper four bits of these first eight bytes are not used (see Figure 17-5).

NOTE

The Address and Data bytes sent to the M980 are low-level active.

M980/M900B Recognition Code ("0A")

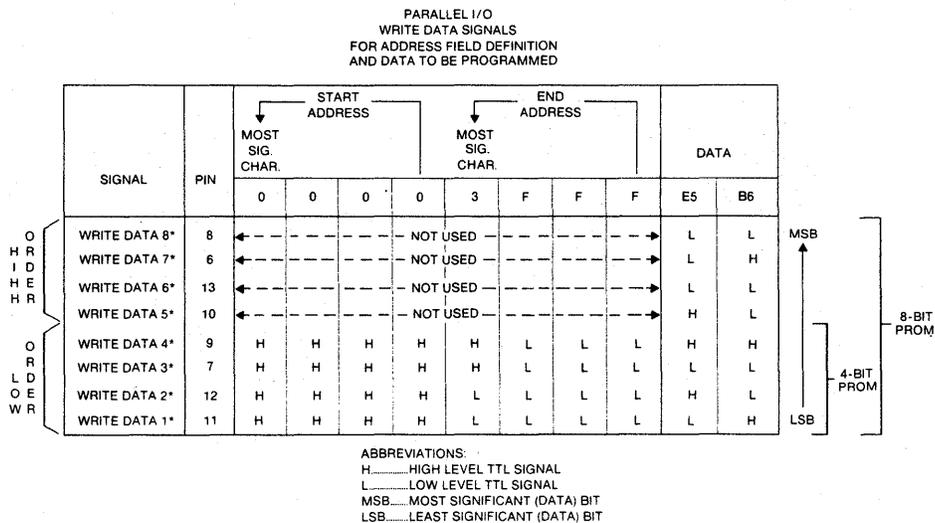
The M980 Slave Unit places an "0A" (binary 0000 1010) on the read data lines to signify that this unit is a 9814 option, as opposed to a 9114 option used on the M900B programmer.

The "0A" occurs just before Address goes low and remains during the address portion of the operation.

The M980 requires eight characters to define the address field, whereas the M900B only requires six characters. The "0A" recognition code allows the Master Controller to identify which model is connected. The recognition code can be ignored if M900B compatibility does not matter.

9814-00 Operating Procedure (M980 Slave Unit)

Connect the Master Controller to the M980 via the parallel interface connector. Depress Key 4 on the M980 keyboard. The M980 display shows "9814-00." Ensure that the Master Controller is conditioned to hold the INTERLOCK signal low. Depress the ENTER key. The display shows "A 00 AAA." If the interface connection is unsuccessful, the display shows "E5" to indicate Not Ready and you must verify that the Master Controller is holding the INTERLOCK low. The left-most display "A" indicates that the interface is looking for the controller to send a 4-digit Start Address, followed by a 4-digit End Address; this defines the Buffer address range to be operated on.



9812M980-24

Figure 17-5. Data Signals for Address Definition

The Master Controller selects either the Read Mode to read data from the Buffer, or the Write Mode to send data to the Buffer.

The display on the Slave M980 shows "1 00 AAA" to indicate that it is inputting data to the Buffer in the Write Mode. The display shows "0 00 AAA" to indicate that it is outputting data from the Buffer in the Read Mode. When the operation is completed, the display shows "1 00 F" for Write Mode Finished and "0 00 F" for Read Mode Finished.

After the M980 Slave has recognized the interface, by raising INTERLOCK the M980 displays "A 00 E5" to indicate Not Ready. By lowering INTERLOCK, the M980 returns to the address field definition phase of the operation and displays "A 00 AAA." Waveform diagrams and flow charts for the Controller are shown on the following pages (see Figures 17-8 through 17-13).

9814-01 and 9814-02 Operating Procedure (M980 Master Controller)

Connect the Slave Unit to the M980 via the parallel interface connector. Depress Key 4 on the Master keyboard. The M908 display shows "9814 00." Key in the "01" format for sending to the Slave Unit, or "02" format for receiving from the Slave Unit. Depress ENTER. At this point, the M980 Master Controller activates the INTERLOCK line. The M980 display shows the First and Last Addresses of the RAM Buffer. The desired Start and End Address of the field to be transferred can now be entered from the M980 keyboard. Depress ENTER to accept the address field. The display shows "A XX AAA," where "XX" is format "01" or "02." If the Slave Unit is ready, the display shows "0 01 AAA" for data output to the Slave, and "1 02 AAA" for data input from the Slave.

When the operation is completed, the display shows "0 01 F" for Write Mode Finished, and "1 02 F" for Read Mode Finished.

The M980 Master Controller releases the INTERLOCK after each operation.

9814—00 M980 Slave Unit Displays Messages		
9814	00	Slave Unit selected.
00	E5	Slave Unit finds INTERLOCK not ready. Reselect option.
A 00	E5	Slave Unit reset by INTERLOCK. Normal waiting state. Slave Unit waiting for INTERLOCK.
A 00	AAA	Slave Unit ready to receive address from Master Controller.
1 00	AAA	Slave Unit receiving data.
0 00	AAA	Slave Unit sending data.
A 00	E3	Mode line error during address field definition. Reselect option.

9814—01 M980 Master Controller Display Messages (Write)		
9814	01	Master Controller Selected (Write).
A 01	AAA	Master Controller waiting for Slave Unit to accept address.
A 01	E3	Master Controller senses incorrect Address or Error line from Slave Unit.
0 01	AAA	Master Controller sending data.
0 01	F	Write operation completed.
0 01	E1	Master Controller senses Error line during data transfer.

9814—02 M980 Master Controller Display Messages (Read)		
9814	02	Master Controller Selected (Read).
A 02	AAA	Master Controller waiting for Slave Unit to accept address.
A 02	E3	Master Controller senses incorrect address or Error line from Slave Unit.
1 02	AAA	Master Controller receiving data.
1 02	F	Read operation completed.
1 02	E1	Master Controller senses error line during data transfer.

9814 INTERFACING

The 9814 interface is a TTL signal compatible interface as defined in the connector tables of Figures 17-6 and 17-7. You must choose the correct cable connection, depending on whether the unit is to be a Master Controller or a Slave Unit.

You can make two M980s talk to each other using a cross-wired cable with each end appropriately wired. With a cross-wired cable, either of the M980s may take the role of Master Controller. Do not connect a straight-wired cable between two M980s, since it may damage the interface circuitry.

We have included signal definitions, timing diagrams, and flow-charts to assist you in designing the remote interface (see Figures 17-6 through 17-13).

SIGNAL DEFINITIONS

INTERLOCK is a signal line from the Master Controller that causes the Slave Unit to recognize the Remote interface. The Master Controller acquires control of the Slave Unit by holding INTERLOCK low, and it can then use the INTERLOCK to reset the Slave Unit to the address field definition phase of the operation if any error is detected.

MODE is a signal line from the Master Controller that indicates to the Slave Unit the direction of data transfer. It must be held low during Address field definition and in the Write Mode, and it must be held high in the Read Mode of operation.

TRANSFER is a signal line from the Master Controller which indicates to the Slave Unit that the Remote Controller is ready to effect a data transfer either to or from the Slave Unit, as indicated by the Mode line. The TRANSFER line must not change from high to low unless RESPONSE is high; it should be held low until the Master Controller detects a low RESPONSE signal. If the Master Controller is sending data to the Slave Unit, the WRITE DATA lines must be stable before TRANSFER occurs. If data is being requested by the Master Controller, the READ DATA lines should be read after the RESPONSE signal goes low and before TRANSFER is removed (high signal).

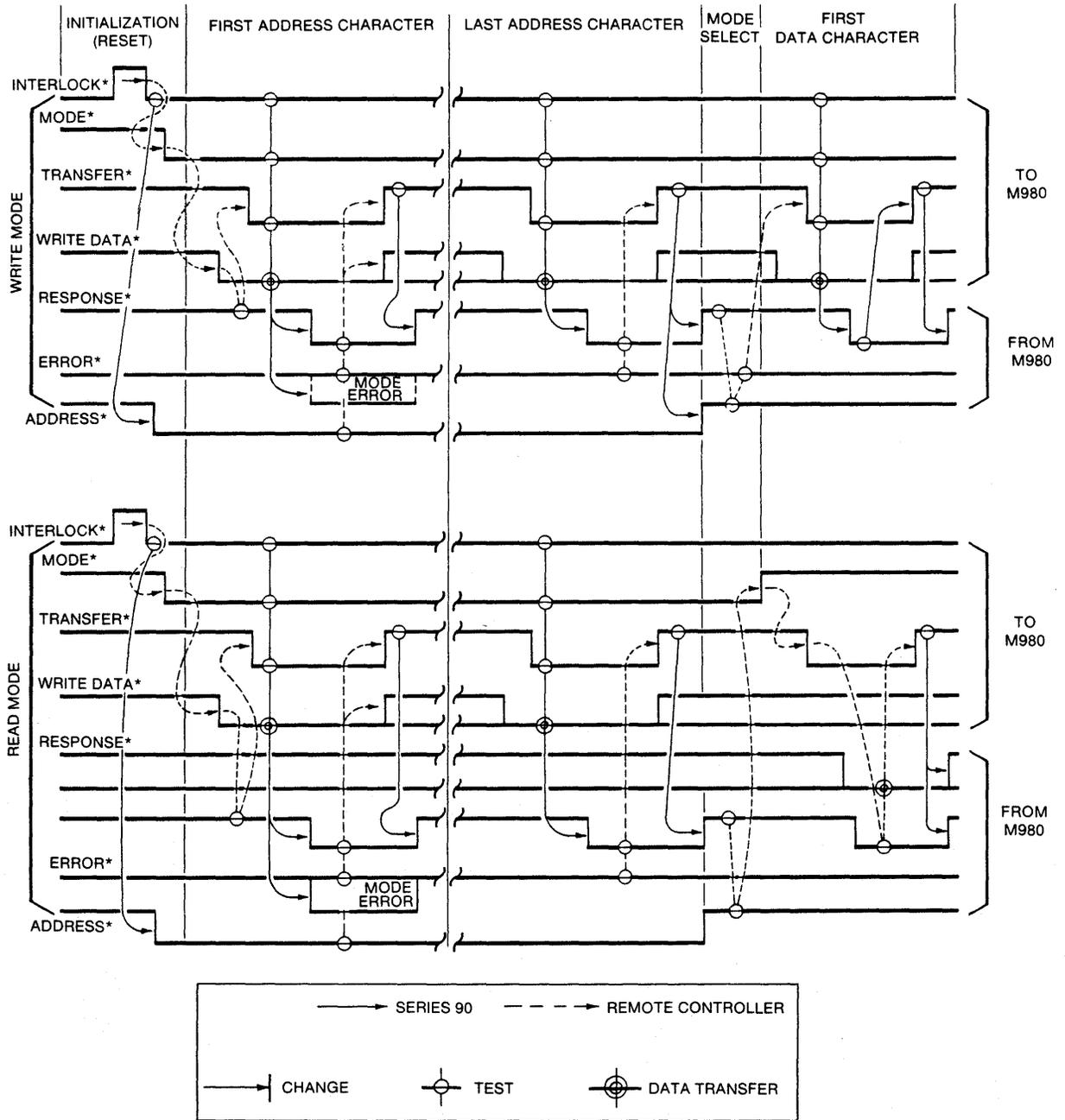
RESPONSE is a signal sent by the Slave Unit as a response to the TRANSFER line. During address field definition, it indicates that the address character has been accepted. RESPONSE remains low until the last address character has been accepted. In the Write Mode, RESPONSE indicates that data has been accepted and stored by the Slave Unit. In the Read Mode, RESPONSE indicates that data is available on the READ DATA lines.

ADDRESS is a signal sent by the Slave Unit to indicate that address field definition is required. It occurs in response to detection of the INTERLOCK signal, whenever the 9814 is selected. ADDRESS remains active until all field definition characters have been transferred to the Slave Unit. It terminates prematurely if the MODE line is in the incorrect state (high).

ERROR is a signal sent by the Slave Unit to indicate an error condition. ERROR occurs in combination with RESPONSE and ADDRESS to indicate Error Mode during address field definition. It may also occur in combination with RESPONSE, to indicate error during data transfer.

WRITE DATA consists of eight data lines from the Master Controller for transferring address information and data information to the Slave Unit. Address information is sent as a series of hex characters. The low-order data lines send the hex address characters. Data to be written is sent as binary data. All 8 data lines are used for 8-bit words and the low-order four lines are used for 4-bit data. The most significant character is sent first, when defining the address.

READ DATA consists of eight data lines to the Master Controller for transferring data from the Slave Unit. Data is sent as binary data. All eight lines are used for 8-bit words and the low-order four lines are used for 4-bit data.



9812M980-25

Figure 17-8. Data Transfer Waveforms

The following flow diagrams represent the required sequence a remote controller must use for Read and Write operations. Note: All signals are low-level active TTL signals.

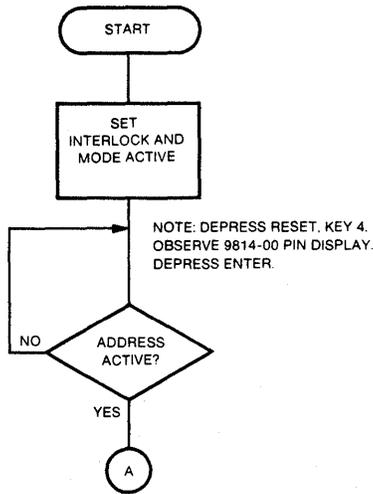


Figure 17-9. Initialization

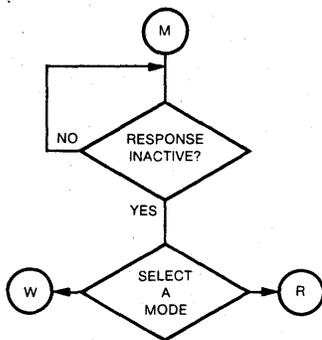


Figure 17-10. Mode Select

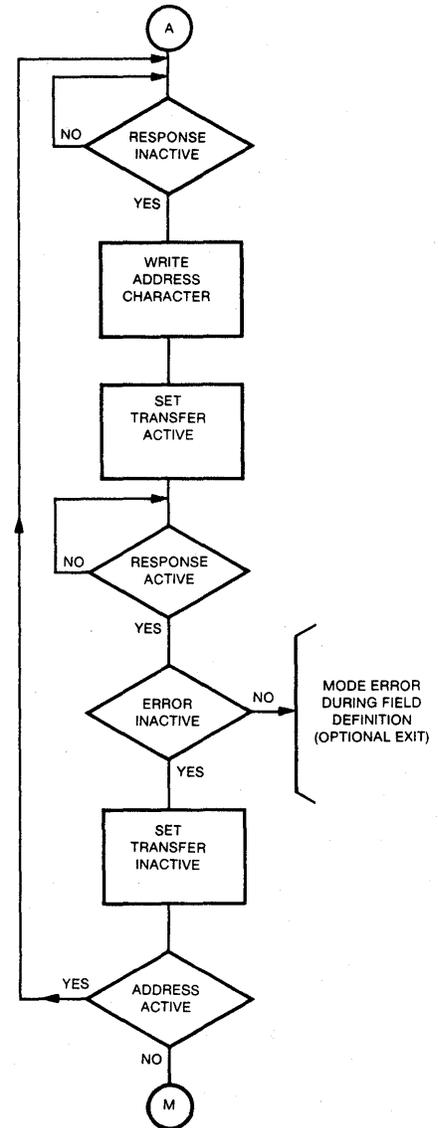


Figure 17-11. Address Definition

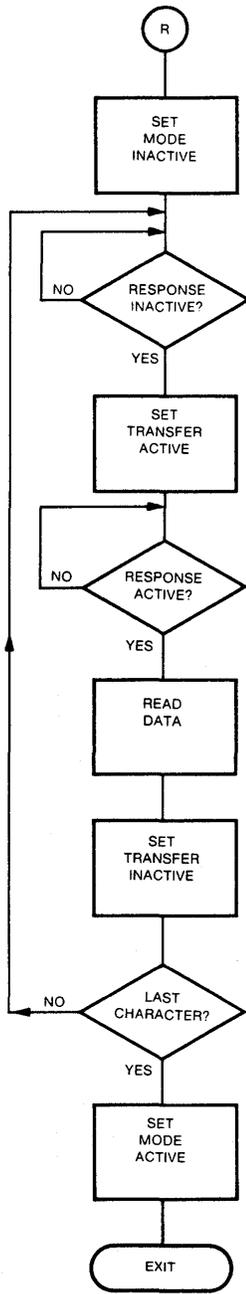


Figure 17-12. Read

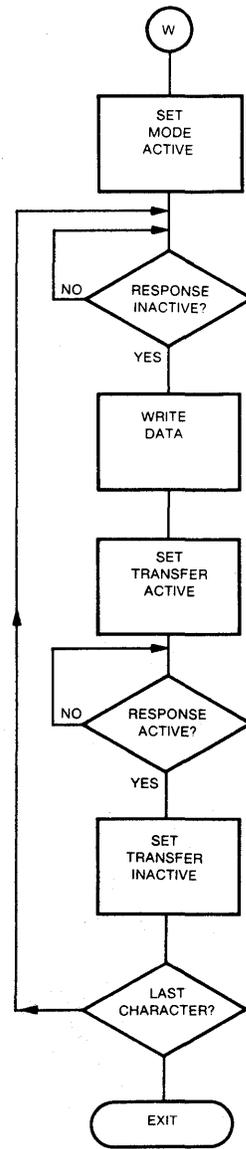


Figure 17-13. Write

9812M980-26

PIN114 (PARALLEL INTERFACE OPTION) APPLICATIONS NOTE

Description

The PIN114 supplies an 8-bit parallel interface between STD BUS Systems and Pro-Log's M980 PROM Programmer. The PIN114 provides the hardware interface that allows a bidirectional transfer of data fields between the user's STD BUS System and the PROM Programmer. Data transfer is asynchronously controlled through handshake lines.

The PIN114 is immediately operational when interconnected to the STD BUS Prototyping Systems. Software to implement the interface is resident within the Prototyping System Monitor Program and PROM Programmer. A listing of this software is also shipped with the PIN114.

The PIN114 consists of 3 separate Pro-Log products: the 7507 I/O Card, RC50-6 Ribbon Cable, and 7140 Parallel Interface Adapter (see Figures 17-14, 17-15 and 17-16).

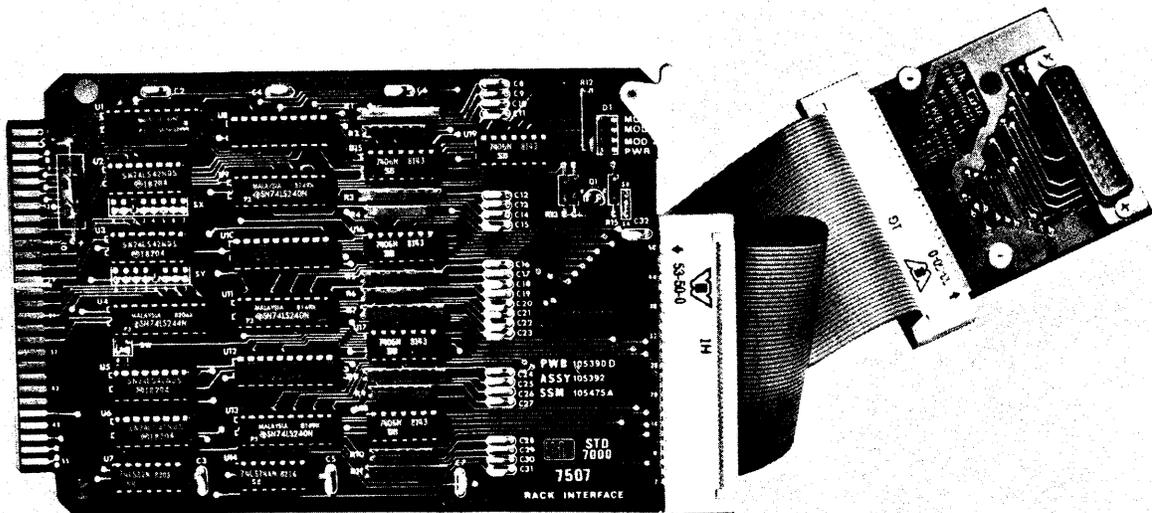
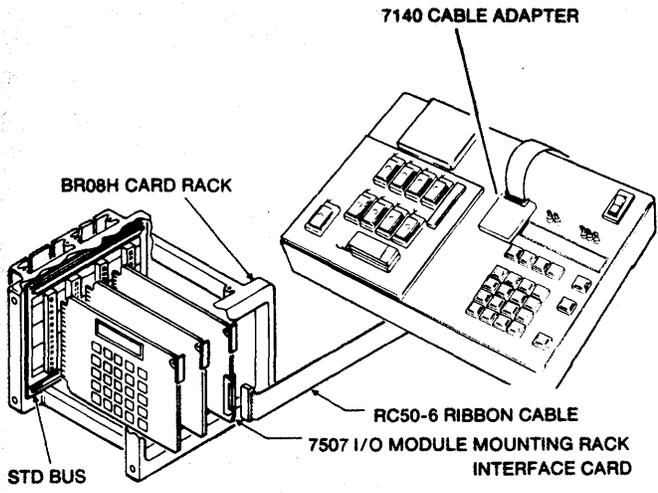
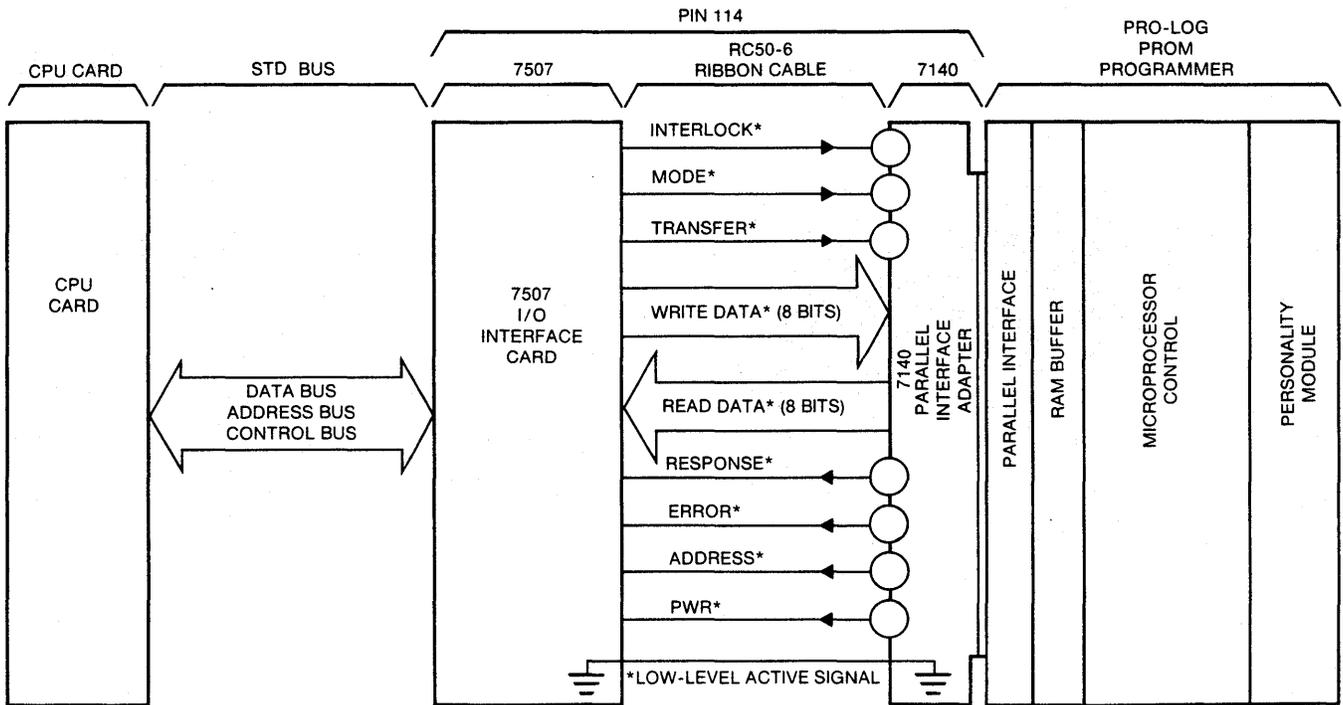


Figure 17-14. PIN 114 Parallel Interface System



9812M980-27

Figure 17-5. PIN 114 connected to a Pro-Log PROM Programmer



9812M980-28

Figure 17-16. PIN 114 System Interconnect

7140 Parallel Interface Adapter

The 7140 Adapter simply connects the proper signal lines from the RC50-6 cable to the proper pins on the programmer's 25-Pin D Connector (see Figure 17-15).

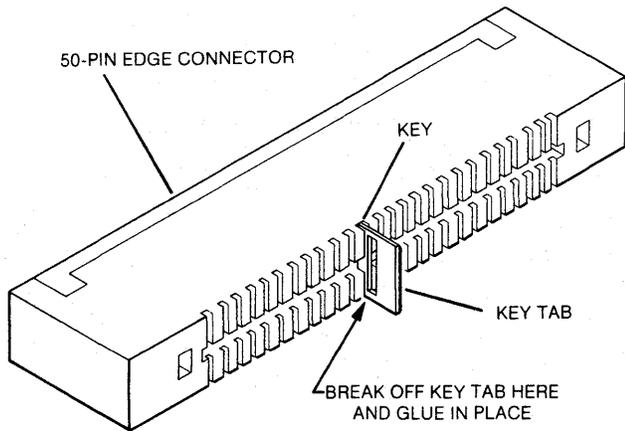
7507 I/O Card

The 7507 is an STD BUS card which is used in the PIN114 as the STD BUS interface (see Figure 17-15). For information on installation and specifications of the 7507 card, see Section 2 of the 7507 User's Manual.

RC50-6 Ribbon Cable

The RC50-6 is a six-foot-long ribbon cable with a 50-pin edge connector at each end (see Figure 17-15). This cable is used to connect the 7507 card, at the STD BUS, to the 7140 adapter at the PROM programmer. Six keys are included with RC50-6 Ribbon Cable. These keys are inserted into one of the slots on the face of the connector and the tab is then broken off. After the tab has been removed, the key should be glued into the slot if it does not fit securely.

Both the 7507 card and the 7140 adapter have key slots. These key slots are located between fingers 24 and 26 of both the 7507 and 7140. Using the RC50-6 polarizing keys insures connectors being inserted correctly. Figure 17-17 shows installation of the RC50-6 polarizing keys.



9812M980-29

Figure 17-17. RC50-6 Keying

PIN114 Bit and Port Assignments

The PIN114 uses the 7507 I/O card for all communications with the STD BUS System. Figure 17-18 is a bit map which shows the bit and port assignments for each of the interface signals.

PORT 50 ¹ —WRITE DATA							
D7	D6	D5	D4	D3	D2	D1	D0
Bit 7				Bit 0			

PORT 51 ¹ —WRITE HANDSHAKE							
T	M	I	²	PWR	A	E	R
Out				In			
Bit 7				Bit 0			

PORT 52 ¹ —READ DATA							
D7	D6	D5	D4	D3	D2	D1	D0
Bit 7				Bit 0			

BIT	SOURCE	LOGIC STATE ³
I	STD BUS System	1=INTERLOCK* Active (low voltage) 0=INTERLOCK* Inactive (high voltage)
M	STD BUS System	1=MODE* Active (low voltage) 0=MODE* Inactive (high voltage)
T	STD BUS System	1=TRANSFER* Active (low voltage) 0=TRANSFER* Inactive (high voltage)
PWR	Programmer	1=Programmer power on 0=Programmer power off
A	Programmer	1=ADDRESS* Active (low voltage) 0=ADDRESS* Inactive (high voltage) (ADDRESS* Inactive means data is present)
E	Programmer	1=ERROR* Active (low voltage) 0=ERROR* Inactive (high voltage)
R	Programmer	1=RESPONSE* Active (low voltage) 0=RESPONSE* Inactive (high voltage)

¹The 7507 is mapped to address 50-52 when shipped.
²Don't care
³Handshake lines are active low electrically, active high on the STD Data Bus or the processor's accumulator.
 *Low Level Active

Figure 17-18. PIN 114 Bit and Port Assignments

NOTE

When not used for the PROM programmer interface, the 7507 and RC50-6 can be used as an industrial I/O interface to OPTO-22, or equivalent module mounting racks, or as a general purpose TTL I/O card with 24 bit-programmable bidirectional lines.

Communications Interface M304 Adapter

JUMPER-SELECTED PARITY AND STOP BITS

In addition to the three panel switches, there are 9 user-accessible jumpers located on the top of the M304 adapter board (see Figures 18-18 and 18-19). These are provided for special configuring by the user, if needed, but should rarely be changed. To change a jumper, unscrew the three mounting screws and remove the cover of the M304; the jumpers that are in place are unsoldered and can be removed or clipped with side cutters. To install a new jumper, solder short pieces of insulated wire in place. A functional description of each jumper follows (see Figure 18-14).

The M304 character format as shipped from Pro-Log is shown in Figure 18-13. Even parity is generated and sent. However, on Receive, parity is not used but must be sent (either odd, even, or fixed) to provide the proper timing for the stop-bit position.

Even Parity Enable (EPE) — Selects whether even or odd parity is generated. The M304 is shipped in the even parity enable position. To select odd parity, remove jumper between E19, E20, and install between E20, E21. Parity is not used by the M980 when receiving. However, it must be sent either ODD, EVEN, or fixed.

Stop-Bit Select (SBS) — Selects whether there are one or two stop bits sent or required when receiving. The M304 is shipped in the one-stop-bit mode. To select two stop bits, remove the jumper between E17, E16, and install a jumper between E17, E18. When transmitting to the M980, the stop bit can be of any length, provided that it is a minimum length of one bit in the one's position, and two bits in the two's position.

Parity (P1) — Selects whether parity is generated or not. The M304 is shipped in the parity enable mode. To inhibit parity generation, remove jumper between E14, E15, and install between E14, E13.

By selecting jumper positions, the following character variations are possible (see Figure 18-14).

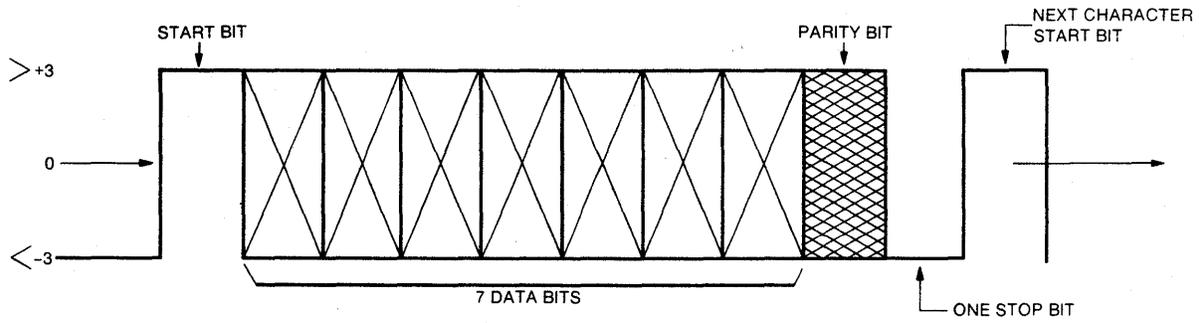
1. One start bit, seven data bits, one stop bit (E16, E17) (E14, E13).
2. One start bit, seven data bits, two stop bits (E17, E18) (E14, E13).
3. One start bit, seven data bits, one stop bit, even parity, (E20, E19) (E17, E16) (E14, E15).
4. One start bit, seven data bits, two stop bits, even parity, (E17, E18) (E20, E19) (E14, E15).
5. One start bit, seven data bits, one stop bit, odd parity (E16, E17) (E14, E15) (E20, E21).
6. One start bit, seven data bits, two stop bits, odd parity (E17, E18) (E14, E15) (E21, E20).

Please refer to Figure 18-14 for M304 jumper locations.

(E12-E11) (E10-E9): These jumpers affect the Request To Send (RTS) line. The M304 is shipped with this line forced high by direct connection to +5V through a resistor. This line is not used by the M980. However, most modems require this line to be high to allow the modems to transmit. If this line is required, by protocol or other requirements, to be directly connected from the modem through to the terminal, remove jumper between E11, E12 and install between E10, E9.

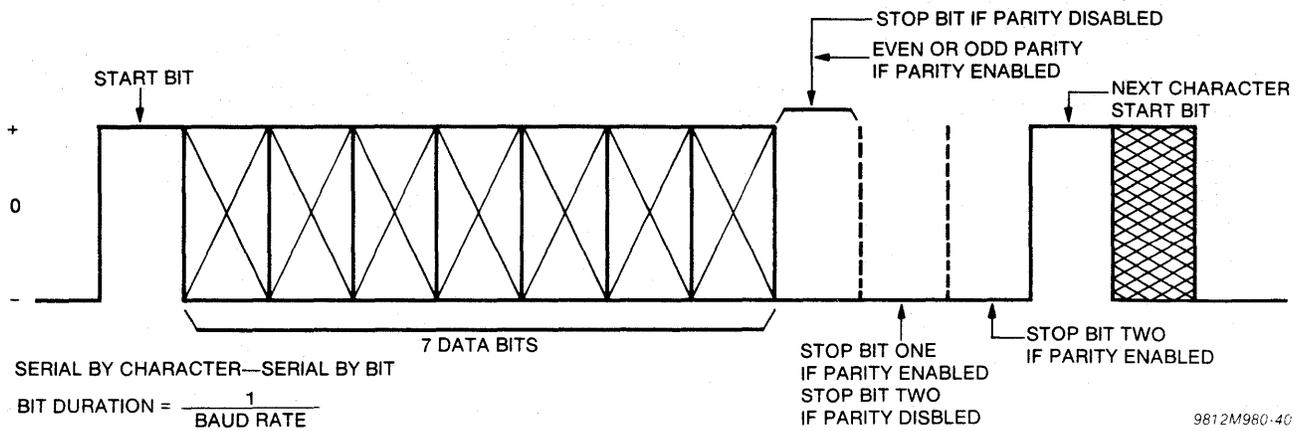
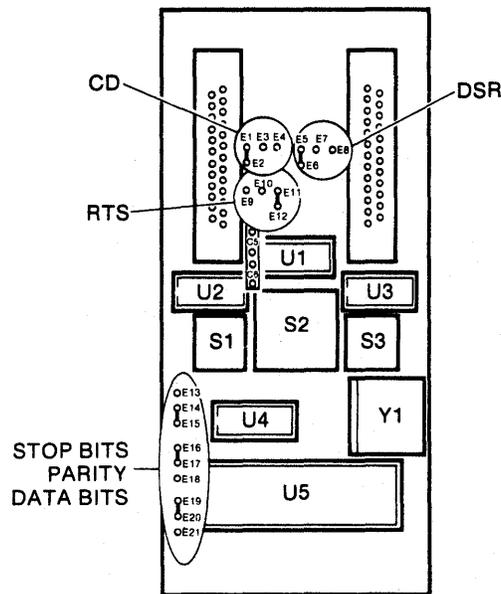
(E1-E2) (E3-E4): These jumpers affect the Carrier Detect (CD) line. The M304 is shipped with this line forced high by direct connection to +5V through a resistor. This line is not used by the M980. However, some terminals may require this line to be high for operation. If this line is required, by protocol or other requirements, to be directly connected from the modem through to the terminal, remove jumper between E1, E2 and install between E3, E4.

(E5-E6) (E7-E8): These jumpers affect the Data Set Ready (DSR) line. The M304 is shipped with this line forced high by direct connection to +5V through a resistor. This line is not used by the M980. However, some terminals may require this line to be high for operation. If this line is required, by protocol or other requirements, to be directly connected from the modem through to the terminal, remove jumper between E5, E6 and install between E7, E8.



9812M980-39

Figure 18-13. Character Format



9812M980-40

Figure 18-14. Jumper Locations and Character Variations Using Jumper

Signal Discipline

The RS-232-C signals (see Figure 18-15) that are provided by the M304 are used by the M980 as follows:

TRANSMIT DATA is used by the terminal to send address, control and data characters to the M980 and/or modem. It is also used by the M980 to send data to the modem.

RECEIVE DATA is used by the M980 to send control and data characters to the terminal. It is also used by the modem to send data to the terminal and M980.

REQUEST TO SEND is held high by the M304 for the modem if required, or can be connected by jumper through to the terminal.

CLEAR TO SEND is used by the M980 to indicate to the terminal it is ready to receive characters. This line is used to indicate the M980 is in the Receive Mode. CTS is also used by the modem.

DATA TERMINAL READY is used by the M980 to determine that the interface is connected and ready to operate. This line should be held continuously high. Operation with the M980 can be aborted by dropping this signal low.

CARRIER DETECT is not used, but is held high by the M304 or can be connected by jumper through to the terminal.

DATA SET READY is not used, but is held high by the M304 or can be connected by jumper through the modem.

ELECTRICAL SPECIFICATIONS

The M304 is designed to work with a high input level of from +3V to +25V and a low input of from -3V to -25V. The output levels of the M304 are approximately +4V for high-level and -4V for low-level. The signals used and the pin assignments for the terminal and modem connectors may be found in the Signal Discipline Section. Signal lines not listed are wired directly from the terminal connector to the modem connector by the M304 adapter (see Figures 18-19 and 18-20).

The M304 provides connection for one modem and connection for one terminal, along with the following Baud rates: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800, 9600.

MECHANICAL SPECIFICATIONS

- Height: Approx. 1 inch
- Length: 6 inches
- Width: 3.1 inches

ENVIRONMENTAL SPECIFICATIONS

- Temperature: Operating: 0°C to +50°C
- Storage: -20°C to +60°C

M304 ADAPTER RS232C INTERFACE CONNECTORS			
PIN NUMBER		PIN NUMBER	
SIGNAL			SIGNAL
	1	14	
TRANSMIT DATA*	2	15	
RECEIVE DATA*	3	16	
REQUEST TO SEND	4	17	
CLEAR TO SEND	5	18	
DATA SET READY	6	19	
SIGNAL GROUND	7	20	DATA TERMINAL RDY
CARRIER DETECT	8	21	
	9	22	
	10	23	
	11	24	
	12	25	
	13		

*Designates Low-Level Logic

Figure 18-15. Signal Discipline

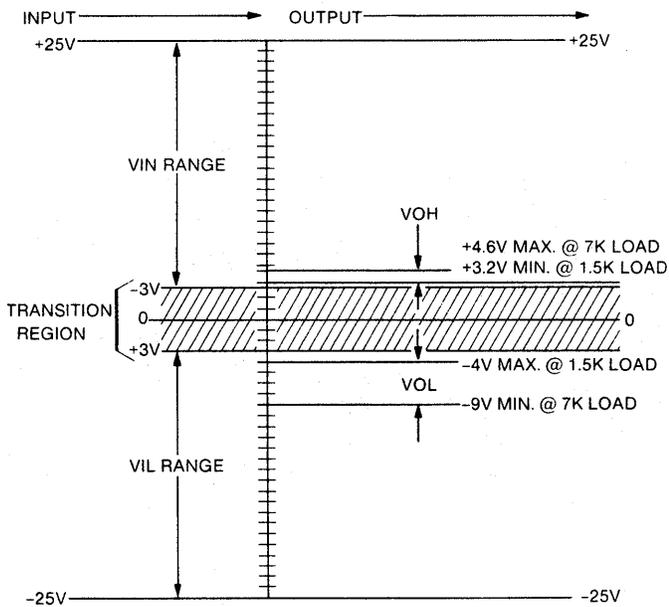
M304 Adapter

PARAMETER		MIN	MAX	UNITS
VOH	High-level output voltage ¹	+3	4.6	V
VOL	Low-level output voltage ¹	-6.6	-3	V
IOS	Output short circuit current, output connected to $\pm 12V$ (duration 1 second max.)		80	mA
CL	Output load capacitance ²		2500	pF
Tr Tf	Output rate of change		30	V/ μ s
VIH	Input high-level voltage	+3	+25	V
VIL	Input low-level voltage	-3	-25	V
IIH	Input high-level current	+0.5	+8.5	mA
IIL	Input low-level current	-0.5	-8.5	mA
EL	Output termination bias	-2.0	+2.0	V
	BAUD rate (bits/second)	50	9600	baud
	Recommended cable length		50 16	feet meters
VO	Driver open circuit output voltage	-12	+5	V
RO	Driver output resistance, power off	300		ohms
RL	Input load resistance	3K	7K	ohms

¹Minimum load resistance 3K ohms

²Includes cable and terminator capacitance

Figure 18-16. Terminal/Modem/I/O Specifications



9812M980-41

Figure 18-17. M304 I/O Specification

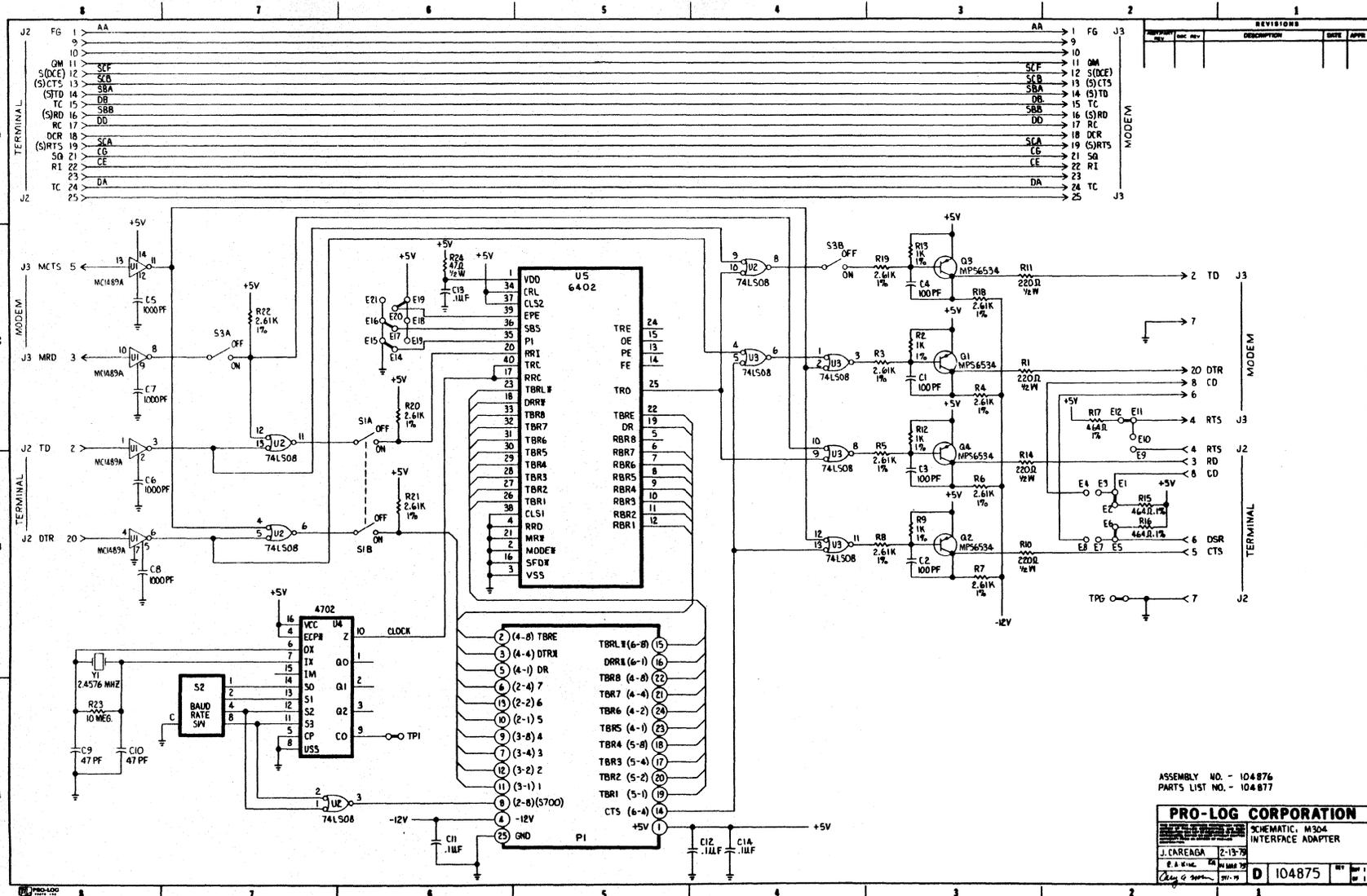


Figure 18-18. M304 Schematic

ASSEMBLY NO. - 104876
PARTS LIST NO. - 104877

PRO-LOG CORPORATION	
J. CAREAGA	2-15-76
E. A. WILSON	2-15-76
Chay & ...	2-15-76
D	104875

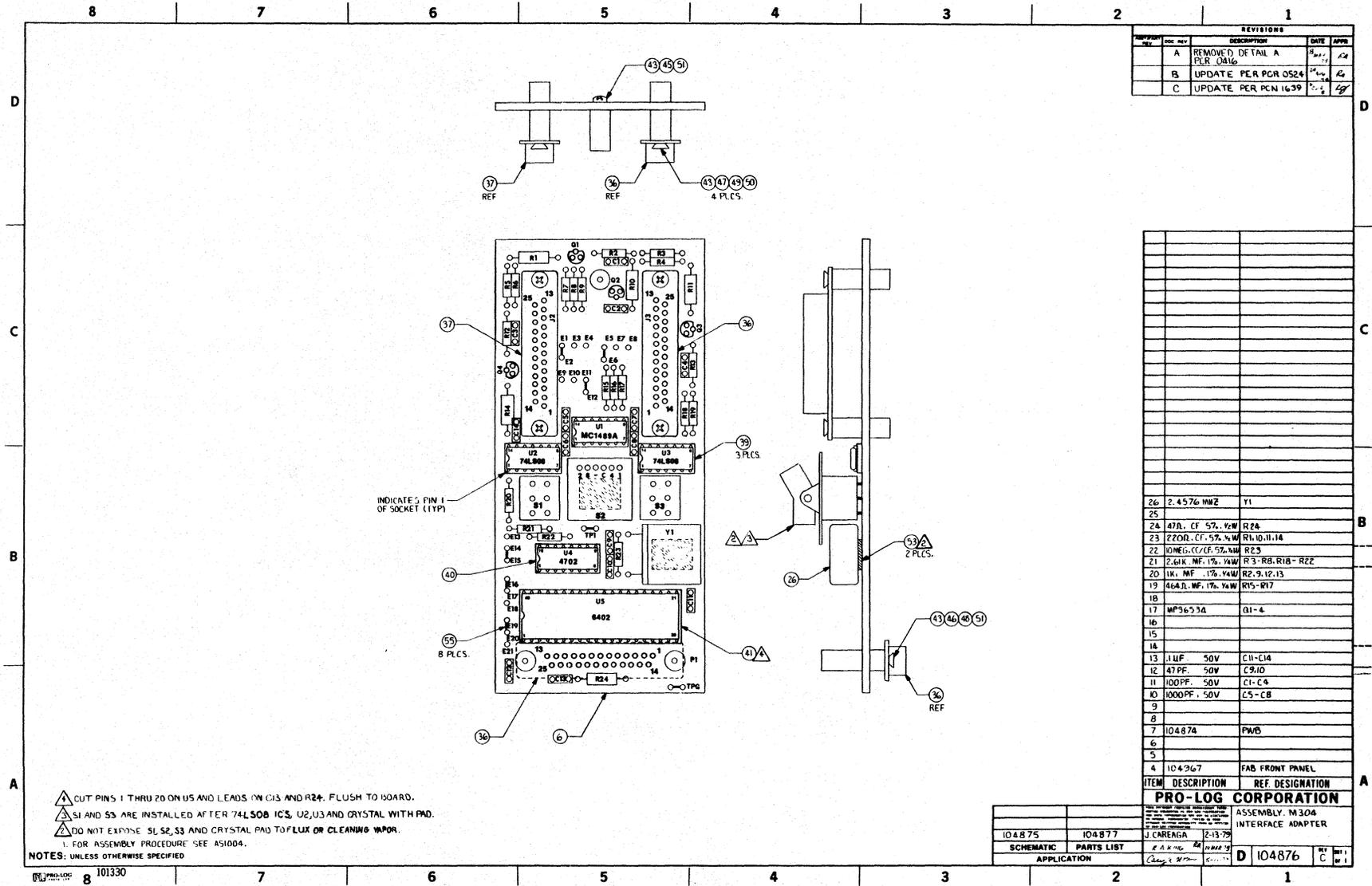


Figure 18-19. M304 Assembly

SECTION 19

9103A UV Erase Light

DESCRIPTION

Model 9103A is an ultraviolet erase lamp designed to accommodate a quantity of UV Eraseable PROMS. The unit consists of dual high-intensity UV lamps mounted in an enclosed case with hinged lid and safety interlock, a presettable 0-60 minute timer, ON and OFF controls, and AC power connector.

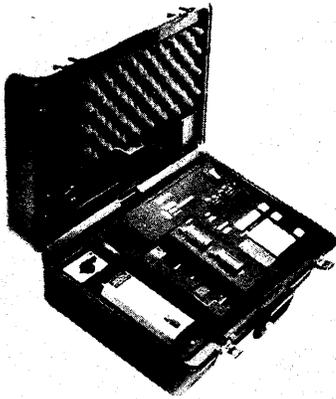


Figure 19-1. 9103A
(Mounted in the M980 Programmer Case)

PHYSICAL CHARACTERISTICS

- Housed in an 11.5-in. (29.2 cm.) by 3.5-in. (8.9 cm.) by 4 in. (10.2 cm.) aluminum case.
- Weight: 2.5 pounds
- Conductive foam pad for EPROMs is 3.5 in. (8.9 cm.) by 2.5 in. (6.4 cm.) and accepts up to 10 24-pin dual-in-line packages or equivalent.

CONTROLS

- **TIMER SET** is a rotary control at the top rear of the unit that adjusts the UV lamp on-time from 0-60 minutes. The control is continuously variable with dial markings in 15-minute increments. Timer set can be adjusted during operation to lengthen or terminate erasure. Lamp power is removed when the control reaches zero.

The Model 9103A is designed as an accessory to the Series 90 PROM Programmer attache case; the 9103A-1 is a stand-alone erase light unit with a 6-foot power line cord, and the 9103A-2 is a stand-alone erase light unit with a 6-foot power line cord for 230V.

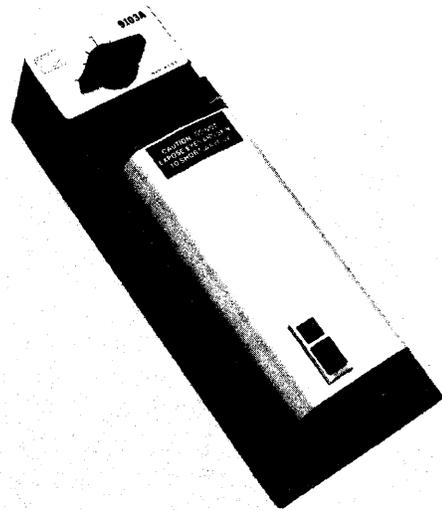


Figure 19-2. 9103A UV Erase Light

- **LAMP ON/OFF:** LAMP ON (black push button) starts the UV lamp, only if the timer has been set to the desired erase time first (see table). LAMP OFF (red push button) can be used to remove lamp power.
- **SAFETY INTERLOCK** is an internal switch that removes lamp power when the chamber lid is raised. The lamp must be restarted using LAMP ON after reclosing the lid.

OPERATING INSTRUCTIONS

1. Proper PROM erasure is the result of timed exposure to a UV light source of critical wavelength and intensity (see Figure 19-3).

2. PROMs that are inadequately erased retain partial changes that may affect the data pattern later. The condition of inadequate erasure is often not detectable when the PROM is reprogrammed.
3. Use the Recommended Erase Time shown below as a minimum timer setting for your PROM type.
4. In order to ensure compliance with the conditions required for the recommended erase times, the following placement procedure should be used:
 - a. A $\frac{3}{8}$ " thick loose pad (supplied) is placed on top of the fixed pad in the 9103A and centered.
 - b. Ensure PROM windows are free of labels and are clean.
 - c. PROMs to be erased (with or without a carrier socket) are placed on the loose pad but not pressed into it. This gives the proper clearance from the erasing tubes (within $\frac{1}{2}$ ").
 - d. The PROM window must be up and directly on the centerline of one of the erasing tubes. Lines have been printed on the loose pad to show the position and extent of proper placement for the window. Try not to go beyond these lines.
 - e. Up to 10 24-pin or 28-pin PROMs can be erased using the arrangement shown in Figure 19-3.
5. Close the lid, set the timer, and hold the LAMP ON button down until a blue glow is observed through the view hole near the lid knob. Unit operation will then be automatically terminated by the timer.
6. If the lid is raised before the timer stops the 9103A, LAMP ON must be used to restart the lamp. Readjust timer setting if necessary.
7. Replace the UV lamp yearly with normal use to maintain recommended erase time, or test the lamp with a UV intensity meter such as the Spectronics DM-245N, or equivalent*. Alternately, the erase times can be proportionately lengthened to accommodate the reduced intensity.

*Minimum reading: 6750 $\mu\text{W}/\text{cm}^2$, measured with the sensor on axis, in the center of the tube, $\frac{1}{8}$ " from the tube body to sensor body, 100 seconds from cold start.

LAMP CHARACTERISTICS

- Unfiltered short wave ultraviolet light
- $\lambda=254$ nanometers (2540 Angstroms)
- Lamp type: UVS-11 or Spectronics 2537S

POWER REQUIREMENTS

115 VAC, 60 Hz, 0.20 ampere

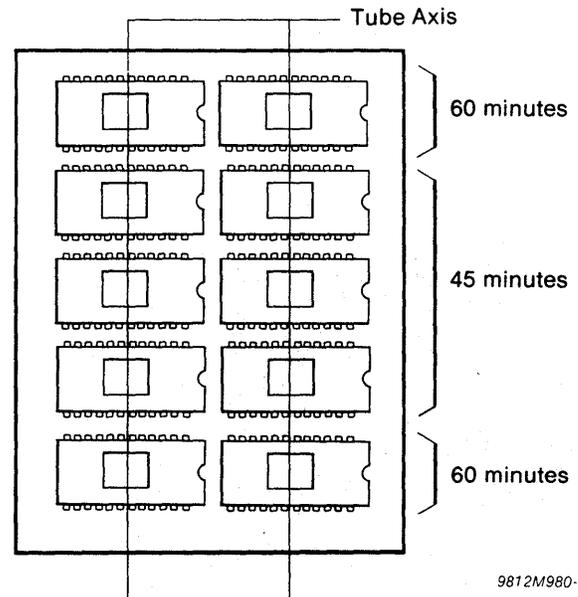


Figure 19-3. Recommended PROM Arrangement and Erase Times**

****ASSUMPTIONS:**

1. Average irradiation in the first one hour after turn on is 85% of the reading after 100 seconds.
2. Degradation of 25% is allowed after 6-700 hours of usage.
3. PROM erasure requires at least 15 W/sec.
4. PROM die is no more than $\frac{1}{2}$ " from erase tube surface.

CAUTION

Ultraviolet light is harmful to eyes and other tissue. Do not defeat the purpose of the 9103A lid interlock or operate unit if the interlock is defective.

ASCII Code Assignments

HEX	MSD				p=1	8	9	A	B	C	D	E	F
					p=0	0	1	2	3	4	5	6	7
LSD	BITS				b8	p	p	p	p	p	p	p	p
					b7	0	0	0	0	1	1	1	1
					b6	0	0	1	1	0	0	1	1
	b4	b3	b2	b5	b1	0	1	0	1	0	1	0	1
	0	0	0	0	0	NUL	DLE	SP	0	@	P	'	p
1	0	0	0	1	SOH	DC1	!	1	A	Q	a	q	
2	0	0	1	0	STX	DC2	▼	2	B	R	b	r	
3	0	0	1	1	ETX	DC3	#	3	C	S	c	s	
4	0	1	0	0	EOT	DC4	\$	4	D	T	d	t	
5	0	1	0	1	ENQ	NAK	%	5	E	U	e	u	
6	0	1	1	0	ACK	SYN	&	6	F	V	f	v	
7	0	1	1	1	BEL	ETB	,	7	G	W	g	w	
8	1	0	0	0	BS	CAN	(	8	H	X	h	x
9	1	0	0	1	HT	EM	)	9	I	Y	i	y
A	1	0	1	0	LF	SUB	*	:	J	Z	j	z	
B	1	0	1	1	VT	ESC	+	;	K	[	k	{
C	1	1	0	0	FF	FS	,	<	L	\	l	|	
D	1	1	0	1	CR	GS	—	=	M	]	m	}
E	1	1	1	0	SO	RS	▪	>	N	^	n	~	
F	1	1	1	1	SI	US	/	?	O	—	o	DEL	

CONTROL CHARACTERS

NUL	Null	FF	Form Feed	CAN	Cancel
SOH	Start of Heading	CR	Carriage Return	EM	End of Medium
STX	Start of Text	SO	Shift Out	SUB	Substitute
ETX	End of Text	SI	Shift In	ESC	Escape
EOT	End of Transmission	DLE	Data Link Escape	FS	File Separator
ENQ	Enquiry	DC1	Device Control 1	GS	Group Separator
ACK	Acknowledge	DC2	Device Control 2	RS	Record Separator
BEL	Bell (audible or attention signal)	DC3	Device Control 3	US	Unit Separator
BS	Backspace	DC4	Device Control 4 (Stop)	DEL	Delete
HT	Horizontal Tabulation (punched card skip)	NAK	Negative Acknowledge		
LF	Line Feed	SYN	Synchronous Idle		
VT	Vertical Tabulation	ETB	End of Transmission Block		

Error Indications

CODE	EXPLANATION
E0	Set-up error. The Source, Destination, or MFG toggle switches are not in the proper position, e.g. a non-valid operation such as program MASTER.
E1	Data error. A failure to Blank Check, Program, Compare.
E2	No option. Option selected does not exist.
E3	Address error. Performing an operation and the address given cannot be complied with. Example: Duplicate Master to Buffer. If you try to move a 2K program into the last 1K of Buffer, this error indication will appear prior to attempting the operation.
E4	No Personality Module. A Personality Module is not installed. Buffer operation may continue.
E5	Option Interface not ready. Option selected, but when checked, the interface is not properly hooked up. Example: 9818 RS-232-C adapter installed but ON-LINE/OFF-LINE switch is in the OFF-LINE position.
E6	Communication CHECKSUM error. When using one of the interfaces in which the checksum of each line is sent over the interface and the checksum does not match, this error will be displayed. An example: Intel Format RS-232-C.
E7	Remote control error indication: Response to the QXN command.
E8	Personality Module Overload Failure (see individual operating instruction).
E9	Invalid Buffer Data during PM9080 update.
EA	Programming Error in updating PM9080 PROMs.

Fold

Fold

PLACE
POSTAGE
HERE



PRO-LOG[®]
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