HP 12909B
pROM WRITER DIAGNOSTIC

reference manual

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SECTION I
Introduction

The HP 12909B pROM Writer Diagnostic verifies proper operation of the HP 12909B pROM Writer Interface Kit. It is one of the HP 2100 Computer system diagnostics executed in conjunction with the HP 2100 Series Diagnostic Configurator. Test sequence and test failure reporting to the operator is provided through a teleprinter (if available) and through the computer memory data register (sometimes referred to as the MDR or T-register). Operator input is required via the switch register for test options.

1-1. GENERAL ENVIRONMENT

The general hardware/software environments and system configuration procedures are described in the *HP 2100 Series Diagnostic Configurator* manual, part no. 02100-90157.

1-2. Hardware Requirement

The required hardware consists of the following:

a. An HP 2100 Computer with a minimum of 4K of memory.

b. A paper tape reader to load the program only; the teleprinter paper tape reader can be used.

c. An HP 12909B pROM Writer Interface Kit and test pROM.

d. A system console teleprinter as a recommended option.

1-3. Software Requirement

The required software consists of the following binary object tapes:

a. HP 2100 Series Diagnostic Configurator (HP product no. 24296).

b. This diagnostic, part no. 24360-16001.

Loading is performed using the Binary Loader. Refer to the appropriate *Front Panel Procedures* manual of the computer being used to use the Binary Loader. The loader is described in the HP manual *Basic Binary Loader — Basic Binary Disc Loader — Basic Moving Head Disc Loader* (part no. 5951-1376).

SECTION II
Operating Procedures

The operating procedures section is divided into three parts: (a) preparation for diagnostic run, (b) running the diagnostic, and (c) diagnostic messages and halts.

2-1. PREPARATION FOR DIAGNOSTIC RUN

Before the tests can be initiated, the user performs the following actions:

- Load the Diagnostic Configurator
- Configure to available system hardware
- Load the diagnostic
- Ready the pROM Writer

2-2. Loading

Using the Binary Loader, load the Diagnostic Configurator. Perform the configuration procedure (see "Configuring" below) before loading the diagnostic. Then load the HP 12909B pROM Writer Diagnostic, using the Binary Loader. The user may verify that the proper diagnostic is loaded by checking memory location 126_8 for the Diagnostic Serial Number = 103005.

2-3. Configuring

Procedures for inputting the system hardware configuration parameters are found in the Diagnostic Configurator manual under "Configuring." At the back of the same manual is a PRODUCT APPLICABILITY sheet, which describes which computers are compatible with this diagnostic.

The configuration procedure accepts six groups of parameters. This diagnostic requires four groups to be defined. They are

- Computer type and options
- Teleprinter as optional system Input B (Slow Input) device
- Teleprinter as optional system Output B (Slow Output) device
- Tape reader as optional system Input A (Fast Input) device (if functions 4 or 12 of table 2-1 are used).

Enter zero or Teleprinter SC (Select Code) for the other two parameters.

Computer Type and Options vary with each installation. The user must determine the parameters of his installation and configure accordingly. A teleprinter is recommended for configuration as *System Input B Device* and *System Output B Device.* The teleprinter serves as the operator/diagnostic communicator. If no teleprinter is available, only the computer type is required. The user must then rely on HALT codes and the switch register to monitor and control test sequence and determine the degree of test success.

2-4. Dumping

Using procedures described in the Diagnostic Configurator manual, the user may dump memory onto paper tape so that the above configuration procedures need not be repeated. The dumped paper tape holding the configured diagnostic can thereafter be loaded via the Binary Loader.

2-5. Readying the pROM Writer

Verify that the proper jumpers are installed on the interface PCA that pertain to a specific type pROM.

2-6. RUNNING THE DIAGNOSTIC

The switch register is first used to specify the select code of the pROM writer being tested. This is set up before execution is initiated. At the first HALT after execution is initiated, the switch register is set up to hold program options. Table 2-1 has a summary of switch register options which are entered after the initial HALT. After options have been entered, the program requests timing parameters for testing the pROM. The program is then executed to the end of the test sequence.

Table 2-1. Switch Register Options

BIT	FUNCTION IF SET
0	Initialization section is restarted (102066_8)
1	Address/data input test (ADTST)
2	Scope loop test (SLTST)
3	Burn pROM test (BPTST)
4	Load pROM pattern tape (LOADT)
5	Verify blank chip (VFYB)
6	Burn pROM (BRNP) to pattern loaded in 4
7	Verify burned pROM (VFYP)
8	*Read one location (RDLOC)
9	*Burn one location (BNLOC)
10	*Dump pROM contents to console (DPPC)
11	Copy pROM contents into buffer (CPPR)
12	Tape loader enable (applies to SWR option 1,3)
13	Suppress all message printout
14	Suppress non-error messages
15	Current test will exit to control program selection (102077_8)

*Teleprinter required to use these functions.

2-7. Operation with Teleprinter or Console Device

The following steps are used when a system has a teleprinter or some type of console device:

a. Load Diagnostic Configurator using BL.

b. Configure using Diagnostic Configurator. Refer to Diagnostic Configurator manual for configuration procedure.

c. Load 12909B Diagnostic using BL.

d. Set P-register to 100_8 (starting address).

e. Load switch register, bits 0 to 5, with the Select Code (SC) of 12909B pROM Writer to be tested.

f. Press PRESET (INTERNAL and EXTERNAL).

g. Press RUN.

Result: HALT

- MDR= 107077_8 if valid SC.

h. Load switch register with selected program options from table 2-1.

i. Press RUN.

Result: HALT

- MDR= 102066_8.

j. Press RUN.

k. During initialization, the program as shown below, will request information concerning the pROM type being programmed. Respond with the information requested; a carriage return (CR) and a linefeed (LF).

(1) MINIMUM BURN TIME (MSEC) ?

Response: User enters a positive decimal four-character integer to specify the length of time that a pROM location is to be burned on first attempt.

(2) MAXIMUM BURN TIME (MSEC) ?

Response: User enters a positive decimal four-character integer to specify the maximum length of time that each pROM location is to be burned.

(3) BURN PULSE INCREMENT ?

Response: User enters a positive decimal four-character integer to specify the burn pulse increment to be used in retrying to burn pROM.

(4) WAIT TIME RATIO?

Response: User enters a positive decimal two-character integer to define the amount of wait time between successive burn passes.

l. The program executes the tests selected. At the end of the test sequence, HALT (102077_8) will occur.

m. The switch register may now be changed to a new set of program options. Press RUN and proceed from step l.

2-8. Operation Without Teleprinter or Console Device

The following steps are used when no teleprinter or console device is available.

a. Load Diagnostic Configurator using BL.

b. Configure using Diagnostic Configurator. Refer to Diagnostic Configurator manual for configuration procedure.

c. Load 12909B Diagnostic using BL.

d. Enter the following parameters into memory through the computer front panel:

Memory Location		Parameter
212	*xxxxxx*	(where *xxxxxx* is the contents of memory location 110_8)
213	0000*xx*	(where *xx* is the octal programmable ROM Writer select code)
214	000001	
215	00*xxxx*	(where *xxxx* is an octal number specifying the minimum burn time in milliseconds)
216	00*xxxx*	(where *xxxx* is an octal number specifying the maximum burn time in milliseconds)
217	00*xxxx*	(where *xxxx* is an octal number specifying the burn time increment in milliseconds)
220	0000*xx*	(where *xx* is an octal number specifying the wait time ratio)

e. Set P-register to 2000_8.

f. Enter program option from table 2-1 into switch register.

g. Press PRESET (INTERNAL and EXTERNAL)

h. Press RUN.

i. Program executes the tests selected. At end of the test sequence, HALT (102077_8) will occur.

2-9. DIAGNOSTIC MESSAGES AND HALTS

The diagnostic communicates with the operator by teleprinter, HALTs, or both, based on configuration and switch register settings. Thus messages consist of HALT codes and teleprinter text. Table 2-2 lists the octal HALT codes and error messages.

Table 2-2. HALT Codes and Error Messages

OCTAL MDR CODE	TEST	MESSAGE	COMMENTS
	START	H01 12909 pROM WRITER DIAGNOSTIC	Header message.
1060XX	ANY	(NONE)	Unexpected trap cell halt XX = select code.
102077		(NONE)	Diagnostic complete.
102076	ALL	(NONE)	End of test.
102011	ADTST,LOADT BPTST	H11 TEST TAPE RDY?	Load test tape and enter Y at console.
102013	ADTST	H13 pROM RDY FOR ADDRESS TEST?	Place pROM in test fixture and enter Y at console. If no console, press RUN.
102017	BRNP	H17 pROM RDY FOR BURN?	Place pROM in test fixture and enter Y at console. If no console, press RUN.
102023	SLTST	H23 CARD RDY FOR SCOPE LOOP?	Enter Y at console. pROM is not needed. If no console, press RUN.
102025	BPTST	H25 pROM RDY FOR BURN TEST?	Place pROM in test fixture and enter Y at console. If no console, press RUN.
102026	VFYB	H26 pROM RDY FOR BLANK VERIFY?	Place pROM in test fixture and enter Y at console. If no console, press RUN.
102027	VFYP	H27 pROM RDY FOR VERIFY?	Place pROM in test fixture and enter Y at console. If no console, press RUN.
102030	INIT*	H30 CLEAR BIT 0	Clear switch register bit 0 to continue.
102031	INIT*	H31 MINIMUM BURN TIME (MSEC)?	Enter minimum burn time on console.
102032	INIT*	H32 MAXIMUM BURN TIME (MSEC)?	Enter maximum burn time on console.
102033	INIT*	H33 BURN TIME INCREMENT (MSEC)?	Enter burn time increment on console.
102034	INIT*	H34 WAIT TIME RATIO?	Enter wait time ratio on console.
102014	TPLD	E14 END OF TAPE ENCOUNTERED. RELOAD TAPE	End of tape encountered. Reload tape. If error persists, a new tape may have to be generated.

*These message types are always printed.

Table 2-2. HALT Codes and Error Messages (cont.)

OCTAL MDR CODE	TEST	MESSAGE	COMMENTS
102015	TPLD	E15 READ ERROR, RELOAD TAPE	Tape read error. Reload tape.
102016	VFYP	E16 VERIFY ERROR ADDR XXX ACT DATA YY EXP DATA ZZ	Verify error. XXX = address YY = address contents ZZ = expected address content
102016	BNLOC	E21 LOC DID NOT BURN CORRECTLY XX	pROM location did not burn correctly. XX = octal contents of pROM location.
102024	VFYB	E24 BLANK ERROR ADDR XXX ACT DATA YY EXP DATA ZZ	Blank error. XXX = address YY = address contents ZZ = expected address contents.
107076	CFGR	(NONE)	Configuration error halt. Set correct bits into switch register (select code) and press RUN.
107077	CFGR	(NONE)	Set program option bits into switch register and press RUN.
102066	INIT*	(NONE)	Halt at the start of initialization Bit 0 of switch register should be 0 to continue.
	RDLOC**	<READ	Request for pROM address to be entered. Enter 3-bit octal address between 000_8 and 377_8. A may be typed to abort input. HALT (102077_8) will occur.
	BNLOC**	<WRITE	Request for pROM address and data to be written into pROM. Enter 3-bit octal address followed by a blank and then by 2-bit octal data to be written. A may be typed to abort input. HALT (102077_8) will occur.
	RDLOC,** BNLOC	INVALID INPUT	Input to READ or WRITE incorrect.

Notes: For all H,E messages, a halt with the message number shown will occur if bit 13 of switch register is set. All messages requiring a response from the operator should be followed by a carriage return (CR) and a line feed (LF). Those messages requiring a yes (Y) or no (N) response may also have an abort (A) answer entered resulting in a HALT (102077_8).

*These message types are always printed.

**Teleprinter required to use these routines.

SECTION III
Test Sections

The HP 12909B pROM Writer Diagnostic provides three different functions. The program is divided into diagnostic, engineering, and utility functions. The diagnostic provides three operator selected tests. The engineering and utility functions give the user additional capability for testing and verifying the pROM writer and pROM's.

3-1. DIAGNOSTIC FUNCTION

The program consists of a string of tests which may be executed in sequence; however, any single test or a given sequence may be run. These tests are (a) address and data input, (b) oscilloscope loop, and (c) pROM burn.

3-2. Address and Data Input

A standard test pattern resident in the diagnostic is compared against a preprogrammed pROM. (The preprogrammed pROM is shipped with the pROM Writer Interface kit. The test pattern is shown in table 3-1.) Errors are printed on the console, listing the error address, the expected data, and the actual data. A coded message is available through program halts when the teleprinter is not used. In addition, a test pattern may be loaded from a tape by setting switch register bit 12 if a tape reader is configured in the Diagnostic Configurator. The pattern loaded is then used to test against a preprogrammed pROM.

3-3. Oscilloscope Loop

From the information supplied in the initialization (refer to para. 2-6), the program provides an oscilloscope test loop encompassing a full burn cycle on two locations. An example is shown in figure 3-1. Test points on the interface PCA are given. Address 000_8 is burned followed by 377_8. Bits 0-3 of the data word are sequentially pulsed to provide one loop for all bits of the data word to be sequenced. The switch register interface provides the means for starting this loop. The loop may be terminated by setting switch register bit 0 or 15, or clearing bit 1.

Table 3-1. Preprogrammed pROM Test Pattern

ADDRESS	PATTERN*							
000-007	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH
010-017	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
020-027	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL
030-037	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH	LLLL
040-047	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH
050-057	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH	LLLL	LLLH
060-067	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL
070-077	HLHH	HHLL	HHLH	HHHL	HHHH	LLLL	LLLH	LLHL
100-107	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH
110-117	HHLL	HHLH	HHHL	HHHH	LLLL	LLHH	LLHL	LLHH
120-127	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL
130-137	HHLH	HHHL	HHHH	LLLL	LLLH	LLHL	LLHH	LHLL
140-147	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH
150-157	HHHL	HHHH	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH
160-167	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL
170-177	HHHH	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL
200-207	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH
210-217	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH
220-227	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH	LLLL
230-237	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL
240-247	HLHL	HLHH	HHLL	HHLH	HHHL	HHHH	LLLL	LLLH
250-257	LLHL	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH
260-267	HLHH	HHLL	HHLH	HHHL	HHHH	LLLL	LLLH	LLHL
270-277	LLHH	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL
300-307	HHLL	HHLH	HHHL	HHHH	LLLL	LLLH	LLHL	LLHH
310-317	LHLL	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH
320-327	HHLH	HHHL	HHHH	LLLL	LLLH	LLHL	LLHH	LHLL
330-337	LHLH	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL
340-347	HHHL	HHHH	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH
350-357	LHHL	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH
360-367	HHHH	LLLL	LLLH	LLHL	LLHH	LHLL	LHLH	LHHL
370-377	LHHH	HLLL	HLLH	HLHL	HLHH	HHLL	HHLH	HHHL

*H = Logic level 1

L = Logic level 0

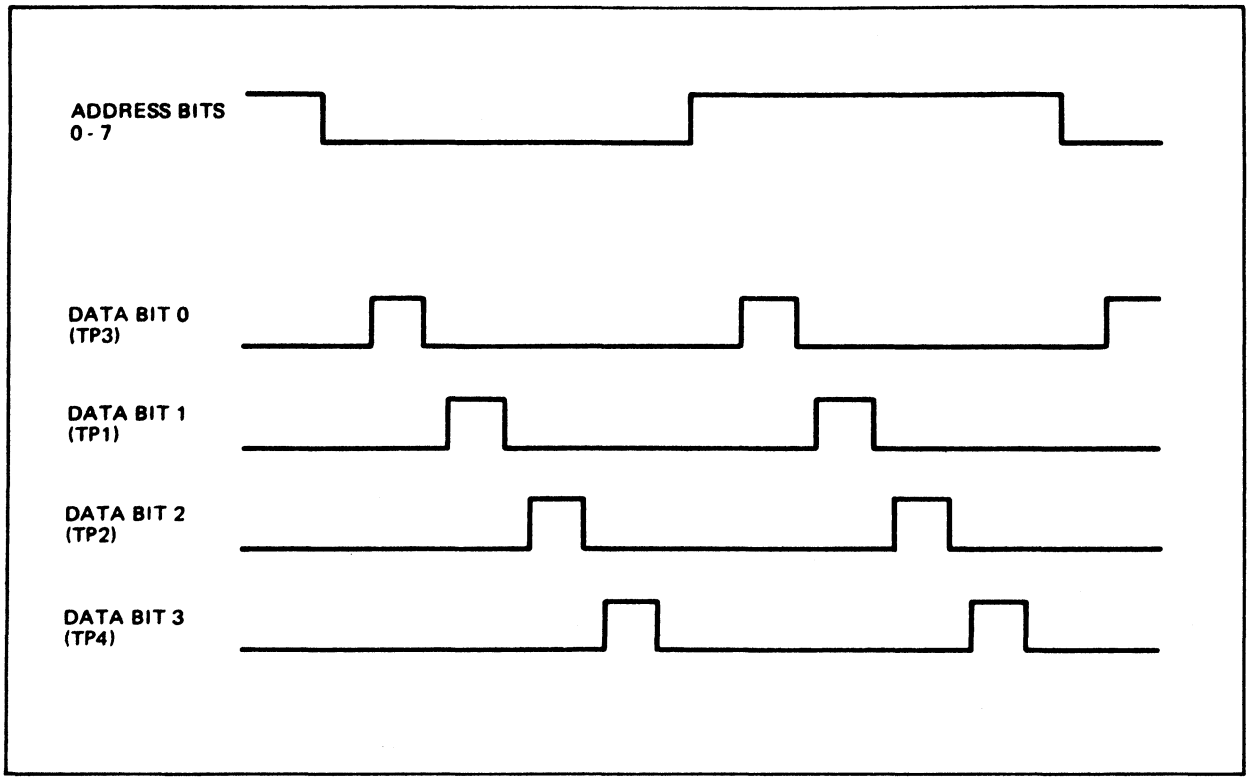

Figure 3-1. Waveforms for Testing pROM

3-4. pROM Burn

The last test provides a final verification of the interface PCA circuitry. The test consists of the verification and burning of a blank pROM to the standard pattern and the verification of the burned pROM. Any errors which occur during this test will be attributed to the pROM by the program. The user must analyze the data errors and decide if the pROM is actually in error or the interface PCA is faulty. A different test pattern may be used to burn a pROM by enabling the tape load function (set switch register bit 12) if a tape reader is configured during the configurator preparation.

3-5. ENGINEERING FUNCTIONS

These functions provide the user with the capability to program a pROM in a manner similar to that being performed by the pROM writer driver. This program is organized in modular sections so that each option may be treated as a stand-alone function after a previous function is performed. That is, once a pattern tape is loaded, it does not need to be reloaded to burn a number of pROM's using the burn functions.

3-6. Load pROM Pattern Tape

Using the configurator tape reader driver, a pROM pattern tape is loaded. The first three records of data are printed as three lines of teleprinter information. Thirty-two records of data are then read and tested for validity. If an error occurs, the program calls for tape reloading. Refer to table 2-2 for the exact format of messages to be supplied.

3-7. Verify Blank pROM

From data supplied during the initialization phase, the program proceeds to sequentially read and test for "1's" in all locations of the pROM. If any errors occur during this test, a message indicating the verify process, the error location, the error data, and the expected data is output to the console. The error data will also be available in the A-register after an error halt (refer to para. 3-9). Once the error has been printed, the user has the option of continuing to verify the blank pROM or aborting to select the next function to be performed, or to perform the verify process again. Switch register bit 0 is set to restart the program at the initialization section and bit 15 is set to restart the program to HALT 102077_8.

3-8. pROM Burn

When selected, the program will proceed to burn a pROM using the data currently in the buffer. The locations are burned in sequence for each address, with one bit being burned for a single interval in time. The initial burn pulse will be the minimum burn time as specified by the user. If one or more bits do not burn properly, the program attempts to reburn the bits in error by increasing the burn pulse width using the increment specified. The program continues to burn the pROM until all bits are burned or the maximum burn time has been reached. During the burning of a pROM, the pulse duty cycle (wait time ratio) is maintained as specified by the user. The verify pROM routine may be used to verify the contents of the burned pROM.

3-9. Verify Burned pROM

This program is similar to the address and data input test of the diagnostic function. The current data pattern in the pattern buffer is substituted for the standard data pattern. If the pROM is not burned properly, the location in error is identified together with the data to be written and with the previously written data. This information is output to the A-register and the console in the format shown below.

Bits	Format
15-12	Actual contents of pROM location
11-8	Expected contents
7-0	Three-digit octal number specifying what pROM location is in error

3-10. UTILITY FUNCTIONS

Four additional functions have been included in the program to allow a greater degree of flexibility in processing the pROM. Two of these functions allow the user to either inspect or program to a single location of a pROM. The appropriate console requests will be made to the operator asking for the address to be inspected or the address and data to be written. Refer to examples in table 3-2. Any errors which occur during the writing of the location are output to the console. These functions are provided as program options 8 and 9 as listed in table 2-1. In addition, program option 10 allows the user to dump the contents of the pROM to the console providing a permanent record of its contents. Program option 11 allows the user to read the contents of a pROM into the pattern buffer. Option 6 may then be used to burn a blank pROM to the pattern in the buffer.

Table 3-2. Examples for Reading or Writing a pROM Location

COMMAND/ADDRESS	REMARKS
Reading a pROM location <READ *xxx* *yy*	*xxx* = 3-bit pROM address (where $000_8 \leq xxx \leq 377_8$) *yy* = 2-bit pROM contents (where $00_8 \leq yy \leq 17_8$)
Writing a pROM location <WRITE *xxx yy*	*xxx* = 3-bit pROM address (where $000_8 \leq xxx \leq 377_8$) *yy* = 2-bit pROM contents (where $00_8 \leq yy \leq 17_8$) There must be a blank space between *xxx* and *yy*.