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Agilent Technologies E1330A/E1330B Quad 8-Bit Digital Input/Output Modules Service Manual

The information in this manual applies directly to E1330A modules with serial number prefixes 2934A and to E1330B modules with serial number prefixes 3221A.

Agilent Technologies

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Contents

E1330A Digital I/O Module Service Manual

Edition 3

Chapter 1. General Information . . . 9

Introduction . . . 9

Safety Considerations . . . 10

Warnings . . . 10

Cautions . . . 11

Digital I/O Description . . . 12

HP E1330A/B Description . . . 12

Digital I/O Module Specifications . . . 12

Digital I/O Module Environment . . . 12

Digital I/O Module Serial Numbers . . . 13

Digital I/O Module Options . . . 13

Recommended Test Equipment . . . 14

Inspection / Shipping . . . 14

Initial Inspection . . . 14

Shipping Guidelines . . . 16

Chapter 2. Verification Tests . . . 17

Introduction . . . 17

Test Conditions / Procedures . . . 17

Performance Test Record . . . 17

Verification Test Examples . . . 17

Functional Verification Test . . . 18

Procedure . . . 18

Example . . . 18

Operation Verification Test . . . 18

Performance Verification Tests . . . 19

Test Cable . . . 19

Test 2-1: Digital Test . . . 19

Performance Test Record . . . 24

Test Limits . . . 24

Measurement Uncertainty . . . 24

Test Accuracy Ratio (TAR) . . . 24

Chapter 3. Replaceable Parts . . . 27

Introduction . . . 27

Replaceable Parts List . . . 27

Mechanical Parts Locator . . . 31

Chapter 4. Service . . . 33

Introduction . . . 33

Equipment Required . . . 33

Service Aids . . . 33

Digital I/O Module Description . . . 33

Repair Strategy 34
Troubleshooting Techniques 34
Identifying the Problem 34
Making Visual Checks 34
Testing the Module 35
Repair and Maintenance Guidelines 36
ESD Precautions 36
Soldering Printed Circuit Boards 36
Post-Repair Safety Checks 36

Appendix A. Verification Tests - C Programs 37

Functional Verification Test 37
Example 37
Performance Verification Test 38
Example: Digital Test 38

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E1330A/E1330B Quad 8-Bit Digital Input/Output Modules Service Manual
Edition 2
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Documentation History

All Editions and Updates of this manual and their creation date are listed below. The first Edition of the manual is Edition 1. The Edition number increments by 1 whenever the manual is revised. Updates, which are issued between Editions, contain replacement pages to correct or add additional information to the current Edition of the manual. Whenever a new Edition is created, it will contain all of the Update information for the previous Edition. Each new Edition or Update also includes a revised copy of this documentation history page.

Edition 1 . . . . . April, 1996
Edition 2 . . . . . December, 2000

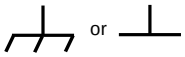
Safety Symbols



Instruction manual symbol affixed to product. Indicates that the user must refer to the manual for specific WARNING or CAUTION information to avoid personal injury or damage to the product.



Indicates the field wiring terminal that must be connected to earth ground before operating the equipment — protects against electrical shock in case of fault.



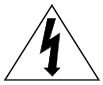
Frame or chassis ground terminal—typically connects to the equipment's metal frame.



Alternating current (AC)



Direct current (DC).



Warning. Risk of electrical shock.

WARNING Calls attention to a procedure, practice, or condition that could cause bodily injury or death.

CAUTION Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

WARNINGS

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), an uninterruptible safety earth ground must be provided from the mains power source to the product input wiring terminals or supplied power cable.

DO NOT operate the product in an explosive atmosphere or in the presence of flammable gases or fumes.

For continued protection against fire, replace the line fuse(s) only with fuse(s) of the same voltage and current rating and type. DO NOT use repaired fuses or short-circuited fuse holders.

Keep away from live circuits: Operating personnel must not remove equipment covers or shields. Procedures involving the removal of covers or shields are for use by service-trained personnel only. Under certain conditions, dangerous voltages may exist even with the equipment switched off. To avoid dangerous electrical shock, DO NOT perform procedures involving cover or shield removal unless you are qualified to do so.

DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture, or any other reason, REMOVE POWER and do not use the product until safe operation can be verified by service-trained personnel. If necessary, return the product to Agilent for service and repair to ensure that safety features are maintained.

DO NOT service or adjust alone: Do not attempt internal service or adjustment unless another person, capable of rendering first aid and resuscitation, is present.

DO NOT substitute parts or modify equipment: Because of the danger of introducing additional hazards, do not install substitute parts or perform any unauthorized modification to the product. Return the product to Agilent for service and repair to ensure that safety features are maintained.

Agilent Technologies	**DECLARATION OF CONFORMITY** **According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014**	

Manufacturer's Name: Agilent Technologies, Inc.
Manufacturer's Address: *Measurement Products Unit*
815 14th Street S.W.
Loveland, CO 80537 USA

Declares, that the product

Product Name: Quad 8-Bit Digital Input/Output Modules
Model Number: E1330A/E1330B
Product Options: *This declaration includes all options of the above product(s).*

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC and carries the CE Marking accordingly.

Conforms with the following product standards:

	Standard	**Limit**
EMC	*IEC 61326-1:1997 + A1:1998 / EN 61326-1:1997 + A1:1998*	
	CISPR 11:1997 + A1:1997 / EN 55011-1991	*Group 1, Class A [1]*
	IEC 61000-4-2:1995+A1998 / EN 61000-4-2:1995	*4 kV CD, 8 kV AD*
	IEC 61000-4-3:1995 / EN 61000-4-3:1995	*3 V/m, 80-1000 MHz*
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	*0.5 kV signal lines, 1 kV power lines*
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	*0.5 kV line-line, 1 kV line-ground*
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	*3 V, 0.15-80 MHz*
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	*1 cycle, 100%*
	Canada: ICES-001:1998	
	Australia/New Zealand: AS/NZS 2064.1	
Safety	*IEC 61010-1:1990+A1:1992+A2:1995 / EN 61010-1:1993+A2:1995*	
	Canada: CSA C22.2 No. 1010.1:1992	
	UL 3111-1	

Supplemental Information:

[1] The product was tested in a typical configuration with Agilent Technologies test systems.

September 5, 2000
Date

Name

Quality Manager
Title

For further information, please contact your local Agilent Technologies sales office, agent or distributor.
Authorized EU-representative: Agilent Technologies Deutschland GmbH, Herrenberger Straβe 130, D 71034 Böblingen, Germany

Revision: A.03 Issue Date: 09/05/00

Notes:

What's in this Manual

Manual Overview

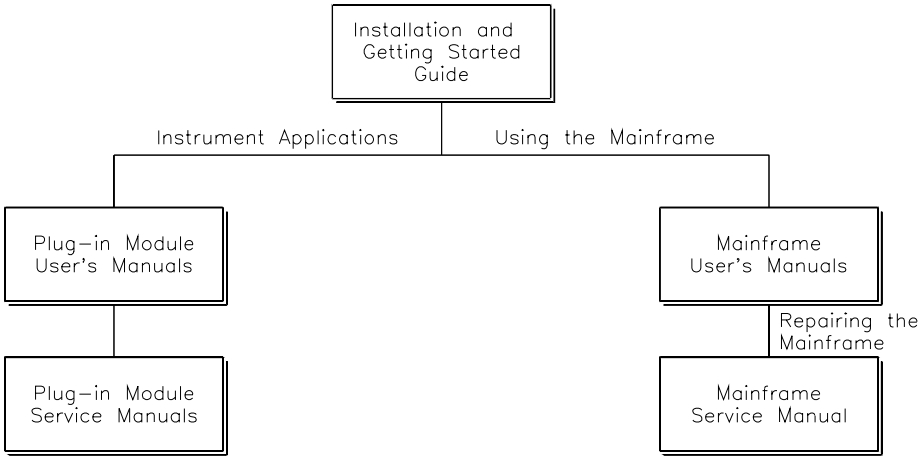
This manual shows how to service the HP E1330A/B Quad 8-Bit Digital I/O Module. Consult the *HP E1330A/B User's Manual* for additional information on installing, configuring, and operating the HP E1330A/B. Consult the appropriate mainframe user's manual for information on configuring and operating the mainframe.

Manual Content

Chapter	Title	Content
1	General Information	Provides a basic description and lists the test equipment required for service.
2	Verification Tests	Functional verification, operation verification, and performance verification tests.
3	Replaceable Parts	Lists replaceable parts for the module.
4	Service	Procedures to aid in fault isolation and repair of the module.

HP 75000 Series B Service Documentation

Suggested Sequence to Use Manuals



Manual Descriptions

Installation and Getting Started Guide. This manual contains step-by-step instructions for all aspects of plug-in module and mainframe installation. Introductory programming information and examples are also included.

Mainframe User's Manual. This manual contains programming information for the mainframe, front panel operation information (for the HP E1301A mainframe), and general programming information for instruments installed in the mainframe.

Plug-In Module User's Manuals. These manuals contain plug-in module programming and configuration information. Each manual contains examples for the most-used module functions, and a complete SCPI command reference for the plug-in module.

Mainframe Service Manual. This manual contains service information for the mainframe. It contains information for ordering replaceable parts and exchanging assemblies. Information and procedures for performance verification, adjustment, preventive maintenance, troubleshooting, and repair are also included.

Plug-In Module Service Manuals. These manuals contain plug-in module service information. Each manual contains information for exchanging the module and/or ordering replaceable parts. Depending on the module, information and procedures for functional verification, operation verification, performance verification, adjustment, preventive maintenance, troubleshooting, and repair are also provided.

Chapter 1
General Information

Introduction

This manual contains information required to test, troubleshoot, and repair the HP E1330A/B Quad 8-Bit Digital I/O Module. See the *HP E1330A/B User's Manual* for additional information on the HP E1330A/B. Figure 1-1 shows the HP E1330A/B Quad 8-Bit Digital I/O Module.

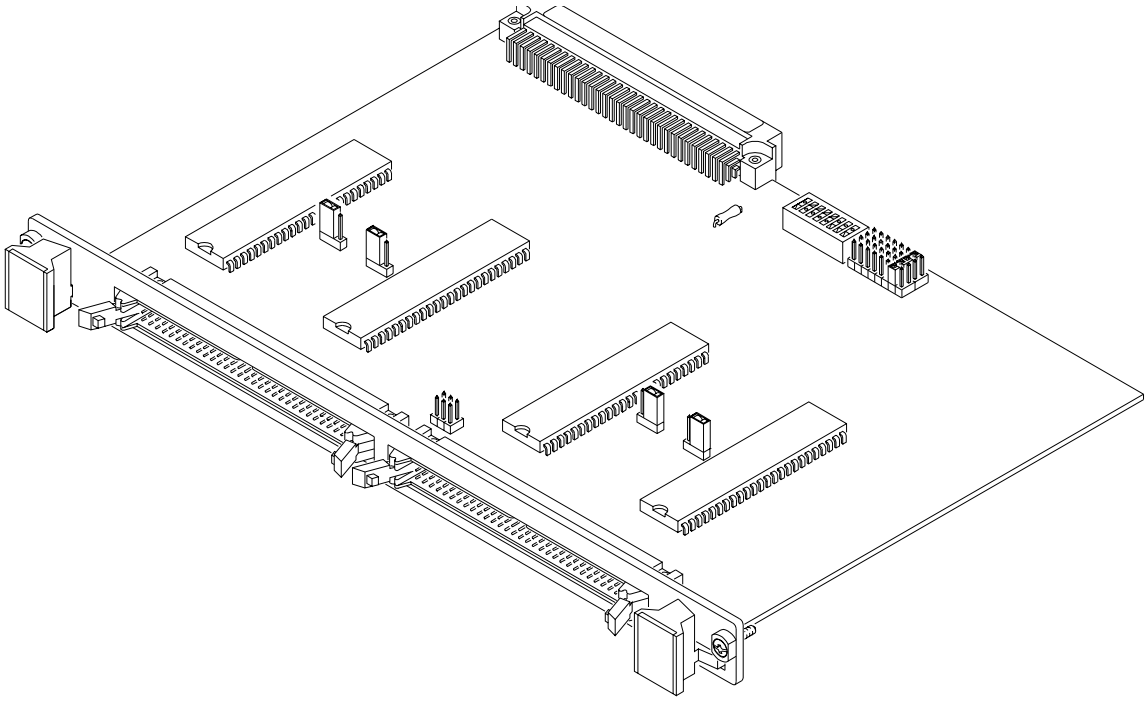


Figure 1-1. HP E1330A/B Digital I/O Module

Safety Considerations

This product is a Safety Class I instrument that is provided with a protective earth terminal when installed in the mainframe. Check the mainframe, Digital I/O Module, and all related documentation for safety markings and instructions before operation or service.

Refer to the WARNINGS page (page iii) in this manual for a summary of safety information. Safety information for preventive maintenance, testing, and service follows and is also found throughout this manual.

Warnings

This section contains WARNINGS which must be followed for your protection when performing equipment maintenance or repair.

WARNING

SERVICE-TRAINED PERSONNEL ONLY. The information in this manual is for service-trained personnel who are familiar with electronic circuitry and are aware of the hazards involved. To avoid personal injury or damage to the instrument, do not perform procedures in this manual or do any servicing unless you are qualified to do so.

CHECK MAINFRAME POWER SETTINGS. Before applying power, verify that the mainframe setting matches the line voltage and that the correct fuse is installed. An uninterruptible safety earth ground must be provided from the main power source to the supplied power cord set.

GROUNDING REQUIREMENTS. Interruption of the protective (grounding) conductor (inside or outside the mainframe) or disconnecting the protective earth terminal will cause a potential shock hazard that could result in personal injury. (Grounding one conductor of a two-conductor outlet is not sufficient protection.)

IMPAIRED PROTECTION. Whenever it is likely that instrument protection has been impaired, the mainframe must be made inoperative and be secured against any unintended operation.

REMOVE POWER IF POSSIBLE. Some procedures in this manual may be performed with power supplied to the mainframe while protective covers are removed. Energy available at many points may, if contacted, result in personal injury. (If maintenance can be performed without power applied, the power should be removed.)

WARNING

USING AUTOTRANSFORMERS. If the mainframe is to be energized via an autotransformer (for voltage reduction) make sure the common terminal is connected to neutral (that is, the grounded side of the main's supply).

CAPACITOR VOLTAGES. Capacitors inside the mainframe may remain charged even when the mainframe has been disconnected from its source of supply.

USE PROPER FUSES. For continued protection against fire hazard, replace the line fuses only with fuses of the same current rating and type (such as normal blow, time delay, etc.). Do not use repaired fuses or short-circuited fuseholders.

Cautions

This section contains CAUTIONS which must be followed to avoid damage to the equipment when performing instrument maintenance or repair.

CAUTION

MAXIMUM VOLTAGE/CURRENT. The maximum voltage that may be applied between any connector pin and any other point, shield, or chassis is 5 VPeak.

STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the Digital I/O module, observe anti-static techniques whenever working on a Digital I/O module.

Digital I/O Description

The HP E1330A/B Digital I/O Module is an "instrument" in a VXIbus mainframe. As such, each Digital I/O module is assigned an error queue, input and output buffers, and a status register.

NOTE

Instruments are based on the logical addresses of the plug-in modules. See the HP 75000 Series B Installation and Getting Started Guide to set the addresses to create an instrument.

HP E1330A/B Description

The HP E1330A/B provides four independent 8-bit digital I/O ports compatible with TTL logic levels. Each port can be software configured for operation as input or output with either positive or negative true logic. The ports can be combined to provide 16 bit (WORD) or 32 bit (LWORD) operations. In addition to the eight digital data lines, six handshake lines are included per port. The handshake lines can also be combined (via jumpers on the component assembly) to provide proper handshaking for combined ports. The data lines of each port are provided with a jumpered pull-up for dry contact closure sensing. User connections to the Digital I/O module are made through two 60-pin connectors on the rear panel.

The HP E1330B added SCPI command capabilities related to LWORD and Block operations. The procedures in this manual work equally well with either an HP E1330A or HP E1330B.

Digital I/O Module Specifications

See *Appendix A* of the *HP E1330A/B User's Manual* for HP E1330A/B specifications. These specifications are the performance standards or limits against which the instrument may be tested.

Digital I/O Module Environment

The recommended operating environment for the HP E1330A/B Digital I/O module is:

Environment	Temperature	Humidity
Operating	0^{o}C to +55^{o}C	<65% relative (0^{o}C to +40^{o}C)
Storage and Shipment	-40^{o}C to +75^{o}C	<65% relative (0^{o}C to +40^{o}C)

Digital I/O Module Serial Numbers

Digital I/O modules covered by this manual are identified by a serial number prefix listed on the title page. Hewlett-Packard uses a two-part serial number in the form XXXXAYYYYY, where XXXX is the serial prefix, A is the country of origin (A=USA), and YYYYY is the serial suffix. The serial number prefix identifies a series of identical instruments. The serial number suffix is assigned sequentially to each instrument.

The serial number plate is located on the backplane connector. If the serial number prefix of your instrument is greater than the one listed on the title page, a Manual Update (as required) will explain how to adapt this manual to your instrument.

Digital I/O Module Options

There are no electrical or mechanical options available for the HP E1330A/B Digital I/O Modules.

Recommended Test Equipment

Table 1-1 lists the test equipment recommended for testing, adjusting, and servicing the Digital I/O modules. Essential requirements for each piece of test equipment are described in the Requirements column.

Table 1-1. Recommended Test Equipment

Instrument	Requirements	Recommended Model	Use*
Controller, HP-IB	HP-IB compatibility as defined by IEEE Standard 488-1987 and the identical ANSI Standard MC1.1: SH1, AH1, T2, TE0, L2, LE0, SR0, RL0, PP0, DC0, DT0, and C1, 2, 3, 4, 5.	HP 9000 Series 300 or IBM compatible PC with HP BASIC	F,O, P,T
Mainframe	Compatible with Digital I/O Module	HP E1300A, E1301A, E13002A or E1401B/T, E1421A (requires E1405A/B)	F,O, P,T
Test Cable	Connects handshake and data lines from Port 0 to Port 2 and from Port 1 to Port 3.	HP E1330-61603	O,P

* F = Functional Verification Tests, O = Operation Verification Tests, P = Performance Verification Tests, T = Troubleshooting

Inspection / Shipping

This section contains initial (incoming) inspection and shipping guidelines for the Digital I/O module.

Initial Inspection

Use the steps in Figure 1-2 as guidelines to perform initial inspection of a Digital I/O module. Performance Verification tests are optional.

WARNING

To avoid possible hazardous electrical shock, do not perform electrical tests if there are signs of shipping damage to the shipping container or to the instrument.

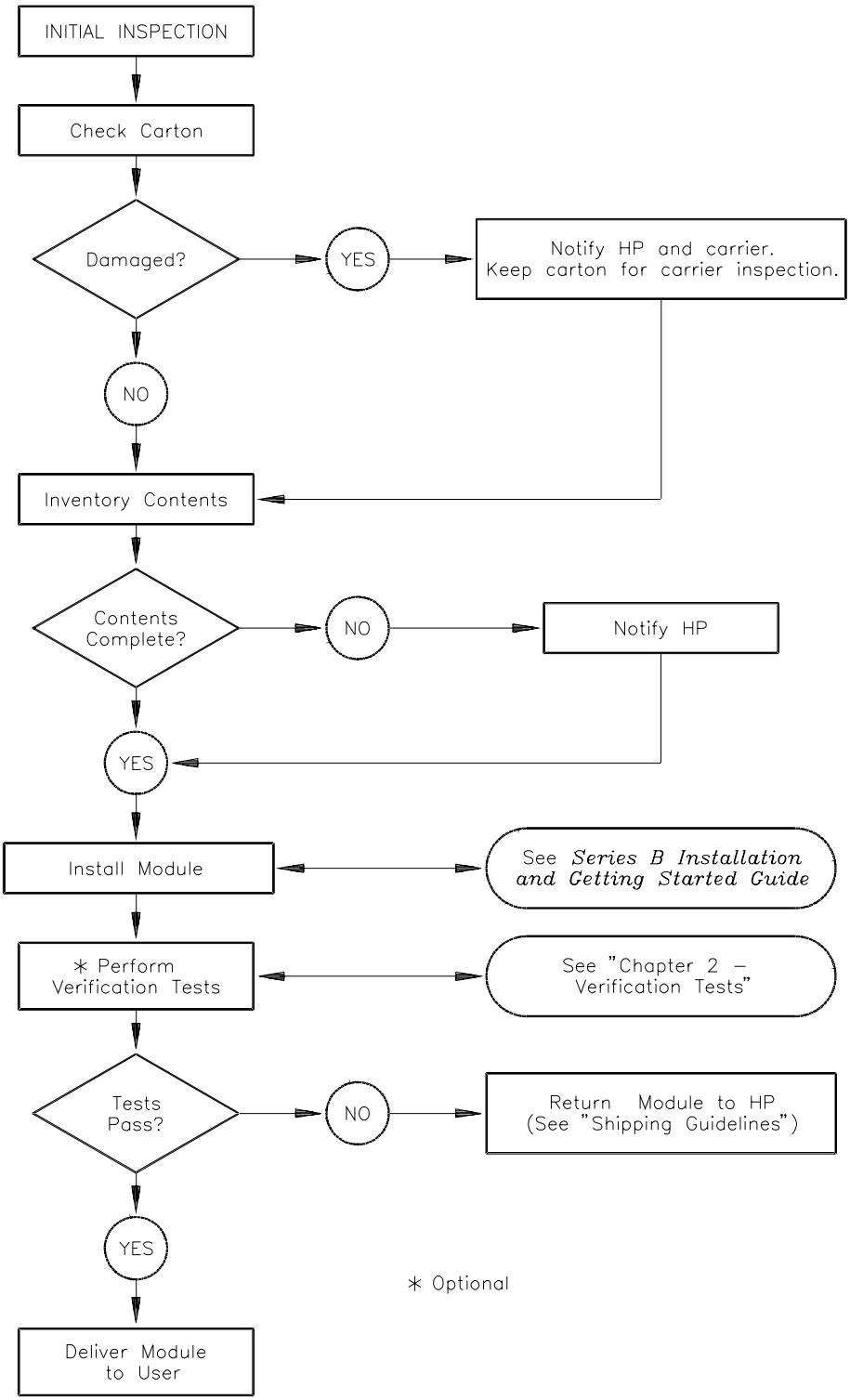
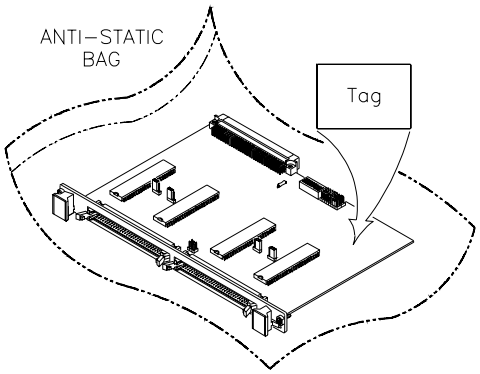
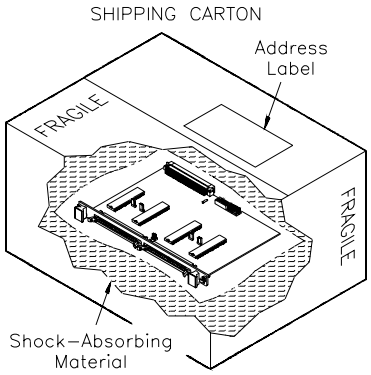


Figure 1-2. Initial (Incoming) Inspection Guidelines

Shipping Guidelines

Follow the steps in Figure 1-3 to return a Digital I/O module to a Hewlett-Packard Sales and Support Office or Service Center.





1 Prepare the Digital I/O module

- Remove user wiring from the module
- Attach tag to module/pod that identifies
  - Owner
  - Model Number/Serial Number
  - Service Required
- Place tagged device in approved anti-static bag

2 Package the Digital I/O module

- Place packaged Digital I/O module in shipping carton*
- Place 75 to 100 mm (3 to 4 inches) of shock-absorbing material around the Digital I/O module
- Seal the shipping carton securely
- Mark the shipping carton FRAGILE

3 Ship the Digital I/O module to Hewlett-Packard

- Place address label on shipping carton
- Send carton to Hewlett-Packard

* We recommend that you use the same shipping materials as those used in factory packaging (available from Hewlett-Packard). For other

Figure 1-3. Packaging/Shipping Guidelines

(commercially-available) shipping materials, use a double wall-carton with minimum 2.4 MPa (350 psi) test.

Chapter 2
Verification Tests

Introduction

This chapter describes the verification tests for the HP E1330A/B modules. The three levels of test procedures described in this chapter are used to verify that the HP E1330A/B:

- is functional (Functional Verification Test)
- meets selected testable specifications (Operation Verification)
- meets all testable specifications (Performance Verification)

Test Conditions / Procedures

See Table 1-1 for test equipment requirements. You should complete the Performance Verification tests at least once a year. For heavy use or severe operating environments, perform the tests more often. The verification tests assume that the person performing the tests understands how to operate the mainframe, the module, and the specified test equipment. The test procedures do not specify equipment settings for test equipment except in general terms. It is assumed that a qualified, service-trained technician will select and connect the cables, adapters, and probes required for the test.

Performance Test Record

The results of each Performance Verification test may be recorded in Table 2-1, *Performance Test Record*, at the end of this chapter. You can make a copy of this form, if desired.

Verification Test Examples

Each verification test procedure includes an example program that performs the test. All example programs assume the following configuration:

- HP 9000 Series 200/300 computer
- HP BASIC programming language
- Module address 70918

Functional Verification Test

The Functional Verification Test for the HP E1330A/B modules consists of sending the *IDN? command and checking the response. This test can be used to verify that the module is connected properly and is responding to a basic command.

Procedure

1. Verify that the module is properly installed in mainframe
2. Verify that the mainframe has passed its power-on test.
3. Send *IDN? to the module (see example following)
4. The return should be as follows (revision number may vary):

   HEWLETT-PACKARD,E1330A,0,A.06.00

NOTES

If the primary address setting, secondary address setting, or the interface select code is set incorrectly, the module will not respond. Verify proper address selection before troubleshooting.

*Both the HP E1330A and HP E1330B return the string shown in Step 4. The HP E1330B will return "E1330A" in response to the *IDN? query.*

Example

An example follows which uses an HP 9000 Series 300 computer with HP BASIC and a module address of 70918.

```
10  DIM A$[100]
20  OUTPUT 70918;"*IDN?"          Send the ID command
30  ENTER 70918;A$                Get response
40  PRINT A$
50  END
```

Operation Verification Test

The procedures in this section are used to provide a high level of confidence that the module is meeting published specifications. The Operation Verification test is a subset of the Performance Verification tests and is suitable for checkout after performing repairs.

The Operation Verification Test is performed by completing the Digital Test (Test 2-1) as described in the Performance Verification test procedures. This test is usually sufficient to verify that the module is meeting its specifications.

Performance Verification Tests

The procedure in this section is used to test the module's electrical performance using the specifications in *Appendix A — Specifications* of the *HP E1330A/B Modules User's Manual* as the performance standard.

The Performance Verification test is a test of each Digital I/O line on each port and a test of the three main handshake lines for each port. This test is sufficient to determine that the module is operating within specifications. This test is suitable for incoming inspection, troubleshooting, and preventive maintenance.

Test Cable

A test cable is required to run the Performance Verification test. This test cable is available from Hewlett-Packard (Part Number E1330-61603).

Test 2-1: Digital Test

This test verifies that all ports meet the specification for the module.

Data Line Test

1. **Setup and Install the Digital I/O module**

   - Remove power from the mainframe. Remove HP E1330A/B from the mainframe (as required).
   - Record the locations of the Pull-up Enable and any FLG Combine jumpers on the HP E1330A/B.
   - Set Port 0 and Port 1 Pull-up Enable jumpers to the Enable position as shown in Figure 2-1.
   - Set Port 2 and Port 3 Pull-up Enable jumpers to the Disable position as shown in Figure 2-1.
   - Remove any FLG Combine jumpers installed.
   - Install the HP E1330A/B in the mainframe.
   - Install the Test Cable as shown in Figure 2-2.
   - Turn the mainframe power ON.

2. **Check Port 0 Write and Port 2 Read**

   - Send *RST to the module.
   - Send SOUR:DIG:DATA0 #B00000001 to the module.
   - Send MEAS:DIG:DATA2? to the module.
   - Enter the response and compare to the binary data sent.
   - Repeat this step using the following binary data strings: "00000010", 00000100", "00001000", "00010000","00100000","01000000",and "10000000". Use the command SOUR:DIG:DATA0 #B*ssssssss* where *ssssssss* = the binary data string.
   - Enter a Pass or Fail in Table 2-1.

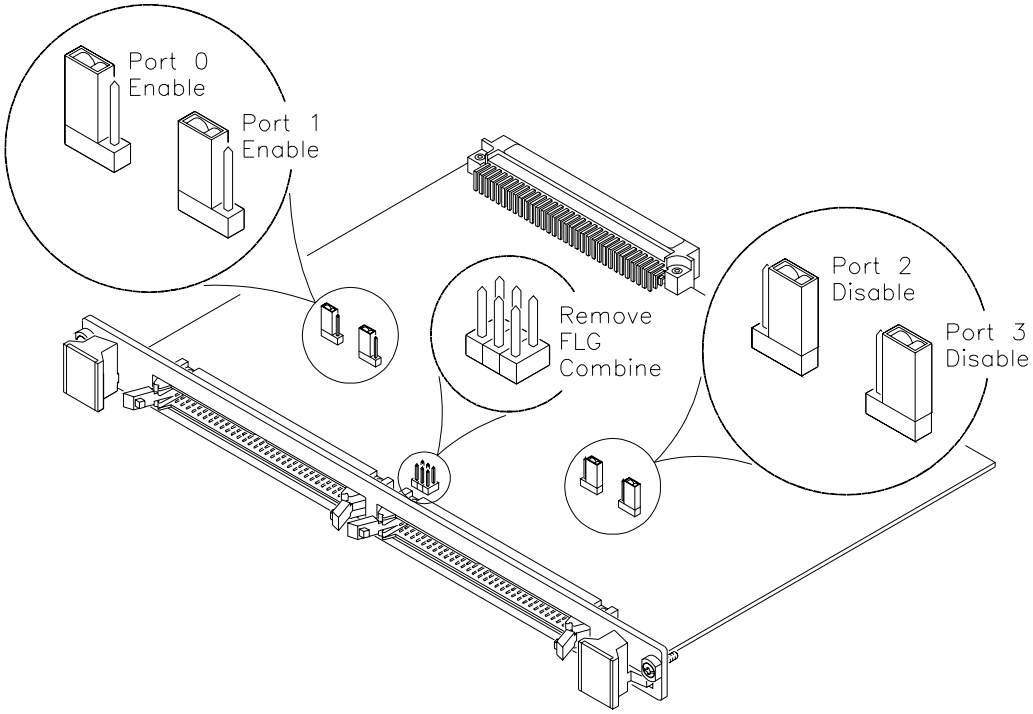


Figure 2-1. Jumper Settings

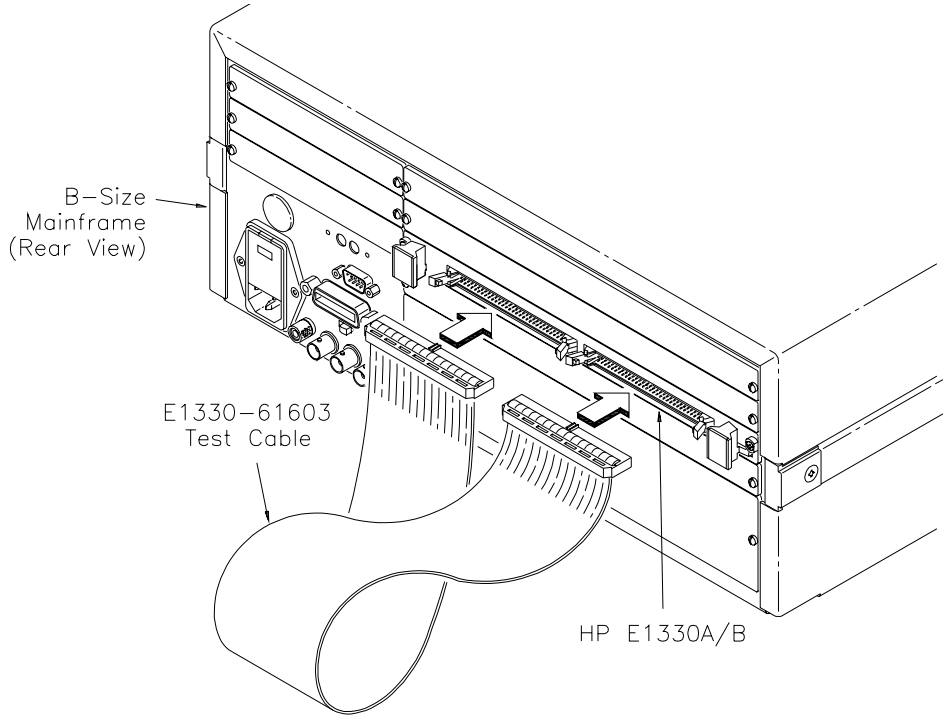


Figure 2-2. Test Cable Installation

3. **Repeat for Ports 1 through 3**

   - Repeat step 2 for ports 1, 2, and 3.
   - Use SOUR:DIG:DATA*n* #B*ssssssss* and MEAS:DIG:DATA*n*? where *n* = port number and *ssssssss* = the binary string.
   - For Port 1 Write, use Port 3 Read. For Port 2 Write, use Port 0 Read. For Port 3 Write, use Port 1 Read.

4. **Check Port 0 CTL and Port 2 FLG handshake lines**

   - Send *RST to the module.
   - Send SOUR:DIG:CONT0 1 to the module.
   - Send MEAS:DIG:FLAG2? to the module.
   - Enter the response. The response should be 1.
   - Enter a Pass or Fail in Table 2-1.
   - Send SOUR:DIG:CONT0 0 to the module.
   - Send MEAS:DIG:FLAG2? to the module.
   - Enter the response. The response should be 0.
   - Enter a Pass or Fail in Table 2-1.

5. **Repeat for Ports 1, 2, and 3**

   - Repeat step 4 for ports 1, 2, and 3.
   - Send SOUR:DIG:CONT*n f* to the module where *n* = port number and *f* = is a binary toggle (0 and 1).
   - Send MEAS:DIG:FLAG*n* to the module where *n* = port number.
   - For Port 1 CTL, use Port 3 FLG. For Port 2 CTL, use Port 0 FLG. For Port 3 CTL, use Port 1 FLG.

6. **Reset the module jumpers**

   - Turn mainframe power OFF.
   - Remove the Test Cable from the module.
   - Remove the module from the mainframe.
   - Reset the module jumpers to the positions recorded in Step 1.

Example: Digital Test

This example performs a bit walk test of all bits on all ports and checks the module's ability to set and reset the handshake lines on each port.

```
10!    RE-SAVE "DIO_TEST"
20     DISP CHR$(129)
30     ASSIGN @Dio TO 70918
40     OUTPUT @Dio;"*CLS"
50     Fail = 0
60     DIM A$[255],B$[32],Bit_walk$(7)[8]
70     DATA  "00000001","00000010","00000100","00001000",
"00010000","00100000","01000000","10000000"
80     READ Bit_walk$(*)
```

```
90     CLEAR SCREEN
100    PRINT  "Install Component Assembly and Test Cable"
110    PRINT
120    PRINT "  1.  Turn mainframe power OFF"
130    PRINT "  2.   Install HP E1330A/B component assembly into
mainframe "
140    PRINT "  3.   Attach test cable to component assembly"
150    PRINT "  4.  Turn mainframe power ON "
160    PRINT "  5. Press Continue when ready to begin testing "
170    PAUSE
180    CLEAR SCREEN
190    OUTPUT @Dio;"*IDN?"
200    ENTER @Dio;A$
210    IF A$[17,21]<>"E1330" THEN
220        PRINT "Incorrect Card Type detected"
230        STOP
240    END IF
250    PRINT "Bit walk test of all ports for read and write (no handshake)"
260    FOR I=0 TO 7
270        FOR J=0 TO 3
280            OUTPUT @Dio;"SOUR:DIG:DATA"&VAL$(J)&"
#B"&Bit_walk$(I)
290            IF J<2 THEN
300                OUTPUT @Dio;"MEAS:DIG:DATA"&VAL$(J+2)&"?"
310            ELSE
320                OUTPUT @Dio;"MEAS:DIG:DATA"&VAL$(J-2)&"?"
330            END IF
340            ENTER @Dio;A$
350            Number=VAL(A$)
360            B$=DVAL$(Number,2)
370            IF B$[25,32]<>Bit_walk$(I) THEN
380                Fail = 1
390                PRINT "Failure of bit walk"
400                PRINT "WRITE at port  ";J
410                IF J<2 THEN
420                    PRINT "READ at port ";J+2
430                ELSE
440                    PRINT "READ at port ";J-2
450                END IF
460            END IF
470        NEXT J
480    NEXT I
490    PRINT "End of bit walk test"
```

```
500    PRINT
510    PRINT "Handshake line test"
520    FOR T=1 TO 0 STEP -1
530       FOR I =0 TO 3
540          OUTPUT @Dio;"SOUR:DIG:CONT"&VAL$(I)&"  "&VAL$(T)
550          IF I <2 THEN
560             OUTPUT @Dio;"MEAS:DIG:FLAG"&VAL$(I+2)&"?"
570          ELSE
580             OUTPUT @Dio;"MEAS:DIG:FLAG"&VAL$(I-2)&"?"
590          END IF
600          ENTER @DIO;A$
610          IF VAL(A$)<>T THEN
620             Fail = 1
630             PRINT "Failure of handshake lines"
640             IF I<2 THEN
650                PRINT "CTL line on port ";I;" to FLG line on port ";I+2
660             ELSE
670                PRINT "CTL line on port ";I;" to FLG line on port ";I-2
680             END IF
690          END IF
700       NEXT I
710    NEXT T
720    PRINT "End of handshake line test"
730    PRINT
740    IF Fail=0 THEN
750       PRINT "Digital I/O PASSED all tests"
760    ELSE
770        PRINT "Digital I/O failed tests"
780    END IF
790    END
```

Typical Result

```
Bit walk test of all ports for read and write (no handshake)

End of bit walk test

Handshake line test

End of handshake line test

Digital I/O PASSED all tests
```

Performance Test Record

Table 2-1, *Performance Test Record*, is a form you can copy and use to record performance verification test results for the Module.

Test Limits

The HP E1330A/B test is a pass/fail test and has no test limits. Minimum and Maximum values are marked NA (Not Applicable) in Table 2-1.

Measurement Uncertainty

The HP E1330A/B test is a pass/fail test and has no measurement uncertainty. The measurement uncertainty column is marked NA(Not Applicable) in Table 2-1.

Test Accuracy Ratio (TAR)

Test Accuracy Ratios (TAR) are not defined for pass/fail measurements, so all measurements show NA (Not Applicable) in the TAR column.

Table 2-1. Performance Test Record (Page 1 of 2)

Model _____ Report No._____ Date _____

General Information

Test Facility:

Name _____ Report No. _____

Address _____ Date _____

City/State _____ Customer _____

Phone _____ Tested by _____

Special Notes:

_____

_____

_____

_____

Test Equipment Record

Test Equipment Used: Description	Model No.	Trace No.	Cal Due Date
1. _____	_____	_____	_____
2. _____	_____	_____	_____
3. _____	_____	_____	_____

Table 2-1. Performance Test Record (Page 2 of 2)

Model _____ Report No._____ Date _____

Performance Test Record

Test No/Description	Minimum Value	Measured Value	Maximum Value	Meas Uncert	Test Acc Ratio (TAR)
Test 2-1: Digital Test					
Read/Write Test					
Port 0 Write/Port 2 Read	NA	Pass Fail	NA	NA	NA
Port 1 Write/Port 3 Read	NA	Pass Fail	NA	NA	NA
Port 2 Write/Port 0 Read	NA	Pass Fail	NA	NA	NA
Port 3 Write/Port 1 Read	NA	Pass Fail	NA	NA	NA
Handshake Test					
Port 0 CTL/Port 2 FLG	NA	Pass Fail	NA	NA	NA
Port 1 CTL/Port 3 FLG	NA	Pass Fail	NA	NA	NA
Port 2 CTL/Port 0 FLG	NA	Pass Fail	NA	NA	NA
Port 3 CTL/Port 1 FLG	NA	Pass Fail	NA	NA	NA

Chapter 3
Replaceable Parts

Introduction

This chapter contains information to order replaceable parts for the HP E1330A Quad 8-Bit Digital I/O Modules with serial number prefixes 2934A and HP E1330B with serial number prefixes 3221A. Table 3-1 lists replaceable parts for the HP E1330A Module and Table 3-2 lists replaceable parts for the HP E1330B Module. Table 3-3 shows reference designators for parts in Tables 3-1 and 3-2. Table 3-4 shows the manufacturer code list for these parts.

To order a part listed in Table 3-1 or 3-2, specify the Hewlett-Packard part number and the quantity required. Send the order to your nearest Hewlett-Packard Sales and Support Office.

Replaceable Parts List

Table 3-1 lists mechanical replaceable parts for the HP E1330A Quad 8-Bit Digital I/O Module with serial number prefix 2934A. Table 3-2 lists mechanical replaceable parts for the HP E1330B Quad 8-Bit Digital I/O Module with serial number prefix 3221A. See Figure 3-1 for locations of mechanical parts.

Table 3-1. HP E1330A Replaceable Parts

Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
			ASSEMBLIES and CABLES		
			(See Figure 3-1)		
	E1330-66201	1	**REPLACEMENT ASSEMBLY**	28480	E1330-66201
A1	E1330-66501	1	PC Assembly - Digital I/O 32-Channel	28480	E1330-66501
CBL1	E1330-61603	1	Test Cable (issued with Service Kit)	28480	E1330-61603
CBL2-CBL3	E1330-61601	2	Ribbon Cable (not illustrated)	28480	E1330-61601
MP1	E1300-45101†	1	HNDL-KIT TOP, HP†	28480	E1300-45101†
MP2	E1300-45102†	1	HNDL-KIT BTM, VXI†	28480	E1300-45102†
F1	2110-0712	1	Fuse-subminiature 4A 125V NTD AX	75915	R251004T1
J1-J2	1252-1044	2	Connector-post type .100-pin-spcg 60-contact	76381	3372-5302
J12	1251-6515	1	Connector-post type .100-pin-spcg 6-contact	18873	67996-606
J15-J16	1251-4927	2	Connector-post type .100-pin-spcg 16-contact	76381	2416-6182TB
J51-J54	1251-4682	4	Connector-post type .100-pin-spcg 3-contact	27264	22-10-2031
P1	1252-1596	1	Connector-post type 2.54-pin-spcg 96-contact	00779	536010-5
P15	1258-0247	1	Four-position Jumper	22526	69146-204
P51-P57	1258-0141	7	Removable Jumper	00779	530153-2
PNL1	E1330-00212†	1	PNL-RR 4 CH DAC†	28480	E1330-00212†
SCR1-SCR2	0515-2140	2	SCR-THD-RLG M2.5 X0.45 14mm	28480	0515-2140
SCR3-SCR4	0515-1968	2	Screw M2.5 X 0.45 11mm-long pan-head	28480	0515-1968
SCR5-SCR6	0515-2743	2	SCR-FH M2.5 X 8 THREAD ROLLING	28480	0515-2743
SW1	3101-3066	1	Switch-dip Rocker 8-1A 0.15A 30 VDC	81073	76YY22968S

† These parts are not compatible with older version fixed handles or their corresponding front panels. To replace one or more of these old parts, you must order all three new parts (Top and Bottom Handle Kits AND Front Panel).

Table 3-2. HP E1330B Replaceable Parts

Reference Designator	HP Part Number	Qty	Part Description	Mfr. Code	Mfr. Part Number
			ASSEMBLIES and CABLES		
			(See Figure 3-1)		
	E1330-66202	1	**REPLACEMENT ASSEMBLY**	28480	E1330-66202
A1	E1330-66521	1	PC Assembly - Digital I/O 32-Channel	28480	E1330-66521
CBL1	E1330-61603	1	Test Cable (issued with Service Kit)	28480	E1330-61603
CBL2-CBL3	E1330-61601	2	Ribbon Cable (not illustrated)	28480	E1330-61601
MP1	E1300-45101†	1	HNDL-KIT TOP, HP†	28480	E1300-45101†
MP2	E1300-45102†	1	HNDL-KIT BTM, VXI†	28480	E1300-45102†
F1	2110-0712	1	Fuse-subminiature 4A 125V NTD AX	75915	R251004T1
J1-J2	1252-1044	2	Connector-post type .100-pin-spcg 60-contact	76381	3372-5302
J12	1251-6515	1	Connector-post type .100-pin-spcg 6-contact	18873	67996-606
J15-J16	1251-4927	2	Connector-post type .100-pin-spcg 16-contact	76381	2416-6182TB
J51-J54	1251-4682	4	Connector-post type .100-pin-spcg 3-contact	27264	22-10-2031
P1	1252-1596	1	Connector-post type 2.54-pin-spcg 96-contact	00779	536010-5
P15	1258-0247	1	Four-position Jumper	22526	69146-204
P51-P57	1258-0141	7	Removable Jumper	00779	530153-2
PNL1	E1330-00212†	1	PNL-RR 4 CH DAC†	28480	E1330-00212†
SCR1-SCR2	0515-2140	2	SCR-THD-RLG M2.5 X0.45 14mm	28480	0515-2140
SCR3-SCR4	0515-1968	2	Screw M2.5 X 0.45 11mm-long pan-head	28480	0515-1968
SCR5-SCR6	0515-2743	2	SCR-FH M2.5 X 8 THREAD ROLLING	28480	0515-2743
SW1	3101-3066	1	Switch-dip Rocker 8-1A 0.15A 30 VDC	81073	76YY22968S

† These parts are not compatible with older version fixed handles or their corresponding front panels. To replace one or more of these old parts, you must order all three new parts (Top and Bottom Handle Kits AND Front Panel).

NOTE

If the 4 IC's placed in the sockets are square in shape rather than rectangular, the PC assembly (A1 reference designator) is the most recent HP E1330B release, as listed above. If the 4 IC's are rectangular (see Figure 3-1), the PC assembly is an earlier E1330B release and must be replaced with a new Replacement Assembly (Part Number E1330-66202).

Table 3-3. HP E1330A/B Reference Designators

HP E1330A/B Reference Designators	
A ..... assembly	MP ..... mechanical part
F ..... fuse	P ..... electrical connector (plug)
J ..... electrical connector (jack)	PNL ..... panel
JM ..... jumper	SCR ..... screw
	SW ..... switch

Table 3-4. HP E1330A/B Code List of Manufacturers

Mfr. Code	Manufacturer's Name	Manufacturer's Address			Zip Code
00779	AMP Inc.	Harrisburg	PA	US	17111
18873	Dupont E I De Nemours & CO	Wilmington	DE	US	19801
22526	Berg Electronics Inc.	Ettersill	PA	US	17319
27264	Molex Inc.	Lisle	IL	US	60532
28480	Hewlett-Packard Company - Corporate	Palo Alto	CA	US	94304
75915	Littelfuse Inc.	Des Plaines	IL	US	60016
76381	3M CO	St Paul	MN	US	55144
81073	Grayhill Inc.	La Grange	IL	US	60525

Mechanical Parts Locator

Figure 3-1 shows the location of selected mechanical parts for the HP E1330A/B Quad 8-Bit Digital I/O Module.

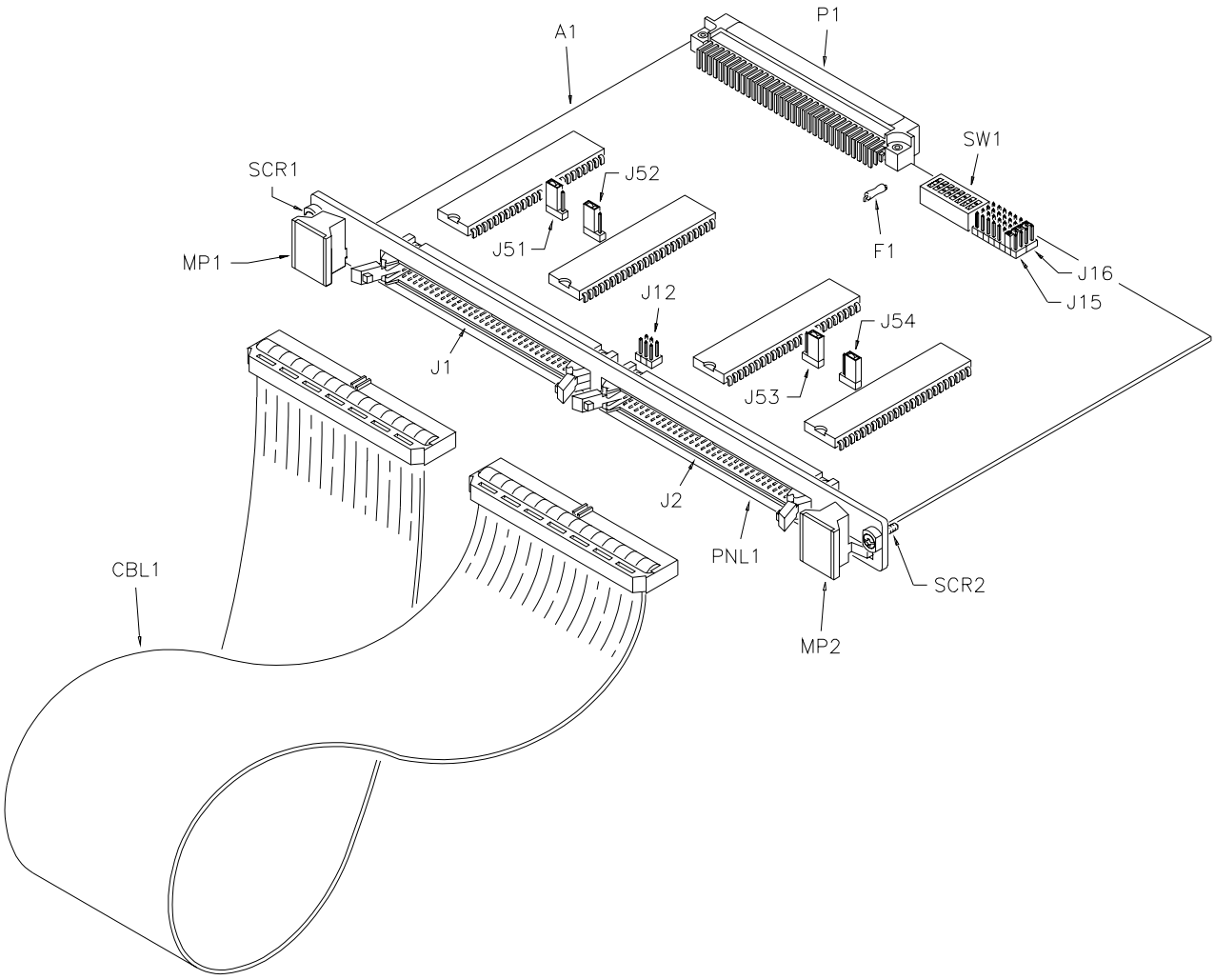


Figure 3-1. Mechanical Parts

Chapter 4
Service

Introduction

This chapter contains service information for the HP E1330A/B Quad 8-Bit Digital I/O Modules. Also included are trouble shooting, repair, and maintenance guidelines.

WARNING

Do not perform any of the service procedures shown unless you are a qualified, service-trained technician and have read the WARNINGS and CAUTIONS in Chapter 1.

Equipment Required

Equipment required for module troubleshooting and repair is listed in *Table 1-1, Recommended Test Equipment.* Any equipment that satisfies the requirements given in the table may be substituted. To avoid damage to the screw head slots, use a T8 Torx driver to remove the front panel handles.

Service Aids

See *Chapter 3 — Replaceable Parts* for descriptions and locations of HP E1330A/B replaceable parts. Service notes, manual updates, and service literature for the modules may be available through Hewlett-Packard. For information, contact your nearest Hewlett-Packard Sales and Service Office.

Digital I/O Module Description

The HP E1330A/B provides four independent 8-bit digital I/O ports compatible with TTL logic levels. Each port can be software configured for operation as either input or output with either positive or negative true logic. The ports can be combined to provide 16 bit (WORD) or 32 bit (LWORD) operations.

In addition to the eight digital data lines, six handshake lines are included per port. The handshake lines can also be combined (via jumpers on the component assembly) to provide proper handshaking for combined ports. The data lines of each port are provided with a jumpered pull-up resistors for dry contact closure sensing. User connections to the Digital I/O module are made through two 60-pin connectors on the rear panel.

Repair Strategy

Hewlett-Packard recommends replacement of the entire assembly in the event of a failure. Procedures in this chapter describe troubleshooting techniques.

Troubleshooting Techniques

To troubleshoot an HP E1330A/B module problem you must first identify the problem and then isolate the cause of the problem to a replaceable assembly. See *Chapter 3 — Replaceable Parts* for descriptions and locations of HP E1330A/B replaceable parts.

Identifying the Problem

Table 4-1 lists some common problems for the HP E1330A/B modules, along with symptoms and possible solutions. If the problem cannot be identified using these steps, replace the assembly.

Table 4-1. HP E1330A/B Typical Problems

Symptom	Possible Solutions
Non-zero error code in response to SYST:ERR?	See Appendix A of the *HP E1330A/B Quad 8-Bit Digital I/O Module User's Manual*.
Module not responding to commands.	See "Making Visual Checks" in this chapter.
Module fails Digital Test (Test 2-1).	See "Testing the Module" in this chapter.

Making Visual Checks

Visual checks for the HP E1330A/B modules include the following. See Table 4-2 for typical checks.

- Check switches/jumpers
- Check for heat damage
- Check connector contacts

NOTE

See the HP E1330A/B Quad 8-Bit Digital I/O Module User's Manual for information on logical address and IRQ settings. If there are no apparent problems following the visual checks, run the Performance Verification Tests in Chapter 2 to see if the module is defective.

Table 4-2. HP E1330A/B Visual Tests/Checks

Test/Check	Reference Designator	Check	Action/Notes
Heat Damage	- - - - - - - - - - - - - - -	Discolored PC boards Damaged insulation Evidence of arcing	If there is damage, do not operate the module until you have corrected the problem.
Switch/Jumper Settings	J15, J16 SW1 J51,J52,J53,J54 J12	IRQ Level setting Logical address setting Pull-up Enable FLG Combine	Factory set at 1 Factory set at 144 Factory set to Enable Factory set to no jumpers
Component Assembly	F1 J1-J2 P1	Fuse continuity Dirty or bent connector pins Dirty or bent connector pins	Check fuse with ohmmeter Straighten/clean pins Straighten/clean pins

Testing the Module

You can use the tests and checks in *Chapter 2 — Verification Tests*, to identify a problem with the assembly. See *Chapter 3 — Replaceable Parts* for locations of mechanical parts.

Repair and Maintenance Guidelines

This section provides guidelines for repairing and maintaining the HP E1330A/B Quad 8-Bit Digital I/O Module including:

- ESD precautions
- Soldering printed circuit boards
- Post-repair safety checks

ESD Precautions

Electrostatic discharge (ESD) may damage static sensitive devices in the module. This damage can range from slight parameter degradation to catastrophic failure. When handling the module observe the following guidelines:

- Always use a static-free work station with a pad of conductive rubber or similar material when handling module components.
- If a device requires soldering, be sure the assembly is placed on a pad of conductive material. Also, be sure that you, the pad, and the soldering iron tip are grounded to the assembly.

Soldering Printed Circuit Boards

The etched circuit board of this module has plated-through holes that provide a solder path to both sides of the insulating material. Soldering can be done from either side of the board with equally good results. When soldering to any circuit board, keep in mind the following guidelines:

- Avoid unnecessary component unsoldering and soldering. Excessive replacement can result in damage to the circuit board, adjacent components, or both.
- Do not use a high power soldering iron on etched circuit boards, as excessive heat may lift a conductor or damage the board.
- Use a suction device or wooden toothpick to remove solder from component mounting holes. When using a suction device, be sure that the equipment is properly grounded.

Post-Repair Safety Checks

After making repairs to the module, inspect the module for any signs of abnormal internally generated heat, such as discolored printed circuit boards or components, damaged insulation, or evidence of arcing. Determine and correct the cause of the condition. Then perform Test 2-1 as described in *Chapter 2 — Verification Tests* to verify that the module is functional.

Appendix A
Verification Tests - C Programs

Functional Verification Test

This program is designed to do the Functional Verification Test found in *Chapter 2 - Verification Tests*.

Example

This example sends a *IDN? command to the Digital I/O Module. This test can be used to verify that the module is connected properly and is responding to a basic command.

```
#include <stdio.h>
#include <sicl.h>

#define ADDR "hpib7,9,18"                /* Address of Device */

void main ()
{
  INST id;                               /* Define id as an instrument */
  char a[256] = {0};                     /* Result variable */

  id = iopen (ADDR);                     /* Open instrument session */

  ipromptf (id, "*IDN?\n", "%t", a);     /* ID command */

  printf ("\n %s", a);                   /* Print result */

  getchar ();                            /* Pause */

  iclose (id);                           /* Close instrument session */
}
```

Performance Verification Test

This program is designed to do the Performance Verification Test found in *Chapter 2 - Verification Tests*.

Example: Digital Test

This example performs a bit walk test of all bits on all ports and checks the module's ability to set and reset the handshake lines on each port.

```
/*  Digital I/O Test        E1330A  */

#include <stdio.h>
#include <stdlib.h>
#include <sicl.h>

#define ADDR "hpib7,9,18"                   /* Address of device */

void main (void)
{
  INST id;                                  /* Define id as an instrument */
  char a[255], b[32];
  char *bit_walk[] = {"00000001", "00000010", "00000100", "00001000",
                      "00010000", "00100000", "01000000", "10000000"};
  int bit_val[] = {1, 2, 4, 8, 16, 32, 64, 128};
  int fail, i, j, number;
  int atoi (const char *a);

  #if defined(__BORLANDC__) && !defined(__WIN32__)
  _InitEasyWin();
  #endif

   ionerror(I_ERROR_EXIT);

   id = iopen (ADDR);                       /* Open instrument session */

  iprintf (id, "*CLS\n");
  fail = 0;

  printf("\nInstall component assembly and test cable");
  printf("\n\n 1. Turn mainframe power off");
  printf("\n 2. Install HP E1330A/B component assemby into
         mainframe");
  printf("\n 3. Attach test cable to component assembly");
  printf("\n 4. Turn mainframe power on");
  printf("\n 5. Press ENTER when ready to begin testing");
  gets (a);

/*-----------------------------------Bit walk test-------------------------------------*/
```

```
  printf("\n\nBit walk test of all ports for read and write (no handshake)");

  for (i = 0; i <= 7; i++)
  {
    for (j = 0; j <= 3; j++)
    {
      iprintf (id, "SOUR:DIG:DATA%u #B%s\n", j, bit_walk[i]);
       if (j < 2)
        iprintf (id, "MEAS:DIG:DATA%u?\n", j+2);
      else
        iprintf (id, "MEAS:DIG:DATA%u?\n", j-2);

      iscanf(id, "%t", a);
      number = atoi(a);
      if (number != bit_val[i])
      {
        fail = 1;
        printf("\nFailure of bit walk");
        printf("\n  WRITE at port %u", j);
        if (j < 2)
          printf("\n  READ at port %u", j+2);
        else
          printf("\n  READ at port %u", j-2);
      }
    }
  }
  printf("\nEnd of bit walk test");

/*---------------------------------Handshake line test-----------------------------*/

  printf("\n\nHandshake line test");
  (j = 1; j >= 0; j = j - 1)
  {
    for (i = 0; i <= 3; i++)
    {
      iprintf(id, "SOUR:DIG:CONT%u %u\n", i, j);
      if (i < 2)
        iprintf(id, "MEAS:DIG:FLAG%u?\n", i+2);
      else
        iprintf(id, "MEAS:DIG:FLAG%u?\n", i-2);
      iscanf(id, "%1t", a);

      if (atoi(a) != j)
      {
        fail = 1;
        printf("\nFailure of handshake lines");
        if (i < 2)
          printf("\n  CTL line on port %u to FLG line on port %u", i, i+2);
        else
          printf("\n  CTL line on port %u to FLG line on port %u", i, i-2);
```

```
      }
    }
  }
  printf("\nEnd of handshake line test\n");

/*-------------------------------------Results-----------------------------------------------*/

  if (fail == 0)
    printf("\nDigital I/O PASSED all tests");
  else
    printf("\nDigital I/O failed tests");

  iclose (id);                                  /* Close instrument session */
}
```



Agilent Technologies



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