Service Guide

For Safety information, Warranties, and Regulatory information, see the pages at the end of the book.

Agilent Technologies 16720A 300 M Vectors/s Pattern Generator

The Agilent 16720A pattern generator module is an expandable stimulus tool designed for the 16700-Series Logic Analysis System. The 16720A provides digital design teams the ability to emulate missing devices and to functionally test prototypes.

Key Characteristics

Some of the key characteristics of the Agilent Technologies 16720A are as follows:

Output Channel: 24 channels at 300 MHz clock; 48 channels at 180MHz clock.

Memory Depth: 16, 777, 216 of vectors.

Logic Level (data pods): TTL, 3-state TTL/3.3v, 3-state TTL/CMOS, ECL/PECL/ LVPECL terminated, ECL unterminated, and differential ECL (without pod).

Data Inputs: 3-bit pattern level sensing (clock pod).

Clock Output: Synchronized to output data, delay of 7ns in 14 steps (clock pod).

Clock Input: DC to 300 MHz (clock pod).

Internal Clock Period: Programmable from 1 MHz to 300 MHz in 1 MHz steps.

External Clock Period: DC to 300 MHz.

External Clock Duty Cycle: 1.3 ns minimum high time.

Maximum Number of Different Macros: 100

Maximum Number of Lines in a Macro: 4096

Maximum Number of "Wait" Event Patterns: 4

Service Strategy

The service strategy for this instrument is the replacement of defective assemblies. This service guide contains information for finding a defective assembly by testing and servicing the Agilent 16720A pattern generator module.

The module can be returned to Agilent Technologies for all service work, including troubleshooting. Contact your nearest Agilent Technologies Sales Office for more details.

Application

This service guide applies to the Agilent 16720A pattern generator module installed in the 16700-series logic analysis system mainframes.

The Agilent 16720A uses operating system version A.02.00 or higher. The 16700-series mainframes with a serial number prefix lower than US4019 are factory-installed with older operating system versions.
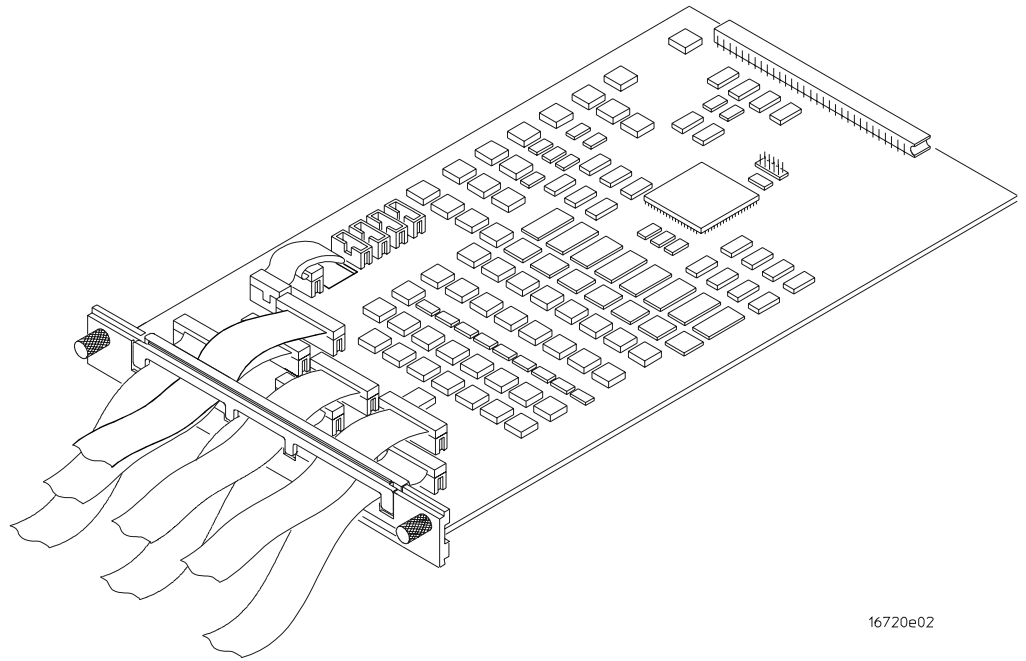
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The Agilent 16720A Pattern Generator

In This Book

This book is the service guide for the Agilent 16720A 300 M Vectors/s Pattern Generator module. Place this service guide in the 3-ring binder supplied with your *16700-Series Logic Analysis System Service Manual*.

This service guide has eight chapters.

Chapter 1 contains information about the module and includes accessories for the module, specifications and characteristics of the module, and a list of the equipment required for servicing the module.

Chapter 2 tells how to prepare the module for use.

Chapter 3 gives instructions on how to test the performance of the module.

Chapter 4 contains calibration instructions for the module.

Chapter 5 contains self-tests and flowcharts for troubleshooting the module.

Chapter 6 tells how to replace the module and assemblies of the module and how to return them to Agilent Technologies.

Chapter 7 lists replaceable parts, shows an exploded view, and gives ordering information.

Chapter 8 explains how the pattern generator works and what the self-tests are checking.

Contents

Contents

1

General Information

This chapter lists the accessories, the characteristics, and the recommended test equipment.

Accessories

The following accessories are supplied with the 16720A pattern generator module.

Accessories Supplied	Agilent Part Number
DATA CABLES	16522-61691
CLOCK CABLE	16522-61602

Mainframe and Operating System

The 16720A pattern generator requires a 16700-series logic analysis system with operating system version A.02.00.00 or higher.

Environmental Characteristics

Clock Probes

Maximum Input Voltage	± 40 V, CAT I, CAT I = Category I, secondary power line isolated circuits.

Operating Environment

Temperature	Instrument, 0 °C to 55 °C (+32 °F to 131 °F).
	Probe lead sets and cables, 0 °C to 65 °C (+32 °F to 149 °F).
Humidity	Instrument, probe lead sets, and cables, up to 95% relative humidity at +40 °C (+122 °F).
Altitude	To 4600 m (15,000 ft).
Vibration	Operating: Random vibration 5 to 500 Hz, 10 minutes per axis, ≈0.3 g (rms).
	Non-operating: Random vibration 5 to 500 Hz, 10 minutes per axis, ≈2.41 g (rms); and swept sine resonant search, 5 to 500 Hz, 0.75 g (0-peak), 5 minute resonant dwell at 4 resonances per axis.
	Operating power supplied by mainframe.
	Indoor use only.
	Pollution Degree 2.

Recommended Test Equipment

Equipment Required

Equipment	Critical Specifications	Recommended Model/Part	Use[*]
Digitizing Oscilloscope		54820A	T

A = Adjustment, P = Performance Tests, T = Troubleshooting

**Instructions for making these test connectors are in chapter 3, "Testing Performance."

2

Preparing for Use

This chapter gives you instructions for preparing the module for use.

Power Requirements

All power supplies required for operating the pattern generator are supplied through the backplane connector in the mainframe.

Operating Environment

The operating environment is listed in chapter 1. Note the non-condensing humidity limitation. Condensation within the instrument can cause poor operation or malfunction. Provide protection against internal condensation.

The pattern generator module will operate at all specifications within the temperature and humidity range given in chapter 1. However, reliability is enhanced when operating the module within the following ranges:

Temperature: +20 °C to +35 °C (+68 °F to +95 °F)

Humidity: 20% to 80% non-condensing

Storage

Store or ship the pattern generator in environments within the following limits:

- Temperature: -40 °C to +75 °C (-40 °F to +167 °F)

- Humidity: Up to 90% at 65 °C

- Altitude: Up to 15,300 meters (50,000 feet)

Protect the module from temperature extremes which cause condensation on the instrument.

To inspect the module

1 Inspect the shipping container for damage.

If the shipping container or cushioning material is damaged, keep them until you have checked the contents of the shipment and checked the instrument mechanically and electrically.

2 Check the supplied accessories.

Accessories supplied with the module are listed in chapter 1, "Accessories Supplied."

3 Inspect the product for physical damage.

Check the module and the supplied accessories for obvious physical or mechanical defects. If you find any defects, contact your nearest Agilent Technologies Sales Office. Arrangements for repair or replacement are made, at Agilent Technologies option, without waiting for a claim settlement.

To prepare the mainframe

CAUTION

Turn off the mainframe power before removing, replacing, or installing the module.

CAUTION

Electrostatic discharge can damage electronic components. Use grounded wrist-straps and mats when performing any service to this module.

1 Remove power from the instrument.

    a Exit all logic analysis sessions. In the session manager, select Shutdown.

    b At the query, select Power Down.

    c When the "OK to power down" message appears, turn the instrument off.

    d Disconnect the power cord.

    e Disconnect any input or output connections.

2 Plan your module configuration.

If you are installing a one-card module, use any available slot in the mainframe.

If you are installing a multi-card module, use adjacent slots in the mainframe.

3 Loosen the thumb screws.

Cards or filler panels below the slots intended for installation do not have to be removed.

Starting from the top, loosen the thumb screws on filler panels and cards that need to be moved.
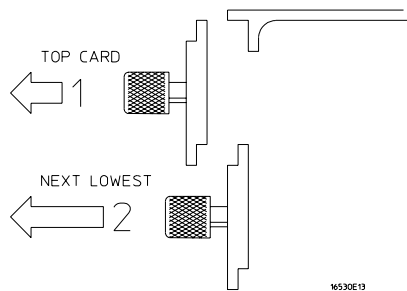
4 Starting from the top, pull the cards and filler panels that need to be moved halfway out.

CAUTION

All multi-card modules will be cabled together. Pull these cards out together.

5 Remove the cards and filler panels.

Remove the cards or filler panels that are in the slots intended for the module installation. Push all other cards into the card cage, but not completely in. This is to get them out of the way for installing the module.

Some modules for the logic analysis system require calibration if you move them to a different slot. For calibration information, refer to the manuals for the individual modules.

To configure a one-card module

- When shipped separately, the module is configured as a one-card module. The cables should be connected as shown in the figure.

- To configure a multicard module into one-card modules, remove the cables connecting the cards. Then connect the free end of the 2x10 cable to the connector labeled "Master" (J6) on each card (see figure below).

CAUTION   If you pull on the flexible ribbon part of the 2x10 cable, you might damage the cable assembly. Using your thumb and finger, grasp the ends of the cable connector. Apply pressure to the ends of the cable connector to disengage the metal locking tabs of the connector from the cable socket on the board. Then pull the connector from the cable socket.

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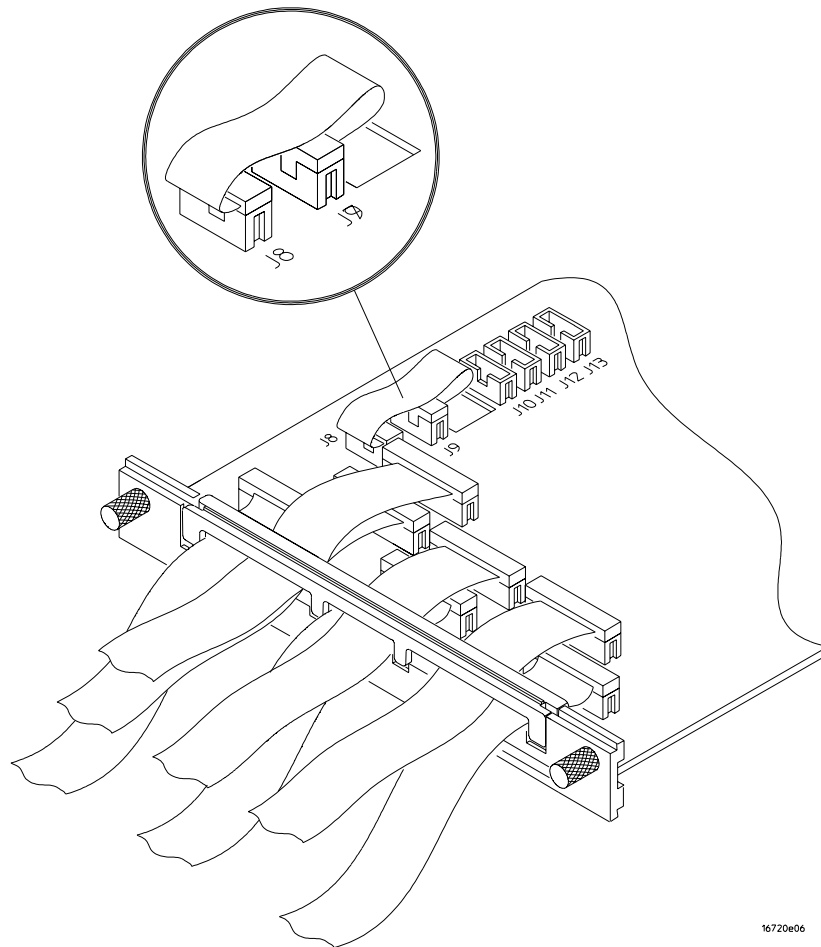
To configure a multi-card module

1 Plan the configuration. Multicard modules can only be connected as shown in the illustration. Select the card that will be the master card, and set the remaining cards aside.

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2 On the expander card, disconnect the end of the 2x10 cable that is plugged into the connector labeled J8.

CAUTION   If you pull on the flexible ribbon part of the 2x10 cable, you might damage the cable assembly.

Using you thumb and finger, grasp the ends of the cable connector. Apply pressure to the ends of the cable connector to disengage the metal locking tabs of the connector from the cable socket on the board. Then, pull the connector from the cable socket.
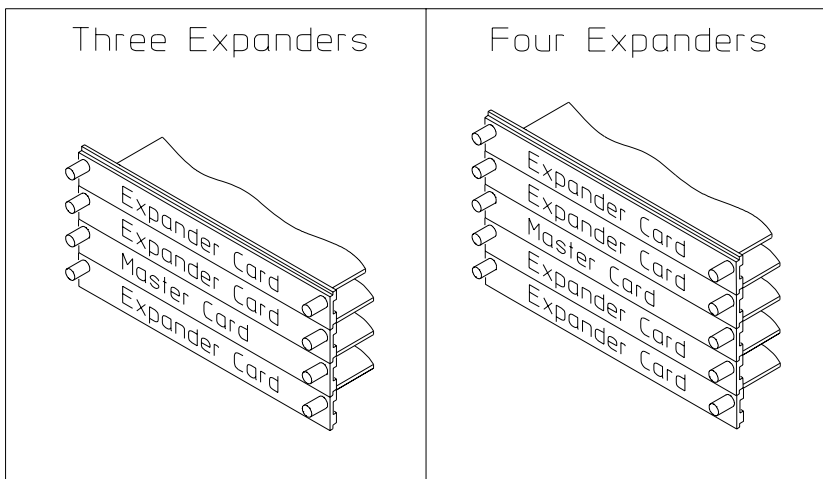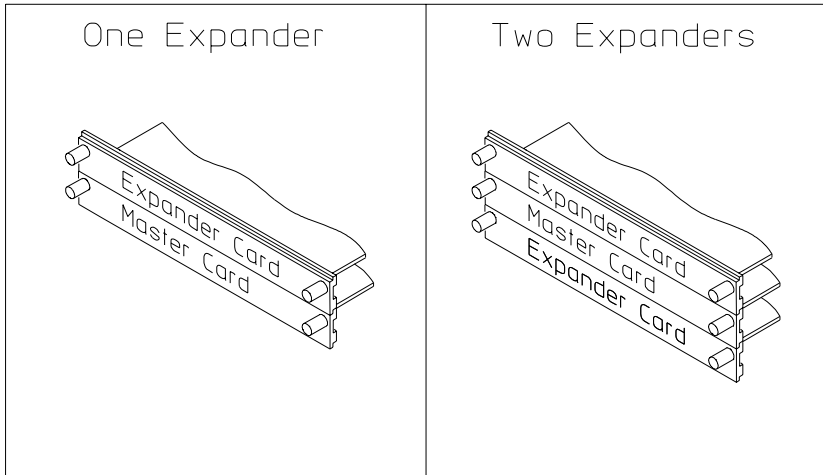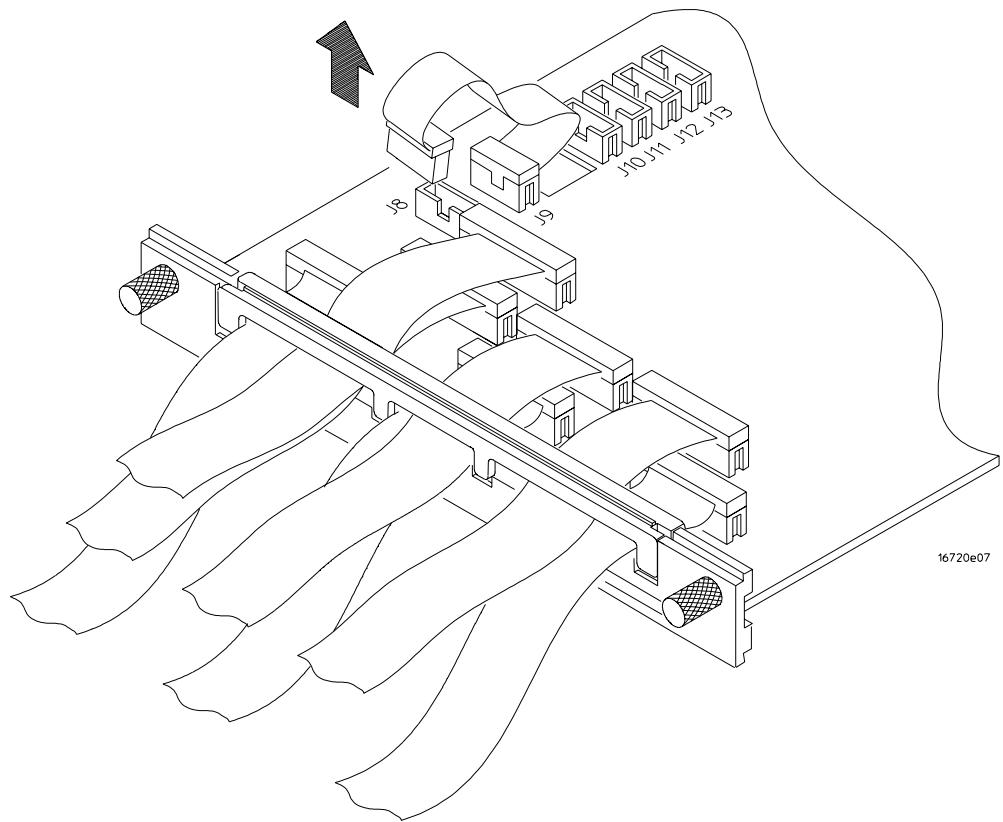

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3 Place the master card on top of any expander cards that are under the master card. Feed the free end of the 2x10 cables of the expander cards through the cable access holes to the master card. Plug the 2x10 cables into J10 (bottom-most expander in a five-card configuration) and J11 (expander that is next to the master card) on the master card.

The illustration below shows the bottom three cards of a five-card configuration.
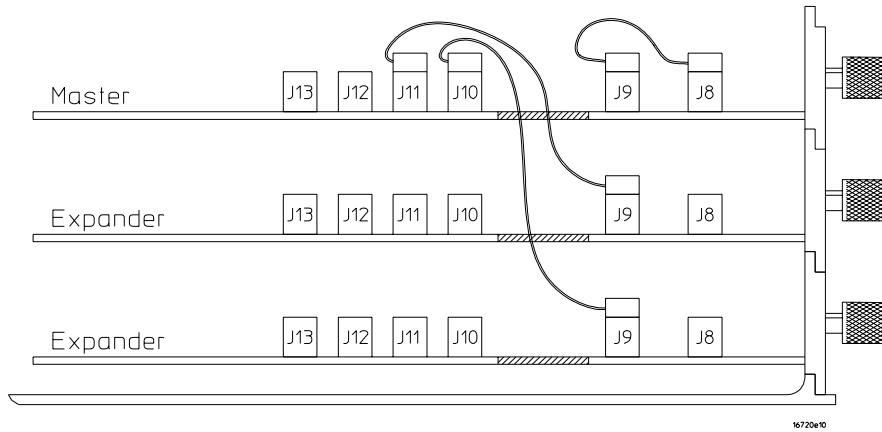
4 Place the remaining expander cards on top of the master board. Feed the free end of the 2x10 cables of the expander cards through the access holes to the master card. Plug the 2x10 cables into J12 (expander that is next to the master card) and J13 (top-most expander in a four or five-card configuration) on the expander cards.
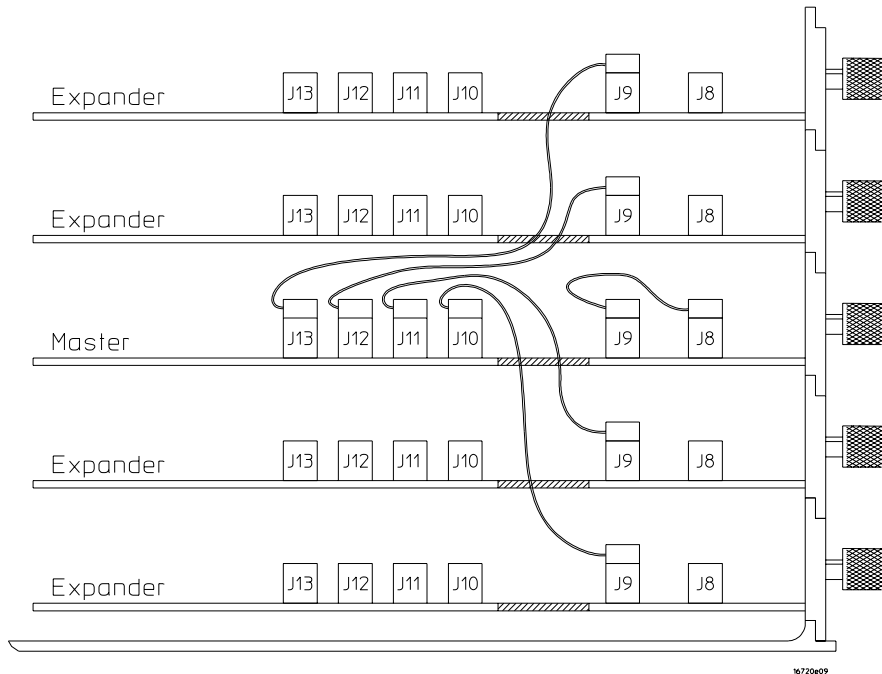
To install the module

1 Slide the cards above the slots for the module about halfway out of the mainframe.

2 With the probe cables facing away from the instrument, slide the module approximately halfway into the mainframe.
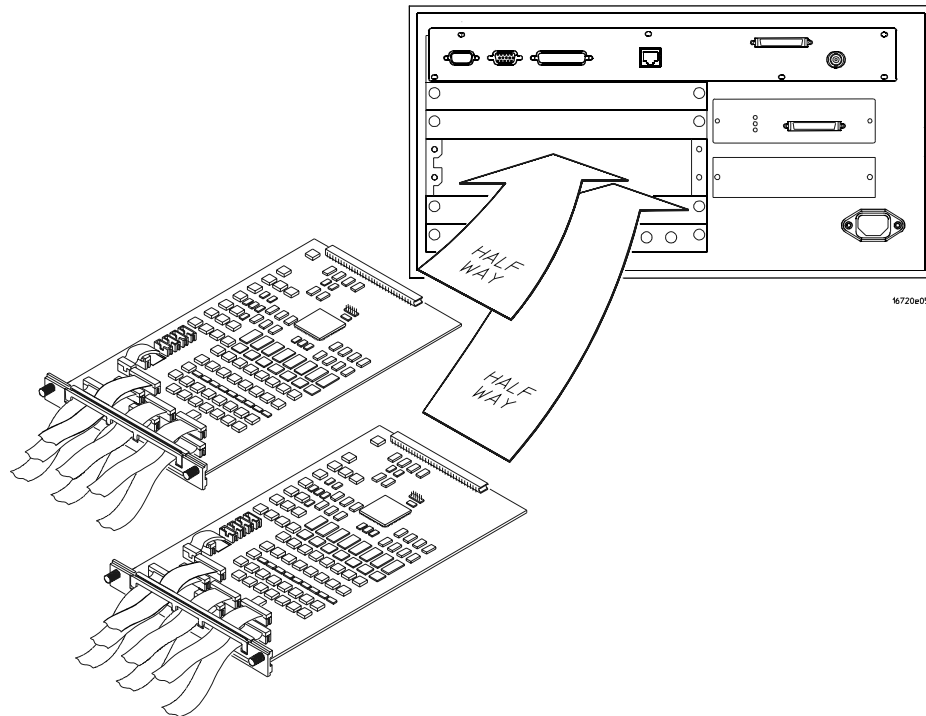
3 Slide the complete module into the mainframe, but not completely in.

Each card in the instrument is firmly seated and tightened one at a time in step 5.

4 Position all cards and filler panels so that the endplates overlap.

5 Seat the cards and tighten the thumbscrews.

Starting with the bottom card, firmly seat the cards into the backplane connector of the mainframe. Keep applying pressure to the center of the card endplate while tightening the thumbscrews finger-tight. Repeat this for all cards and filler panels starting at the bottom and moving to the top.
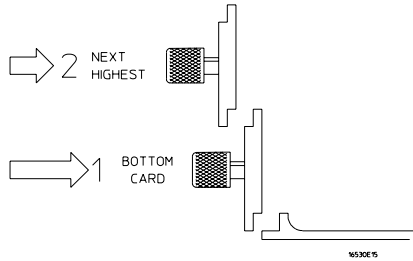
CAUTION   Correct air circulation keeps the instrument from overheating. For correct air circulation, filler panels must be installed in all unused card slots. Keep any extra filler panels for future use.

To turn on the system

1 Connect the power cable to the mainframe.

2 Turn on the instrument power switch.

When you turn on the instrument power switch, the instrument performs powerup tests that check mainframe circuitry. After the powerup tests are complete, the screen will look similar to the sample screen below.
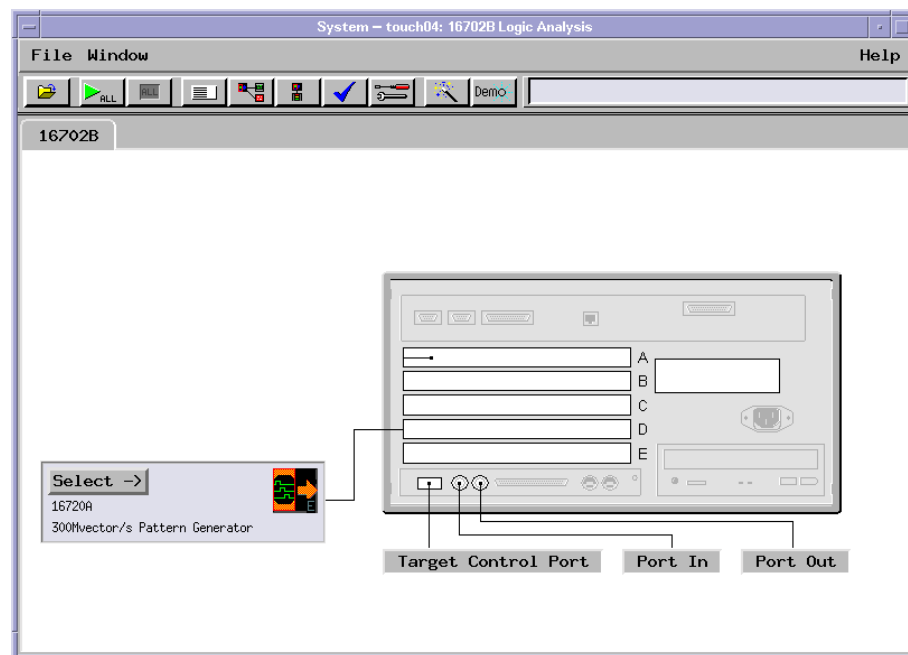
To test the module

The pattern generator module does not require an operational accuracy calibration or adjustment. After installing the module, you can test and use the module.

• If you require a test to verify the specifications, start at the beginning of chapter 3, "Testing Performance."

• If you require a test to initially accept the operation, perform the self-tests in chapter 3.

• If the module does not operate correctly, go to the beginning of chapter 5, "Troubleshooting."

To clean the module

- With the mainframe turned off and unplugged, use mild detergent and water to clean the rear panel.

- Do not attempt to clean the module circuit board.

3

Testing Performance

To ensure the logic analysis system is operating correctly, you can perform software tests (self-tests) on the system. Directions for performing the software tests are given in this chapter.

This chapter normally tells you how to test the performance of the logic analysis system against the specifications listed in chapter 1. Because there are no specifications for the 16720A, there are no performance verification tests.

Self-Tests

There are two types of self-tests: self-tests that automatically run at power-up, and self-tests that you select on the screen. For descriptions of the tests, refer to chapter 8 "Theory of Operation."

Perform the self-tests as an acceptable test when receiving the logic analysis system or when the logic analysis system is repaired.

If a test fails, refer to chapter 5, "Troubleshooting."

Perform the power-up tests

The logic analysis system automatically performs power-up tests when you apply power to the instrument. Any errors are reported in the boot dialogue. Serious errors will interrupt the boot process.

The power-up tests are designed to complement the instrument on-line Self Tests. Tests that are performed during power-up are not repeated in the Self Tests.

The monitor (16700 only), keyboard and mouse must be connected to the mainframe to observe the results of the power-up tests. (The 16702B does not require a mouse, keyboard or monitor.)

1 Disconnect all inputs and exit all logic analysis sessions.

In the Session Manager, select **Shutdown**. In the window, select **Powerdown**.

2 When the "OK to power down" message appears, turn off the power switch.

3 After a few seconds, turn the power switch back on. Observe the boot dialogue for the following:

- ensure all of the installed memory is recognized

- any error messages

- interrupt of the boot process with or without error message

A complete transcript of the boot dialogue is in Chapter 8, "Theory of Operation".

4 During initialization, check for any failures.

If an error or an interrupt occurs, refer to Chapter 5, "Troubleshooting".

To perform the self-tests

The self-tests verify the correct operation of the logic analysis system. Self-tests can be performed all at once or one at a time. While testing the performance of the logic analysis system, run the self-tests all at once.

1 Launch the Self-Tests

    a   In the System Window, select the System Admin icon.

    b   In the System Administration window, select Self-Test...

    c   In the query pop-up, choose Yes to exit the current session.

The Self-Test closes down the current session because the test algorithms leave the system in an unknown state. Re-launching a session at the end of the tests will ensure the system is properly initialized.

2 In the Self-Test window choose Test All.

When the tests are finished, the Status will change to TEST passed or TEST failed. You can find detailed information about the test results in the Status Message field of the Self-Test window.

The System CPU Board tests returns Untested because the CPU tests require user action. To test the CPU Board, select CPU Board, then choose each test individually.

For more information on tests that are not executed, refer to Chapter 8, "Troubleshooting."

3 Select Quit to exit the Test menu.

4 In the Session Manager, select Start Session This Display to re-launch a logic analysis session.

4

Calibrating

This chapter gives you instructions for calibrating the pattern generator.

Calibration Strategy

The 16720A pattern generator does not require an operational accuracy calibration.

5

Troubleshooting

This chapter helps you troubleshoot the module to find defective assemblies.

The troubleshooting consists of flowcharts, self-test instructions, a cable test, and a test for the auxiliary power supplied by the probe cable.

If you suspect a problem, start at the top of the first flowchart. During the troubleshooting instructions, the flowcharts will direct you to perform the self-tests or the cable test.

The service strategy for this instrument is the replacement of defective assemblies. This module can be returned to Agilent for all service work, including troubleshooting. Contact your nearest Agilent Technologies Sales Office for more details.

CAUTION   Electrostatic discharge can damage electronic components. Use grounded wrist-straps and mats when you perform any service to this instrument or to the cards in it.

To use the flowcharts

Flowcharts are the primary tool used to isolate defective assemblies. The flowcharts refer to other tests to help isolate the trouble. The circled numbers on the charts indicate connections with the other flowcharts. Start your troubleshooting at the top of the first flowchart.

Mainframe Operating System

Before starting the troubleshooting on the16720A, ensure that the required version of 16700-series mainframe operating system is installed on the mainframe. The required operating system software versions are listed in Mainframe and Operating System" on page 8. To check the operating system version number, open the System Administration window, select the Admin tab, then select About...

If the proper version is not loaded, obtain a copy of the updated operating system software and install it on the mainframe.

```
                        ┌──────────┐
                        │  Start   │
                        └──────────┘
                             │
         (1)─────────────────┤◄─────────────────────────────────────────────
                             │
                        ┌──────────┐
                        │Apply Power│
                        └──────────┘
                             │
                      ╱─────────────╲
                     ╱ Does the display╲      ┌──────────────┐      ┌─────────────────┐
                    ╱ show the module   ╲ No  ╱ Is the current╲ No  │Install latest    │  (1A)
                    ╲ config correctly? ╱────►╲software version╱────►│operating system  │──►
                     ╲                 ╱      ╲  installed?   ╱      │version.          │
                      ╲───────────────╱        ╲────────────╱       └─────────────────┘
                             │ Yes                   │ Yes
```

Does the display show the module config correctly? No → Is the current software version installed? No → Install latest operating system version. → 1A

Yes ↓ (from display question)

Yes ↓ (from software version)

Are ALL cards properly seated in the mainframe? Yes → 2x10 cable faulty or not installed correctly between J3 and J6 on circuit board(s). Check 2x10 cable(s) Refer to Chapter 2.

No ↓

Remove power and properly seat all cards in the mainframe.

Do the procedure To run the self tests in Chapter 3 on the suspect module.

Does the module self-test pass? No → Are expander boards installed? Yes → Remove power from the mainframe.

2x10 cable faulty or not installed correctly between J10 and J15 or J14 and J19 on circuit boards. Check 2x20 cables.

Are 2x20 cables properly seated? Yes →

No ↓

Reset 2x20 cable

Are expander boards installed? No ↓

Remove power, replace defective board. Reapply power and re-run module self-tests.

Does the module self-test pass? Yes ↓

Exit the Self Test and start a logic analyzer session.

(2)

Troubleshooting Flowchart 1

```
            ( 2 )
              │
              ▼
      ◇ Is the user problem ◇  ──Yes──▶  ┌─────────────────────┐
        still present?                   │ Perform procedure "To│
              │                          │ verify the pattern   │
             No                          │ output" on suspect   │
              │                          │ pod.                 │
              ▼                          └─────────────────────┘
          ( End )                                  │
                                                   ▼
                                         ◇ Does pattern output ◇ ──Yes──▶ ┌────────────────────┐
                                           test pass?                     │ The module is      │
                                                │                         │ functioning        │
                                               No                         │ properly.          │
                                                │                         └────────────────────┘
                                                ▼                                   │
                                       ┌─────────────────────┐                      ▼
                                       │ Replace pod with    │                  ( Done )
                                       │ known good pod and  │
                                       │ repeat procedure.   │
                                       └─────────────────────┘
                                                │
                                                ▼
                                       ◇ Does pattern output ◇ ──Yes──▶ ┌────────────────────┐
                                         test pass?                     │ Replace suspect pod.│
                                                │                       └────────────────────┘
                                               No
                                                │
                                                ▼
                                       ┌─────────────────────┐
                                       │ Replace cable with  │
                                       │ known good cable and│
                                       │ repeat procedure.   │
                                       └─────────────────────┘
                                                │
                                                ▼
                                       ◇ Does the pattern ◇ ──Yes──▶ ┌────────────────────┐
                                         output test pass?           │ Replace suspect     │
                                                │                     │ cable.              │
                                               No                     └────────────────────┘
                                                │
                                                ▼
                                       ┌─────────────────────┐
                                       │ Replace defective   │
                                       │ board.              │
                                       └─────────────────────┘
```

Troubleshooting Flowchart 2

To verify pattern output

Equipment Required

Equipment	Critical Specification	Recommended Model/Part
Oscilloscope	≥ 500 MHz Bandwidth	54820A
Probe	500 MHz Bandwidth	1160A
Output Data Pod	no substitute	10460A-series

1 Connect one of the 10460-series data pods t the end of the pattern generator Pod 1 cable.

2 Select Output Patterns. In the pop-up menu, choose Checkerboard Pattern 100M.
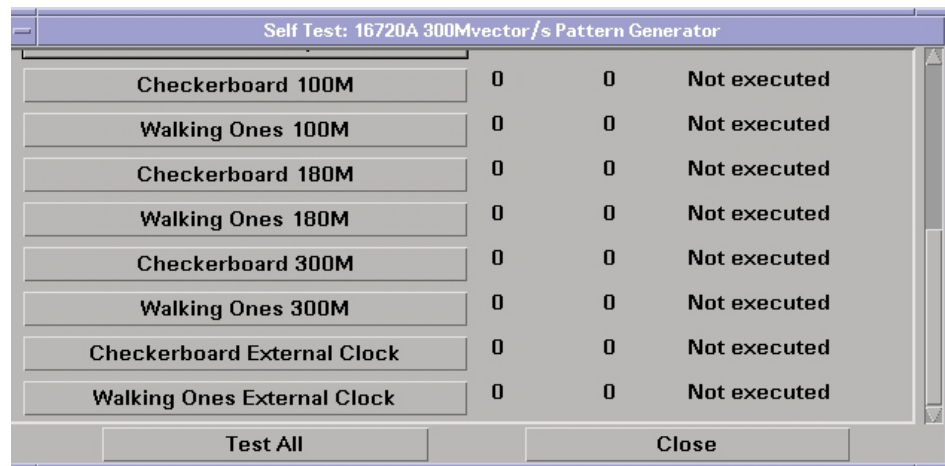
3 Using an oscilloscope, verify the existence of logic-level transitions by touching the oscilloscope probe to each channel of Data Pod 1 and doing an Autoscale. The signal levels that appear on the oscilloscope display should correspond with the logic levels represented by the 10460-series pod being used.

4 Repeat step 3 for each of the remaining data pods.

5 Connect one of the 10460-series clock pods to the end of the pattern generator clock cable.

6 Using the oscilloscope as in step 3, verify the existence of logic-level transitions by touching the oscilloscope probe to each clock output of the clock pod.

7 In the pattern generator Output Patterns menu, select the Stop icon, then choose Done to exit the menu.

To exit the test system

To exit the test system

1 Select Close to close any module or system test windows.

2 In the Self Test window, select Quit.

3 In the session manager window, select Start Session to launch a new logic analyzer session.

6

Replacing Assemblies

This chapter contains the instructions for removing and replacing the pattern generator module, the circuit board of the module, and the probe cables of the module as well as the instructions for returning assemblies.

CAUTION　　Turn off the instrument before installing, removing, or replacing a module in the instrument.

Tools Required

- A T10 TORX screwdriver, to remove screws connecting the probe cables and screws connecting the back panel.

- A 1/4-inch hollow-shaft nutdriver, to remove the nut holding the cable to the module panel insert.

To remove the module

Electrostatic discharge can damage electronic components. Use grounded wriststraps and mats when performing any service to this module.

1 Remove power from the instrument.

   a Exit all logic analysis sessions. In the session manager, select Shutdown.

   b At the query, select Power Down.

   c When the "OK to power down" message appears, turn the instrument off.

   d Disconnect the power cord.

2 Loosen the thumb screws.

   Starting from the top, loosen the thumb screws on the filler panels and cards located above the module and the thumb screws of the module.
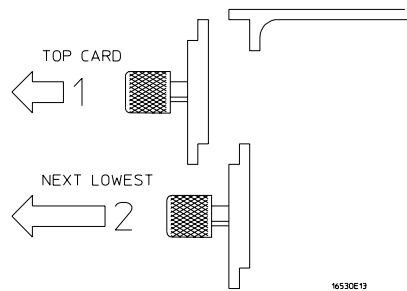
3 Starting from the top, pull the cards and filler panels located above the module half-way out.

4 If the module consists of a single card, pull the card completely out.

   If the module consists of multiple cards, pull all cards completely out.

5 Push all other cards into the card cage, but not completely in.

   This is to get them out of the way for removing and replacing the module.

6 If the module consist of a single card, replace the faulty card.

   If the module consists of multiple cards, remove the cables from J9 and J10 of all cards. Remove the 2x10 cables from J4, J5, J7, and J8 from the master card. Remove the faulty card from the module.

To replace the circuit board

1 Remove power from the mainframe.

2 Remove the 16720A module from the mainframe.

3 Remove the three screws that secure the cable clamp to the rear panel.

4 If you are replacing the circuit board, unplug all cables from the board. Continue with "To replace the circuit board."
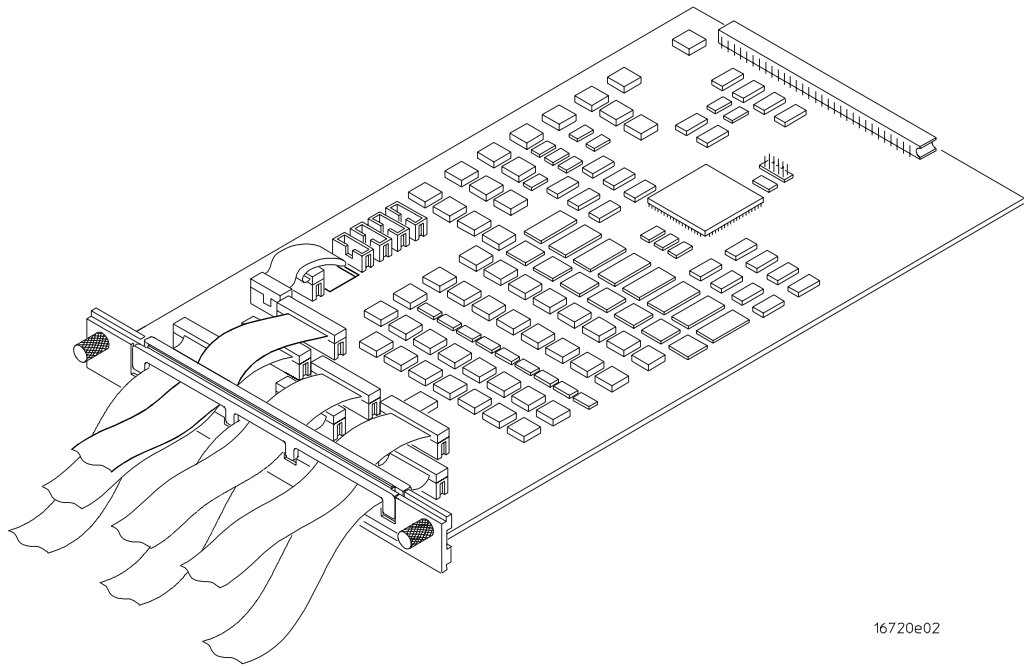
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To replace the circuit board

1 Remove the cables (use procedure above).

2 Remove four screws attaching the ground spring and rear panel to the circuit board, then remove the back panel and ground spring.

3 Replace the faulty circuit board with a new circuit board. On the circuit board, make sure the 20-pin ribbon cable is connected between J7 and J8.

4 Position the ground spring and back panel on the back edge of the replacement circuit board. Install four screws to connect the back panel and ground spring to the circuit board.

5 Continue with "To install the cables."

To install the cables

1 Plug the six data cables and the clock cable in the appropriate connectors on the circuit board. If a single cable is being replaced, plug the cable in the appropriate connector.

Note that the clock cable is connected to J6 on the 16720A board.

2 Position the cables on the rear panel so the cable clamp can be properly installed on the rear panel.

3 Install three screws that secure the cable clamp onto the rear panel.

4 Install the 16720A module into the mainframe.

To replace the module

1 If the module consists of one card, go to step 2.

If the module consists of more than one card, connect the cables together in a master/expander configuration. Follow the procedure "To configure a multicard module" in chapter 2.

2 Slide the cards above the slots for the module about halfway out of the mainframe.

3 With the probe cables facing away from the instrument, slide the module approximately halfway into the mainframe.

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4 Slide the complete module into the mainframe, but not completely in.

Each card in the instrument is firmly seated and tightened one at a time in step 6.

5 Position all cards and filler panels so that the endplates overlap.
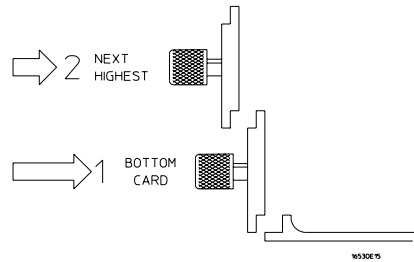
6 Seat the cards and tighten the thumbscrews.

Starting with the bottom card, firmly seat the cards into the backplane connector of the mainframe. Keep applying pressure to the center of the card endplate while tightening the thumbscrews finger-tight. Repeat this for all cards and filler panels starting at the bottom and moving to the top.

CAUTION   Correct air circulation keeps the instrument from overheating. For correct air circulation, filler panels must be installed in all unused card slots. Keep any extra filler panels for future use.

To replace the probe cable

1 Remove power from the instrument.

   a Exit all logic analysis sessions. In the session manager, select Shutdown.

   b At the query, select Power Down.

   c When the "OK to power down" message appears, turn the instrument off.

   d Disconnect the power cord.

2 Remove the screws that hold the probe cable to the rear panel of the module.

3 Remove the faulty probe cable from the connector and install the replacement cable.

4 Install the label on the new probe.

If you order a new probe cable, you will need to order new labels. Probe cables shipped with the module are labeled. Probe cables shipped separately are not labeled. Refer to chapter 7, "Replaceable Parts," for the part numbers and ordering information.

5 Install the screws connecting the probe cable to the rear panel of the module.

CAUTION   If you over tighten the screws, the threaded inserts on the back panel might break off of the back panel. Tighten the screws only enough to hold the cable in place.

16720e03
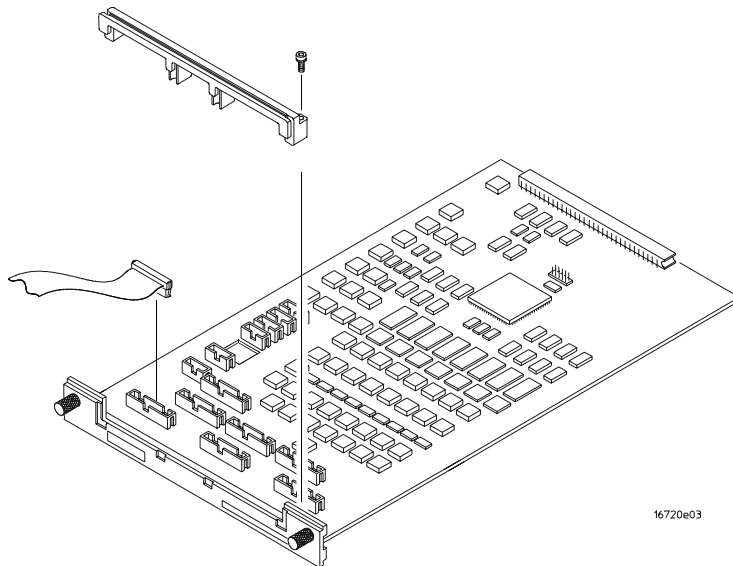
To return assemblies

Before shipping the module to Agilent, contact your nearest Agilent Technologies Sales Office for additional details.

1 Write the following information on a tag and attach it to the module.

- Name and address of owner

- Model number

- Serial number

- Description of service required or failure indications

2 Remove accessories from the module.

Only return accessories to Agilent if they are associated with the failure symptoms.

3 Package the module.

You can use either the original shipping containers, or order materials from an Agilent sales office.

CAUTION   For protection against electrostatic discharge, package the module in electrostatic material.

4 Seal the shipping container securely, and mark it FRAGILE.

7

Replaceable Parts

This chapter contains information for identifying and ordering replaceable parts for your module.

Replaceable Parts Ordering

Parts listed

To order a part on the list of replaceable parts, quote the Agilent Technologies part number, indicate the quantity desired, and address the order to the nearest Agilent Technologies Sales Office.

Parts not listed

To order a part not on the list of replaceable parts, include the model number and serial number of the module, a description of the part (including its function), and the number of parts required. Address the order to your nearest Agilent Technologies Sales Office.

Direct mail order system

To order using the direct mail order system, contact your nearest Agilent Technologies Sales Office.

Within the USA, Agilent Technologies can supply parts through a direct mail order system. The advantages to the system are direct ordering and shipment from the Agilent Part Center in Mountain View, California. There is no maximum or minimum on any mail order. (There is a minimum amount for parts ordered through a local Agilent Technologies Sales Office when the orders require billing and invoicing.) Transportation costs are prepaid (there is a small handling charge for each order) and no invoices.

In order for Agilent Technologies to provide these advantages, a check or money order must accompany each order. Mail order forms and specific ordering information are available through your local Agilent Technologies Sales Office. Addresses and telephone numbers are located in a separate document shipped with the *16700-series Logic Analysis System Service Manual*.

Exchange assemblies

Some assemblies are part of an exchange program with Agilent Technologies.

The exchange program allows you to exchange a faulty assembly with one that has been repaired and performance verified by Agilent Technologies.

After you receive the exchange assembly, return the defective assembly to Agilent Technologies. A United States customer has 30 days to return the defective assembly. If you do not return the defective assembly within the 30 days, Agilent Technologies will charge you an additional amount. This amount is the difference in price between a new assembly and that of the exchange assembly. For orders not originating in the United States, contact your nearest Agilent Technologies Sales Office for information.

16720A Replacement Parts

16720 Replaceable Parts

Ref Des.	Part Number	Qty	Description
A1	16720-69501		Rebuilt circuit board
A1	16720-66501	1	Circuit board assembly
H1	0510-0684	2	Retaining ring
H2	0515-0430	3	Machine screw
H3	0515-0665	4	MSPH M2X14 T10
H4	16500-22401	2	Rear panel screw
MP1	16500-41201	7	Ribbon cable ID clip
MP2	16500-29101	1	Ground Spring
MP3	16510-40501	1	Rear panel
MP4	16510-40502	1	Cable clamp
MP5	01650-94309	1	Probe label
MP6	16720-94301	1	ID label
W1	16522-61601	6	Data Cable (J1-J5)
W2	16522-61602	1	Clock cable (J6)
W3	16522-61603	1	Interconnect cable

Exploded View

MP4

H3 (4)

W1

W3

W2

H2 (3)

MP2

MP3

MP6

H1

H4

A1

16720e08
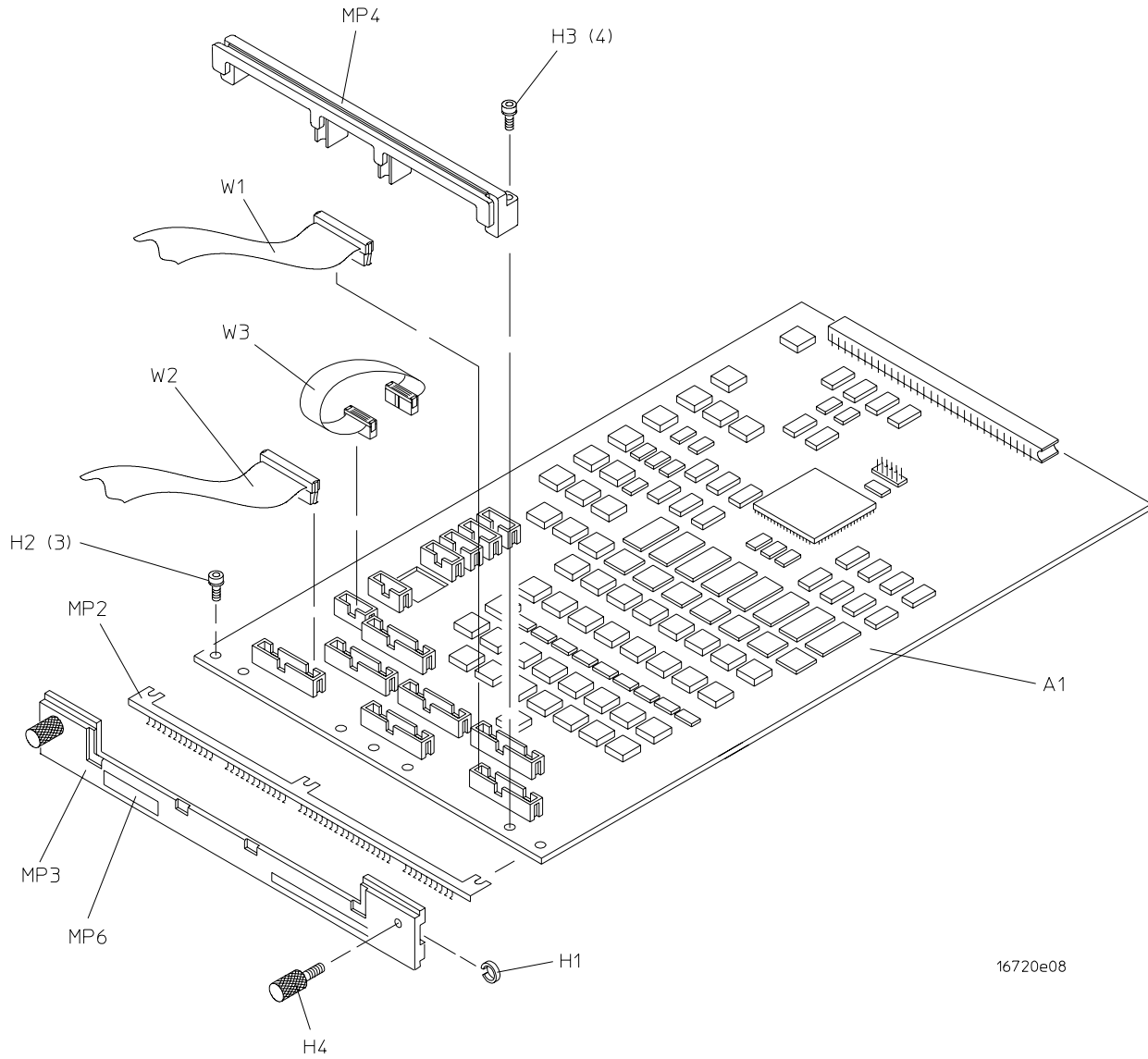
Exploded view of the 16720A pattern generator.

8

Theory of Operation

This chapter presents the theory of operation for the pattern generator module and describes the self-tests.

The information in this chapter is to help you understand how the module operates and what the self-tests are testing. This information is not intended for component-level repair.

Block-Level Theory

The 16720 Pattern Generator
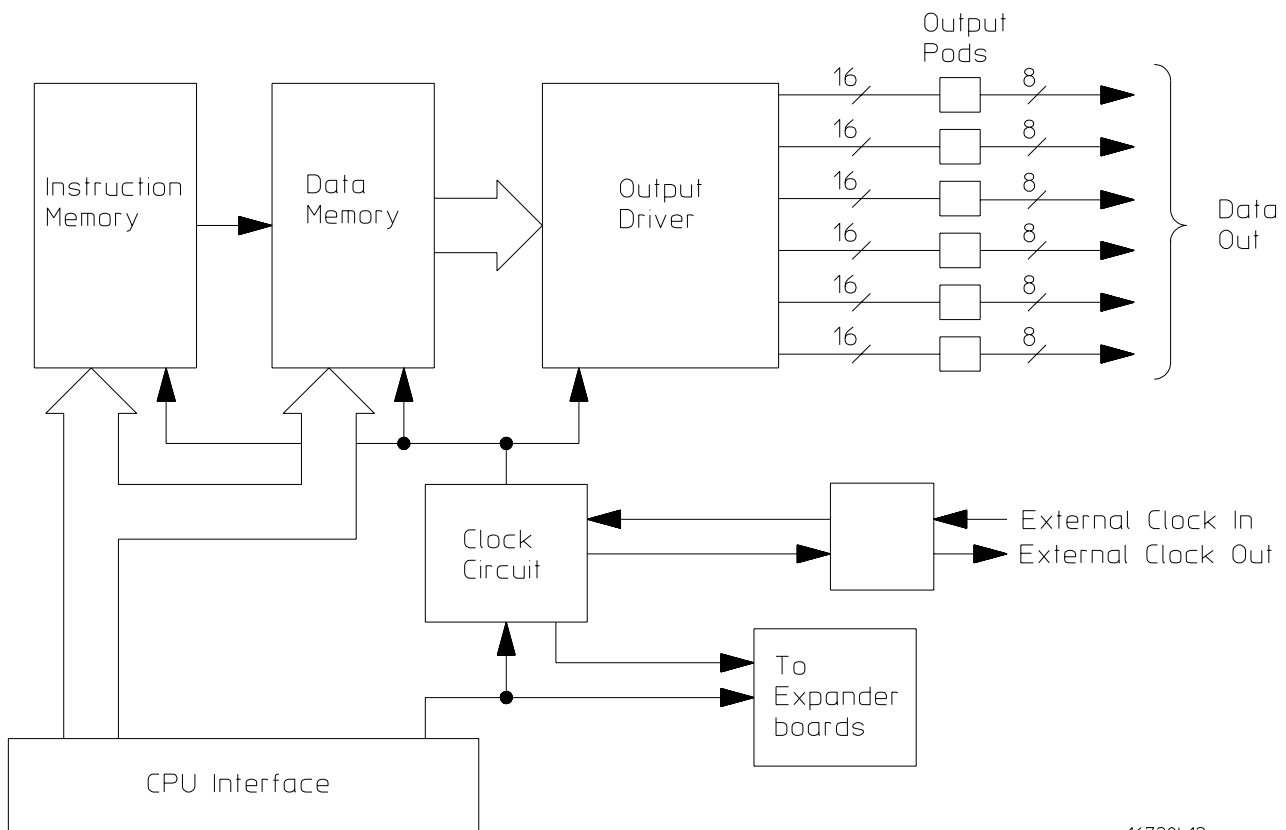
16720b12

Instruction Memory. The instruction memory holds the programmable vector flow information and is paced in parallel with the data memory. User-programmable instructions are stored in instruction memory and control the pattern flow output.

Data Memory. Consisting of six 4Mx16 DRAM ICs and RAM addressing circuitry, the data memory stores the desired pattern that appears at the module output. The RAM addressing circuitry is merely a counter which addresses the pattern locations in data memory. When the end of the vector listing is reached, the addressing circuitry is loaded from the loop register with the address of the first vector of the listing to provide an uninterrupted vector loop. The RAM output is sent to the output driver circuit where the patterns are presented into a logic configuration usable by the output pods.

Output Driver. The output driver circuit is made up of a series of FIFO queues, latch/logic drivers, and multiplexers. The FIFO queue stabilizes and pipelines the pattern flow between data memory and the latch/logic drivers. The latch/logic drivers direct the pattern to multiplexers at ECL voltage levels.

The multiplexers, one per channel, direct the programmed data patterns to the output channels. The single-ended ECL-level signals are converted to differential signals, which are routed to the output cables and to the pods. Note that the differential ECL output signal of the pattern generator modules not suited to directly drive ECL circuitry.

Clock Circuit. The clock circuit paces the instruction memory, data memory, and the FIFO pattern queue and multiplexers in the output driver according to the desired data rate. Two phase-locked loops drive the clock circuit according to the user-selected data rate. The output of the multiplexer, which represents the user-selected clocking rate, is distributed to the above listed subcircuits on both the master board and all expander boards that are configured with the master board.

The output of the clock select multiplexer is also distributed to an external clock out circuit. The clock signal is routed to a bank of external clock delay select multiplexer. The output of this multiplexer, which represents the desired clock delay, is directed to the external clock out pin on the clock pod. Consequently either the internal clock or external clock is redirected to the clock out pin with a user-selected clock delay.

CPU Interface. The CPU interface is a single programmable logic device (PLD) which interprets the Agilent 16700-series mainframe backplane logic and translates the logic into signals to drive and program the pattern generator module.

Pod. The Clock or Date Pod converts the differential output ECL signal to logic levels of interest. Because the output of the pattern generator module cannot directly drive ECL circuitry, the Clock and Data Pod is required to interface the pattern generator with the system under test.

Self-Tests Description

The self-tests for the pattern generator identify the correct operation of major functional areas in the module.

Internal Loopback Test. The internal loopback test verifies the operation of the module backplane interface IC. A walking ones pattern is written into module memory at a specific memory location, read, and compared with known values.

Passing the internal loopback test implies the module backplane interface IC is functioning and the system is able to write to module memory.

In case of error, the following diagnostic integer will be displayed.

Bit#	39 - 16	15 - 8	7 - 0
	Memory	Expected	Actual
	Address	Value	Value

Clock Test. The clock test verifies that three clock modes can be set to verify both phase-locked loop (PLL) clock generators are functioning. Additionally, the clock test verifies the RUN/STOP control circuit is functional. Parts of the module backplane interface IC and the intermodule bus (IMB) are also tested.

Passing the clock test implies that the module can generate clocks through the advertised frequency range.

In case of error, the following diagnostic integer will be displayed.

Bit#	15 - 12	11 - 8	7 - 4	3 - 0
	300 MHz	200 MHz	100 MHz	not
	clock	clock	clock	used

The four bit values have the following definition:

    0 - passed
    1 - failed to run
    2 - failed to stop

Simple RAM Test. The RAM test verifies that the entire module memory is functioning. Patterns of all "0", then all "1", then alternating "0" and "1" are written, read, and compared with known values.

Bit#	15 - 7	6	5	4	3	2	1	0
	not	#7	6	5	4	3	2	1
	used	&8						

Passing the simple RAM test verifies that all of the module RAM is functioning properly.

In case of error, the following diagnostic integer indicating the status of the memory IC number will be displayed.

The one bit value has the following definition:

    0 - passed
    1 - failed

RAM Persistence Test. The RAM persistence test verifies the module memory refresh, addressing and data retention. A pattern sequence is written to blocks in module memory. Because of this pattern writing process, a long delay is introduced before the patterns are read and verified. The patterns are then read and verified, then compared with known values.

Passing the RAM persistence test implies that the module memory retains the data at each memory location that is programmed.

In case of error, the following diagnostic integer indicating the status of the memory IC number will be displayed.

Bit#	15 - 7	6	5	4	3	2	1	0
	not	#7	6	5	4	3	2	1
	used	&8						

The one bit value has the following definition:

> 0 - passed
> 1 - failed

Marching Bits RAM Test. The marching bits RAM test is a very extensive test and may take hours to complete. Therefore this test is not included in "Test All." If the simple RAM test and RAM persistence test are run and you still suspect a memory problem, then run the marching bits RAM test.

The marching bits RAM test attempts to uncover any possible failure mode of module memory. Several walking "0" and walking "1" patterns are written to memory, read, and compared with known values. A total of five read/write passes are done with each pattern.

Passing the marching bits RAM test implies there is very high confidence that every module memory IC data and address memory pipeline is operating properly.

Wait Test. The wait test verifies the correct operation of the WAIT pattern registers in the module backplane interface IC. Test events are loaded into the WAIT pattern registers, then correct operation of the module is verified.

Passing the wait test implies the module will operate properly to user commands.

In case of error, the following diagnostic integer will be displayed.

Bit#	15 - 12	11 - 8	7 - 4	3 - 0
	Event D	Event C	Event B	Event A

The four bit values have the following definition:

> 0 - passed
> 1 - failed to stop on break with no event wait
> 2 - failed on wait with setting of no event
> 3 - failed to stop on break or wait with wait any event

Instruction Interrupt Test. The instruction interrupt test verifies the WAIT IMB and SIGNAL IMB instruction decoder. The module is configured for a run, then verified that it is running. The module is again configured for a run, then halted by a break command.

Passing the instruction interrupt test verifies that the module will operate properly to user commands.

In case of error, the following diagnostic integer will be displayed.

Bit#	15 - 4	3 - 0
	not used	Status

The four bit values have the following definition (errors are or'ed):

    0 - passed
    1 - stopped without a break
    2 - failed to stop from software
    4 - failed to stop with break
    8 - stopped by something other than break

Generate Patterns. The performance test will set up two predefined patterns for examining the module from an external analyzer or oscilloscope. This allows the user to check the output pipelines for functionality.

The data is output based on the frequency mode chosen by the user:

    100MHz Mode - 10.000 ns period
    180MHz Mode - 5.555 ns period
    300MHz Mode - 3.333 ns period

Either a checkerboard pattern (alternating "1" and "0" across the output channels) or a walking "1" pattern are available.

Index

Index

Document Warranty
The information contained in
this document is subject to
change without notice.
**Agilent Technologies
makes no warranty of any
kind with regard to this
material, including, but not
limited to, the implied
warranties of
merchantability or fitness
for a particular purpose.**
Agilent Technologies shall not
be liable for errors contained
herein or for damages in
connection with the furnishing,
performance, or use of this
material.

Safety
This apparatus has been
designed and tested in
accordance with IEC
Publication 1010, Safety
Requirements for Measuring
Apparatus, and has been
supplied in a safe condition.
This is a Safety Class I
instrument (provided with
terminal for protective
earthing). Before applying
power, verify that the correct
safety precautions are taken
(see the following warnings).
In addition, note the external
markings on the instrument
that are described under
"Safety Symbols."

Warning

• Before turning on the
instrument, you must connect
the protective earth terminal of
the instrument to the
protective conductor of the
(mains) power cord. The mains
plug shall only be inserted in a
socket outlet provided with a
protective earth contact. You
must not negate the protective
action by using an extension
cord (power cable) without a
protective conductor
(grounding). Grounding one
conductor of a two-conductor
outlet is not sufficient
protection.

• Only fuses with the required
rated current, voltage, and
specified type (normal blow,
time delay, etc.) should be
used. Do not use repaired fuses
or short-circuited fuseholders.
To do so could cause a shock or
fire hazard.

• Service instructions are for
trained service personnel. To
avoid dangerous electric shock,
do not perform any service
unless qualified to do so. Do not
attempt internal service or
adjustment unless another
person, capable of rendering
first aid and resuscitation, is
present.

• If you energize this
instrument by an auto
transformer (for voltage
reduction), make sure the
common terminal is connected
to the earth terminal of the
power source.

• Whenever it is likely that the
ground protection is impaired,
you must make the instrument
inoperative and secure it
against any unintended
operation.

• Do not operate the
instrument in the presence of
flammable gasses or fumes.
Operation of any electrical
instrument in such an
environment constitutes a
definite safety hazard.

• Do not install substitute
parts or perform any
unauthorized modification to
the instrument.

• Capacitors inside the
instrument may retain a charge
even if the instrument is
disconnected from its source of
supply.

Safety Symbols

⚠

Instruction manual symbol: the
product is marked with this
symbol when it is necessary for
you to refer to the instruction
manual in order to protect
against damage to the product.

⚡

Hazardous voltage symbol.

⏚

Earth terminal symbol: Used to
indicate a circuit common
connected to grounded
chassis.

WARNING

The Warning sign denotes a
hazard. It calls attention to a
procedure, practice, or the like,
which, if not correctly
performed or adhered to, could
result in personal injury. Do not
proceed beyond a Warning sign
until the indicated conditions
are fully understood and met.

CAUTION

The Caution sign denotes a
hazard. It calls attention to an
operating procedure, practice,
or the like, which, if not
correctly performed or
adhered to, could result in
damage to or destruction of
part or all of the product. Do
not proceed beyond a Caution
symbol until the indicated
conditions are fully understood
or met.