
User's Guide

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For Safety information, Warranties, and Regulatory information, see the pages behind the Index

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MultiProbe 2-Output Control Module

The MultiProbe System

The MultiProbe system is an analog probe multiplexing system for the HP 16500B/C Logic Analysis System. Using the MultiProbe system, you can debug and verify complex digital systems quickly and easily.

The MultiProbe system increases your productivity

The MultiProbe system allows you to connect high-fidelity analog probes to hundreds of pins. Then, you can select two of those signals at a time to route to an internal or external oscilloscope. You select the signals with the software user interface instead of moving your probes for each measurement.

The MultiProbe system performance matches your high-speed design

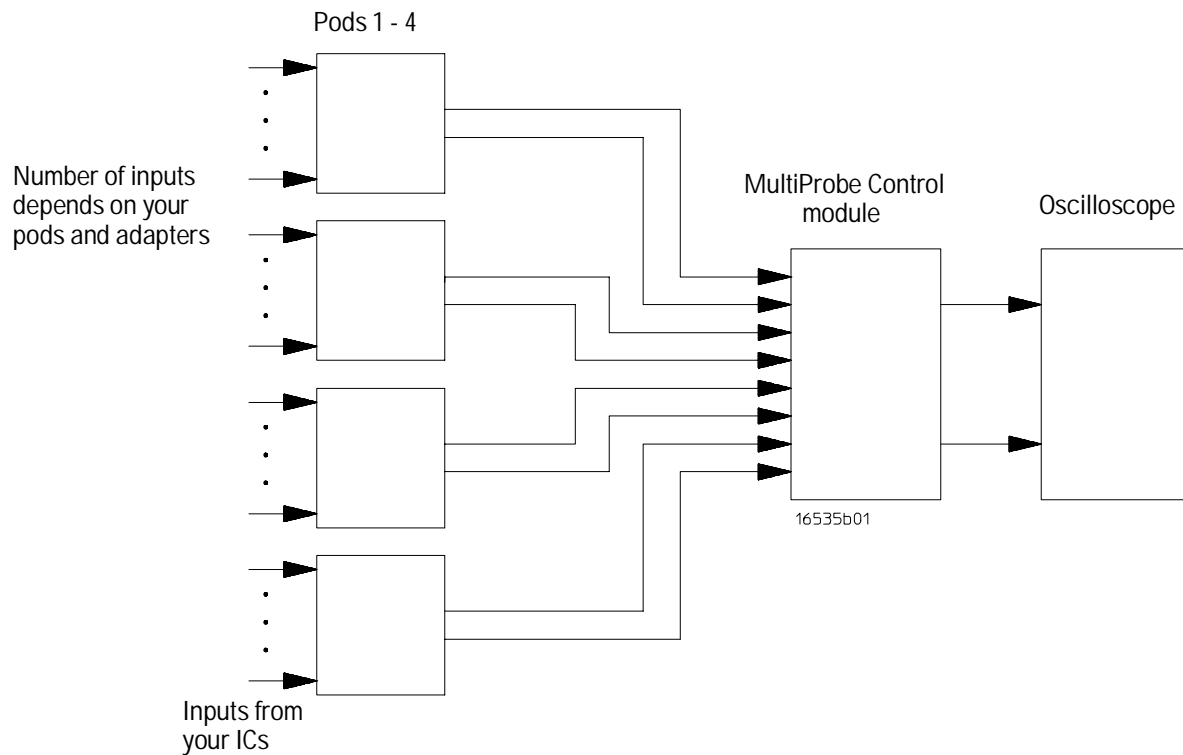
The MultiProbe system has the signal measurement capabilities to reliably detect the anomalies that will cause problems in high-speed CMOS, TTL, ECL, and GTL circuits.

The MultiProbe system offers reliable connections

With the MultiProbe system, you can reliably attach analog probes to all the pins of a device under test (DUT) at once with minimal intrusion. The reliable attachment gives you confidence that your measurements are valid. From the HP 16500B/C front panel, you can check signal activity on each pod. Also, you can use the calibration fixture that comes with the pods to program and check the pod grounding.

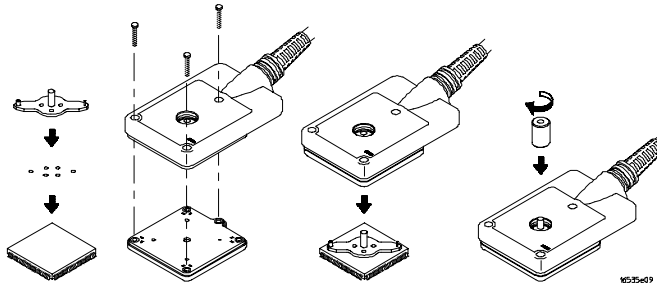
The MultiProbe system selects two of many signals

The main components of a MultiProbe system are the general-purpose pods, the high-density pods, and the MultiProbe Control module. The MultiProbe system lets you select any two inputs from any attached pods, and applies them to oscilloscope inputs. The two inputs selected can be on the same pod or on different pods. You can connect up to four pods to one MultiProbe 2-Output Control module.



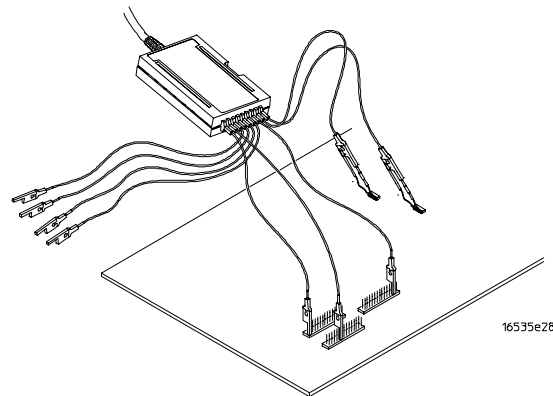
High-Density MultiProbe Pods connect to all pins of a DUT at once

The high-density pods attach directly to retainers that you adhere to your surface-mount IC or other device under test (DUT). The pods make connections to all the pins of the DUT. Multiplexers in the pod select two of the input signals. These two signals are applied to the cable going to the MultiProbe Control module.



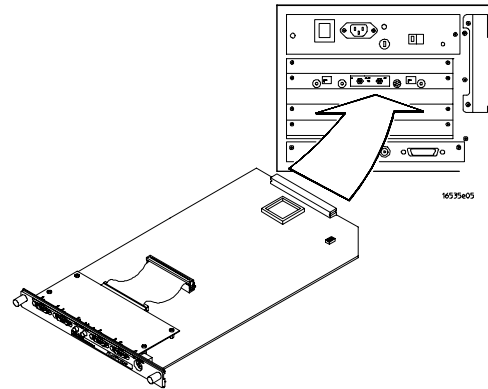
General-Purpose MultiProbe Pods connect to various points

The general-purpose pods have individual probe leads for attaching to miscellaneous nodes in your circuit using the accessories provided. A multiplexer in the pod selects two of the input signals, then applies them to the cable going to the MultiProbe Control module.



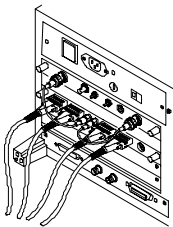
A control module selects the signals

The HP 16535A MultiProbe 2-Output Control module resides in the HP 16500B/C. It has four input connectors for pods and two output connectors for connecting to an oscilloscope, and it provides the power and control signals to the pods. Using the control module, you select which signals from which pods to apply to the oscilloscope.

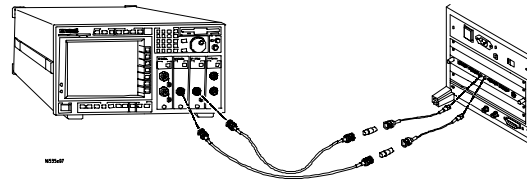


An oscilloscope displays the signals

The signals from the control module are sent through cables that you connect to an oscilloscope in the HP 16500B/C or to an external oscilloscope. Using the oscilloscope, you acquire and analyze the signals.



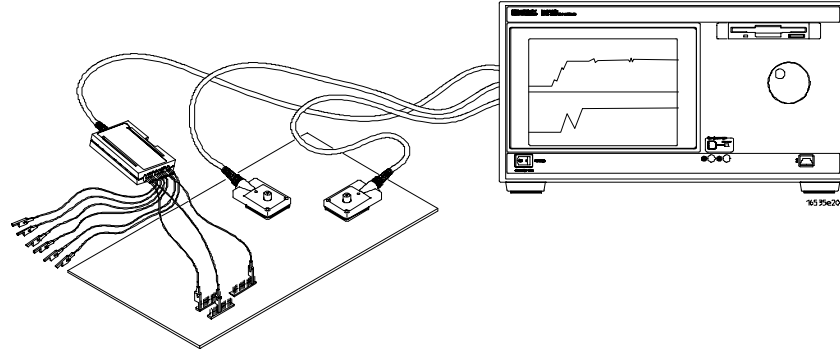
Internal scope



External scope

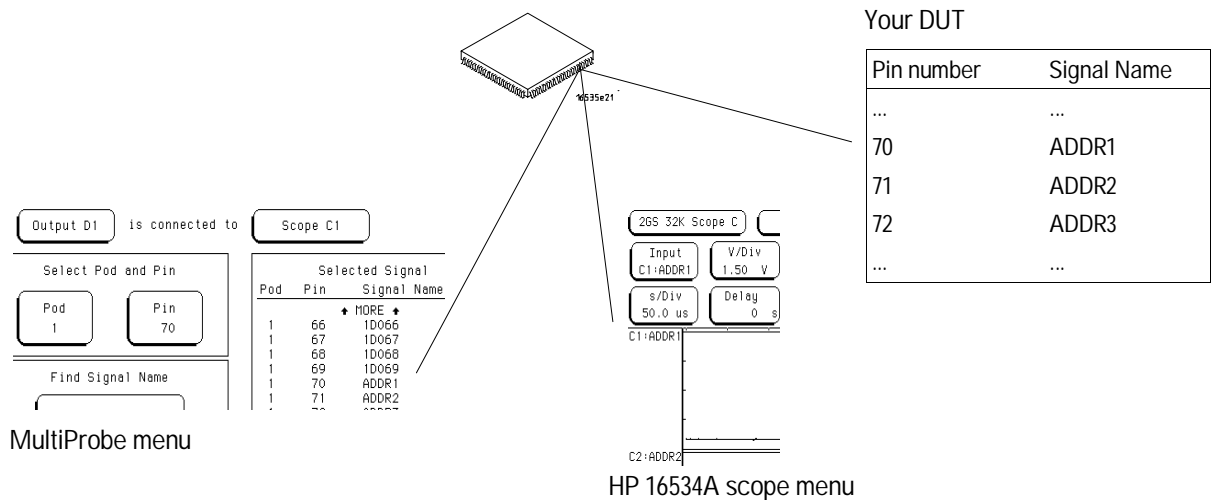
Make measurements without moving probes

With the MultiProbe system, you can use an oscilloscope to acquire and analyze analog signals on hundreds of pins, two at a time, without moving the probes.



Use your signal names in the measurements

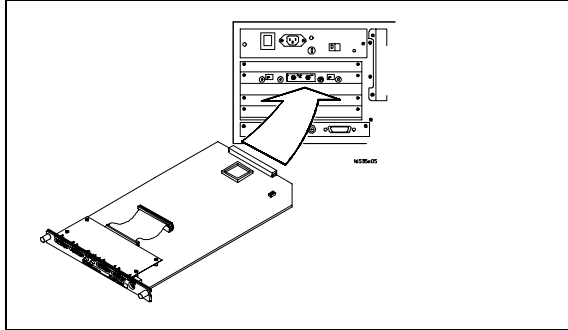
The MultiProbe system lets you assign your signal names to the signals that you acquire and view. When using the HP 16533/34A oscilloscope with the MultiProbe system, the signal names you assign appear in the label field on the HP 16533/34A oscilloscope display. Also, the signal names appear on printouts and are stored with the signal when you store a file to the HP 16500B/C disk drive.



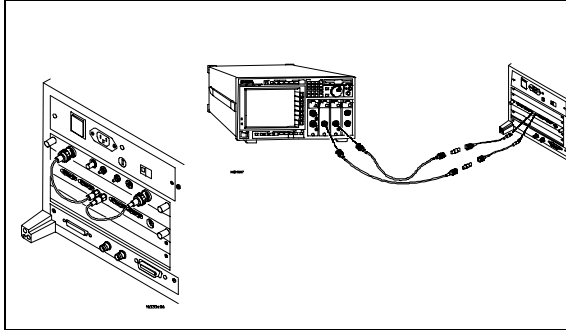
Using the MultiProbe system requires setting up the components

To make measurements using the MultiProbe system, you will need to connect and set up the system.

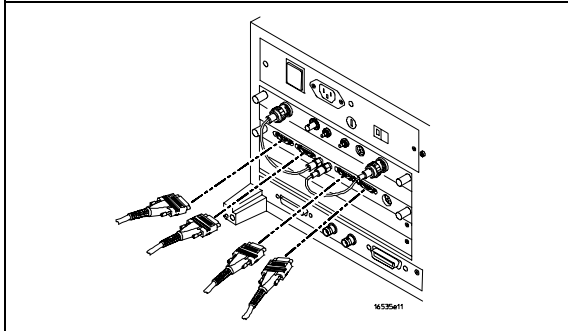
Step 1 Install the module.



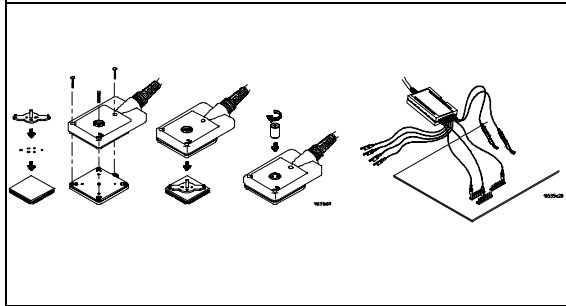
Step 2 Connect to the internal or external scope.



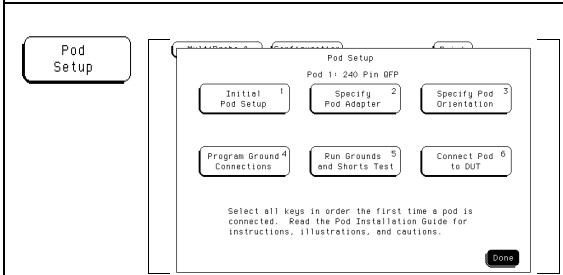
Step 3 Connect the pods.



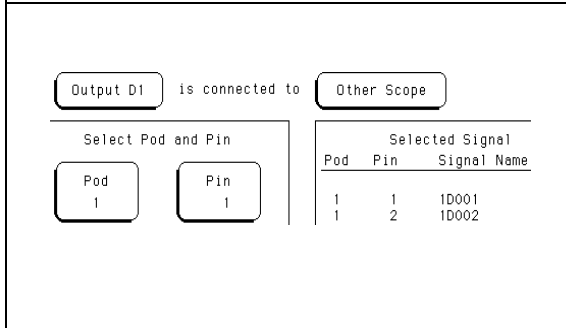
Step 4 Set up the pods and connect to your DUTs. Refer to your pod *Installation Guide*.



Step 4 (continued) For high-density pods, this includes adhering retainers and programming ground connections. Refer to the Pod Setup menu.



Steps 5 and 6 Select and acquire the signals.



In This Book

This User's Guide contains the information needed to use the HP 16535A MultiProbe 2-Output Control module, your high-density pod or general-purpose pod, and an oscilloscope as a MultiProbe system.

This book is divided into nine chapters.

Chapter 1 leads you through an example of using the MultiProbe system.

Chapters 2 through 5 cover using the MultiProbe system, from the physical connections through saving the measurements.

Chapter 6 provides problem solving information and lists error messages.

Chapter 7 lists the fields on the screen and describes their function.

Also provided are chapters on programming commands and product information.

See Also

For installing and servicing the pods, including adhering retainers and programming grounds, refer to the *Installation and Service Guide* for your high-density pod, and the *Installation and Service Guide* for your general-purpose pod.

For information about using the HP 16500B, refer to the *HP 16500B Logic Analysis System User's Reference*. For information about using the HP 16500C, refer to the *HP 16500C Logic Analysis System User's Reference*.

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Using the MultiProbe System

Using the MultiProbe System

This chapter guides you through an example of using the MultiProbe system. The example provides you with an idea of how the MultiProbe system fits into your debug process.

Also, this chapter provides a quick overview of other examples using the MultiProbe system.

The MultiProbe system can improve your processes because of the following:

- Once you connect the MultiProbe pods, you have hands-off probing of the signals.
- Using the HP 16500B/C front panel, you can select two signals to acquire and view from among hundreds of probed signals.
- You can use up to five MultiProbe Control modules in a frame to acquire ten signals at once.

Debugging digital systems using the HP 16500B/C and the MultiProbe system

The ability to simultaneously view target system activity that is time-correlated in multiple domains, from code execution to analog behavior, is invaluable for debugging complex system problems. Often the indication of a problem is best identified in one domain, while the cause can only be identified in another domain or in the relationship between different domains. Clues from more than one domain are often needed to locate and verify the cause of a problem.

The MultiProbe system can help you look for the root cause of signal integrity or timing-related failures. Before starting with the MultiProbe system, you can use logic analyzers in the HP 16500B/C Logic Analysis System and your test code for isolating possible causes. When the possible causes are narrowed down sufficiently, then use the MultiProbe system.

- **Cross-domain triggering**

You can use cross-domain triggering to pinpoint and acquire data that is related in context to a failure or to a symptom of a failure. Triggering on code execution, for instance, may be the best way to positively identify the indication of a problem. Once you have successfully set up the trigger condition on a state analyzer to trigger on a fault, then you can cross-trigger other state analyzers, timing analyzers, or scopes as needed to view the system behavior at the time of the fault.

In many cases, positively triggering on the fault is aided by using the trigger resources in different analyzers and the intermodule triggering capabilities in the HP 16500B/C.

- **Time-correlated display**

The time-correlated display on the HP 16500B/C allows you to relate cause-and-effect and to confirm causal relationships.

- **The MultiProbe system**

With the MultiProbe system, you can quickly and easily search through hundreds of analog signals for clues to the cause of problems. Acquiring many analog signals often can be helpful because the clue to a failure may lay in the relationship between many different events on different signals occurring at the same time.

The following example illustrates the debug process using the HP 16500B/C and the MultiProbe system.

Example

The first indication of a problem might be an operating system crash when running a particular application under certain conditions.

1 Monitor the processor bus.

Monitor the processor bus with a state analyzer to see what causes the operating system to crash. For this example, let's say you identify an unrecoverable parity error as the cause.

2 Trigger on and monitor the error.

Set up the state analyzer to trigger on that error condition and observe the processor bus and other buses to see what led up to the parity error. As a result, you find that a DMA write to a specific address range followed by a read from that address range is causing the error.

3 Simulate the failure.

To avoid waiting for the operating system to crash, write test code that consistently produces the failure. Using the test code, you can reproduce the failure within seconds instead of once a day as first indicated. Modify the test code to positively identify the address ranges that do and do not cause the failure.

4 Monitor the buses.

Monitor all the buses involved in the memory read and write operations with the state analyzer, while running the test code that causes consistent failures, to see where the values are being corrupted.

5 View the bus timing.

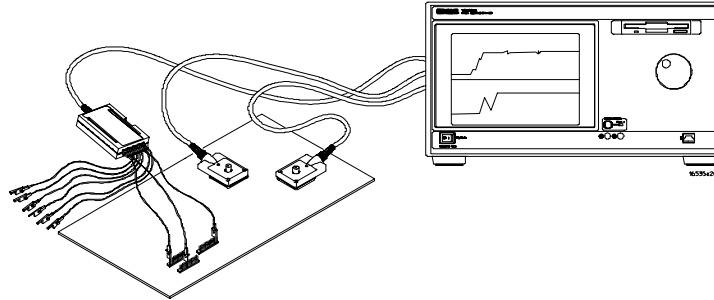
Use a timing analyzer to view the bus timing on the suspect transactions. The timing analyzer reveals that the timing on the main memory bus is varying considerably depending on the address range.

6 Identify the cause.

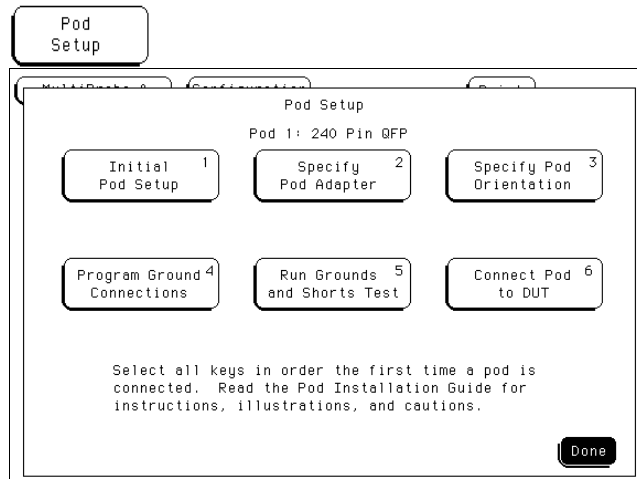
Use the MultiProbe system and an oscilloscope to identify the cause of the timing variation. The MultiProbe system makes it easy to view all the critical analog signals without having to reprobe.

a Connect and set up the MultiProbe system on the suspect nodes.

You can reliably attach oscilloscope probes to all the pins of a device under test (DUT) at once using a high-density pod. Refer to chapter 2, "Connecting the MultiProbe System," for instructions.



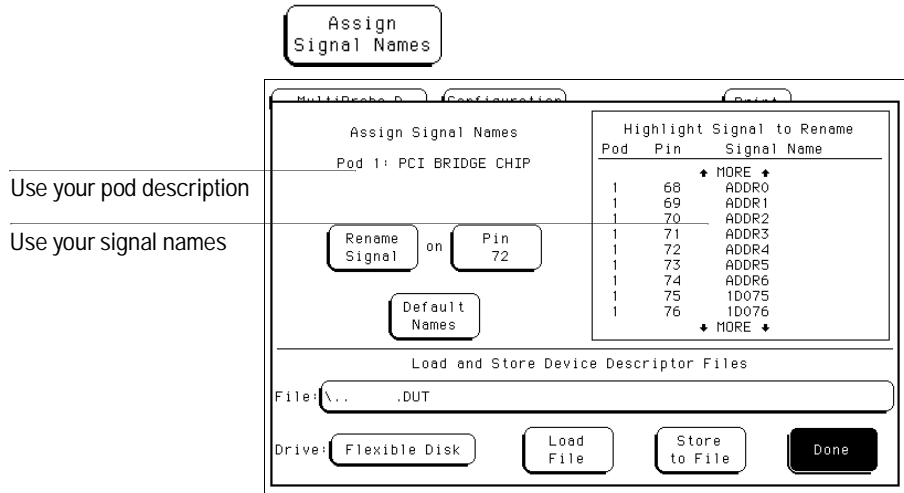
When setting up the high-density pod, you use the pod setup procedures in the *MultiProbe High-Density Pod Installation and Service Guide* for your pod and the Pod Setup menu.



You have the option of assigning the signal names of your DUT to the inputs of the MultiProbe pods.

Another option is to change the pod description from the default description to one that helps you track the measurements.

Refer to chapter 3, "Setting Up the MultiProbe System," for instructions.



b Cause the failure to occur.

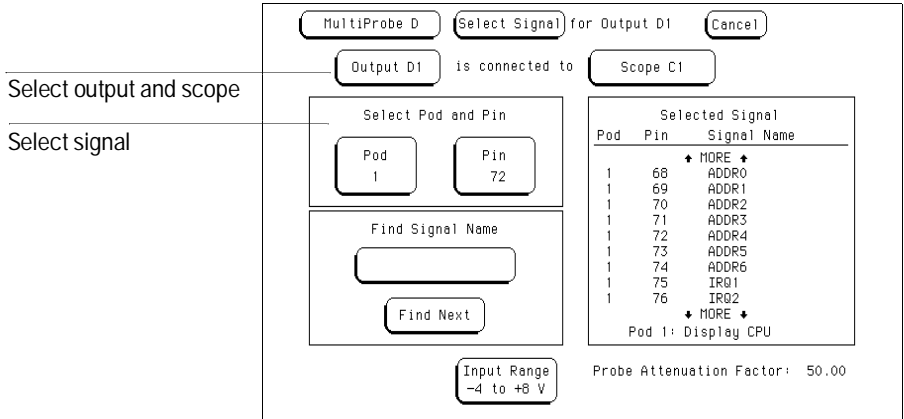
c Trigger the oscilloscope on the failure.

If you need triggering information, refer to your oscilloscope documentation.

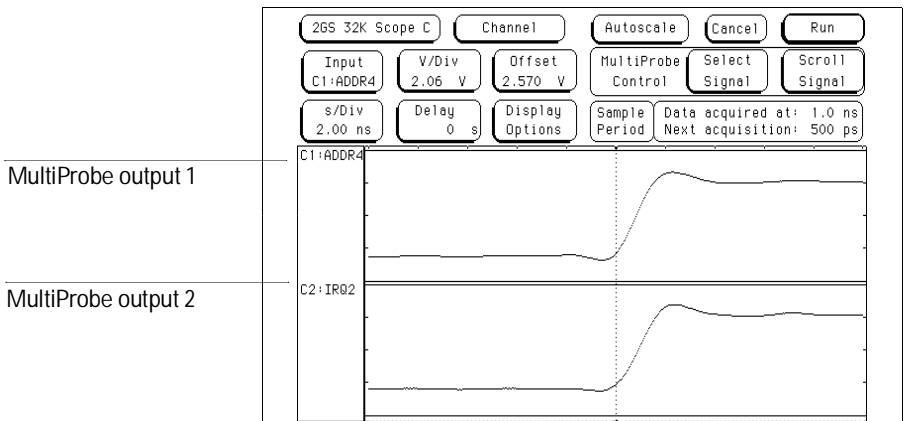
d Acquire data on the suspect nodes.

1 Make the measurements.

Select two of all the probed pins to send to the oscilloscope. For outputs 1 and 2, select the scope and the signal. Refer to chapter 4, "Making Measurements," for instructions.



Acquire the signals with the oscilloscope. This example shows an HP 16534A screen.

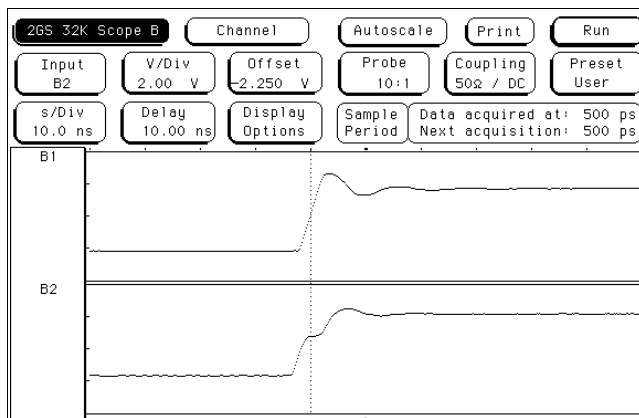
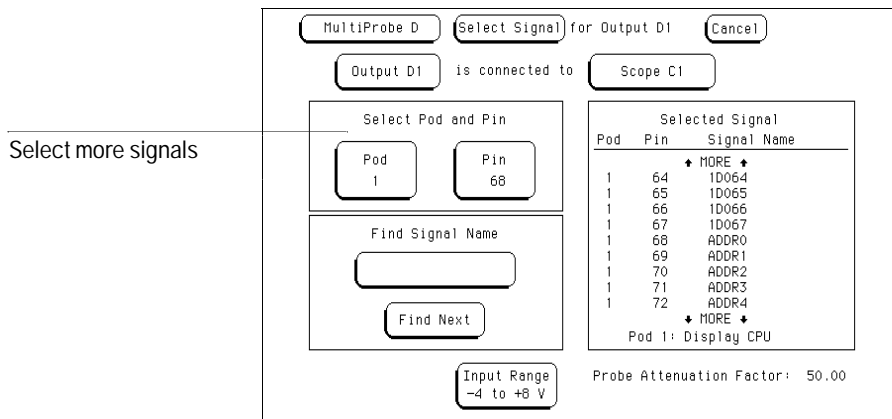


2 Record the signals.

You can save the measurements to files or print the screen. Refer to chapter 4, "Making Measurements," for instructions.

3 Acquire and record more signals.

Once you have connected the MultiProbe system to the DUT, you do not need to reprobe. Simply use the MultiProbe menus to select new signals to acquire and view. Continue triggering on the failure and acquiring and recording the data until you have all the desired measurements.



E Examine the data.

For this example, you might find the cause is due to ground bounce compounded by drive contention.

Improving confidence in the reliability of complex digital designs

The following examples show how the MultiProbe system can help to improve your confidence in the reliability of complex digital designs.

- **Verify timing and signal integrity**

When designing complex digital designs, you need to verify that your design satisfies the timing and signal integrity requirements for the devices used.

Use the MultiProbe system to acquire and record signals on all nodes or on selected nodes. You can then compare the signals to data sheet specs for the devices used and examine the violations.

- **Compare prototype signals with simulated signals**

Designs of reliable high-speed digital systems start with simulating analog behavior. When you have a prototype, you can make measurements on the prototype, then you can compare them with the simulated signals.

After simulating the design, use the MultiProbe system to acquire all the signals from your prototype. You can then compare the prototype signals to the simulated signals, and analyze and summarize the differences.

- **Document designs**

When you document the signal integrity of a design at each stage, then you have a reference for comparing later engineering changes, vendor changes, or new designs that are modifications of the existing design. If you make an engineering change or change part of a design, and the signals of the new design match those of the previous design, then you can be confident about signal integrity in the new design.

Use the MultiProbe system to acquire and record all signals. On the next design or engineering change, use the MultiProbe system again to acquire and record all signals. Then you can compare the new signals to the original signals and analyze the differences.

- **Characterize corner cases**

Exercising the corner cases of your design can help you find design problems.

Using test software running on the target system or stimulus from a pattern generator, force the target system into behavior that will induce the worst-case for signal integrity or timing. Using the MultiProbe system, acquire and record waveforms from nodes of interest. Then, examine the waveforms. For example, you could look at the relationship between the amplitude of simultaneous switching noise or crosstalk with the number of outputs switching.

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Connecting the MultiProbe System

Connecting the MultiProbe System

This chapter provides instructions for connecting the MultiProbe hardware. The instructions are for installing the MultiProbe Control module into the HP 16500B/C mainframe, connecting the module to an internal or an external oscilloscope, and connecting MultiProbe pods to the module and to your device under test (DUT).

When connecting the pods to your DUT, you will be referred to the pod *Installation and Service Guide* for complete instructions.

For more information about using an external or internal scope, refer to chapter 4, "Making Measurements," or chapter 9, "Product Information."

CAUTION

Use grounded wrist straps and mats when installing or performing any service to the pods, modules, or the HP 16500B/C Logic Analysis System. Electrostatic discharge can damage electronic components.

Step 1. Installing the MultiProbe Control module

- **Single card module**

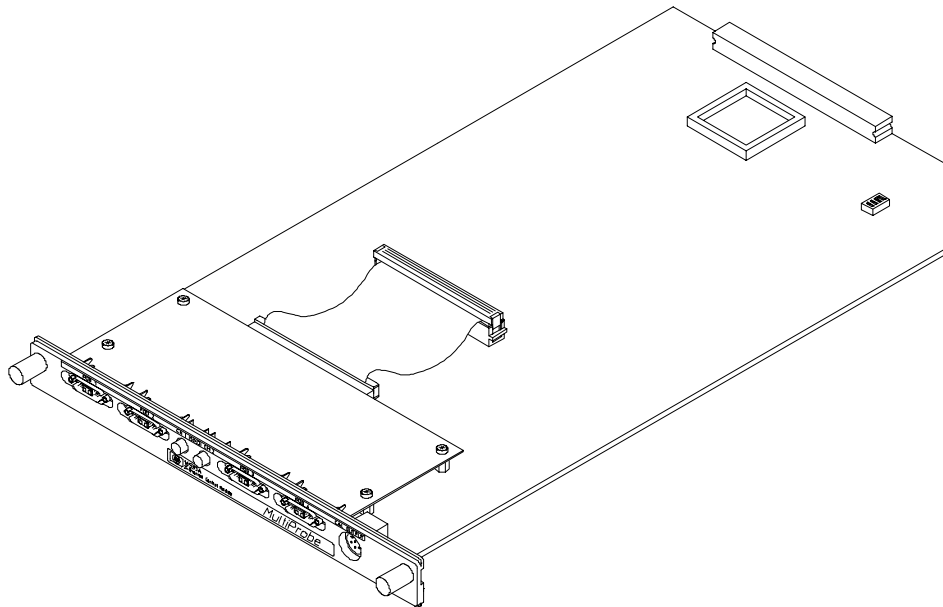
The MultiProbe Control module is already configured and ready for installation into the HP 16500B/C Logic Analysis Mainframe or the HP 16501A Expansion Frame.

- **Multiple modules**

The HP 16535A MultiProbe Control module can be used as a single module or as multiple modules in a system. Using multiple MultiProbe Control modules requires no special configuration.

See Also

"Connecting for testing the maximum number of signals (optional)," later in this chapter.

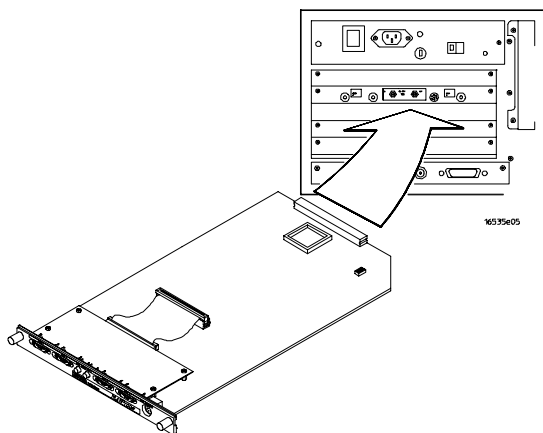


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- 1 Turn off power to the HP 16500B/C mainframe.
- 2 Note the cards that are above the slot where you want to insert the module. Slide them about halfway out of the frame.

Connecting the MultiProbe System
Step 1. Installing the MultiProbe Control module

- 3 With the probe connectors facing away from the frame, slide the module into the frame, but not completely in.



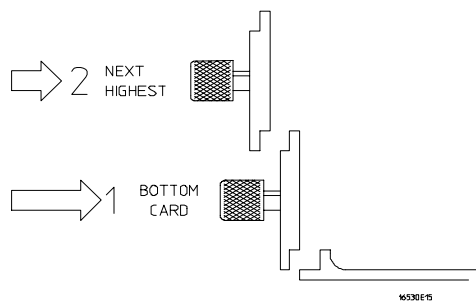
Each card will be firmly seated and tightened in the next steps.

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

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

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.



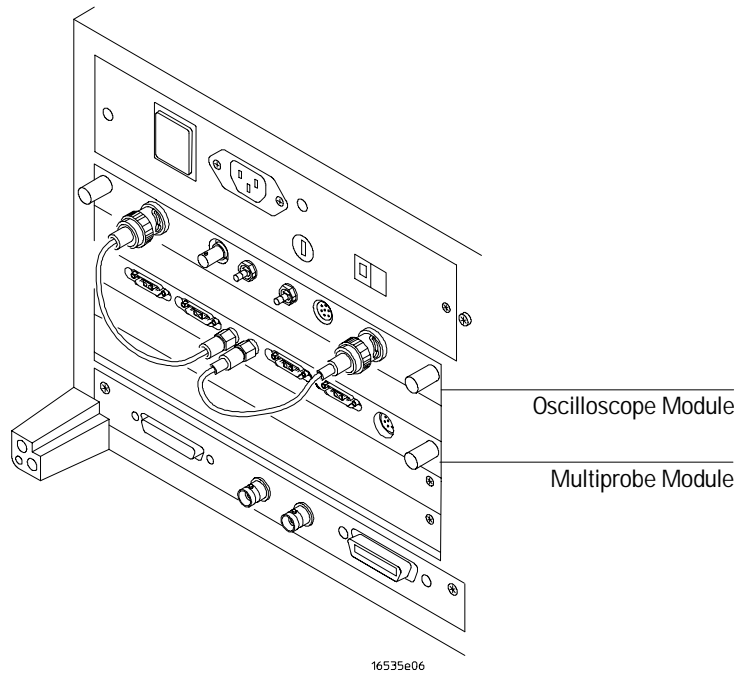
- 6 Turn on the HP 16500B/C Logic Analysis System.

Step 2. Connecting the control module to an oscilloscope

1 Connect the outputs of the control module to the inputs of the oscilloscope.

- Using an internal oscilloscope

Connect output 1 of the HP 16535A MultiProbe Control module to input 1 of the internal oscilloscope, and connect output 2 to input 2. An internal oscilloscope is one that is internal to the HP 16500B/C or HP 16501A frames.

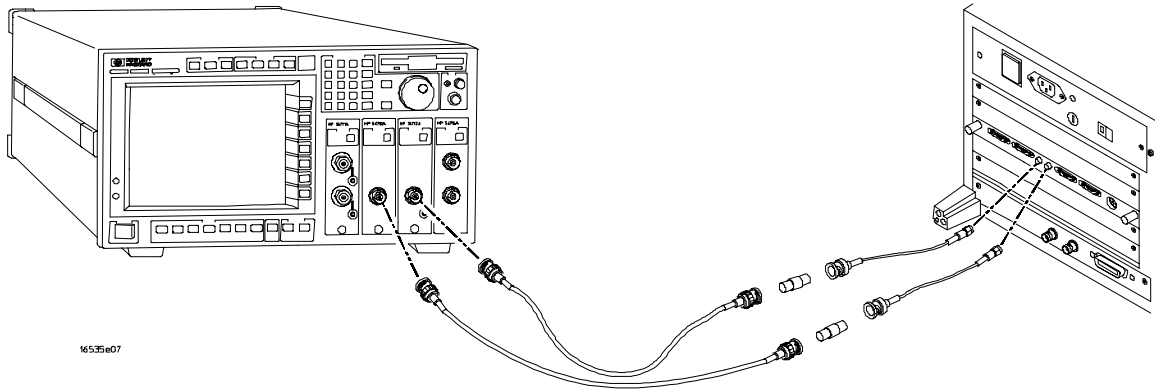


Step 2. Connecting the control module to an oscilloscope

- Using an external oscilloscope

Connect outputs 1 and 2 of the HP 16535A MultiProbe Control module to the inputs of your oscilloscope. An external oscilloscope is one that is external to the HP 16500B/C or HP 16501A frames.

You can use the MultiProbe system with any oscilloscope with inputs set to 50 Ω . If the scope does not have 50 Ω inputs, you can use 50 Ω terminations at the oscilloscope input connectors.



2 Calibrate the control module (optional).

After connecting the control module outputs to the oscilloscope inputs, you may want to calibrate the control module. Refer to "Calibrating the MultiProbe Control module" in the Calibrating and Adjusting section of this manual.

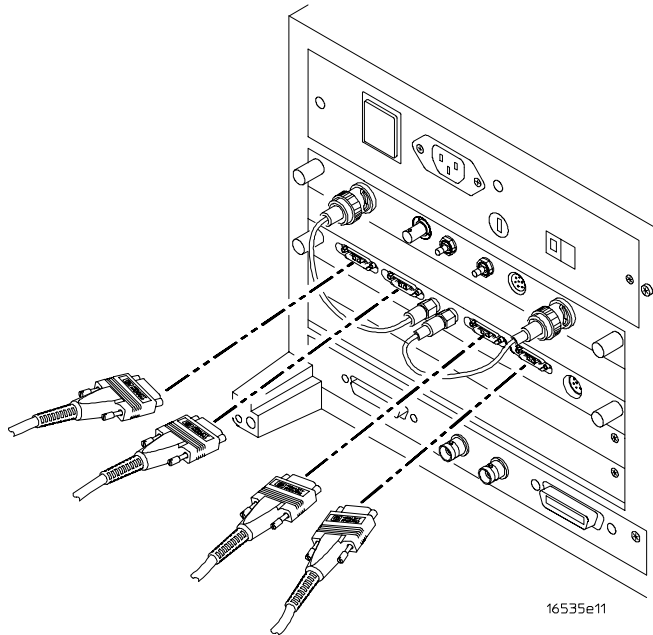
3 Adjust the skew (optional).

After connecting the control module outputs to the oscilloscope inputs, you may want to adjust the oscilloscope skew. Refer to "Adjusting and skew" in the Calibrating and Adjusting section of this manual. If you are just becoming familiar with the MultiProbe system, it is suggested that this step be skipped for now.

Step 3. Connecting the pods to the control module

- Connect the pods to the rear panel of the HP 16535A MultiProbe Control module.

You can connect up to four MultiProbe pods to one MultiProbe Control module. Tighten the screws on either side of the pod cable.



Step 4. Installing the pods

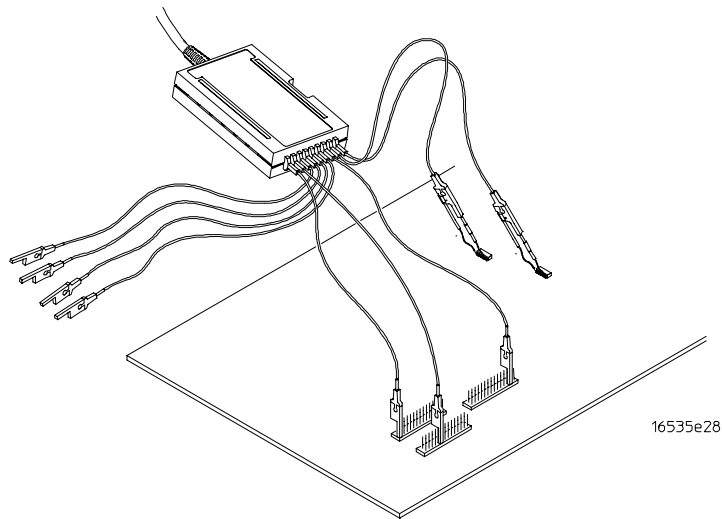
CAUTION

Use grounded wrist straps and mats when installing or performing any service to the pods, modules, or the HP 16500B/C Logic Analysis System. Electrostatic discharge can damage electronic components.

- **Installing the MultiProbe General-Purpose pods**

Use general-purpose pods to acquire reference signals that might not be located on the same DUT where the high-density pods are attached. Also, use this pod for probing a net that has several nodes on many different DUTs, such as a clock signal.

For more information about connecting the general-purpose pods, refer to the *Installation and Service Guide* for your pod.



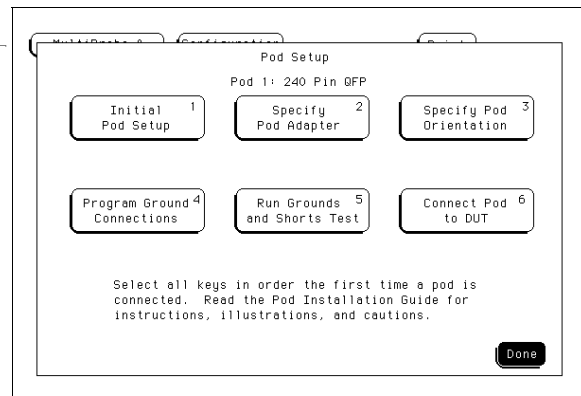
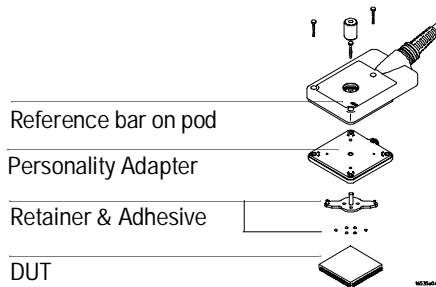
- Install the MultiProbe High-Density pods by following the instructions in your pod *Installation and Service Guide* and in the Pod Setup menu

The pods attach directly to your DUT. During installation, you will need to adhere a retainer to your DUT, install and program a personality adapter, orient the pod to your DUT pin numbering, then attach the adapter to the pod and the pod to the retainer. Refer to the *Installation and Service Guide* for your pod and to the Pod Setup menu.

Pod Orientation

The high-density pods can be mounted in any of four orientations, depending on your clearance. Note the pin number of the DUT that lines up with the reference bar on the pod. You will use this information to orient the pod to your DUT. Refer to your pod *Installation and Service Guide* and the Pod Setup menu for more information.

Pod Setup menu



Personality Adapters

When the personality adapters are not in use, keep them in their original containers.

To label your programmed personality adapter, you can attach a label onto the box, or you can write on the part of the adapter that fits over the retainer.

Do not attach a label onto the adapter. A label will prevent the adapter from making reliable contact with the pod.

Connecting different MultiProbe configurations (optional)

To connect a four-channel internal scope and two independent MultiProbe 2-Output systems

You can test up to four signals in one measurement acquisition. Also, you can follow this same procedure to install a four-channel system into the HP 16501A Expander Frame, for a total of 8 channels.

- 1** Install two HP 16534A oscilloscope cards and two HP 16535A MultiProbe Control modules into the HP 16500B/C mainframe.

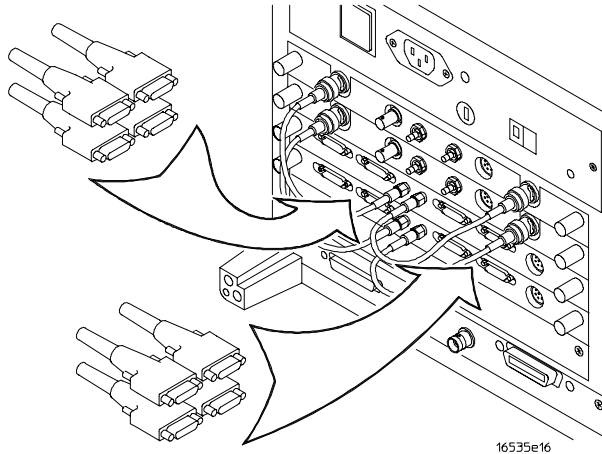
Position the oscilloscope cards together. Multimodule oscilloscopes must be configured in adjacent slots. Refer to the oscilloscope documentation for master and expander cabling connections, making a four-channel scope.

Position the MultiProbe Control modules in the slots above or below the scope cards. You will have two independent MultiProbe systems.

- 2** Connect cables from the MultiProbe Control modules to the oscilloscope cards.
- 3** Connect pods to the MultiProbe Control modules, then connect them to your DUTs .

Refer to the *Installation and Service Guide* for your pod.

Now you are be able to test four signals at a time on your DUTs.



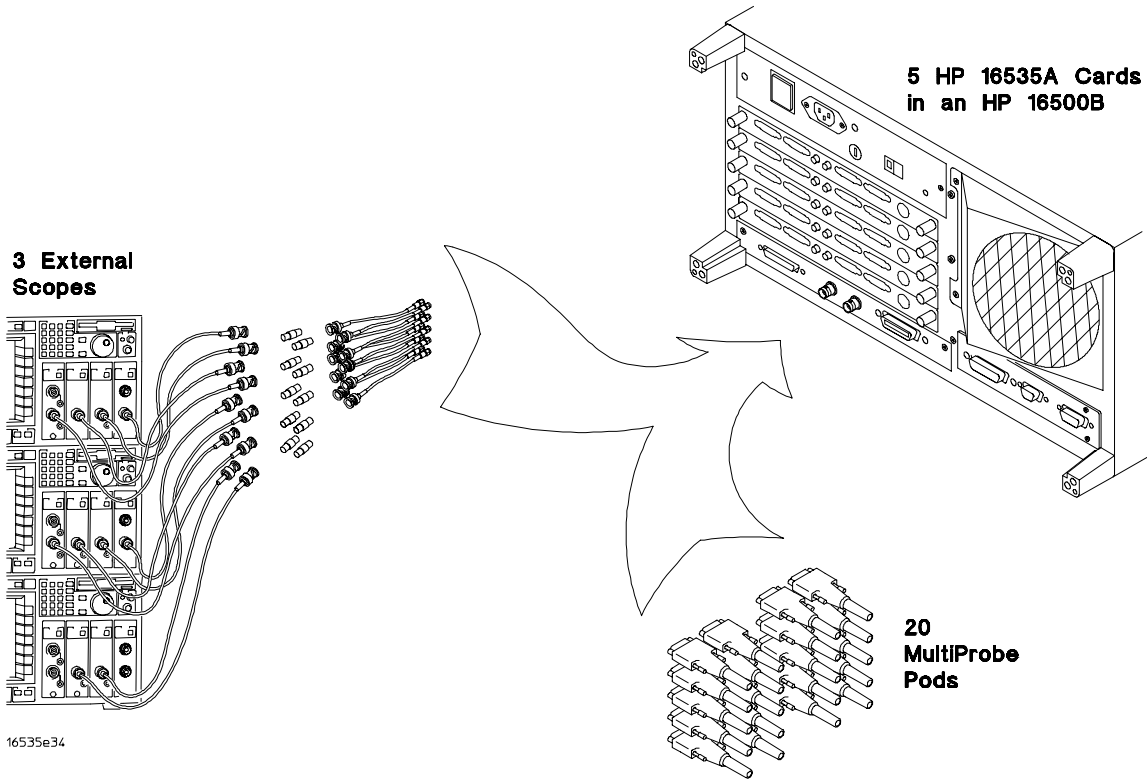
To connect the maximum possible MultiProbe outputs to external scopes

You can install multiple MultiProbe Control modules into the HP 16500B/C and HP 16501A frames. Then, use multiple external scopes to acquire and view the signals.

- 1** Install multiple MultiProbe Control modules into the HP 16500B/C mainframe and the HP 16501A expansion frame.
- 2** Connect cables from the MultiProbe Control modules to the external oscilloscope inputs.
- 3** Connect pods to the MultiProbe Control modules, then connect them to your DUTs .

Refer to the *Installation and Service Guide* for your pod.

If you use four-channel external scopes, then three scopes would be sufficient. Now you are able to test 10 signals at a time on your DUTs.



Checking signal activity (optional) 3-3

Changing a pod description (optional) 3-4

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Saving the signal names to a file (optional) 3-7

Loading a file containing signal names (optional) 3-8

Creating a file of signal names using an ASCII editor (optional) 3-9

Setting Up the MultiProbe System

Setting Up the MultiProbe System

After you have connected the MultiProbe system, including installing the pods, you can use the MultiProbe menus to make optional setups. This chapter provides optional procedures for setting up the MultiProbe system.

Pod setups are required

If you are using high-density pods in your MultiProbe system, you must follow the Pod Setup menu and the pod *Installation Guide*. The pod setups include the following:

- Specify the personality adapter type.
- Orient the pod to the pins of your device under test (DUT).
- Program the ground connections.

If you decide to install the pod on a different DUT with different ground connections, you must adhere a new retainer to that DUT, remove the pod and personality adapter from the old DUT, install and program a new adapter (if you are testing a different package type or a package with different grounds), and attach the new assembly to the new DUT. If you are using a different type of personality adapter, you must install a new adapter file. Then, you need to orient the reference bar on the pod to the pins of the DUT. Refer to "If you want to test a different DUT with the high-density pod" in chapter 6 and the *Installation Guide* for your pod.

Other setups are optional

Optional procedures in this chapter will help make your MultiProbe measurements more usable.

You can check the signal activity on each pod, change the pod descriptions, and change the MultiProbe signal names to match your DUT signal names.

Also, you can save the signal names to a file, load a file of signal names that you saved, or load a file of signal names that you created using your ASCII text editor.

Checking the signal activity (optional)

This check provides you with a list of signal activity for a pod.

1 Access the Activity menu.

Select **MultiProbe** from the module field and **Activity** from the menu field.

2 Select the pod.

Use the **Pod** field and the knob or keypad to select a pod number.

The first time you select the Pod field, the field is highlighted. Then, either use the knob or select the field again to access the keypad.

3 Set the threshold.

Use the **Threshold** field and the knob or keypad to set the threshold.

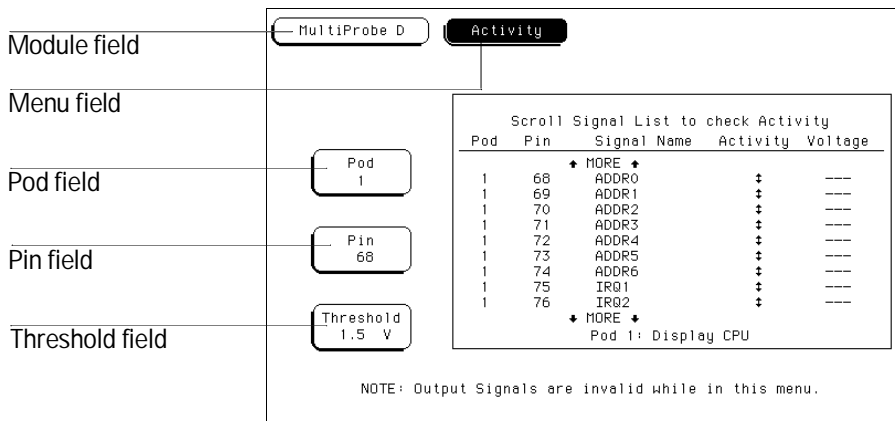
The first time you select the threshold field, the field is highlighted. Then either use the knob or select the field again to access the keypad.

4 View the activity.

Highlight the **Pin** field, then use the knob or keypad to scroll through the signals.

The Activity Indicators show if the signal level is above or below the threshold. An "H" indicates a high, or above the threshold. An "L" indicates a low, or below the threshold. A double-ended arrow indicates a transitioning signal.

The Voltage Indicators show voltage levels of the signals. Signals that are transitioning above and below the threshold will not show a voltage.



Module field: MultiProbe D

Menu field: Activity

Pod field: Pod 1

Pin field: Pin 68

Threshold field: Threshold 1.5 V

Scroll Signal List to check Activity				
Pod	Pin	Signal Name	Activity	Voltage
		↑ MORE ↑		
1	68	ADDR0	↓	---
1	69	ADDR1	↓	---
1	70	ADDR2	↓	---
1	71	ADDR3	↓	---
1	72	ADDR4	↓	---
1	73	ADDR5	↓	---
1	74	ADDR6	↓	---
1	75	IR01	↓	---
1	76	IR02	↓	---
		↓ MORE ↓		
Pod 1: Display CPU				

NOTE: Output Signals are invalid while in this menu.

Changing a pod description (optional)

Instead of using the default pod descriptions, you can use descriptions more meaningful to your application. For example, default descriptions might be "9 Lead Probe" and "240 Pin QFP". You might change them to something like "Control 1" or "240-pin Display CPU."

1 Access the Configuration menu.

Select **MultiProbe** from the module field and **Configuration** from the menu field.

2 Select the pod description.

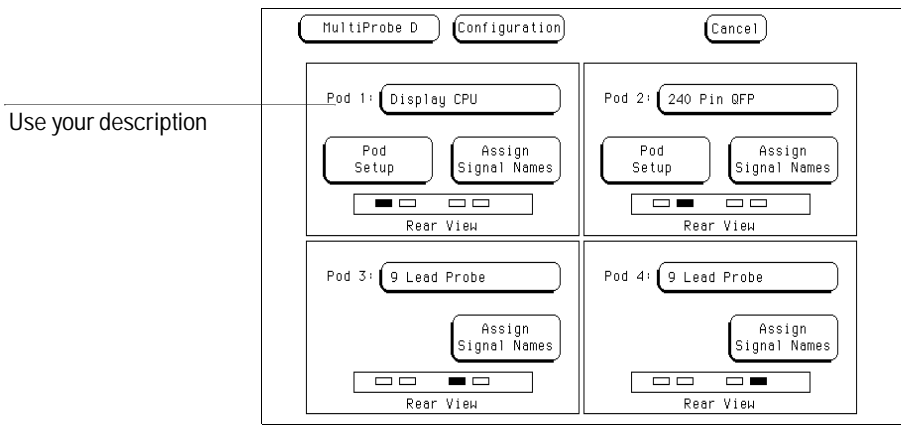
In the Configuration menu, the pod description is the field next to the pod number.

3 Enter the new description.

Using the keypad, enter the new description, then select **Done**.

Embedded spaces are allowed in pod descriptions.

Make pod descriptions a maximum of 20 characters, including embedded spaces.



Using your signal names (optional)

You can change the default signal names to names of the probed signals on your DUT. Your signal names are then used in the measurements. When using the HP 16533/34A oscilloscope with the MultiProbe system, the signal names you assign appear in the label field on the oscilloscope display. Also, the signal names appear on printouts and are stored when a configuration is saved to a file on the HP 16500B/C disk drive.

1 Access the Configuration menu.

Select **MultiProbe** from the module field and **Configuration** from the menu field.

2 Select Assign Signal Names.

In the Configuration menu, select **Assign Signal Names** for the pod.

Default Names The default names refer to the pod number, the slot letter of the module, and the pin number. For example, signal name 4D003 refers to pod 4, slot D, pin 003. Use the Default Names field to return all signal names on that pod to their default value.

3 Select the pin number.

To select a pin number you can do one of the following:

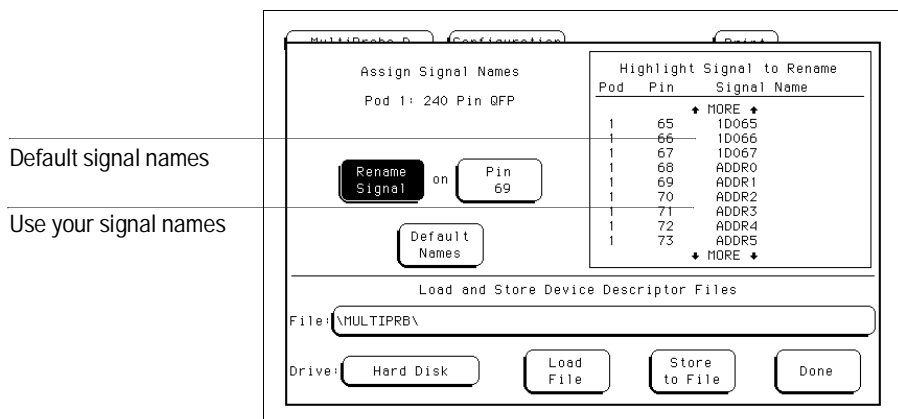
- Use the knob to scroll through the list of pin numbers.
- Select the **Pin** field, then enter a pin number using the keypad.

4 Enter the new name.

- Use the **Rename Signal** field to enter the name for the specified pin number.
- Make signal names a maximum of 16 characters with no embedded spaces.
- When you exit the keypad, the Pin number field and the green bar automatically go to the next pin.

Hint for entering a list of signal names

For entering a long list, you can use a keyboard connected to the HP 16500B/C. After selecting the pin number and Rename Signal, use the keyboard to type the signal name. Then on the keyboard, press the Return key twice, type the next name, and press Return twice. Continue this process until you have named all the signals. Pressing the Return key twice enters the name you typed into the



Default signal names

Use your signal names

signal names list, then displays the keypad for entering the next name.

Saving the signal names to a file (optional)

1 Access the Configuration menu.

Select **MultiProbe** from the module field and **Configuration** from the menu field.

2 Select Assign Signal Names.

In the Configuration menu, select the **Assign Signal Names** field for the pod.

3 Select a disk drive.

Select **Hard Disk** or **Flexible Disk**. When you select the field, you will see the two choices.

4 Enter the Device Descriptor File Selection menu.

Select the field next to File.

5 Change to the desired directory, then select a file.

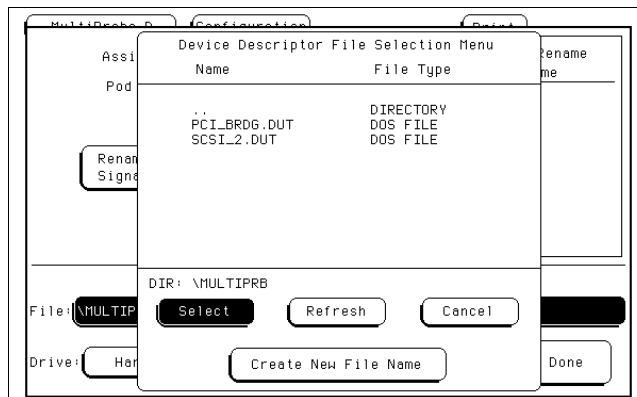
Use the knob to highlight the directory name, then choose **Select**.

In the File Selection menu, you can select a file or create a new one. New files are created in the currently selected directory.

- To select a file, use the knob to highlight the file, then choose **Select**.
- To create a new file, select **Create New File Name**, then use the keypad.

6 Store the file.

Select **Store to File** to save the signal names to the file. Select **Refresh** to see the updated list of files.



Loading a file containing signal names (optional)

1 Access the Configuration menu.

Select **MultiProbe** from the module field and **Configuration** from the menu field.

2 Select Assign Signal Names.

In the Configuration menu, select the **Assign Signal Names** field for the pod.

3 Select a disk drive.

Select **Hard Disk** or **Flexible Disk**. When you select the field, you will see the two choices.

4 Enter the Device Descriptor File Selection menu.

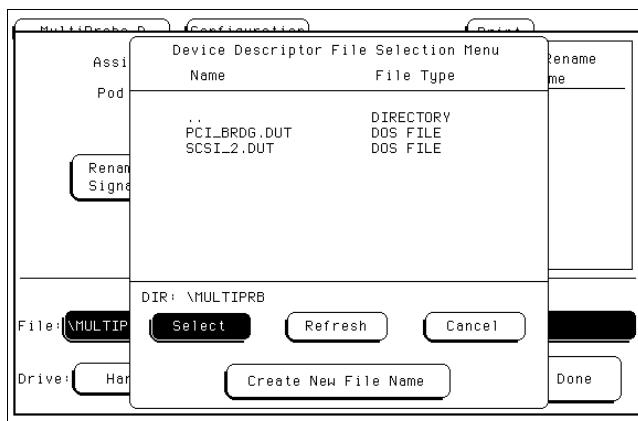
Select the field next to File.

5 Change to the desired directory, then select a file.

Use the knob to highlight the directory name, then choose **Select**. Use the knob to highlight the file you want to load, then choose **Select**.

6 Load the file.

With the file name displayed in the File field, select **Load File**.



Copying signal names

You can copy signal names from one pod to another by storing the names to a file, then loading the file to the other pod. Copying the names helps if you move a pod from one input on the MultiProbe Control module to another.

Creating a file of signal names using an ASCII editor (optional)

1 Create the file.

Use an ASCII text editor to create a list of signal names, then save them in a file. In this file, you can specify the pod description, the pod orientation, and the names of any or all signals in the pod.

General rules for creating the file

- Each pod needs to have its own file.
- If any information is omitted, the previous value is retained.
- Any line containing a syntax error or an invalid pin number is skipped, and the file load procedure continues on the next line.
- Reading of the file is aborted after syntax errors are detected on three lines.
- Spaces at the beginning of a line and empty lines are ignored.
- A line beginning with a pound sign (#) is considered to be a comment and is ignored.
- To show the end of each line, use either a line feed character or the combination of a carriage return followed by a line feed.
- Each line can be a maximum of 120 characters. This restriction includes comment lines. If your comment line exceeds 120 characters, begin a new comment line and use a pound sign (#) before the 120 character limit.
- All pin numbers should be ASCII integers between 1 and the number of pins on the pod. Pin numbers should not contain any sign or decimal point.

The three recognized keywords

The program recognizes the following three words as keywords.

- DESCRIPTION

After this keyword and the following white space, the rest of the line (up to 20 characters) is considered to be the pod description. The pod description may have embedded spaces in it.

- ORIENTATION

After this keyword and the following white space, only a pin number should be found. This should be the number of the pin on the probed part that lines up with the reference bar on the pod.

- NAME

This keyword should be the only item on its line and should not occur in the file before the other two keywords. All lines after this line are considered to be signal name definitions.

There should only be one signal name definition per line, consisting of the pin number, a space or a tab, and the name that is assigned to it. Names are a maximum of 16 characters, and names longer than that are truncated. Names may not contain embedded spaces.

Lines containing signal names may occur in any order, and all pins do not need to be assigned names. Names need not be unique, and may contain any printable ASCII character.

Blank names are not allowed.

Example File

```
# Adapter Description for this pod.
DESCRIPTION    208-Pin Display CPU

# Pod Orientation  This is the number of the IC pin (your
# device under test for this example) that lines up with the
# reference bar on the pod.
ORIENTATION    53

# Everything after this next line is a signal name.
NAME

1   RMC
2   R/~W
3   SIZ1
4   SIZ0
5   ~DataStrobe
6   ~AddrStrobe
7   ~BG_ACK
8   ~Bus_Grant
9   ~Bus_Request
10  ~BusError
```

```
11  ~HALT
12  ~RESET
13  GND
14  CLKOUT
15  Vcc
16  XFC
17  Vcc
18  EXT_Crystal
19  VccSyn
20  Crystal
21  GND
22  MODCK
.
.
.
.
.
.
.
196  IO14
197  PIO15
198  GND
199  PIO16
200  PIO17
201  PIO18
202  PIO19
203  GND
204  PIO20
205  PIO21
206  PIO22
207  PIO23
208  GND
```

2 Load the file.

Copy the file onto either the hard disk or a compatible flexible disk.

For loading the file, follow the directions "To load a file containing signal names," earlier in this chapter.

Step 5. Selecting the signals to acquire 4-3

Step 6. Acquiring signals with an oscilloscope 4-6

Using an HP 16533/34A oscilloscope 4-6

Using any other oscilloscopes 4-9

Saving measurements (optional) 4-13

Loading measurement files (optional) 4-13

Making Measurements

Making Measurements

After you have connected the MultiProbe system and set up the menus, you are ready to make measurements.

An HP 16533/34A is the oscilloscope easiest to use with the MultiProbe System

The HP 16533/34A Oscilloscope installed in the HP 16500B/C Logic Analysis System is the oscilloscope easiest to use with the MultiProbe system. Using this oscilloscope, you can select signals to acquire from the oscilloscope menu, not just from the MultiProbe menu. Also, the calibration correction factors for the MultiProbe system are automatically applied in the oscilloscope.

See Also

"Product Information," chapter 9, for the oscilloscopes to use with the MultiProbe system.

Step 5. Selecting the signals to acquire

In the Select Signal menu, the scope that is physically connected to each output of the MultiProbe Control module must be specified. Once that is done, you can select any input of any pod that you have connected for either output. The selected signals can be on the same pod or different pods.

1 Access the Select Signal menu.

Select **MultiProbe** from the module field and **Select Signal** from the menu field.

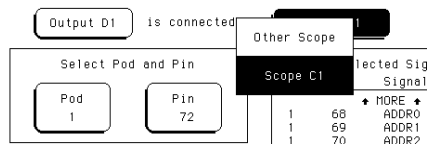
2 Specify the oscilloscope that each control module output is connected to.

Repeat the following for Output 1 and Output 2.

- a Select the **Output** field to choose Output 1 or Output 2 of the control module. For example, Output D1 would be Output 1 from the control module in slot D.
- b Select the **Scope** field, then choose the scope. You are specifying the oscilloscope that is connected to the output that you chose in the previous step.

Example

Output 1 of the MultiProbe Control module is specified as being connected to input 1 of the HP 16534A oscilloscope located in slot C.



Connect the cables

You must physically connect cables from the outputs of the control module to the inputs of your oscilloscope. Refer to chapter 2, "Connecting the MultiProbe System," for help.

3 Select the signal for each Output.

If you are using an HP 16533/34A Oscilloscope, you can select signals in either the MultiProbe menu or the Scope menu. Using the Scope menu means that you do not need to change back to the MultiProbe menu every time you want to choose a different signal. If you are using any other oscilloscope, you must select the signals in the MultiProbe menu.

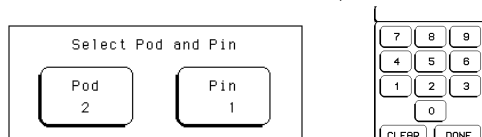
a Access a MultiProbe signal selection menu.

If you are using an HP 16533/34A scope, access the MultiProbe Select Signal menu or access the Scope Channel menu and select the **Select Signal** field.

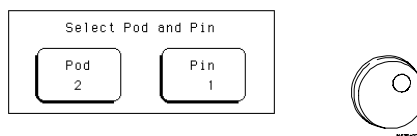
If you are using any other scope, access the MultiProbe Select Signal menu.

Select the signals in the following ways:

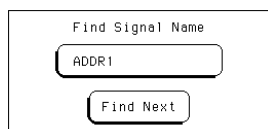
- Choose the pod number and the pin number of the signal.
Select the **Pod** or **Pin** field, then use the keypad.



- With the **Pod** or **Pin** field highlighted, use the knob to scroll through the Selected Signal list.

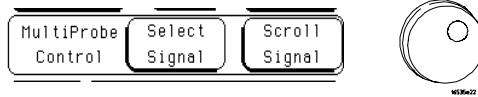


- Go directly to a signal name.
Select the **Find Signal Name** field, use the keypad to insert the signal name, then select **Done** to close the keypad. Select **Find Next**.



b Access the MultiProbe Scroll Signal field from the scope channel menu.

- Choose the **Scroll Signal** field, then use the knob. The Scroll Signal field is available only in the HP 16533/34A Scope Channel menu.

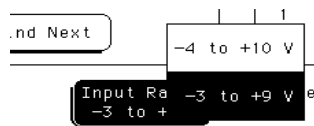


Hint for finding signal names

Using Find Signal Name, you can go to signal names without entering the full name of the signal. Simply enter the first character or two, and select Done. Then select Find Next. The green scroll bar will move to the first occurrence of a signal name starting with the characters you entered. If you select Find Next again, the scroll bar will move to the next occurrence. In all cases, the selected signal is the one currently highlighted by the green scroll bar.

4 Set the Input Range for each Output.

Selecting the Input Range control shows the two available ranges for high-density pods, -3 V to +9 V and -4 V to +10 V. The corresponding input ranges for the general-purpose flying lead probe are -3V to +10V and -6V to +13V. Changing the Input Range also changes the probe attenuation factor. If you are using an HP 16533/34A oscilloscope with the MultiProbe system, the probe attenuation factor is automatically sent to the oscilloscope.



Step 6. Acquiring signals with an oscilloscope

Using an HP 16533/34A oscilloscope

If you are using an HP 16533/34A oscilloscope, then follow this procedure.

1 Access the oscilloscope menus.

To view your measurements with an HP 16533/34A oscilloscope, you need to exit the MultiProbe Control menus, then enter the oscilloscope menus.

Select **Oscilloscope** from the module field.

2 Use the oscilloscope controls to run and adjust the measurement.

If you need help, refer to the documentation for your oscilloscope.

Now that you have captured measurements, you might need to save them to a file. If you need help, refer to "Saving measurements" later in this chapter. Also, refer to the *HP 16500B Logic Analysis System User's Reference* or the *HP 16500C Logic Analysis System User's Reference* for more information about saving files.

3 Select different signals to view.

Choose from all the pins and pods that are connected to the MultiProbe Control module. You can select signals from the oscilloscope Select Signal field, the oscilloscope Scroll Signal field, or the MultiProbe Select Signal menu, as shown in "Step 5. Selecting the signals to acquire," earlier in this chapter.

Attenuation Factor and Skew Factors

If you are using an HP 16533/34A oscilloscope with the MultiProbe system, the probe attenuation and skew factors are automatically sent to the oscilloscope.

Note that the skew values are automatically set to zero every time the MultiProbe pod is disconnected and reconnected to the oscilloscope.

Select different signals using the oscilloscope Select Signal field.

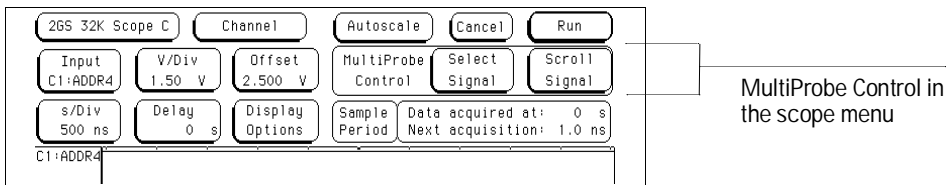
In the oscilloscope Channel menu, select the **Select Signal** field. Then, select the signal using one of the following ways.

- Use the **Select Pod** and **Pin** fields and the resulting keypads.
- Use the knob to select signals from the Selected Signal list.
- Use the **Find Signal Name** field, the resulting keypad, then the **Find Next** field.

Hint for finding signal names
 Using Find Signal Name, you can go to signal names without entering the full name of the signal. Simply enter the first character or two, and select Done. Then select Find Next. The green scroll bar will move to the first occurrence of a signal name starting with the characters you entered. If you select Find Next again, the scroll bar will move to the next occurrence.

Select different signals using the oscilloscope Scroll Signal field.

In the oscilloscope Channel menu, select the **Scroll Signal** field, then use the knob to scroll through the signals. You can see the signal names change on the Input field and in the field to the left of the scope waveforms.



Select different signals using the MultiProbe Select Signal menu.

Exit the oscilloscope menu, enter the MultiProbe Control Select Signal menu, then select the signal using one of the following ways.

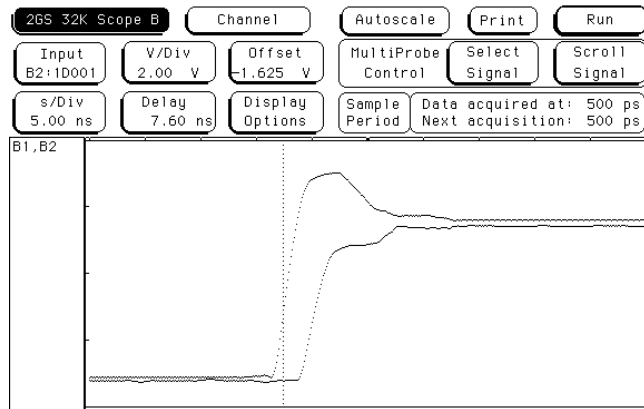
- Use the **Select Pod** and **Pin** fields and the resulting keypads.
- Use the knob to select signals from the Selected Signal list.
- Use the **Find Signal Name** field, the resulting keypad, then the **Find Next** field.

Step 6. Acquiring signals with an oscilloscope

Hint for overlaying two traces on the same area of the display

Follow these steps:

- Select the trace label field twice. It is to the left of the trace display area.
- Select delete all and then continue.
- Select the channel mode to be overlaid.
- Select the first label.
- Select the second label.
- Select done.



Using any other oscilloscopes

If you are using any oscilloscope except the HP 16533/34A, then follow this procedure.

- 1** Set the input impedance to $50\ \Omega$ for each oscilloscope input that is connected to a MultiProbe Control module output.
- 2** Select different signals using the MultiProbe Select Signal menu, as shown in "Step 5. Selecting the signals to acquire," earlier in this chapter.
- 3** Enter the probe attenuation factor into the oscilloscope for each oscilloscope input that is connected to a control module output.
 - Using the default input range (-3V to +9V), the nominal probe attenuation factor is 25:1.
 - Using the larger input range (-4V to +10V), the nominal probe attenuation factor is 50:1.
 - For the best accuracy (optional), as different signals are selected, enter the probe attenuation factor displayed in the Select Signal menu for each signal.

Using the probe attenuation factor

The attenuation may be different for each pod and pin selected. You only need to use the displayed value when you need to make the most accurate measurements. For most applications, you can use an average probe attenuation factor. Determine a good average value by writing down the attenuation values for several of the pins you are interested in, then computing the average.

- 4** Enter the skew (probe delay) factor into the oscilloscope (optional).

See the section on "Adjusting the skew" for information on adjusting and using the oscilloscope skew.

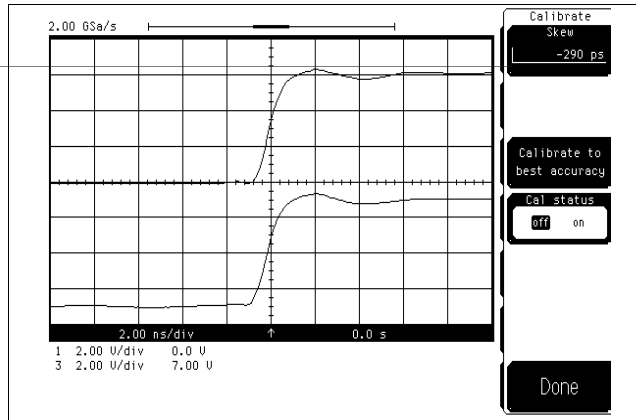
If you are making precise time measurements between signals, enter the skew factor displayed at the bottom of the Select Signal menu into the oscilloscope. Most HP oscilloscopes, such as the HP 54100 series, HP 54500 series, and HP 54700 series, have inputs for entering the channel-to-channel skew factor.

Making Measurements
Step 6. Acquiring signals with an oscilloscope

HP 54700 Example

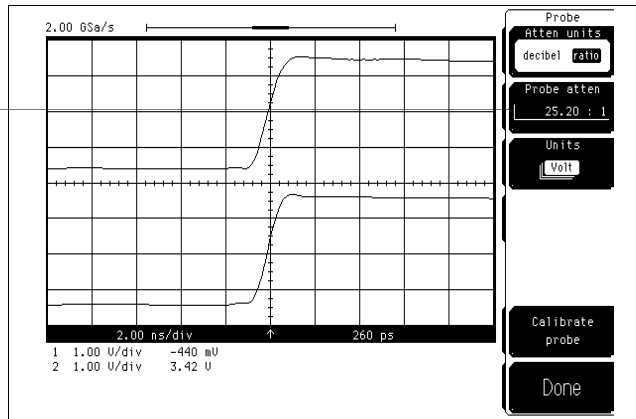
Enter the skew value in the scope Calibrate menu.

Enter the skew



Enter the probe attenuation in the scope Probe menu.

Enter the probe attenuation

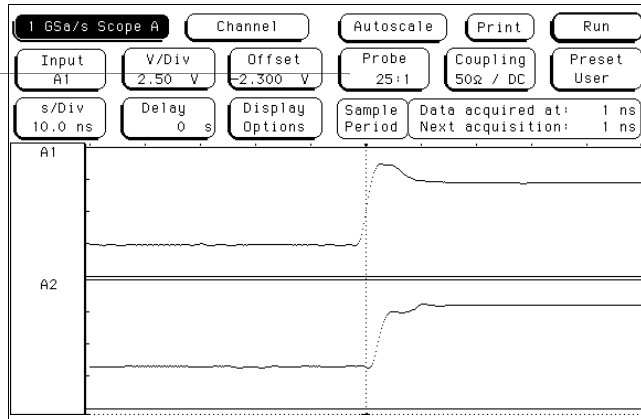


Step 6. Acquiring signals with an oscilloscope

HP 16532A Example

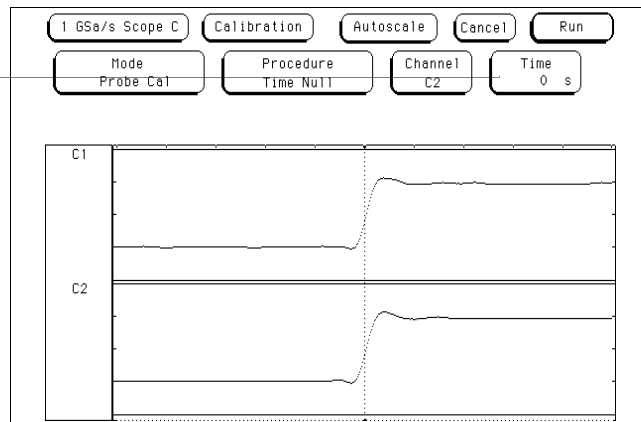
Enter the probe attenuation in the HP 16532A Channel menu.

Enter the probe attenuation



Enter the skew in the Calibration menu.

Enter the skew



5 Use the oscilloscope controls to run and view the measurement.

6 Select different signals to view.

For either output, you can choose from all the pins and pods that are connected to the MultiProbe Control module. To select different signals, use the MultiProbe Control Select Signal menu.

Enter the MultiProbe Select Signal menu, then select the signal using one of the following ways.

- Use the **Select Pod** and **Pin** fields and the resulting keypads.
- Use the knob to select signals from the Selected Signal list.
- Use the **Find Signal Name** field, the resulting keypad, then the **Find Next** field.

Hint for finding signal names

Using Find Signal Name, you can go to signal names without entering the full name of the signal. Simply enter the first character or two, and select Done. Then select Find Next. The green scroll bar will move to the first occurrence of a signal name starting with the characters you entered. If you select Find Next again, the scroll bar will move to the next occurrence.

See Also

"Step 5. Selecting the signals to acquire," earlier in this chapter, for more details.

Saving measurements, configurations, and data (optional)

- **Internal Oscilloscope**

When using an internal scope, you can use the HP 16500B/C system to save the oscilloscope configuration and data and the MultiProbe Control module configuration. To save the measurement configurations and data, go to the System Hard Disk or Flexible Disk menu and use the Store command.

- **External Oscilloscope**

When using an external scope, you can use the HP 16500B/C system to save the configuration of the HP 16535A MultiProbe Control module. To save the HP 16535A MultiProbe Control module configuration, go to the System Hard Disk or Flexible Disk menu and use the Store command.

See Also

The *HP 16500B/16501A Logic Analysis System User's Reference* or the *HP 16500C/16501A Logic Analysis System User's Reference* for detailed steps about loading and storing files.

Loading measurement, configuration, and data files (optional)

You can use the HP 16500B/C system to load previously saved measurement files. To load the measurement configurations and data, go to the System Hard Disk or Flexible Disk menu and use the Load command.

See Also

The *HP 16500B/16501A Logic Analysis System User's Reference* or the *HP 16500C/16501A Logic Analysis System User's Reference* for detailed steps about loading and storing files.

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Calibrating and Adjusting

Calibrating and Adjusting

This chapter gives you instructions for performing module and pod operational accuracy calibration and for adjusting the skew between outputs. Also included is a self test that you can perform on the module after installing it into the HP 16500B/C.

Operational accuracy calibration has been performed at Hewlett-Packard on your MultiProbe Control module and pods.

For measurement accuracy, use equal length cables to connect the module outputs to the oscilloscope inputs and calibrate the module after changing the oscilloscope configuration.

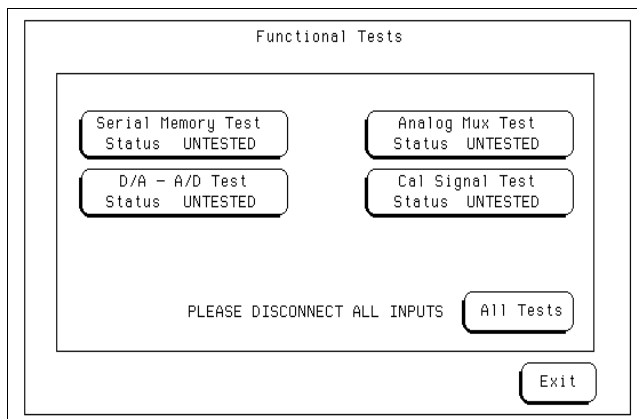
For the best timing accuracy, adjust the skew between oscilloscope inputs after changing the oscilloscope configuration or changing the cables connecting the module outputs to the oscilloscope inputs.

The MultiProbe Control module and pods require periodic operational accuracy calibration under any of the following conditions:

- At six-month intervals or every 1,000 hours of operation
- If the ambient temperature changes more than ± 5 °C
- To optimize measurement accuracy

Performing the self-test (optional)

- 1 Disconnect all inputs to and outputs from the MultiProbe Control module, then access the System Test menu.**
Select **System** from the module field and then select **Test** from the menu field.
- 3 Load the test system.**
In the System Test menu, select the box labeled **Touch Box to Load Test System**.
- 4 Access the MultiProbe Control menu.**
In the Test System menu, select **Test System**, then select **MultiProbe**.
- 5 Run all tests.**
In the MultiProbe menu, select **All Tests**.



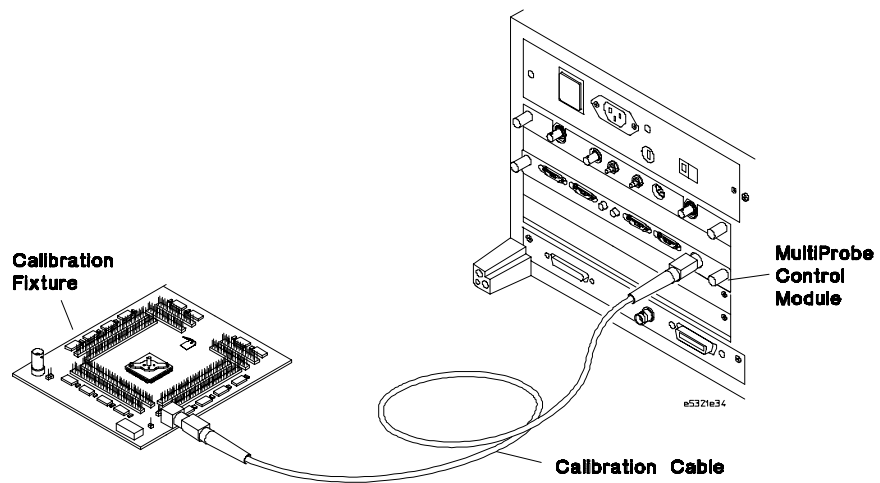
You can run all tests at one time by selecting All Tests. To see more details about each test when troubleshooting failures, you can run each test individually. Refer to the optional *MultiProbe Control Service Guide* for more information.

- 6 Exit the test menu.**
When the tests finish, the status will show Passed or Failed. Select **Exit**, then select **Test System**.
- 7 Exit the Test System.**
In the Test System menu, select **Test** then select the box labeled **Touch Box to Exit Test System**.

To test the CAL OUTPUT port (optional)

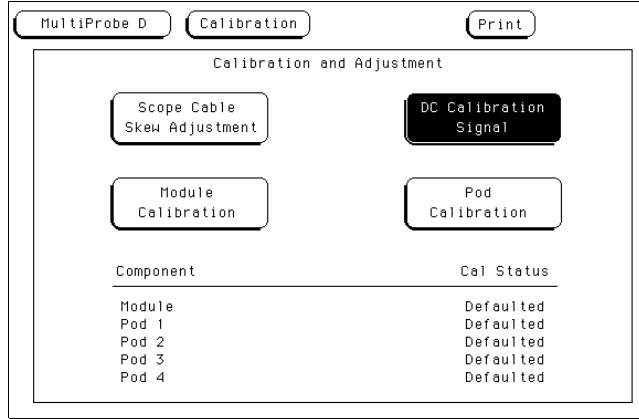
Testing the CAL OUTPUT port checks that the CAL OUTPUT voltages are operating within limits, so that they can provide accurate stimulus for the instrument operational accuracy.

- 1** Connect the calibration fixture to the MultiProbe Control module.
 - a** Connect one end of the calibration cable to the MultiProbe Control module CAL OUTPUT port.
 - b** Connect the free end of the calibration cable to the calibration fixture signal input port.
 - c** If a MultiProbe High-Density pod is attached to the calibration fixture, then remove the pod and place it in the ESD cover.

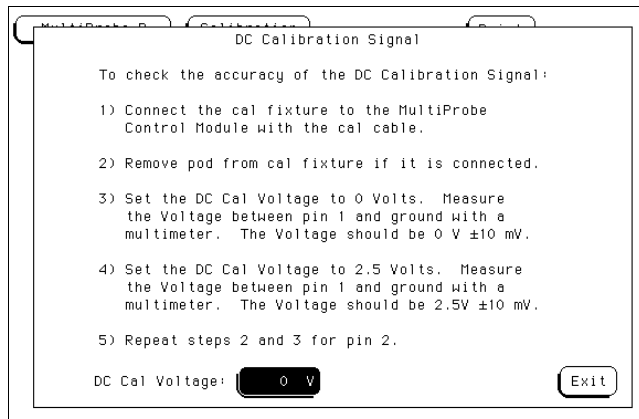


2 Set up the Calibration menu.

- a** Select **MultiProbe** from the module field and **Calibration** from the menu field.
- b** In the Calibration menu, touch **DC Calibration Signal**.



- c** In the DC Calibration menu, touch the **DC Cal Voltage** field. At the numeric pop-up menu, enter 0 and touch **Done**.



- 3 Check the voltages on pin 1 of the calibration fixture.
 - a Use a voltmeter to measure the voltage between pin 1 and GND. The voltage should be 0.00V +/- 10 mV.
 - b In the DC Calibration menu, touch the **DC Cal Voltage** field. At the numeric pop-up menu, enter 2.5V and touch **Done**.
 - c Use a voltmeter to measure the voltage between pin 1 and GND. The voltage should be 2.50V +/- 10 mV.
- 4 Check the voltages on pin 2 of the calibration fixture.
 - a In the DC Calibration menu, touch the **DC Cal Voltage** field. At the numeric pop-up menu, enter 0 and touch **Done**.
 - b Use a voltmeter to measure the voltage between pin 2 and GND. The voltage should be 0.00V +/- 10 mV.
 - c In the DC Calibration menu, touch the **DC Cal Voltage** field. At the numeric pop-up menu, enter 2.5V and touch **Done**.
 - d Use a voltmeter to measure the voltage between pin 1 and GND. The voltage should be 2.50V +/- 10 mV.
- 5 Touch **Exit** to exit the DC Calibration Signal menu.

Setting the PROTECTED/UNPROTECTED switch (optional)

You can use the switch located on the MultiProbe Control module to protect the module calibration factors. The switch is initially set on UNPROTECTED. In order to change the switch, you must slide the module out. If you need instructions for removing and replacing the module, refer to "Installing and Removing Cards" in the *HP 16500B/16501A User's Reference* or *HP 16500C/16501A User's Reference*.

Because the module needs to be re-calibrated every time that the oscilloscope configuration changes, protected mode is not recommended unless you are certain that the oscilloscope configuration will not be changing. If you decide to use the switch, do the following steps each time you perform calibration or adjustments.

CAUTION

Turn off the instrument before installing, removing, or replacing a module in the instrument. Failure to do so could damage the equipment.

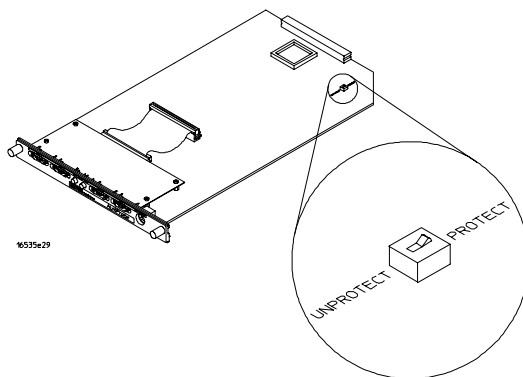
1 Set the switch to UNPROTECTED.

Turn off the instrument. Remove the control module, set the switch to UNPROTECTED, then install the module.

2 Perform the calibration.

Turn on the instrument. Perform the calibration by following on-screen procedures.

3 Set the switch to PROTECTED.



Turn off the instrument. Remove the control module, set the switch to PROTECTED, then install the module.

Calibrating the MultiProbe Control module (optional)

For the best accuracy, the MultiProbe Control module should be re-calibrated each time the oscilloscope configuration is changed.

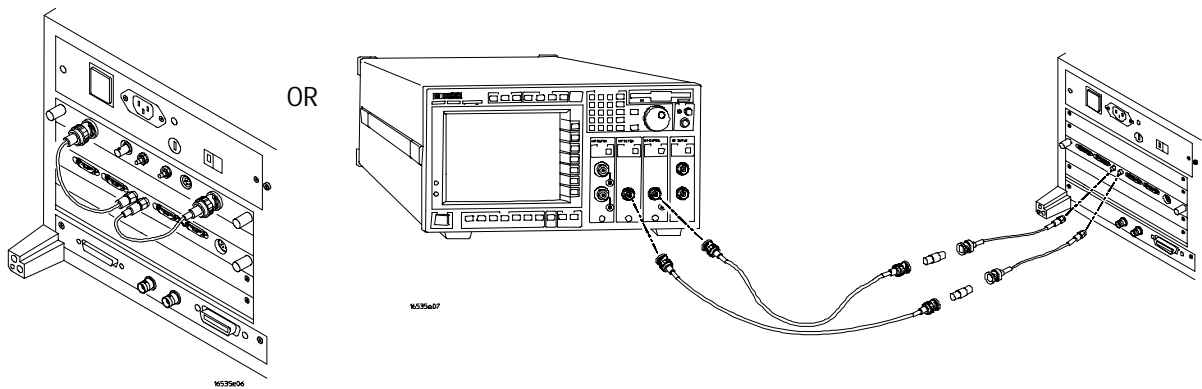
1 Access the Calibration menu.

Select **MultiProbe** from the module field and **Calibration** from the menu field.

2 Select Module Calibration.

3 Follow the Module Calibration procedure on screen.

The connections are shown in the following figure.



Calibrating the pods (optional)

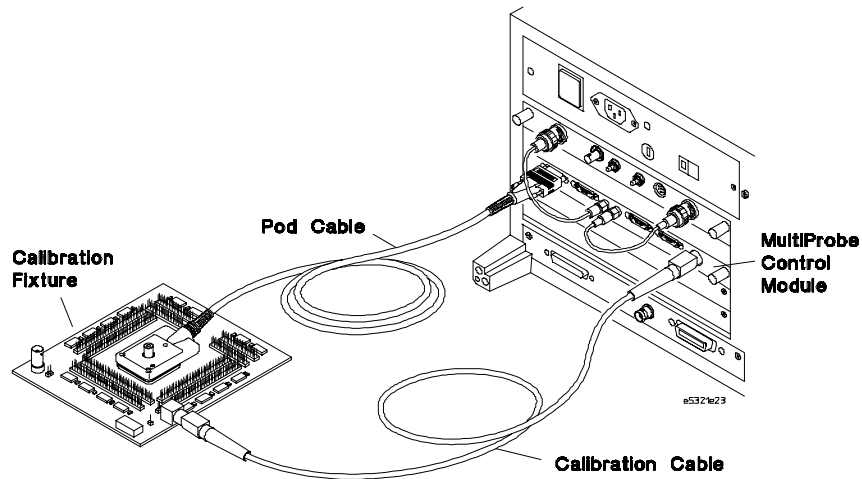
1 Access the Calibration menu.

Select **MultiProbe** from the module field and **Calibration** from the menu field.

2 Select **Pod Calibration**.

3 Follow the Pod Calibration procedure on screen.

The connections for calibrating high-density pods are shown in the following figure. The figure shows using an internal scope and a high-density pod.



Calibrating general-purpose pods

If you are calibrating a general-purpose pod, you will use the calibration fixture for general-purpose pods. To perform the calibration, all nine flying leads will be plugged into calibration connectors on the fixture.

Adjusting the skew (optional)

All probes introduce time delay between the probe input and the probe output. When using multiple oscilloscope inputs, each with a different probe, time delay differences between the probes causes the signals at the oscilloscope inputs to be misaligned in time. This introduces time errors in measurements made with the oscilloscope.

With a conventional single input probe, the time delay of the probe is a fixed constant. Measurement errors caused by time delay differences between probes can be removed by adjusting the skew (probe delay) of the oscilloscope inputs. Correctly adjusting the skew causes signals that are aligned in time at the probe inputs to be aligned in time on the oscilloscope display, even if the signals are not aligned in time at the oscilloscope inputs. With conventional probes, the skew adjustment only needs to be made once since the time delay of the probes is constant.

A MultiProbe system has many inputs and two outputs. The time delay between a given pod input and control module output is constant. However, the time delay of one pod input is not necessarily the same as the time delay of a different input on the same pod. The maximum variation in time delay across all inputs of a high-density pod is less than 0.5 ns. For example, the input with the least time delay might have 10.3 ns of delay and the input with the most time delay might have 10.7 ns of delay. The variation in time delay across inputs of a pod is a source of time error that can be corrected using the skew adjustment of the oscilloscope.

The typical time delay between a MultiProbe pod input and control module output is 10.5 ns. As with conventional probes, this time delay can vary from one pod to the next. The variation in the typical time delay between different pods, regardless of the types of pods, is ± 0.4 ns. The variation in time delay between different pods is another source of time error that can be corrected using the skew adjustment of the oscilloscope.

Outputs of the MultiProbe Control module are connected to the oscilloscope inputs with 50- Ω coaxial cables. These cables essentially become part of the MultiProbe probing system since they are between the probe inputs and the oscilloscope inputs. Any good quality 50- Ω cables can be used. The variation in time delay between these cables is the last source of error in the MultiProbe system that may need to be corrected using the skew adjustment of the oscilloscope.

Time delay differences between MultiProbe pod inputs, between different pods, and between coaxial cables to the oscilloscope cause different MultiProbe signal paths to have different time delays. Each MultiProbe pod has a non-volatile memory that contains calibration factors and other information. Time delays of the pod are measured at the factory and stored in the pods memory. This means that the only component of the MultiProbe system time delay that is not known is the time delay of the coaxial cables to the oscilloscope.

If cables with matched time delays are used, then the MultiProbe system can provide calibrated skew factors to be used by the oscilloscope. The skew factors correct for the time delay variations as different pods and pod inputs are selected. If the time delays of the cables to the oscilloscope are not matched, then the oscilloscope skew must first be adjusted to correct for the time delay mismatch of the cables. After adjusting the skew to correct for the cables, the skew may then be reset to correct for each signal path as different pods and pod inputs are selected.

When using the MultiProbe system, adjusting and using the oscilloscope skew is a two step process. First, the skew is adjusted to correct for the cables to the oscilloscope. Next, the "adjusted" value of skew is reset as different pods and pod inputs are selected.

When using the MultiProbe system with a 16533/34A oscilloscope, the oscilloscope skew is automatically reset as different pods and pod inputs are selected. If the cables to the oscilloscope are matched, then no skew adjustment or resetting is required by the user. When using the MultiProbe system with an other oscilloscope, the skew of the oscilloscope inputs may, if necessary, be reset as different pods and pod inputs are selected.

The MultiProbe system can also be used along with other, conventional probes. Time delay differences between the conventional probes and the MultiProbe signal paths can also be corrected by adjusting the oscilloscope skew. As before, adjusting and using the oscilloscope skew is a two step process. However, when using conventional probes, the skew adjustment corrects for time delay differences between the conventional probes and the MultiProbe system as well as correcting for time delay differences between the cables to the oscilloscope.

Adjusting and Resetting the Oscilloscope Skew

There are many possible configurations of conventional probes, MultiProbe pods, control modules, and oscilloscopes. Whether or not the oscilloscope skew needs to be adjusted depends on the amount of time delay mismatch between the cables to the oscilloscope, the amount of time delay difference between any conventional probes being used and the MultiProbe system, and the accuracy of timing measurements that is required. For all configurations, there are basically two procedures that can be used to adjust the oscilloscope skew.

The first procedure uses an internal test signal (TstSig) that is generated in the control module. The signal is applied to each of the two control module outputs such that the signals on the outputs are aligned in time. Adjusting the oscilloscope skew to align the displayed waveforms removes the error caused by time delay differences between the cables to the oscilloscope inputs. This procedure is the easiest to perform but can only be used when the signals of interest come from the two outputs of a single control module. This procedure cannot be used to adjust skew when using more than one control module or when using conventional probes along with the MultiProbe system.

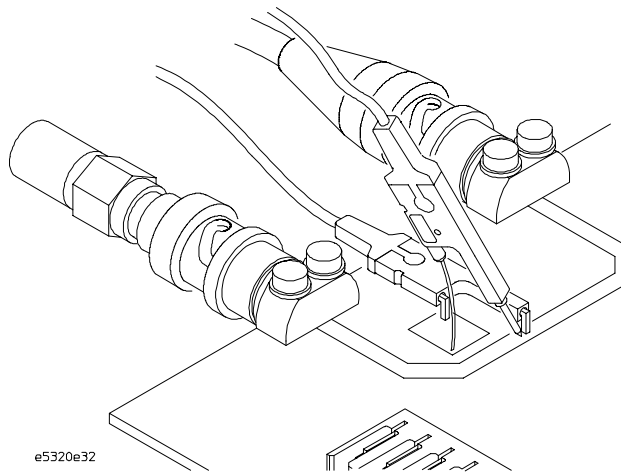
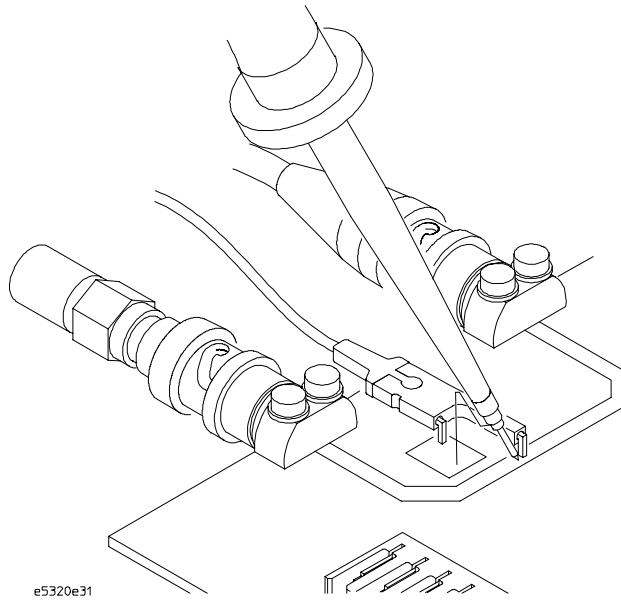
The second procedure for adjusting the oscilloscope skew can be used with any configuration of probes and control modules. With this procedure, an externally generated signal (ExtSig) is applied to two probe inputs and the oscilloscope skew is adjusted until the displayed waveforms from the two probes are aligned in time. Any signal with a fast transition time (~1 ns) can be used assuming the signal can be probed with two probes. As an example, the "Demo Pulse" on the calibration fixture of the General-Purpose pod provides a pulse with 1.5 ns transition times. There is also a 50- Ω trace between two BNC connectors on the calibration fixture that can be used to apply a signal from a fast pulse generator to two probe inputs.

It is not necessary to adjust skew for each pod in a MultiProbe system. The time delays of each pod are measured at the factory and stored in the pod. This means that the time delay differences between any inputs of any pods connected to a control module are known. Appropriate skew factors can be calculated for all pods connected to a control module once the oscilloscope skew has been adjusted using any one of the pods.

<p>Note that the skew values are automatically set to zero every time the MultiProbe pod is disconnected and reconnected to the oscilloscope.</p>

**Examples of
applying a signal**

Use the calibration fixture for the MultiProbe General-Purpose pod along with an external pulse generator to apply a signal to the input of two probes.



When using an HP 16533/34A oscilloscope:

The following table shows various configurations of MultiProbe Control modules, conventional probes and oscilloscope cables. The value of skew in the oscilloscope is automatically reset as different pods and pod inputs are selected.

Table 5-1

Configurations using an HP 16533/34A oscilloscope				
Number of Control modules	Using other conventional probes also	Matched cables to scope	Adjust skew (using)	Time error between scope inputs
1	No	Yes	No	±0.2 ns
1	No	No	TstSig	±0.2 ns
1	Yes	either	ExtSig	±0.2 ns
>1	No	Yes	No	±0.3 ns
>1	No	either	ExtSig	±0.2 ns
>1	Yes	either	ExtSig	±0.2 ns

To adjust the oscilloscope skew using the internal test signal:

- 1** Select **MultiProbe** from the module field, and **Select Signal** from the menu field.
- 2** Verify that the oscilloscope selection is correct for both control module outputs.
- 3** Select **Calibration** from the menu field.
- 4** Select the **Scope Cable Skew** adjustment, and then press **Continue**.
- 5** Turn on the **Test Signal**, and press **Exit**.
- 6** Select the **Oscilloscope** module field.
- 7** Set up the oscilloscope to view the edges from outputs 1 and 2 of the control module.

Set the oscilloscope timebase to ~1 ns/Div. Overlaying the waveforms and using averaging will increase the resolution of the adjustment.
- 8** Adjust the oscilloscope skew by selecting **Calibration** from the menu field, setting the Mode to **Probe Cal**, and adjusting the **Time** field until the rising (or falling) edges are aligned in time.
- 9** After aligning the edges, return to the **Scope Cable Skew** adjustment menu and turn off the internal test signal.

To adjust the oscilloscope skew using an externally generated signal:

- 1** Connect the probe input(s) to a node containing a signal with a fast transition.
- 2** Follow steps 1 through 4 of the previous page.
- 3** Follow steps 6 through 8 of the previous page.

If, for example, one conventional probe and one MultiProbe pod are being used, the pod input with the signal applied can be selected to both Output1 and Output2 of the control module. Now, the oscilloscope input with the conventional probe, and both inputs from the control module can be aligned in time.

When using an other oscilloscope such as the HP 16532A or an oscilloscope that is external to the HP 16500B/C:

The following table shows various configurations of MultiProbe Control modules, conventional probes and oscilloscope cables. If desired, the value of skew in the oscilloscope can be reset as different pods and pod inputs are selected.

Table 5-2

Number of Control modules	Using other probes	Matched cables to scope	Adjust skew (using)	Time error	
				Without Resetting skew	Resetting skew/each pod input
1	No	Yes	No	±0.8 ns	±0.2 ns
1	No	No	TstSig	±0.8 ns	±0.2 ns
1	Yes	either	ExtSig	±0.8 ns	±0.2 ns
>1	No	Yes	No	±0.9 ns	±0.3 ns
>1	No	either	ExtSig	±0.8 ns	±0.2 ns
>1	Yes	either	ExtSig	±0.8 ns	±0.2 ns

Some oscilloscopes only allow skew to be adjusted on inputs other than Channel 1. When using an oscilloscope that does not allow skew to be adjusted on Channel 1, if it is necessary to reset the oscilloscope skew as different pods and pod inputs are selected, then only one control module can be used. The following are the only configurations that can be used when using one of these oscilloscopes if the skew needs to be reset for each pod and pod input.

Scope In1	Scope In2	Scope In3 (optional)	Scope In4 (optional)
MultPrb Out1	MultPrb Out2	Not used	Not used
Other Probe	MultPrb Out2	Not used	Not used
Other Probe	Other Probe	MultPrb Out1	MultPrb Out2

Two control modules can still be used if skew does not need to be reset for each pod input. This makes the maximum time error ±0.8 ns.

To adjust the oscilloscope skew using the internal test signal:

- 1 Select **MultiProbe** from the module field, and **Select Signal** from the menu field.
- 2 Verify that the oscilloscope selection is correct for both control module outputs.
- 3 Select **Calibration** from the menu field.
- 4 Select the **Scope Cable Skew** adjustment, and then press **Continue**.
- 5 Turn on the **Test Signal**.
- 6 Adjust the oscilloscope skew (probe delay) until the edges are aligned in time.

Set the oscilloscope timebase to ~1 ns/Div. Overlaying the waveforms and using averaging will increase the resolution of the adjustment.

- 7 Specify whether the skew on the oscilloscope input connected to output 1 of the control module **IS** or **IS NOT** adjustable.
- 8 Enter the value of skew that aligned the edges for each oscilloscope input.
- 9 Enter the polarity of the skew adjustment on your oscilloscope by specifying which direction the waveform moves when the value of skew is increased.

All of this information will be used by the MultiProbe system in order to re-calculate new values of skew as different pods and pod inputs are selected. Then, if necessary, the new values of skew can be reset in the oscilloscope.

- 10 After aligning the edges, turn off the internal test signal.

To adjust the oscilloscope skew using an externally generated signal:

- 1** Connect the probe input(s) to a node containing a signal with a fast transition.
- 2** Follow steps 1 through 4 of the previous page.
- 3** Follow steps 6 through 9 of the previous page.

If, for example, one conventional probe and one MultiProbe pod are being used, the pod input with the signal applied can be selected to both Output1 and Output2 of the control module. Now, the oscilloscope input with the conventional probe and both inputs from the control module can be aligned in time.

When using cables of unequal time delays, if the oscilloscope skew is not adjusted, then the difference in time delay of the cables adds to the time error between oscilloscope inputs.

When using the MultiProbe system with other conventional probes, if the oscilloscope skew is not adjusted, then the difference in time delay between the MultiProbe system and the hand held probe adds to the time error between the oscilloscope inputs. The typical time delay between a MultiProbe pod input and control module output is 10.5 ns.

6

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If you want to test a different DUT with the high-density pod 6-3

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Advisory messages 6-7

Warning messages 6-8

Solving Problems

Solving Problems

This chapter provides some problem solving information for using the MultiProbe system.

See Also

If the MultiProbe system does not appear to be functioning properly, refer to the troubleshooting section of the following documents:

- *MultiProbe Control Module Service Guide.*
- *MultiProbe High-Density Pod Installation and Service Guide*
- *MultiProbe General-Purpose Pod Installation and Service Guide*

Verifying ground connections

For high-density pods, you can use the calibration fixture that is shipped with your pod to verify the ground connections that you set up during pod installation. Refer to the "Run the grounds and shorts test" section in the *MultiProbe High-Density Pod Installation and Service Guide*.

If you want to test a different DUT with the high-density pod

To test a different DUT with the same high-density pod, you will need to do the following:

- 1 Remove the pod from the device under test (DUT).
- 2 Remove the personality adapter from the pod.
- 3 Proceed with the pod installation process by following the *MultiProbe High-Density Pod Installation and Service Guide* and the Pod Setup menu.
 - Check the clearance and determine the orientation of the pod.
 - During the installation, you will adhere a different retainer to the new DUT.
 - If the new DUT has a different ground pattern, use a new personality adapter and program the grounds on the new adapter.
 - If the new DUT has different signal or pin assignments, reassign the signal names.
 - If you need to order additional parts, refer to the pod *Installation and Service Guide* for the parts list.

Personality Adapters

When the personality adapters are not in use, keep them in their original containers.

To label your programmed personality adapter, you can attach a label onto the box, or you can write on the part of the adapter that fits over the retainer.

Do not attach a label onto the adapter. A label will prevent the adapter from making contact with the pod.

Error Messages

16535A: A/D converter error. Adc Busy line stuck low.

16535A - Adapter file not found: /MULTIPRB/filename The personality adapter file was not found. The file name is appended to the message.

16535A checksum failure. Memory corrupted The pod failed checksum, indicating that memory has been corrupted.

16535A memory data transfer error The serial ROM did not pull the ACK line low after a data transfer.

Adapter is not compatible with pod The adapter does not work with the pod. Verify that the adapter filename is correct.

All pods have not been removed from MultiProbe module. The calibration was halted because the pods were not removed. Remove the pods, then calibrate.

Cal switch on MultiProbe module is set to PROTECTED. The calibration switch must be set to UNPROTECTED in order to perform calibration.

Calibration failed. The calibration on the MultiProbe Control module failed.

Calibration failed. Cal factors set to default. The calibration failed and calibration factors were set to default. The cal factors are set to default if the calibration fails and the pod has not been calibrated previously.

Calibration failed on some pins. The calibration failed on some of the pod pins and the previous cal factors were retained. The cal factors on the pins that passed were changed.

Cannot read <filename>. You have plugged in a new pod. The full path name of the .DUT file last loaded into the pod cannot be read. Verify that the path name and filename are correct. If the path name begins with A:, make sure the flexible disk is in the drive.

Cannot Select Empty Choice. Use Cancel to Exit. You have selected an empty file name in File Browser.

Failure to init File Browser Failure to allocate a File Browser table for this process. This is probably a software problem, perhaps in system memory allocation routines.

File Name must end in .DUT. You have entered a new file name that does not end in .DUT. Re-enter the file name using .DUT at the end.

Gain value out of range. Pin xxx The gain (attenuation) calibration value is out of range.

Insufficient Memory to Read 16535 Config File. Cannot allocate enough memory to read in a temporary copy of the MultiProbe instrument structure. The CONFIG section of file will be skipped.

Invalid Revision Number for 16535 Config File. The revision number in the section header of the loaded Config file is invalid.

Invalid Pin # in Line xxxx. Skipping... Displayed while loading a Pod's Signal Names from a file if the pin number for a Signal Name is too large or too small. If a pod is connected, pin numbers greater than the pod has are skipped.

Memory programming timeout The serial ROM programming took too long.

Memory verification error at location 0xxx The serial ROM verify failed at the indicated byte address.

Offset value out of range. Pin xxx The offset calibration value is out of range.

Output X, Pod X: Input offset value out of range. The input offset calibration value is out of range.

Output X, Pod X: Gain value out of range. The gain calibration value is out of range.

Output X, Pod X: Offset value out of range. The offset calibration value is out of range.

Pod descriptor file not found: /MULTIPRB/filename The descriptor file was not found. The file name is appended to the message. Check that the pod descriptor file is in the /MULTIPRB directory on the hard disk.

Pod not connected. The pod being calibrated is not connected.

Pod X adapter file not found. MULTIPRB/filename adapter file not found in /MULTIPRB directory on the hard disk.

Syntax Error in Line xxxx. Skipping... Displayed when a syntax error is encountered while loading a Pod's Signal Names from a file. The line is skipped and the file continues to be read.

Unable to complete ground check A/D error encountered in a ground check, so the check is invalid.

Unable to Connect to Scope 1 Either a NULL pointer was encountered when trying to connect to a Scope Input, or the call itself failed. Check the software versions and hardware configurations to make sure that everything is compatible.

Unable to Disconnect from Scope 1 Either a NULL pointer was encountered when trying to disconnect from a Scope Input, or the call itself failed. Check the software versions and hardware configurations to make sure that everything is compatible

Unable to read directory. The File Browser can read the disk drive, but cannot open the desired directory. The default directory \MULTIPRB probably does not exist. Create the \MULTIPRB directory.

Unable to Read Drive The File Browser was unable to read the selected disk drive, or else the default directory \MULTIPRB does not exist on the hard disk.

Advisory Messages

Calibration Done This is set when the calibration fails, along with calibration failed message.

Calibration passed! Calibration passed.

Loading description info from pod memory. Displayed during pod calibration. The system is getting data from serial ROM on the pod.

Loading file... Displayed when loading pod signal names from a file.

No grounded pins or shorts found No grounded pins or shorts found during the ground and shorts test.

Performing gain calibration Performing a gain calibration.

Performing MultiProbe Control module calibration Performing a calibration on the MultiProbe Control module.

Performing offset calibration Performing a pod offset calibration.

Performing pod ground and shorts test Performing a ground and shorts test on a pod.

Pod adapter installed. The personality adapter software is installed.

Storing cal factors Storing the calibration factors in the pod memory.

Skew value saved in nonvolatile memory. The skew value is entered and saved in nonvolatile memory on the MultiProbe Control module.

Skew values saved in nonvolatile memory. The skew values are entered and saved in nonvolatile memory on the pod.

Storing to file... This is displayed when storing pod signal names to a file.

Warning Messages

File already exists. Overwrite? When storing pod signal names to a file, the code first checks to see if the specified filename already exists. If so, this message is displayed when the Cancel/Continue choice is presented.

Pod #x is wrong Pod Type. Skipping... The pod type in the configuration file does not match the type for the attached Pod/Adapter pair. The pod information is not loaded.

Signal Name not found. The Find Next operation failed to find a signal name matching the search string.

HP 16535A MultiProbe Control Module Fields 7-3

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Calibration Menu Map 7-11

Fields and Menus

Fields and Menus

This chapter provides you with descriptions of the MultiProbe menu fields and the HP 16533/34A oscilloscope fields that are affected when used with the MultiProbe System.

Also included in this chapter are menu maps for the MultiProbe menus.

HP 16535A MultiProbe Control Module Fields

The following table lists the fields, the menu locations, and the functions for fields in the HP 16535A MultiProbe Control menus.

MultiProbe Control Fields

The field label	In this menu	Performs this function
-3 V to +9 V	Select Signal, Input Range	Advises that the output sensitivity is set to a high setting. High is an input range of -3 V to +9 V for high-density pods, and -3 V to +10 V for the general-purpose pods. An attenuation factor of approximately 25:1 is applied. Select this to toggle to the other setting.
-4 V to +10 V	Select Signal, Input Range	Advises that the output sensitivity is set to a low setting. Low is an input range of -4 V to +10 V for high-density pods, and -6 V to +13 V for the general-purpose pod. An attenuation factor of approximately 50:1 is applied. Select this to toggle to the other setting.
(Pod Description)	Configuration	Select this to change the pod description. The default description of a MultiProbe General-Purpose pod is "9 Lead Probe". The default description of a MultiProbe High-Density pod is specific to the pod you have connected. For example, for a 240-pin pod, the default description is "240-Pin QFP". The description that you put in can be up to 20 ASCII characters and may have embedded spaces.
Assign Signal Names	Configuration	Displays a menu for assigning, loading, and storing signal names. Signal Names can be up to 16 ASCII characters and may not contain embedded spaces.
Cancel	Configuration, Assign Signal Names, File	Cancels the file selection and closes the File Selection menu.
Connect Pod to DUT	Configuration, Pod Setup	Lists the steps for connecting the MultiProbe High-Density pod to the device under test (DUT).
Create New File Name	Configuration, Assign Signal Names, File	Displays a keypad for naming a new file.
Default Names	Configuration, Assign Signal Names	Resets all the signal names of a pod to the default name. An example of a default name is 2C001, where 2 is the pod number, C is the module slot, and 001 is the pin number.

Fields and Menus
HP 16535A MultiProbe Control Module Fields

The field label	In this menu	Performs this function
DC Calibration Signal	Calibration	Allows you to check the accuracy of the DC cal signal.
File: (file name)	Configuration, Assign Signal Names	Displays a File Selection menu used for selecting or creating a file name. The file that you select or create in the File Selection menu is displayed in this field. This filename is used when loading or storing signal name files to disk.
Find Next	Select Signal	Selects the next signal that matches the name or partial name that you specified with Find Signal Name.
Find Signal Name	Select Signal	Displays a keypad for finding signal names. After entering the signal name, use Find Next to go that signal.
Initial Pod Setup	Configuration, Pod Setup	Lists the steps for the initial pod setup.
Is (Is Not)	Configuration, Pod Setup, Set Pod Orientation	Selects whether pin 1 of your device under test is or is not a corner pin. The information orients the pod to the pin numbers of your IC.
Load File	Configuration, Assign Signal Names	Loads a file containing previously assigned signal names. The file and path names are displayed in the File field.
Module Calibration	Calibration	Provides directions for calibrating the MultiProbe Control module.
Scope Cable Skew	Calibration	Provides directions for measuring the skew between oscilloscope inputs.
Other Scope	Select Signal	Selects a scope other than an HP 16533/34A for the selected MultiProbe output. The other scope can be an internal scope in the Logic Analysis frame or an external scope. Select this to change to an HP 16533/34A scope.
Output (slot, output)	Select Signal	Selects which one of two outputs of the MultiProbe Control module that the Select Signal menu currently applies to. The letter is for the slot location of the control module, and the number is for output 1 or output 2. Select this to toggle to the other output.
Pin (number)	Configuration, Pod Setup, Set Pod Orientation	Selects the pin number on your device under test that aligns with the reference bar located on the pod.
Pin (number)	Activity	Selects which signal (pin number) to check the activity on.

The field label	In this menu	Performs this function
Pin (number)	Select Signal	<p>Selects which signal (pin number) to send to the output of the control module. You can also select signals by using the knob to move the green bar, scrolling through the connected pods and pins.</p> <p>Using the touchscreen, select this field once to use the knob for scrolling, and select it twice to use a keypad for entering a number.</p> <p>The pin number is an integer between 1 and the number of pins on the pod.</p>
Pod Calibration	Calibration	Provides directions for calibrating pods.
Pod (number)	Activity	Selects which pod to check for activity.
Pod (number)	Select Signal	<p>Selects which pod you are choosing a signal from to send to the output of the control module.</p> <p>Using the touchscreen, select this field once to use the knob for scrolling, and select it twice for a keypad to enter a number.</p>
Pod Setup	Configuration	Displays a menu for setting up a MultiProbe High-Density pod. Use this menu along with the installation guide to set up your pod.
Program Ground Connections	Configuration, Pod Setup	Provides the procedure for programming the grounds on a personality adapter. Refer to the installation guide on MultiProbe High-Density pods for more detail on the procedure.
Refresh	Configuration, Assign Signal Names, File	Rereads the current working directory on the selected disk and refreshes the File Selection menu.
Rename Signal	Configuration, Assign Signal Names	Displays a keypad for assigning signal names to the pins.
Run Grounds and Shorts Test	Configuration, Pod Setup	Provides directions for checking grounds and shorts on a personality adapter. Refer to the installation guide on MultiProbe High-Density pods for more detail on the procedure.
Scope (slot, channel)	Select Signal	Selects the HP 16533/34A scope for the selected MultiProbe output. If an HP 16533/34A scope is not installed in the frame, this choice will not appear. The letter is for the slot location of the scope module, and the number is for channel 1 or 2. Select this to change to Other Scope or to change to a different HP 16533/34A scope.
Select	Configuration, Assign Signal Names, File	If a filename is highlighted, that file is selected for a load or store operation. If a directory name is highlighted, it becomes the new current working directory.

Fields and Menus
HP 16535A MultiProbe Control Module Fields

The field label	In this menu	Performs this function
Specify Pod Orientation	Configuration, Pod Setup	Displays a menu to align the reference bar located on the high-density pod to a pin on your device under test. Refer to the installation guide on MultiProbe High-Density pods for more detail on the procedure.
Specify Pod Adapter	Configuration, Pod Setup	Provides directions for loading a file for a personality adapter. Refer to the installation guide on MultiProbe High-Density pods for more detail on the procedure.
Store to File	Configuration, Assign Signal Names	Stores the assigned signal names for the chosen pod to a file. The path and filename are displayed in the field next to File.
Threshold	Activity	Allows you to change the threshold of the activity indicators.

HP 16533/34A Oscilloscope Fields

The following fields in the HP 16533/34A oscilloscope menus are affected by using the MultiProbe system with the HP 16533/34A. The described functions for each field are available only when the HP 16533/34A has been selected in the Select Signal menu for the MultiProbe Control module.

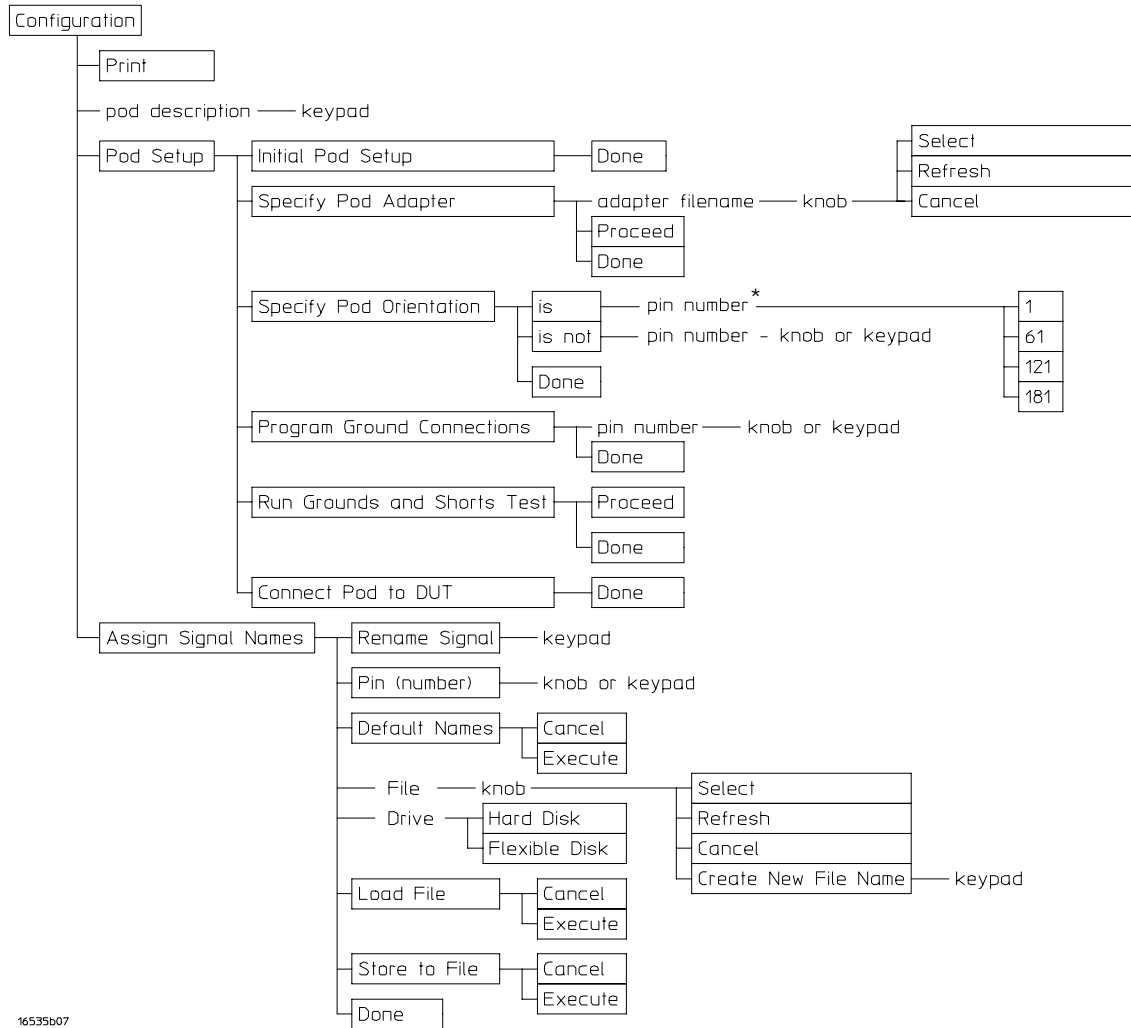
HP 16533/16534 Oscilloscope Fields

The field label	In this menu	Performs this function
Coupling	HP 16533/34A Scope, Channel	When a MultiProbe signal is selected, coupling is fixed at 50 Ω by the MultiProbe Control module and cannot be changed. This field is not available when a MultiProbe signal is selected.
Preset	HP 16533/34A Scope, Channel	Sets the vertical settings to user-defined, TTL, or ECL when a MultiProbe signal is not selected. This field is not available when a MultiProbe signal is selected.
Probe Attenuation	HP 16533/34A Scope, Channel	When a MultiProbe signal is selected, this is set to the probe attenuation of the MultiProbe Control module and cannot be changed. Nominal values are 50:1 or 25:1, depending on the Input Range for that MultiProbe output. This field is not available when a MultiProbe signal is selected.
Scroll Signal	HP 16533/34A Scope, Channel	Enables you to use the knob to scroll through the list of signal names from the MultiProbe Control module.
Select Signal	HP 16533/34A Scope, Channel	Displays the MultiProbe Select Signal menu. In the Select Signal menu, you can select the pod, pin, and signal name for the input from the MultiProbe Control module.

See Also The oscilloscope documentation for more information about the oscilloscope fields.

Configuration Menu Map

The following menu map illustrates all fields and the available options in the Configuration menu.

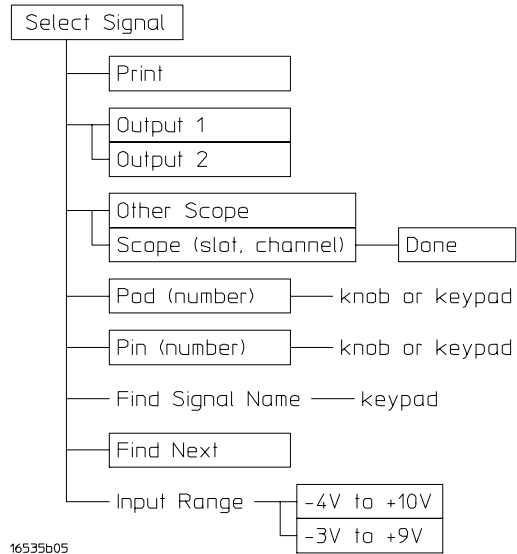


16535b07

*The four choices available when pin 1 is a corner pin will vary, depending on your personality adapter.

Select Signal Menu Map

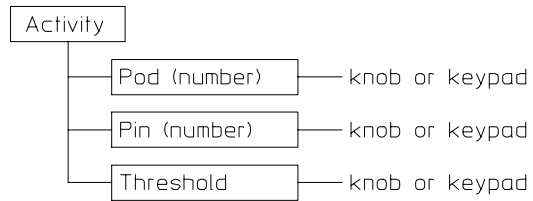
The following menu map illustrates all fields and the available options in the Select Signal menu.



16535b05

Activity Menu Map

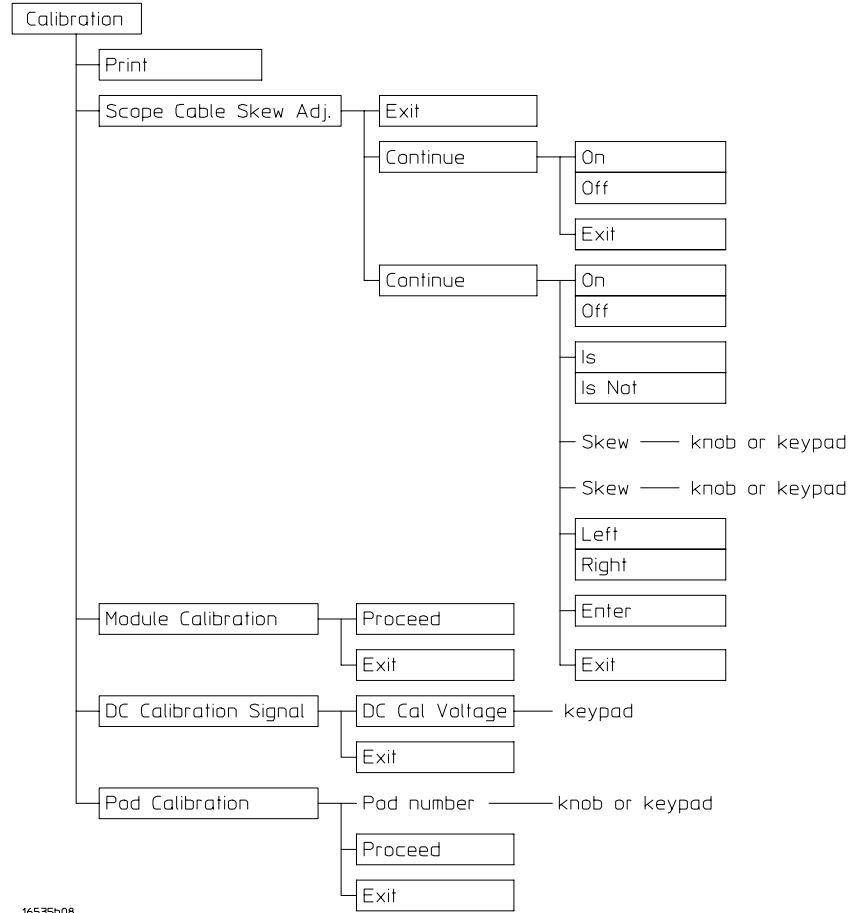
The following menu map illustrates all fields and the available options in the Activity menu.



16535b06

Calibration Menu Map

The following menu map illustrates all fields and the available options in the Calibration menu.



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POD Commands 8-8

Programming Commands

Programming Commands

This chapter introduces you to the basic command structure used to program the HP 16535A MultiProbe Control module.

For information about programming the Logic Analysis System, refer to the *HP 16500B/16501A Programmer's Guide* or the *HP 16500C/16501A Programmer's Guide*.

You need to select the HP 16535A MultiProbe Control module

Before you can program the MultiProbe Control module, you must first "select" it. This directs your commands to the module.

To select the MultiProbe Control module, use the system command :SElect followed by the numeric reference for the slot location of the module (1 through 10 refers to slot A through J respectively). For example, if the HP 16535A MultiProbe Control module is in slot E, then the following command would select this module:

```
:SElect 5
```

For more information about the select command, refer to the *HP 16500B/16501A Programmer's Guide* or the *HP 16500C/16501A Programmer's Guide*.

Command Set Organization

The following table shows the command tree for the HP 16535A MultiProbe Control module. The (x) following the SElect command at the top of the table represents the slot number in which the control module is installed. The slot number may range from 1 through 10, representing slots A through J, respectively.

HP 16535A Command Set

SElect (x)

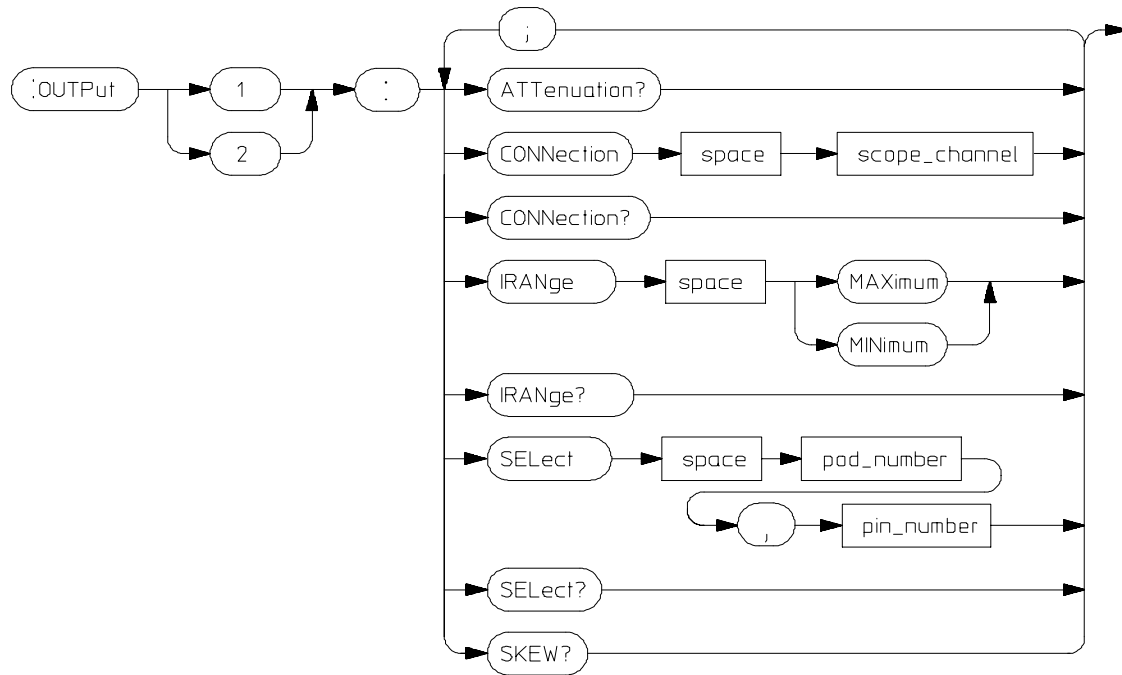
:OUTPut{1 2}:	:POD{1 2 3 4}:
ATTenuation	DESCription
CONNection	DNAMes
IRANge	LOAD
SElect	NAME
SKEW	ORientation
	PINS
	STORe

OUTPut Commands

The OUTPut commands and queries are for programming the HP 16535A MultiProbe Control module outputs. The choices are control module output 1 or output 2. For HP 16533/34A scopes, the output number must match the scope input number.

Command :OUTPut {1 | 2}

OUTPut Syntax Diagram



16535b02

ATTenuation

Query `:OUTPut {1 | 2}:ATTenuation?`

The ATTenuation query returns the current probe attenuation.

Returned Format `[:OUTPut {1 | 2}:ATTenuation] <attenuation_value>`

`<attenuation_value>` real number representing probe attenuation value of the currently selected signal for this output.

CONNection

Command `:OUTPut {1 | 2}:CONNection <scope_channel>`

The CONNection command specifies the scope channel that the HP 16535A MultiProbe Control module output is connected to. The input number of the scope channel must be the same as the output number of the MultiProbe Control module.

`<scope_channel>` {A1 | A2 | B1 | B2 | . . . | J1 | J2 | OTHER} the slot letter and channel number of the scope module connected to the HP 16535A MultiProbe Control module output.

Query `:OUTPut {1 | 2}:CONNection?`

Returned Format `[:OUTPut {1 | 2}:CONNection] <scope_channel>`

Example

To connect output 1 of the MultiProbe module in slot B:
`OUTPUT XXX; ":SELECT 2;:OUTPUT1:CONNECTION A1"`

To connect output 1 to an external oscilloscope:
`OUTPUT XXX; ":OUTP1:CONN OTH"`

IRANge	
Command	:OUTPut {1 2} :IRANge {MAXimum MINimum}
Query	<p>The IRANge command sets the input range for the HP 16535A MultiProbe Control module output to either MAXimum or MINimum. MAXimum corresponds to an input range of -4 V to +10 V, and MINimum corresponds to an input range of -3 V to +9 V.</p> <p>:OUTPut {1 2} :IRANge?</p>
Returned Format	<p>The IRANge query returns the input range for the HP 16535A MultiProbe Control module output.</p> <p>[:OUTPut {1 2} :IRANge] {MAXimum MINimum}</p>

SElect	
Command	:OUTPut {1 2} :SElect <pod_number>, <pin_number>
Query	<p>The SElect command sets the pod and pin number for the signal switched to the HP 16535A MultiProbe Control module output.</p> <p><pod_number> {1 2 3 4} number of the selected pod</p> <p><pin_number> number of the selected pin</p> <p>:OUTPut {1 2} :SElect?</p>
Returned Format	<p>The SElect query returns the <pod_number> and <pin_number> for the selected signal that is currently switched to the HP 16535A MultiProbe Control module output.</p> <p>[:OUTPut {1 2} :SElect] <pod_number>, <pin_number></p>

SKEW

Query :OUTPut {1 | 2} :SKEW?

The SKEW query returns the time delay of the current pod and pod input for the specified output.

Returned Format [:OUTPut {1 | 2} :SKEW] <skew_value>

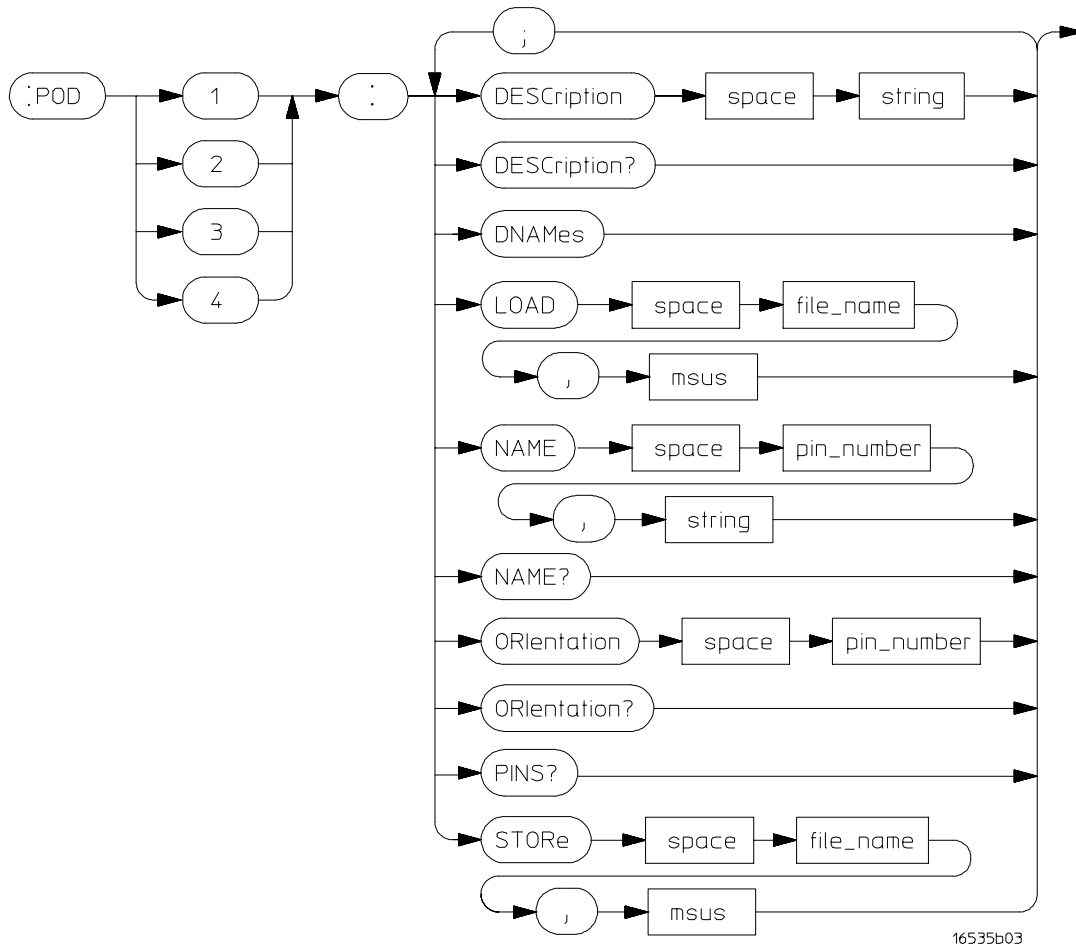
<skew_value> real number indicating time delay of the selected pod and pod input

POD Commands

The POD commands and queries are for programming the pods connected to the HP 16535A MultiProbe Control module. The choices for the pod number are 1 through 4.

Command :POD{1 | 2 | 3 | 4}

POD Syntax Diagram



DESCription

Command	:POD{1 2 3 4}:DESCription <string>
	The DESCription command sets the pod description in quotes for the specified pod.
<string>	string of up to twenty alphanumeric characters in quotes
Query	:POD{1 2 3 4}:DESCription?
	The DESCription query returns the description for the pod.
Returned Format	[:POD{1 2 3 4}:DESCription] <string>

DNAMes

Command	:POD{1 2 3 4}:DNAMes
	The DNAMes command sets the signal names for the specified pod to their default names. The default name is determined by the probe type.

LOAD

Command	:POD{1 2 3 4}:LOAD <file_name>, <msus>
	The LOAD command loads the pod signal names from disk.
<file_name>	For LIF, a string of up to 10 alphanumeric characters. For DOS, a string of up to 64 alphanumeric characters, which may include the directory.
<msus>	{ INTernal0 INTernal1 } the mass storage unit specifier, where INTernal0 is for the hard disk drive and INTernal1 is for the floppy drive. The drive must be specified.
	In the path name, you may use either "/" or "\" for the disk drive. If a full path name is not specified, the current directory is set by using the System MEMEM:CD command. It will not get the current directory from the File Selection menu in the front-panel user interface.

	NAME
Command	<code>:POD{1 2 3 4}:NAME <pin_number>, <string></code>
	The NAME command sets the signal name for the specified pod and pin number.
	<code><pin_number></code> number of the pin
	<code><string></code> string of up to sixteen alphanumeric characters in quotes, with no embedded spaces
Query	<code>:POD{1 2 3 4}:NAME? <pin_number></code>
	The NAME query returns the signal name for the specified pod and pin number.
Returned format	<code>[:POD{1 2 3 4}:NAME <pin_number>] <string></code>

ORientation

Command	<code>:POD{1 2 3 4}:ORientation <pin_number></code>
	The ORientation command sets the pod orientation with respect to the target IC. It specifies the pin number of the device under test that aligns with the reference bar on the pod. This command is for high-density MultiProbe pods and should not be used for general-purpose MultiProbe pods.
	<code><pin_number></code> number of the pin
Query	<code>:POD{1 2 3 4}:ORientation?</code>
	The ORientation query returns the pin number of the device under test that aligns with the reference bar on the pod.
Returned Format	<code>[:POD{1 2 3 4}:ORientation] <pin_number></code>

PINS

Query :POD{1|2|3|4}:PINS?

The PINS query returns the number of pins on the pod. If no pod is connected or the pod is not recognized, it returns 0.

Returned format [:POD{1|2|3|4}:PINS] <number_of_pins>

<number_of_pins> number of pins on the pod

STORE

Command :POD{1|2|3|4}:STORE <file_name>, <msus>

The STORE command stores the pod signal names to disk.

<file_name> For LIF, a string of up to 10 alphanumeric characters. For DOS, a string of up to 64 alphanumeric characters, which may include the directory.

<msus> {INTernal0|INTernal1} the mass storage unit specifier, where INTernal0 is for the hard disk drive and INTernal1 is for the flexible disk drive. The drive must be specified.

In the path name, you may use either "/" or "\" for the drive. If a full path name is not specified, the current directory is set by using the System MMEM:CD command. It will not get the current directory from the File Selection menu in the front-panel user interface.

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Product Information

Product Information

This chapter gives you product information about the MultiProbe System.

Oscilloscopes to use with the MultiProbe system

Oscilloscope easiest to use with the MultiProbe system

The HP 16533/34A oscilloscope installed in the HP 16500B/C Logic Analysis System is the easiest oscilloscope to use with the MultiProbe system. Using this oscilloscope, you can select signals to acquire from the oscilloscope menu, not just from the MultiProbe menu. Also, the calibration correction factors for the MultiProbe system are automatically applied in the oscilloscope.

Most examples in this User's Guide are using the HP 16534A oscilloscope.

Other oscilloscopes

In the HP 16500B/C Logic Analysis System, you can also use the HP 16530/32A oscilloscopes.

You can use the MultiProbe system with any external oscilloscope, such as the HP 54100, HP 54500, HP 54600, and HP 54700 series oscilloscopes.

When using these scopes with the MultiProbe system, you give up MultiProbe features that work with the HP 16533/34A. The following list shows how MultiProbe works with other oscilloscopes.

- Signal input selection will be done in the MultiProbe Select Signal menu only, not in the oscilloscope menu.
- Signal names will not appear in the label fields on the oscilloscope display.
- Signal names will not be stored with waveforms.
- Input coupling must be set to 50 Ω dc using the oscilloscope controls.
- Oscilloscope probe attenuation must be set nominally to 25:1 or 50:1, depending on the input range selected. The default attenuation of the MultiProbe system is 25:1.
- For best accuracy, oscilloscope probe attenuation and skew factors must be set to calibrated values displayed in the MultiProbe Select Signal menu.

Calibrating and adjusting

An operational accuracy calibration can be performed on the MultiProbe Control module itself. Refer to the *Installation and Service Guide* for the MultiProbe pods for information on performing an operational accuracy calibration on the entire MultiProbe system, which includes both the MultiProbe pod and the MultiProbe Control module.

HP 16535A MultiProbe Control module calibration intervals

Operational accuracy calibration has been performed at Hewlett-Packard on your MultiProbe Control module and pods. For best measurement accuracy, you can perform the control module calibration and adjustment when the oscilloscope configuration is changed.

The MultiProbe Control module and pods require periodic operational accuracy calibration and skew adjustment under any of the following conditions:

- At six month intervals or every 1,000 hours
- If the ambient temperature changes more than ± 5 °C
- To optimize measurement accuracy

For information on calibration procedures, refer to the optional *HP 16535A MultiProbe 2-Output Control Module Service Guide*. You can order the service guide from your HP Sales Office.

To clean the module

With the instrument turned off and unplugged, use mild soap and water to clean the front of the module. Harsh soap might damage the water-based paint.

Supplemental characteristics

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.

Testing performance

There are no specifications for the HP 16535A MultiProbe 2-Output Control module alone (without MultiProbe pods). Specifications listed in the *MultiProbe System Technical Specifications* documentation, however, apply for the whole MultiProbe system from the pod inputs to the MultiProbe Control module outputs. Consequently, manual performance testing (full calibration) is done while a MultiProbe pod is connected to the HP 16535A. All inputs are CAT I.

See Also

See the *Installation and Service Guide* for the MultiProbe pod of interest for information on specifications and manual performance testing.

Accessories supplied

The following accessories are supplied with the HP 16535A MultiProbe Control module.

Accessories Supplied	Qty
Calibration Cable	1
SMA/BNC Cable	2
User's Guide	1

Accessories for the MultiProbe pods are listed in the *Installation and Service Guides* for the pods.

Accessories available

Other accessories available for the HP 16500B/C Logic Analysis System are listed in the *Accessories for HP Logic Analyzers* brochure.

Related documentation

The following list shows other documentation about using the MultiProbe system. For ordering, contact your HP sales office.

- **MultiProbe 2-Output Control Module Service Guide**
This Service Guide helps you perform any servicing, troubleshooting, and parts replacement for the HP 16535 MultiProbe Control module.
- **Installation and Service Guides (for the pods)**
These guides provide step-by-step installation, calibration, performance verification, and troubleshooting for the MultiProbe pods.
- **MultiProbe Configuration Guide**
Pods and personality adapters are available for a variety of surface-mount quad flat pack IC packages. Refer to this Configuration Guide for the latest information on pods and adapters available.
- **MultiProbe System Technical Specifications**
This document provides specifications and characteristics of the MultiProbe pods when used with different oscilloscopes. It also provides the dimensions of the different pods. It is included when you order your MultiProbe system.
- **HP 16500B/16501A User's Reference and HP 16500C/16501A User's Reference**
These manuals detail basic operations of the HP 16500B/C Logic Analysis System and the HP 16501A Expander Frame.
- **HP 16533/34A Oscilloscope User's Reference**
This manual provides information for using the HP 16533/34A Oscilloscope.

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About this edition

This is the *HP 16535A MultiProbe Control User's Guide*.

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New editions are complete revisions of the manual. Many product updates do not require manual changes and manual corrections may be done without accompanying product changes. Therefore, do not expect a one-to-one correspondence between product updates and manual updates.

DECLARATION OF CONFORMITY

according to ISO/IEC Guide 22 and EN 45014

Manufacturer's Name: Hewlett-Packard Company

Manufacturer's Address: Colorado Springs Division
1900 Garden of the Gods Road
Colorado Springs, CO 80907 USA

declares, that the product

Product Name: Multiprobe Oscilloscope Multiplexer Module

Model Number(s): HP 16535A / E5321A

Product Option(s): All

conforms to the following Product Specifications:

Safety: IEC 1010-1:1990+A1 / EN 61010-1:1993
UL 3111
CSA-C22.2 No. 1010.1:1993

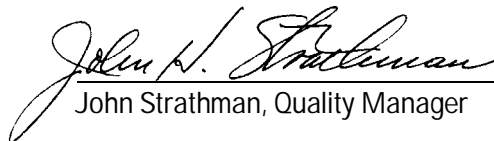
EMC: CISPR 11:1990 / EN 55011:1991 Group 1 Class A
IEC 555-2:1982 + A1:1985 / EN 60555-2:1987
IEC 555-3:1982 + A1:1990 / EN 60555-3:1987 + A1:1991
IEC 801-2:1991 / EN 50082-1:1992 4 kV CD, 8 kV AD
IEC 801-3:1984 / EN 50082-1:1992 3 V/m, {1kHz 80% AM, 27-1000 MHz}
IEC 801-4:1988 / EN 50082-1:1992 0.5 kV Sig. Lines, 1 kV Power Lines

Supplementary Information:

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.

This product was tested in a typical configuration with Hewlett-Packard test systems.

Colorado Springs, 05/11/95


John Strathman, Quality Manager

European Contact: Your local Hewlett-Packard Sales and Service Office or Hewlett-Packard GmbH, Department ZQ / Standards Europe, Herrenberger Strasse 130, D-71034 Böblingen Germany (FAX: +49-7031-14-3143)

Product Regulations

Safety IEC 1010-1:1990+A1 / EN 61010-1:1993
UL 3111
CSA-C22.2 No.1010.1:1993

EMC This Product meets the requirement of the European Communities (EC)
EMC Directive 89/336/EEC.



Emissions EN55011/CISPR 11 (ISM, Group 1, Class A equipment)

Immunity	EN50082-1	Code ¹	Notes ²
	IEC 555-2	1	
	IEC 555-3	1	
	IEC 801-2 (ESD) 4kV CD, 8kV AD	2	
	IEC 801-3 (Rad.) 3 V/m	1	
	IEC 801-4 (EFT) 0.5 kV, 1kV	1	

¹ Performance Codes:

- 1 PASS - Normal operation, no effect.
- 2 PASS - Temporary degradation, self recoverable.
- 3 PASS - Temporary degradation, operator intervention required.
- 4 FAIL - Not recoverable, component damage.

² Notes: (none)

Sound Pressure Level N/A