User's Guide

Publication number E3459-97010
May 2002

For Safety and Regulatory information,
see the pages behind the index.

Agilent Technologies E5900B Option 300 Emulation for ARM

# Agilent Technologies E5900B Option 300 Emulation Probe—At a Glance

This manual describes how to set up several emulation products: an emulation probe, an emulation module, and an emulation migration.

The emulation probe provides a low-cost way to debug embedded software for ARM7/ARM9 family microprocessors. The emulation probe lets you use the target processor's built-in JTAG debug port features, including: run control, register access, and memory access. A high-level source debugger can use the emulation probe to debug code running on the target system.

The emulation probe can be controlled by a debugger on a host computer or by the Emulation Control Interface on an Agilent 16700-series logic analysis system.
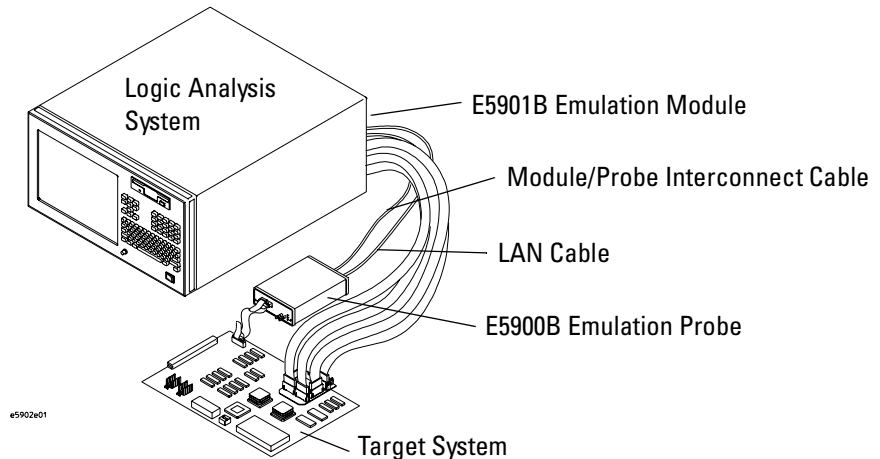
E5900B Emulation Probe

The emulation probe communicates with a host computer or logic analysis system via LAN.

e8130e05
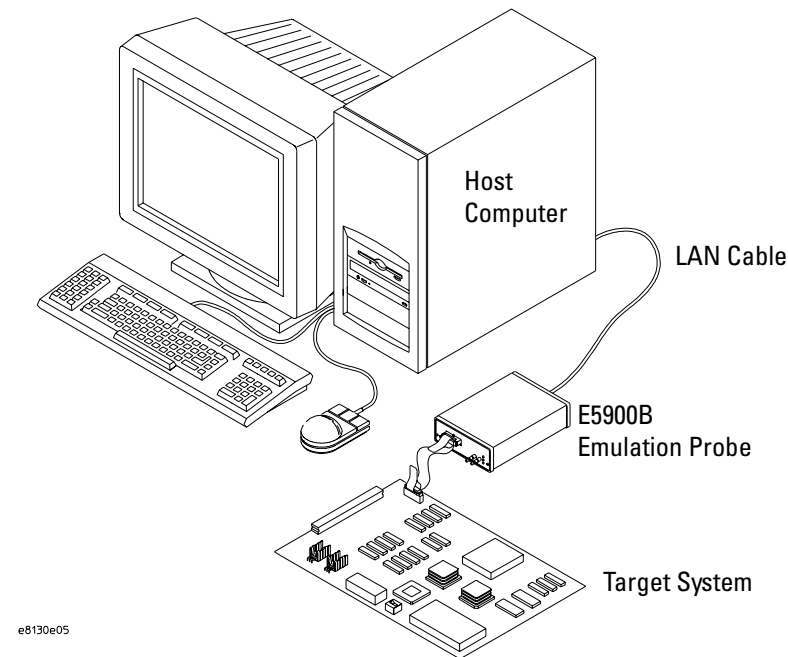
E5901B Emulation Module

The Agilent E5901B emulation module plugs into your Agilent 16700-series logic analysis system frame. It provides power, cross triggering, and limited communication for the E5900B emulation probe through the module/probe interconnect cable. The logic analysis system communicates with the target system through the LAN connection to the E5900B emulation probe.

The E5901B emulation module must be used with an E5900B emulation probe.

This is a major change from the E5901A (16610A) emulation module, which could be connected directly to a target system through a target interface module (TIM).

E5902B Emulation Migration

The emulation migration includes the parts needed to use an emulation probe for a new processor family.

Emulation Solution

If you have an E9xxxB emulation solution, refer to the *Solution User's Guide* for information on how to connect the analysis probe, then return to this book for information on connecting the emulation probe.

In This Book

This book documents the following products:

Emulation Probe	
Product ordered	**Includes**
Agilent E5900B Option #300	Agilent Technologies E5900B emulation probe, cables, software, and manual

Emulation Module	
Product ordered	**Includes**
Agilent E5901B Option #300	Agilent Technologies E5901B emulation module, E5900B Option #300 emulation probe, cables, software, and manual

Emulation Migration	
Product ordered	**Includes**
Agilent E5902B Option #300	Target board adapter, front panel, tool kit, cables, software, and manual

Emulation Solution	
Product ordered	**Includes**
Agilent E9495B Option #001	E5901B emulation module, E5900B #300 emulation probe, cables, software, and manual, plus analysis software as described in the *Solution User's Guide*

Processors Supported

The following processors are supported by the Agilent products listed on the previous page:

Processors Supported
ARM7TDMI
ARM7DI
ARM710T
ARM720T
ARM9TDMI
ARM740T
ARM 920T
ARM 922T
ARM 925T
ARM 940T
ARM 946ES
ARM 966ES

Processors Supported

Contents

1 Overview   15

Contents

Contents

Contents

Contents

8 Configuring for Multiple Processor Systems   97

9 Using the Emulation Probe with a Debugger   105

Contents

Contents

13 **Troubleshooting the Emulation Probe** 135

Contents

1

Overview

This chapter describes:

- Setup flowchart
- Equipment used with the emulation probe
- Connection sequences for the emulation probe
- Equipment used with the emulation module
- Additional information sources

Setup Flowchart

```
┌─────────────────────┐    ┌─────────────────────┐    ┌─────────────────────┐
│  Emulation module   │    │  Emulation migration│    │   Emulation probe   │
│     HP E5901B       │    │     HP E5902B       │    │     HP E5900B       │
└─────────────────────┘    └─────────────────────┘    └─────────────────────┘
          │                          │                          │
          ▼                          ▼                          ▼
┌─────────────────────┐    ┌─────────────────────┐    ┌─────────────────────┐
│  Install emulation  │    │  Install new target │    │   Connect power     │
│      module         │    │  board adapter and  │    │      supply         │
│   (if necessary)    │    │  front panel in     │    └─────────────────────┘
└─────────────────────┘    │  emulation probe    │              │
          │                └─────────────────────┘              ▼
          ▼                          │             ┌─────────────────────┐
┌─────────────────────┐              ▼             │    Connect to LAN   │
│  Connect emulation  │         ◇ Migrating ◇      └─────────────────────┘
│  probe to emulation │  Module │ a module or │ Probe
│      module         │─────────│  a probe?   │──────────
└─────────────────────┘         ◇ ◇ ◇ ◇ ◇ ◇ ◇
          │
          ▼
┌─────────────────────┐
│  Connect emulation  │
│   probe to LAN      │
└─────────────────────┘
```

Install software on logic analysis system

Update emulator firmware (if necessary)

Connect emulator to target system or analysis probe

Installation done. Begin making measurements.

E8130F01.VSD

Agilent E5900B Emulation Probe

Equipment supplied

- Emulation probe.
- 12V power supply for the emulation probe.
- Power cord.
- Ferrite (reduces electromagnetic interference on power cord).
- Serial cable and RJ12-to-DB9 adapter (for setting the emulation probe's IP address from a PC).
- 14-pin cable.
- 20-pin low density cable.
- 20-pin high density cable.
- ARM TI/VLSI/20-pin high density cable adapter board.
- ARM 14-pin cable adapter board.

- This *User's Guide*.

Minimum equipment required

The following equipment is required to use the emulation probe:

- A method for connecting the emulation probe to the target system. The target system must have an appropriate JTAG debug port connector. The target system must meet the criteria on page 56.
- A host computer, such as a PC or workstation. You can also connect the emulation probe to an Agilent 16700-series logic analysis system.
- A LAN (local area network) to connect the emulation probe to the host computer or logic analysis system.
- A user interface on the host computer, such as a high-level source debugger or the logic analysis system's Emulation Control Interface.

Emulation Probe

Power Supply

RJ12 to DB9
Adapter

Ferrite

Serial Cable

User's
Guides

Power Cord

e5902e11

14-pin
20-pin low
20-pin high

Cable Adapter Boards
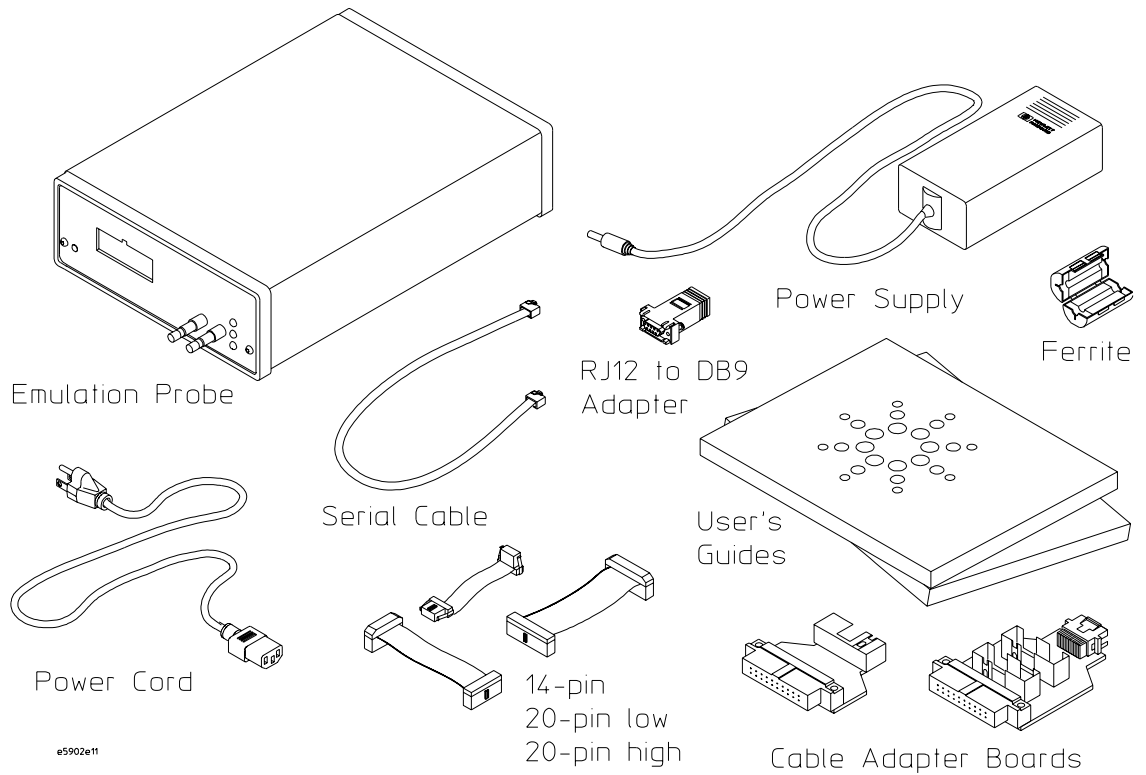
To connect the emulation probe to a power source

The emulation probe is shipped from the factory with a power supply and cord appropriate for your country. If the cord you received is not appropriate for your electrical power outlet type, contact your Agilent Technologies sales and service office.

WARNING: ⚠ Use only the supplied Agilent F1044B power supply and cord. Failure to use the proper power supply could result in electric shock.

CAUTION: Use only the supplied Agilent power supply and cord. Failure to use the proper power supply could result in equipment damage.

1 Install the ferrite on the 12V power cord, near the end which plugs into the emulation probe.

2 Connect the power cord to the power supply and to a socket outlet.

e3493e06
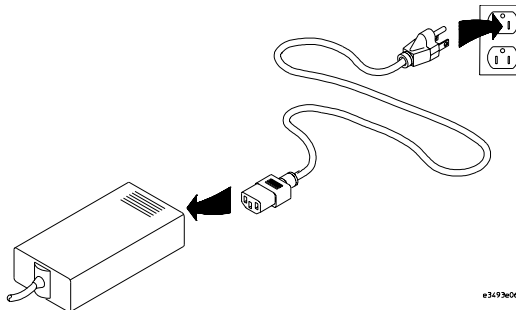
3 Connect the 12V power cord to the back of the emulation probe.

Ferrite

e6130ele
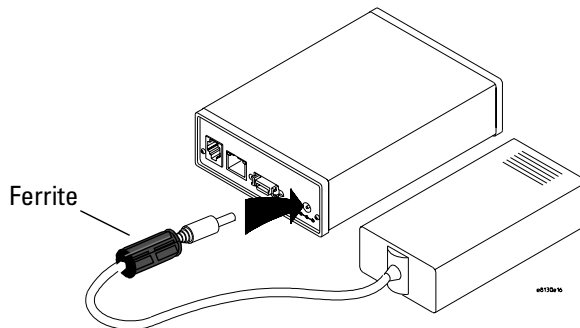
4 Turn on the emulation probe power switch.

Connection Sequence

Disconnect power from the target system, emulation probe, and logic analyzer before you make or break connections.

1 Connect the emulation probe to a LAN (page 27).

2 Connect the emulation probe to your target system (page 65).

3 Configure the emulation probe (page 71).

To power on the system

With all components connected, power on your system as follows:

1 Logic analyzer, if you are using one.

2 Emulation probe.

3 Your target system.

To power off the system

Power off your system as follows:

1 Your target system.

2 Emulation probe.

3 Logic analyzer, if you are using one.

Agilent E5901B Emulation Module

Equipment supplied

The equipment supplied with your emulation module includes:

- All of the parts listed for the Agilent E5900B emulation probe on page 18 (except the serial cable and RJ12 to DB9 adapter).
- Agilent E5901B emulation module. If you ordered an emulation module as part of your Agilent 16700-series logic analysis system, it is already installed in the frame.
- Module/probe interconnect cable (connected to the emulation module).
- Software for the Emulation Control Interface and firmware for the emulation probe on a single CD-ROM.
- Torx T-10 and T-15 screwdrivers.

Minimum equipment required

The following equipment is required to use the emulation module:

- A method for connecting the emulation probe to the target system. The target system must have an appropriate JTAG debug port connector. The target system must meet the criteria on page 56.
- An Agilent 16700-series logic analysis system.
- A user interface, such as a high-level source debugger or the logic analysis system's Emulation Control Interface.

Emulation Probe

Emulation Module

Ferrite

14-pin
20-pin low
20-pin high

Power Cord

Software

Power Supply

Interconnect
Cable

User's Guides

Cable Adapter Boards

Screwdrivers

e5902e13.cdr
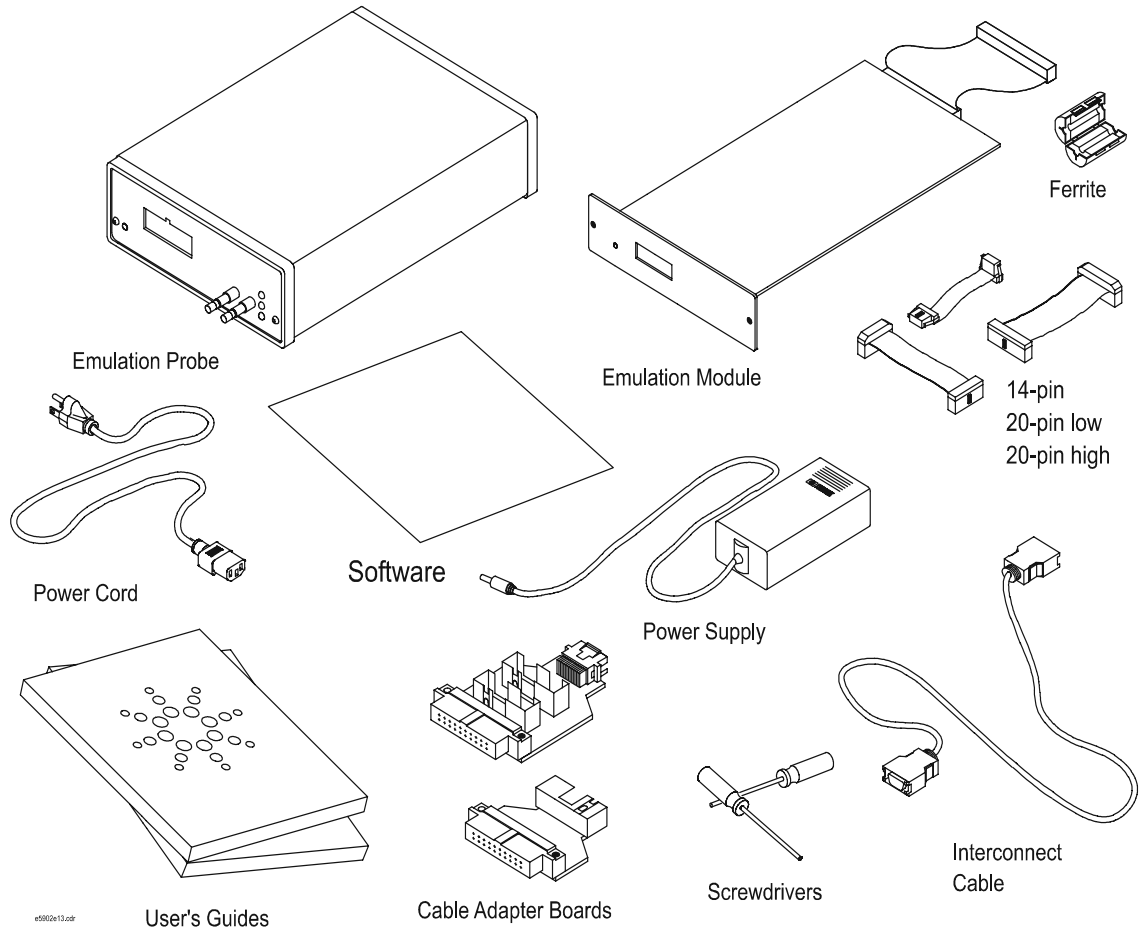
Agilent E5902B Emulation Migration

Equipment supplied

The equipment supplied with your emulation migration includes:

- A emulation probe personality board (target board adapter) for the E5900B emulation probe.
- Firmware for the emulation probe and updated software for the Emulation Control Interface on a CD-ROM (use if you have a 16700-series logic analysis system).
- Firmware for the emulation probe on floppy disks (use if you do not have a logic analysis system).
- 14-pin cable.
- 20-pin low density cable.
- 20-pin high density cable.
- ARM TI/VLSI/20-pin high density cable adapter board.
- ARM 14-pin cable adapter board.
- Front panel for the emulation probe.
- Tool kit including a 1/4 inch wrench, a #1 Phillips screw driver, and a Torx T-10 screwdriver.
- This *User's Guide Update*.
- An *Emulation User's Guide* for your processor.

Minimum equipment required

The following equipment is required to use the emulation migration:

- An Agilent E5900B emulation probe.
- A method for connecting the emulation probe to the target system. The target system must have an appropriate JTAG debug port connector. The target system must meet the criteria on page 56.
- A host computer such as a PC, a workstation, or an Agilent 16700-series logic analysis system.
- A user interface, such as a high-level source debugger or the logic analysis system's Emulation Control Interface.
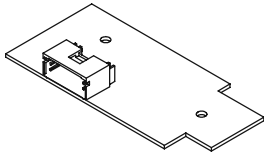
Emulation Probe
Personality Board
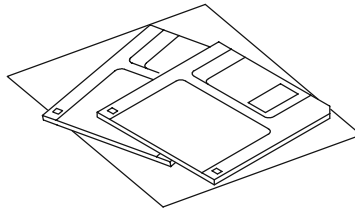
Software &
Firmware
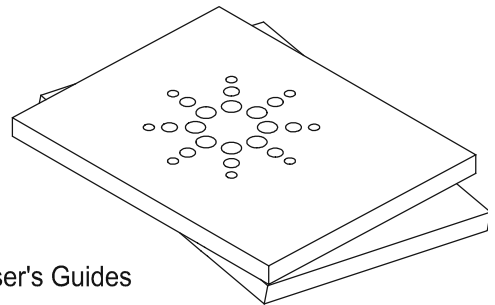
User's Guides
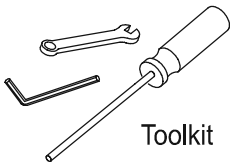
Toolkit
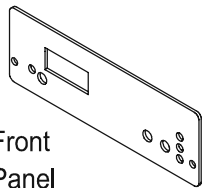
Front
Panel
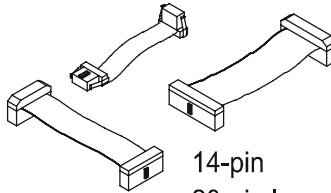
14-pin
20-pin low
20-pin high
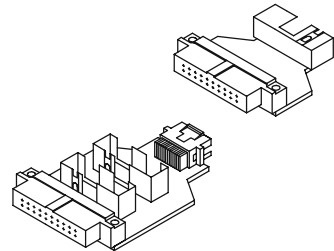
Cable Adapter Boards

e5902e12

E9495B Emulation Solution

If you ordered an emulation solution, the manual supplied with your inverse assembler will provide additional information.

Additional Information Sources

Additional or updated information can be found in the following places:

Newer editions of this manual may be available. Contact your local Agilent Technologies representative.

If you have an analysis probe, the instructions for connecting the probe to your target microprocessor are in the analysis probe documentation. The *Solutions User's Guide* for your microprocessor provides information on using the analysis probe and emulation module together.

Application notes may be available from your local Agilent representative or on the World Wide Web at:

http://www.agilent.com/find/logicanalyzer

If you have an Agilent 16700-series logic analysis system, the **online help** for the Emulation Control Interface has additional information on using the emulation probe.

The **measurement examples** include valuable tips for making emulation and analysis measurements. You can find the measurement examples under the system help in your Agilent 16700-series logic analysis system.

2

Connecting the Emulation Probe
to a LAN

> You need to set up a LAN connection for the E5900B emulation probe, even if you are using an E5901B emulation module.

The emulation probe has an IEEE 802.3 Type 10/100Base-TX LAN connector.

The emulation probe is compatible with both 10 Mbps (10BASE-T) and 100 Mbps (100BASE-TX) twisted-pair ethernet LANs. The probe automatically negotiates the data rate for the LAN it is connected to.

Before the Emulation Control Interface can connect to the emulation probe, the probe's LAN parameters (that is, its IP address, gateway address, and subnet mask) must be set up.   The IP address and other network parameters are stored in nonvolatile memory within the emulation probe.

See Also
For information on connecting a debugger to the emulation probe, see Chapter 9, "Using the Emulation Probe with a Debugger," beginning on page 105.

To choose a point-to-point or site LAN connection

You can connect the emulation probe to your site LAN, or you can create an isolated network between a 16700-series logic analysis system and the emulation probe using a point-to-point connection.

A point-to-point connection is especially useful when you have a 16700-series logic analysis system, and:

- You do not have a site LAN, or
- The measurement setup will be on a cart, or
- You do not want to connect the measurement setup to a LAN because of security reasons.

Advantages of a point-to-point connection:

- If you have an E5901B emulation module, all LAN parameters will be set automatically.
- No need for a system administrator to assign IP addresses. (You can use

any IP address for the emulation probe, and it will not conflict with other devices on the LAN.)

- The logic analysis system cannot be accessed across the network (required in some high-security environments).
- Can be used when a site LAN is not available.

Disadvantages of a point-to-point connection:

- Neither logic analysis system nor the emulation probe are connected to a site LAN.
- A special "crossover" LAN cable must be used.

  If you have an emulation module, use the LAN crossover cable supplied with the emulation module (Agilent part number 5061-7341). If you do not have an emulation module, use a Category 3 (for 10BASE-T) or Category 5 (for 100BASE-TX) crossover cable.

- The emulation probe must be near the logic analysis system. The length of the crossover cable supplied with emulation modules is 1.5m (5 feet).
- Remote file systems cannot be mounted for access to source code files, symbol files, or executable files.
- The emulation probe cannot be controlled by a debugger on a host computer.

Connection Method	Go to Page
Site LAN connection	page 30
Point-to-point	page 38

Connecting the Emulation Probe to a Site LAN

1 Connect the LAN cable to the connector on the emulation probe.

Be sure to use the appropriate Category 3 or Category 5 cable for your LAN. Do not use the LAN cable supplied with the emulation probe—it is a crossover cable used for point-to-point connections only.

2 Find out the IP address and other LAN parameters to use for the emulation probe. See "To obtain an IP address" on page 31.

3 Decide how you want to configure the LAN parameters:

If you have this equipment...	Use this procedure
Emulation probe only	"To configure LAN parameters using a serial connection" on page 32, or "To configure LAN parameters using DHCP" on page 35
Emulation probe and a logic analysis system without an E5901B emulation module	"To configure LAN parameters using a logic analysis system without an emulation module" on page 36
Emulation probe and a logic analysis system with an E5901B emulation module	"To configure LAN parameters using a logic analysis system with an emulation module" on page 37

4 Verify that your emulation probe is now active and on the network. See "To verify LAN communications" on page 40.

To obtain an IP address

1 Obtain the following information from your local network administrator or system administrator:

- An IP address for the emulation probe.

    You can also use a "LAN name" for the emulation probe, but you must configure it using the integer dot notation (such as 127.0.0.1).

- The gateway address.

    The gateway address is an IP address and is entered in integer dot notation. The default gateway address is 0.0.0.0, which allows connections only on the local network or subnet. If connections are to be made to workstations on other networks or subnets, this address must be set to the address of the gateway machine.

- The subnet mask.

    A subnet mask blocks out part of an IP address so that the networking software can determine whether the destination host is on a local or remote network. It is usually represented as decimal numbers separated by periods; for example, 255.255.248.0.

2 Find out whether port numbers 6470 and 6471 are already in use on your network and if that use constitutes a conflict.

The host computer interfaces communicate with the emulation probe through two TCP service ports. The default base port number is 6470. The second port has the next higher number (default 6471).

In almost all cases, the default numbers (6470, 6471) can be used without change. If necessary the base port number can be changed if the port numbers conflict with some other product on your network.

To change the port numbers, see page 34. If you have already set the IP address, you can use a telnet connection instead of a serial connection to connect to the emulation probe.

To configure LAN parameters using a serial connection

The E5900B emulation probe has a 9600 baud RS-232 serial interface with an RJ12 connector.

The emulation probe is shipped with a serial cable (with RJ-12 connectors on both ends, with 6-wire straight-through connections) and an adapter (female RJ-12 to female 9-pin D subminiature). The adapter plugs into the 9-pin serial port found on most PCs.

Serial connections on a workstation

If you are using a UNIX® workstation as the host computer, you need to use a serial device file. If a serial device file does not already exist on your host, you need to create one. Once it exists, you need to ensure that it has the appropriate permissions so that you can access it. See the system documentation for your workstation for help with setting up a serial device.

Serial connections on a PC

Serial connections are supported on PCs. You must use hardware handshaking if you will use the serial connection for anything other than setting LAN parameters.

If you are using a PC as the host computer, you do not need to set up any special files.

1 Connect the serial cable from the host computer to the emulation probe.

Use the DB9-to-RJ12 adapter and the serial cable supplied with the emulation probe.

e8130e21
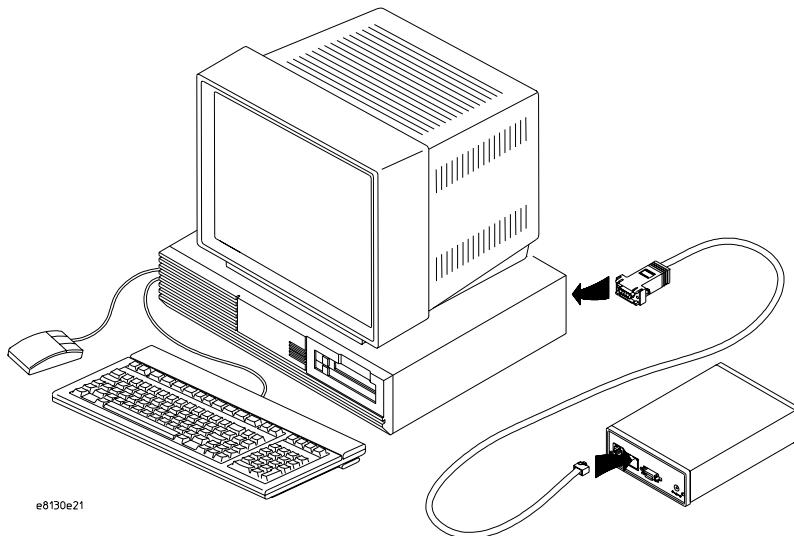
2 Start a terminal emulator program on the host computer.

If you are using a PC, the HyperTerminal application in Microsoft Windows® will work fine.

If you are using a UNIX workstation, you can use a terminal emulator such as cu or kermit.

3 Configure the terminal emulator program for:

- Communication rate: 9600 baud
- Bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

4 Turn on power to the emulation probe.

When the emulation probe powers up, it sends a version message to the serial port, followed by a prompt.

5 Press the Return or Enter key a few times.

You should see a prompt such as "p>" or "R>".

For information about the commands you can use, enter ? or help at the prompt.

6 Display the current LAN configuration values by entering the **lan** command:

```
R> lan
lan is enabled
   Link Status is UP
   100BaseTX
   lan -i 15.5.24.116
   lan -g 15.5.23.1
   lan -s 255.255.248.0
   lan -p 6470
   Ethernet Address : 08000909BAC1
R>
```

The Ethernet address, also known as the link level address, is preassigned at the factory, and is printed on a label on the emulation probe.

7 Enter the following command:

```
lan -i <internet> [-g <gateway>] [-p <port>] [-s
<subnet>]
```

The lan command parameters are:

-i <internet> The IP address which you obtained from your network administrator.

-g <gateway> The gateway address. Setting the gateway address allows access outside your local network or subnet.

-s <subnet> This changes the subnet mask.

-p <port> This changes the base TCP service port number, normally 6470.

Do not change the default port numbers (6470, 6471) unless they conflict with some other product on your network. The numbers must be greater than 1024. If you change the base port, enter the new value in the configuration of your debugger (and, for UNIX workstations, in the /etc/services file).

8 Cycle power on the emulation probe.

The IP address and any other LAN parameters you change are stored in nonvolatile memory and will take effect when the emulation probe is powered

off and back on again.

Example

To assign an IP address of 192.6.94.2 to the emulation probe, enter the following command:

```
R>lan -i 192.6.94.2
```

Cycle power on the emulation probe so that the new address will take effect.

---

9 Verify your emulation probe is now active and on the network. See "Verifying LAN Communications" on page 40.

Once you have set a valid IP address, you can use the telnet utility to connect to the emulation probe, and use the lan command to change LAN parameters.

To configure LAN parameters using DHCP

If there is a DHCP server on your network which responds to BOOTP requests and supports "static allocation" of IP addresses, it can be used to set the trace port analyzer's LAN parameters.

1 Ask your system administrator to set up an IP address for the emulation probe on the DHCP server.

You will need to supply the link-level address of the emulation probe.

The link-level address (LLA) is printed on a label above the LAN connector on the emulation probe. This address is configured in each emulation probe shipped from the factory and cannot be changed.

2 Connect the LAN cable to the connector on the emulation probe.

3 Cycle power on the emulation probe by powering it off then on again.

4 Wait at least 20 seconds for the emulation probe to recognize the LAN.

5 Verify that your emulation probe is now active and on the network. See "To verify LAN communications" on page 40.

What is DHCP?

DHCP (Dynamic Host Configuration Protocol) allows clients to obtain LAN parameters automatically from a server.

How does the emulation probe use DHCP?

The trace port analyzer uses "static allocation" (sometimes called "manual allocation") to obtain a permanent IP address. Every time the trace port analyzer is turned on, it sends out a BOOTP request packet. If the DHCP server on the network responds to BOOTP requests and has been configured to reply to the trace port analyzer's link-level address, it will respond with the IP address and other LAN parameters.

The trace port analyzer does not support "automatic allocation", which permanently allocates IP addresses from a pool of addresses.

Nor does the trace port analyzer support "dynamic allocation" of IP addresses—it does not track lease duration and request a new IP address when the lease is about to expire.

How does DHCP interact with other methods of setting LAN parameters?

Every time the trace port analyzer is turned ON, it sends out a BOOTP request packet (even if the LAN parameters have already been configured). As long as the DHCP server is configured to reply to BOOTP requests from the trace port analyzer's link-level address, it will respond with the IP address and other LAN parameters.

To configure LAN parameters using a logic analysis system without an emulation module

1 Connect the LAN cable to the connector on the emulation probe.

2 In the logic analysis system interface, open the Workspace window.

3 Drag the emulation probe tool from the toolbox to the workspace.

4 From the emulation probe icon, select Init Probe LAN Addresses....

5 Enter the link-level address of the probe you wish to set up.

6 Enter the internet address, gateway IP and subnet mask in the appropriate fields.

7 Select OK.

If "ERROR - no response from emulation probe" is displayed, check that the emulation probe is properly connected to the LAN.   Then try selecting OK again.

If no error message is displayed, the internet address and other network parameters will be stored in nonvolatile memory and will take effect when power is cycled.

8 Cycle power on the emulation probe by powering it off then on again.

To configure LAN parameters using a logic analysis system with an emulation module

1 Connect the emulation module to the emulation probe. (See page 47.)

2 Connect the LAN cable to the connector on the emulation probe.

3 Cycle power on the emulation probe by powering it off then on again.

4 Wait at least 20 seconds for the emulation probe to recognize the LAN.

5 From the E5901B emulation module icon, select Modify Interconnected Probe LAN Addresses....

6 Select Read Probe Addresses to read the current settings.

7 Enter the internet address, gateway IP and subnet mask in the appropriate fields.

8 Select OK.

9 Cycle power on the emulation probe. The new addresses will take effect after you do this.

Setting up a Point-to-Point Connection

A point-to-point connection creates an isolated network with only two nodes—the logic analysis system and the emulation probe.

There are two ways to set up the connection:

If you have this equipment...	Use this procedure
Emulation probe and a logic analysis system *with* an E5901B emulation module	"To set up a point-to-point connection with an emulation module" on page 38
Emulation probe and a logic analysis system *without* an E5901B emulation module	"To set up a point-to-point connection without an emulation module" on page 39

To set up a point-to-point connection with an emulation module

1 Connect the emulation module to the emulation probe (page 47).

2 Connect the crossover LAN cable between the logic analysis system and the emulation probe.

3 In the logic analysis system main window, open the System Administration dialog and check that networking is enabled.

4 Select the emulation module icon then select Start Session....

This will automatically configure the LAN connection and start the Emulation Control Interface. There is no need to set the IP address of the emulation probe.

To set up a point-to-point connection without an emulation module

1 Connect the crossover LAN cable between the logic analysis system and the emulation probe.

2 Turn on power to the emulation probe.

3 In the logic analysis system main window, select the System Administration icon.

4 Select Network Setup....

5 Select Standard to turn on networking.

6 Select Default Network.

Leave the network parameters with the default values. The IP address should be 192.0.2.231.

7 In the Network Setup dialog, select OK.

8 In the main system window, select the Workspace icon.

9 Drag the emulation probe icon onto the workspace.

10 From the emulation probe icon, select Init Probe LAN Addresses....

11 Enter the link-level address of the emulation probe.

The link-level address (LLA) is printed on a label above the LAN connector on the emulation probe.

12 Enter the following IP address: 192.0.2.233

13 Select OK then follow the instructions.

Note about the Setup Assistant: If networking is *dis*abled for the 16700-series logic analysis system, the Setup Assistant will guide you through the process of setting up a point-to-point connection. If networking is *en*abled, the Setup Assistant assumes you want to connect the emulation probe to a site LAN.

Verifying LAN Communications

Verify your emulation probe is now active and on the network by issuing a
ping or **telnet** command to the IP address.

To verify LAN communications using ping

These instructions assume you are using a PC running Microsoft® Windows®
95 or Windows® 98. The procedure for other operating systems is slightly
different.

1 Open an MS-DOS window or select Start➞Run....

2 Enter the **ping** command followed by the IP address of the emulation
probe.

Example

```
C:\WINDOWS>ping 192.35.12.6

Pinging 192.35.12.6 with 32 bytes of data:

Reply from 15.6.253.138: bytes=32 time=1ms TTL=254
Reply from 15.6.253.138: bytes=32 time=1ms TTL=254
Reply from 15.6.253.138: bytes=32 time=1ms TTL=254
Reply from 15.6.253.138: bytes=32 time<10ms TTL=254
```

If You Have Problems   If the response is something like "100% packet loss" or "Destination host
unreachable", see "Problems with the LAN Interface" on page 156.

To verify LAN communications using telnet

1 Verify your emulation probe is now active and on the network by issuing a telnet to the IP address.

This connection will give you access to the emulation probe's built-in terminal interface.

2 To view the LAN parameters, enter the lan command at the terminal interface prompt.

3 To exit from this telnet session, type <CTRL>D at the prompt.

The best way to change the emulation probe's IP address, once it has already been set, is to telnet to the emulation probe and use the terminal interface lan command to make the change. Remember, after making your changes, you must cycle power before the changes take effect. Doing this will break the connection and end the telnet session.

To use telnet on a 16700-series logic analysis system, select the System Administration icon, select the Networking tab, then select telnet….

If You Have Problems   "Problems with the LAN Interface" on page 156.

Example

```
$ telnet 192.35.12.6
R>lan
lan is enabled
lan -i 192.35.12.6
lan -g 0.0.0.0
lan -s 255.255.248.0
lan -p 6470
Ethernet Address : 08000F090B30
```

3

Installing the Emulation Module

This chapter shows you how to install an emulation module in your Agilent Technologies 16700-series logic analysis system and how to connect the emulation module to an emulation probe.

> You need to set up a LAN connection for the E5900B emulation probe, even if you are using an E5901B emulation module.

If your emulation module is already installed in your logic analysis system frame, you may skip this chapter.

CAUTION: Electrostatic discharge can damage electronic components. Use grounded wrist straps and mats when you handle modules.

To install the emulation module in an Agilent 16700-series logic analysis system or expansion frame

You will need T-10 and T-15 Torx screw drivers (supplied with the emulation module)

1 Turn off the logic analysis system and REMOVE THE POWER CORD.

Remove any other cables (including mouse or video monitor cables).

2 Turn the logic analysis system frame upside-down.

3 Remove the bottom cover.
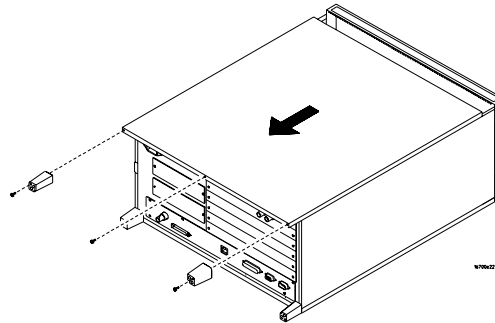
4 Remove the slot cover.

You may use either slot.
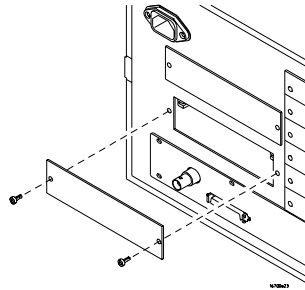
5 Install the emulation module.

e5902e05
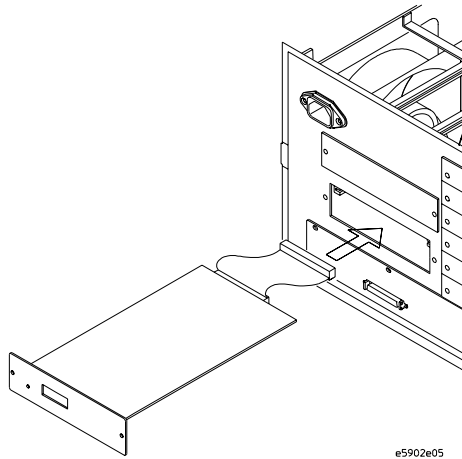
6 Connect the cable and re-install the screws.

You may connect the cable to either of the two connectors.

e5902e06
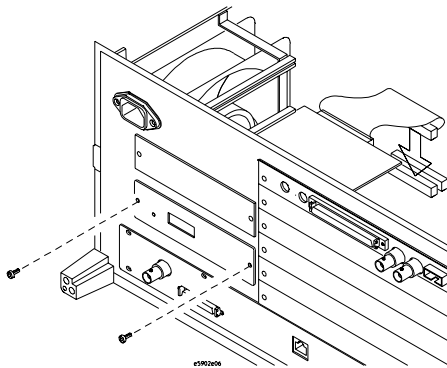
7 Reinstall the bottom cover, then turn the frame right-side-up.

8 Plug in the power cord, reconnect the other cables, and turn on the logic analysis system.

The new emulation module will be shown as an "E5901B Emulation Module" in the system window.

To connect the E5901B emulation module to the E5900B emulation probe

1 Connect one end of the module/probe interconnect cable to the E5901B emulation module in the logic analysis system mainframe.

2 Connect other end of the module/probe interconnect cable to the "Emulation Module" connector on the E5900B emulation probe.

e8130e10
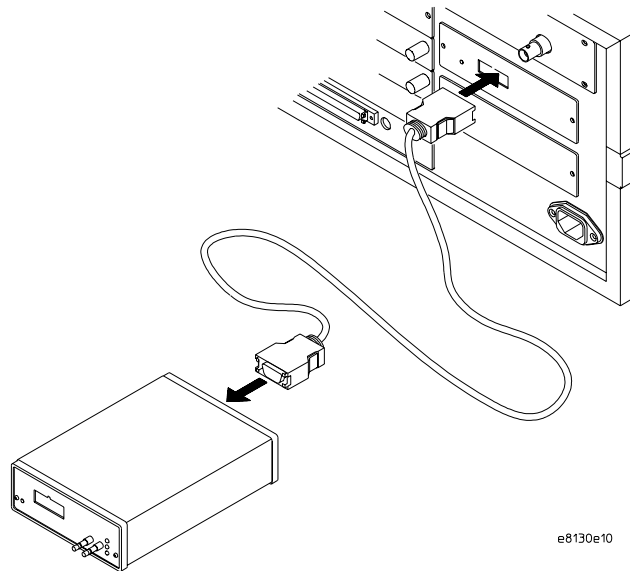
3 Power on the emulation probe.

The LED next to the switch is lit when the switch is turned on and the probe is being supplied with power.

Power is supplied by the 16700-series logic analysis system through the module/probe interconnect cable. The external power supply is not necessary for normal operation.

See Also Chapter 2, "Connecting the Emulation Probe to a LAN," beginning on page 27. (You need to connect the emulation probe to the LAN, even when you are using an emulation module.)

Chapter 6, "Connecting the Emulation Probe to Your Target System," beginning on page 65.

Installing the Emulation Module

4

Installing Software on a 16700-Series
Logic Analysis System

This chapter explains how to install the software you will need for your analysis probe or emulation solution.

Installing and loading

Installing the software will copy the files to the hard disk of your logic analysis system. Later, you will need to **load** some of the files into the appropriate hardware module.
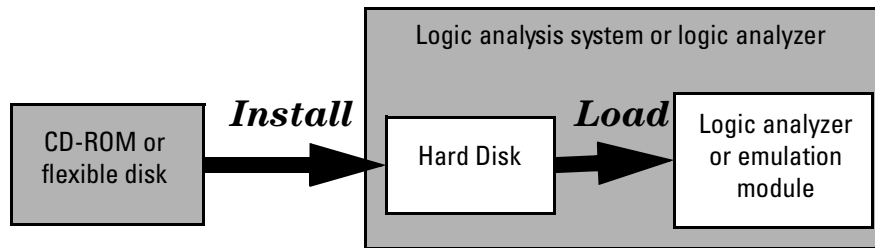
What needs to be installed

HP 16600A/700A-series logic analysis systems

If you ordered an emulation solution with your logic analysis system, the software was installed at the factory.

The following files are installed when you install a processor support package from the CD-ROM:

- Logic analysis system configuration files
- Inverse assembler (automatically loaded with the configuration files)
- Personality files for the Setup Assistant
- Emulation module firmware (for emulation solutions)
- Emulation Control Interface (for emulation solutions)

The HP B4620B Source Correlation Tool Set is installed with the logic analysis system's operating system.

To install the software from CD-ROM (16600A/700A)

Installing a processor support package from a CD-ROM will take just a few minutes. If the processor support package requires an update to the Agilent Technologies 16600A/700A operating system, installation may take approximately 15 minutes.

If the CD-ROM drive is not connected, see the instructions printed on the CD-ROM package.

1 Turn on the CD-ROM drive first and then turn on the logic analysis system.

 If the CD-ROM and analysis system are already turned on, be sure to save any acquired data. The installation process may reboot the logic analysis system.

2 Insert the CD-ROM in the drive.

3 Click the System Administration icon.

4 Click the Software Install tab.

5 Click Install....

 Change the media type to "CD-ROM" if necessary.

6 Click Apply.

7 From the list of types of packages, double-click "PROC-SUPPORT."

 A list of the processor support packages on the CD-ROM will be displayed.

8 Click on the "ARM" package.

 If you are unsure whether this is the correct package, click Details for information about the contents of the package.

9 Click Install.

 The Continue dialog box will appear.

10 Select Continue.

 The Software Install dialog will display "Progress: completed successfully" when the installation is complete.

11 If required, the system will automatically reboot. Otherwise, close the software installation windows.

The configuration files are stored in /logic/configs/hp/arm. The inverse assemblers are stored in /logic/ia.

See Also   The instructions printed on the CD-ROM package for a summary of the installation instructions.

The online help for more information on installing, licensing, and removing software.

To list software packages which are installed (16700)

In the System Administration Tools window, click List... .

5

Designing a Target System for an
Emulation Probe

Designing a Target System

This chapter will help you design a target system that will work with the emulation probe.

The Agilent Technologies emulation probe is connected to a target system through one of the IEEE 1149.1 (JTAG) Port connectors. The included connectors are:

- Agilent/ARM 20-pin low density (0.100 inch pin spacing)
- Agilent/ARM 20-pin high density connector
- ARM EmbeddedICE 14-pin (0.100 inch pin spacing)
- VLSI Jumpstart 14-pin (0.100 inch pin spacing)
- TI XDS510 14-pin (0.100 inch pin spacing)

NOTE: The 14-pin connectors are supported by the emulation probe, but should not be designed into new systems due to their susceptibility to noise and cross-talk. New designs should use the Agilent/ARM 20-pin connector described below.

This section will help you design a target system that will work with the Agilent Technologies emulation probe.

Agilent/ARM 20-pin low density connector and Agilent/ARM 20-pin high density connector pinout

The following diagram shows the pinout for both 20-pin low density and 20-pin high density connectors.
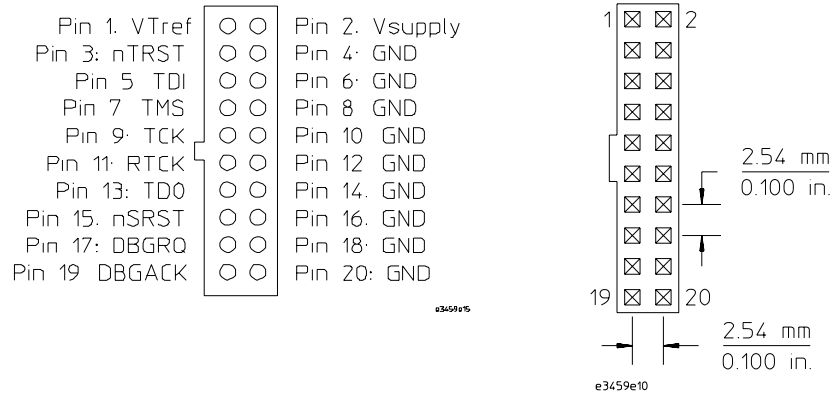
NOTE: The 20-pin low density connector is strongly recommended for new designs.

Signal descriptions (20-pin connectors)

Required Signals

VTref signal. The VTref signal is used to sense when the target system is connected to the emulation probe. This signal is also used as a reference voltage for all signals driven by the emulation probe as well as for a threshold reference for received signals. The emulation probe does not use this pin for power.

TDI signal. The TDI signal is a core JTAG signal and should be connected to TDI on the target.

TDO signal. The TDO signal is a core JTAG signal and should be connected to TDO on the target.

TCK signal. The TCK signal is a core JTAG signal.

TMS signal. The TMS signal is a core JTAG signal.

Strongly recommended signals

nTRST signal. The nTRST signal is the JTAG reset signal. Most target systems implement a reset by holding TMS high for 5 consecutive clock cycles. nTRST can be used as a substitute for that operation.

DBGRQ signal. The DBGRQ signal is used to quickly enter debug mode after receiving a "BREAK IN" signal from the logic analyzer. This allows the logic analyzer triggering capability to be used for complex breakpoints. Without DBGRQ, the processor must be stopped by using the JTAG scan chains, and the processor may not stop until several hundred instructions have been executed. This may cause complications when attempting to correlate the state of the logic analyzer and the emulation probe after the breakpoint has been reached. In general, DBGRQ is much more useful than DBGACK for system debug.

DBGACK signal. The DBGACK signal is used to quickly detect entry or exit from debug mode. If DBGACK is available, then the "TRIGGER OUT" signal from the emulation probe can be used to start or stop the logic analyzer. Without DBGACK, the emulation probe must do polling over the JTAG scan chains to determine when the processor is in debug mode. Without the use of DBGACK, there will be a substantial and variable delay between the processor stopping and

"TRIGGER OUT" being driven. This may cause some difficulty in correlating the trace of the logic analyzer with the exact time that the processor entered debug mode.

Optional signals

VSupply signal. The VSupply signal is used by some JTAG controllers as a power source. The emulation probe does not use this pin for power. This pin should be left unconnected if it is not available. If it is available, then the emulation probe can accept 0 V - 5 V at this pin.

nSRST signal. The nSRST signal is a current limited, open collector signal that is driven and monitored by the emulation probe. nSRST is connected to the ARM signal nRESET. If this signal is not available, then the emulation probe will be unable to reset the target system.

RTCK. RTCK is the Return Test Clock signal from the target JTAG port to the JTAG interface unit. Some targets need to synchronize the JTAG port to internal clocks. To assist in meeting this requirement, RTCK, which is a returned (and re-timed) TCK, can be used to dynamically control the TCK rate. Targets that don't require RTCK should tie it to a fixed signal level.

Electrical requirements for the TDO, TDI, TCK, TMS and nTRST signals

TDO, TDI, TCK, TMS and nTRST signal traces between the JTAG connector and the ARM target must be less than 3 inches long. If these signals are connected to other nodes, the other nodes must be daisy chained between the JTAG connector at one end and the ARM microprocessor at the other end. These signals are sensitive to crosstalk and must not be routed along active signals such as clock lines on the target board.

The TDI, TCK, TMS and nTRST signals must not be actively driven by the target system when the debug port is being used.

Place the connector as close as possible to the processor to ensure signal integrity.

14-pin connectors

If your target system already has a 14-pin connector, you may use the existing connector; however, noise and/or crosstalk may cause problems.

ARM EmbeddedICE 14-pin connector

The following diagram shows the pinout for the ARM EmbeddedICE connector.
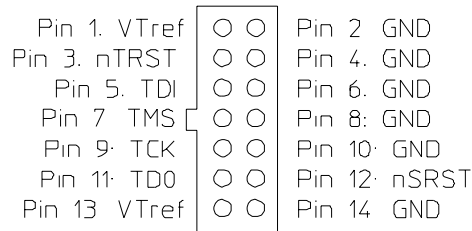
```
Pin  1.  VTref   O  O    Pin  2   GND
Pin  3.  nTRST   O  O    Pin  4.  GND
     Pin  5.  TDI   O  O    Pin  6.  GND
  Pin  7   TMS   O  O    Pin  8:  GND
   Pin  9·  TCK   O  O    Pin 10·  GND
   Pin 11·  TD0   O  O    Pin 12·  nSRST
Pin 13   VTref   O  O    Pin 14   GND

                         e3459e12
```

ARM EmbeddedICE 14-pin Connector

TI 14-pin connector

The following diagram shows the pinout for the TIXDS510 14-pin connector.
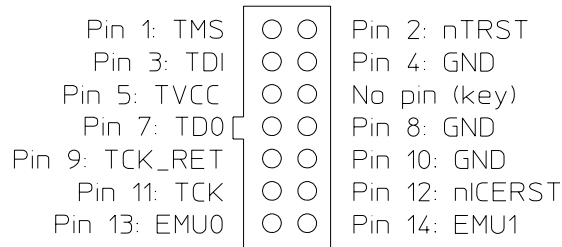
```
   Pin  1:  TMS   O  O    Pin  2:  nTRST
   Pin  3:  TDI   O  O    Pin  4:  GND
  Pin  5:  TVCC   O  O    No pin (key)
   Pin  7:  TD0   O  O    Pin  8:  GND
Pin  9:  TCK_RET   O  O    Pin 10:  GND
   Pin 11:  TCK   O  O    Pin 12:  nICERST
  Pin 13:  EMU0   O  O    Pin 14:  EMU1
                         e3459e13
```

TI XDS510 14-pin Connector

VLSI 14-pin connector

The following diagram shows the pinout for the VLSI Jumpstart 14-pin connector.

```
   Pin  1:  +5V   | O  O |  Pin  2:  GND
   Pin  3:  nTRST | O  O |  Pin  4:  PN0/GND*
   Pin  5:  TDI   | O  O |  Pin  6:  PN1/GND*
   Pin  7:  TMS   | O  O |  Pin  8:  PN2/GND*
   Pin  9:  TCK   | O  O |  Pin 10:  PT/GND*
   Pin 11:  TD0   | O  O |  Pin 12:  nRST
   Pin 13:  3.3V  | O  O |  Pin 14:  GND
```
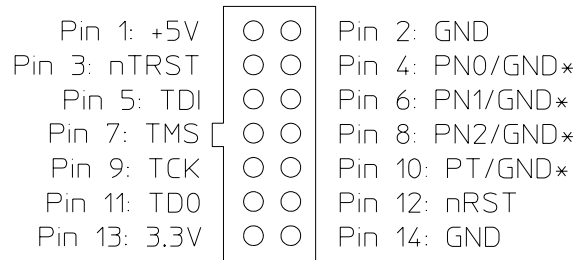
*PN[2:0] and PT are used for the VLSI MDP board
 and are grounded on other VLSI targets.

VLSI Jumpstart 14-pin Connector

Signal descriptions (14-pin connectors)

This section describes signals which differ from the descriptions of the signals for the Agilent/ARM 20-pin connector, which is described on page 58.

ARM 14-pin connector

TDO, TDI, TMS,TCK: Same as Agilent/ARM 20 pin

VTref signal. The VTref signal is used to sense when the target system is connected to the emulation probe. This signal is also used as a reference voltage for all signals driven by the emulation probe as well as for a threshold reference for received signals. The emulation probe does not use this pin for power.

nTRST: Input: The nTRST signal is the JTAG reset signal. Most target systems implement a reset by holding TMS high for 5 consecutive clock cycles. nTRST can be used as a substitute for that operation.

nSRST: Input: target reset.

TI 14-pin connector

TDO, TDI, TMS,TCK: Same as Agilent/ARM 20 pin.

TVCC: Output from target system; 0 to 1 volt ➜ system is not powered. The emulation probe will not drive TDO, TDI, TMS,TCK. 1 to 5 V ➜ the target system is powered. The emulation probe will drive TDO,DTI,TMS,TCK.

EMU0, EMU1: No connection on emulation probe.

nICERST: Input: target reset.

VLSI 14-pin connector

TDO, TDI, TMS,TCK: Same as Agilent/ARM 20 pin.

+5V: Output. No connection on emulation probe.

3.3V: Output. 0 to 1 volt ➜ system is not powered. The emulation probe will not drive TDO, TDI, TMS,TCK. 1 to 5 V ➜ the target system is powered. The

emulation probe will drive TDO,DTI,TMS,TCK.

nRST: Input: target reset.

PN0/GND, PN1/GND, PN2/GND,PT/GND: Target input. On most VLSI targets these pins are grounded. On the VLSI MDP board these pins are inputs to the target which select which processor is being addressed. The emulation probe drives these pins with a high on PT and a low on PN0, PN1, PN2.

Pullup/Pulldown resistor connections

The following table shows recommended pullup and pulldown resistor connections. The table is presented for 20-pin connectors. To apply this information to 14-pin connector configurations refer to the "Signal Name" column and ignore the "20-Pin Header Number" column.

ARM Connections

20-Pin Header Number	Signal Name	Board Resistor
1	VTref	series 1 kΩ or less
2	Vsupply	
3	nTRST	10 kΩ pullup
4	$\overline{\text{GND}}$	
5	TDI	10 kΩ pullup
6	GND	
7	TMS	10 kΩ pullup
8	GND	
9	TCK	10 kΩ pullup
10	GND	
11	$\overline{\text{RTCK}}$	10 kΩ pullup
12	GND	
13	$\overline{\text{TDO}}$	no pullup/down
14	GND	
15	$\overline{\text{nSRST}}$	10 kΩ pullup
16	GND	
17	DBGRQ	10 kΩ pulldown
18	GND	
19	DBGACK	no pullup/down
20	GND	

6

Connecting the Emulation Probe to
Your Target System

This chapter explains how to connect the emulation probe to the target system and how to configure the emulation probe and target.

Here is a summary of the steps for connecting and configuring the emulation probe:

1 Make sure the target system is designed to work properly with the emulation probe. (See page 56.)

2 Install the emulation module in your logic analysis system, if necessary. (See page 43.)

3 Connect the emulation probe to your target system using the ribbon cable. (See page 67.)

4 Update the firmware of the emulation probe, if necessary. (See page 117)

5 Configure the emulation probe. (See page 71.)

6 Connect a debugger to the emulation probe, if applicable. (See page 105.)

See Also Chapter 9, "Using the Emulation Probe with a Debugger," beginning on page 105 for information on configuration with a debugger.

To connect the emulation probe to the target system

The emulation probe may be connected to your target system through one of five types of headers, depending on which connector is installed on the target system. See page 56 for a list of connector types.

The emulation probe should be connected to the target system using one of the ribbon cables provided. You may also need to use one of the adapter boards provided.

1 Turn off power to the target system.

If you plan to connect the emulation probe to a powered target system, configure the emulation probe for hot plugging (see page 90).

2 Turn off power to the emulation probe.

CAUTION: The target system and/or the emulation probe may be damaged if the correct connector board is not used!

3 Select the appropriate ribbon cable and connector board:

Target System Connector	Agilent Cable Part Number	Connector Board
20-pin low density	E3459-61605	none
20-pin high density	E3459-61601	E8130-66513
ARM EmbeddedICE 14-pin	E3459-61602	E8130-66505
VLSI Jumpstart 14-pin	E3459-61602	E8130-66513
TI XDS510 14-pin	E3459-61602	E8130-66513

4 Insert the connector board into the emulation probe.

NOTE: Skip this step if you are using the 20-pin low density cable. It connects directly to the emulation probe without a connector board.

Using the Agilent E8130-66513 Connector Board

Insert the board into the emulation probe, then plug a ribbon cable into one of the three sockets.

TI 14-pin connector

Connect to E5900B emulation probe

e8130e24

VLSI 14-pin connector

Agilent/ARM 20-pin high density connector
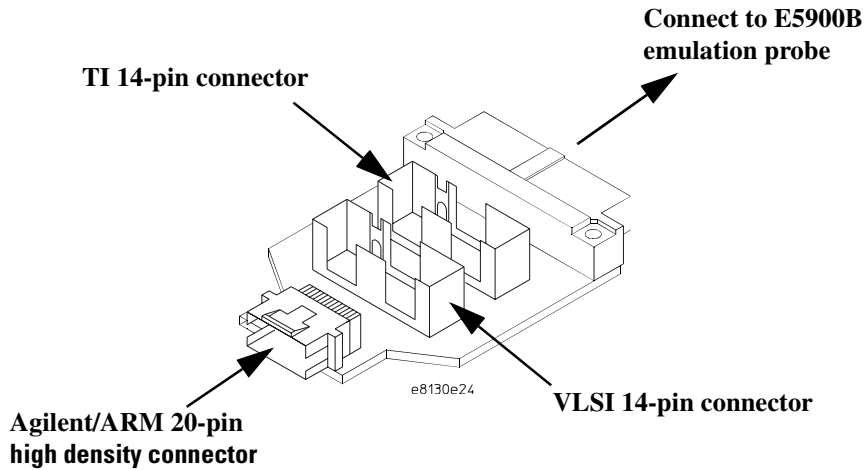
Using the Agilent E8130-66505 Connector Board

Insert the board into the emulation probe, then plug the ribbon cable into the 14-pin socket.

Connect to E5900B emulation probe

e8130e27

ARM EmbeddedICE 14-pin connector
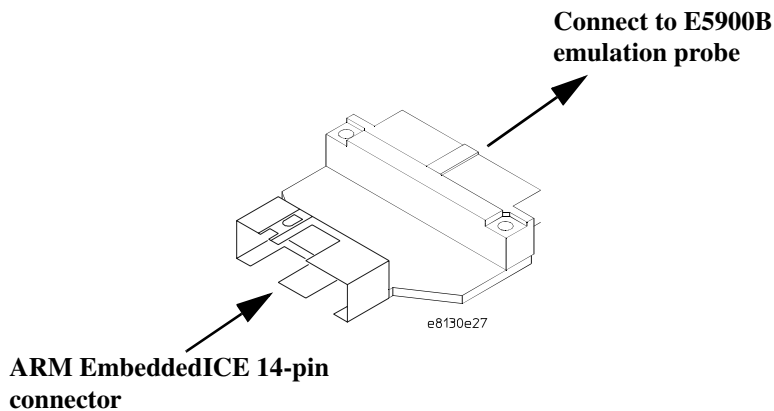
Using the 20-pin low density cable (adapter board not required)

Plug the ribbon cable into the emulation probe.
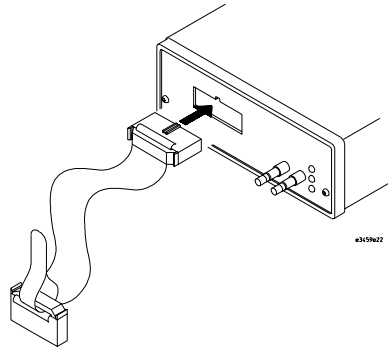
5 Connect one end of the cable to the appropriate socket on the connector board.

NOTE: If you are using a 14-pin socket on the E8130-66513 board, be sure to use the appropriate socket. They are marked "TI" and "VLSI."

CAUTION: The target system and/or the emulation probe may be damaged if not properly connected.

NOTE: Connecting the ribbon cable to the JTAG debug port on the target system or
analysis probe is possible without halting processor execution (see page 90).

6 Plug the other end of the cable into the JTAG debug port on the target
system or on the analysis probe.

Pin 1

e5900e01
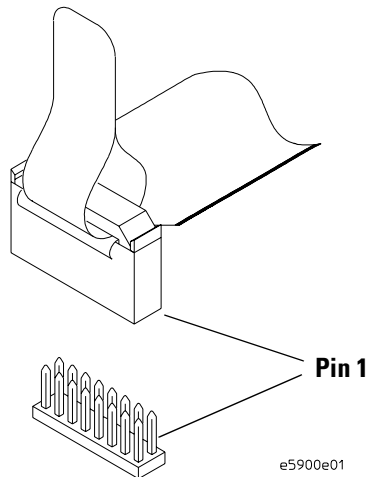
CAUTION: Observe connector orientation and connect pin 1 of the cable to pin 1 of the
target system. If the connector is rotated, your target system or the emulation
probe may be damaged.

7 Turn on power to the emulation probe.

8 Turn on power to the target system.

After you have connected the emulation probe to your target system, you may
need to update the firmware in the emulation probe.

See Also   For information on designing a debug port on your target board, see page 55.

For a list of the parts supplied with the emulation probe, see page 18.

7

Configuring the Emulation Probe

The emulation probe has several user-configurable options. These options may be customized for specific target systems and saved in configuration files for future use.

> The easiest way to configure the emulator is through the Emulation Control Interface in an Agilent Technologies 16600A or 16700A logic analysis system.

If you use the Emulation Control Interface, please refer to the online help in the Configuration window for information on each of the configuration options.

Other ways to configure the emulation probe are by using:

- The emulation probe's built-in terminal interface
- Your debugger, if it provides an "emulator configuration" window which can be used with this Agilent Technologies emulation probe

What can be configured

The following options can be configured using the Emulation Control Interface or using built-in commands:

- Processor type
- Availability of DBGACK and DBGRQ signals
- Restriction to real-time runs
- JTAG clock speed
- Fast JTAG parameter
- Memory model
- Coprocessor register RAM address
- Debug communications channel
- Describing coprocessors
- Reset behavior
- Vector catch register
- Trigger out behavior
- Break in behavior
- Voltage reference
- Voltage threshold

To configure using the Emulation Control Interface

The easiest way to configure the emulation probe is to use the Emulation Control Interface in an Agilent 16700-series logic analysis system.

1 Start an Emulation Control Interface session.

In the system window, click the Emulation Control Interface icon, and then select **Start Session...**.

2 Open a Configuration window.

Select **Configuration...** from the Emulation Control Interface icon or from the Navigate menu in any Emulation Control Interface window.
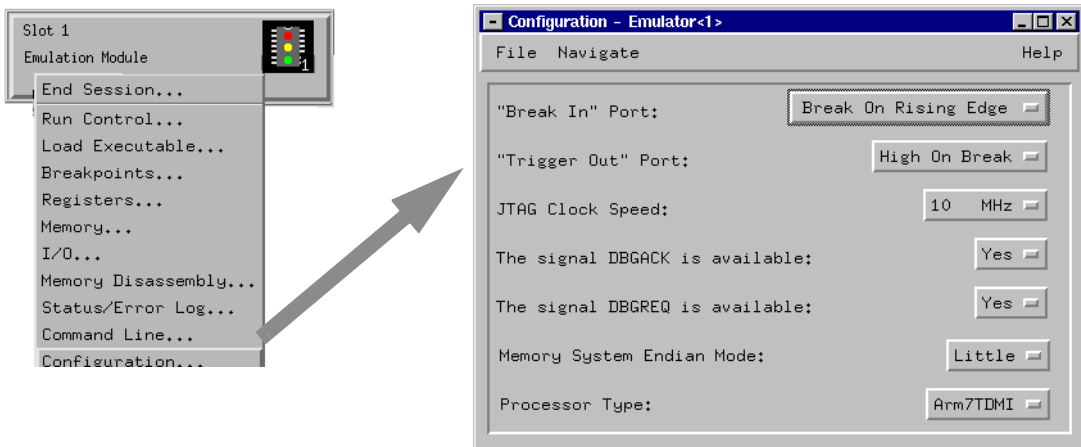
3 Set the configuration options, as needed.

Configuration changes will take effect when you close the configuration window or when you move the mouse pointer outside the window.

4 Save the configuration settings.

To save the configuration settings, open the File Manager window and click **Save...**.

See Also   **Help→Help** on this window in the Configuration window for information on each of the configuration options.

Help in the Emulation Control Interface menu for help on starting an

Emulation Control session.

To configure using the built-in commands

If you are unable to configure the emulation probe with the Emulation Control Interface or a debugger interface, you can configure the emulation probe using the built-in "terminal interface" commands.

1 Connect a telnet session to the emulation probe over the LAN.

For example, on a UNIX system, for an emulation probe in Slot 1 enter:

```
telnet LAN_address 6472
```

2 Enter **cf** to see the current configuration settings.

3 Use the **cf** command to change the configuration settings.

See Also   Enter **help cf** for help on the configuration commands.

For information on connecting the emulation probe to a LAN, see Chapter 2, "Connecting the Emulation Probe to a LAN," beginning on page 27. For information on built-in commands, see page 146.

Example

To see a complete list of configuration items, type **help cf**. This
command displays:

```
cf - display or set emulation configuration

    cf                      - display current settings for all config items
    cf <item>               - display current setting for specified <item>
    cf <item>=<value>       - set new <value> for specified <item>
    cf <item> <item>=<value> <item>   - set and display can be combined

    help cf <item>          - display long help for specified <item>

--- VALID CONFIGURATION <item> NAMES ---
    proc    - Set type of Arm Processor
    reset   - RESET actions
    rrt     - Enable or Disable Restriction to Real-Time Runs
    breakin - Select SMB break input option
    trigout - Select SMB trigger output option
    dbgack  - Toggle availability of DBGACK
    dbgreq  - Toggle availability of DBGREQ
    speed   - Set JTAG Clock Divisor
    endian  - Specify Big or Little Endian
    cparea  - RAM region used by cpreg command
    comms   - Enable debug communications channel polling
M>
```

To see a more detailed description of any configuration item, use the
command "help cf <item>". For example:

```
M>help cf rrt

    Enable or Disable Restriction of Real-Time Runs

    cf rrt=no
    cf rrt=yes

When enabled and while the processor is running the user program, any
command that requires a break to the monitor will be rejected except 'rst',
'b', 'r' or 's'.

When disabled, commands that require a break to the monitor will always be
accepted.
M>
```

To see a list of the current configuration settings, use "cf":

```
M>cf
  cf proc=Arm7TDMI
  cf reset=auto
  cf rrt=no
  cf breakin=rising
  cf trigout=monhigh
  cf dbgack=no
  cf dbgreq=no
  cf speed=3
  cf endian=little
  cf cparea=20
  cf comms=off
  cf vref=external
  cf thresh=1/2
  cf fastjtag=no
  cf hotplug=no
```

To configure using a debugger

Because the Agilent Technologies emulation probe can be used with several third-party debuggers, specific details for sending the configuration commands from the debugger to the emulation probe cannot be given here. However, all debuggers should provide a way of directly entering terminal mode commands to the emulation probe. Ideally, you would create a file that contains the modified configuration entries to be sent to the emulation probe at the beginning of each debugger session.

See Also   Information about specific debuggers in Chapter 9, "Using the Emulation Probe with a Debugger," beginning on page 105.

Your debugger manual.

Configuration Items

The configuration items must be set correctly for each target system.

To set the type of ARM processor

Processor	Built-in command
ARM7TDMI™ (default)	cf proc=Arm7TDMI
ARM7DI	cf proc=Arm7DI
ARM710T	cf proc=Arm710T
ARM720T	cf proc=Arm720T
ARM9TDMI	cf proc=Arm9TDMI
ARM740T	cf proc=Arm740T
ARM 920T	cf proc=Arm920T
ARM 922T	cf proc=Arm922T
ARM 925T	cf proc=Arm925T
ARM 940T	cf proc=Arm940T
ARM 946ES	cf proc=Arm946ES
ARM 966ES	cf proc=Arm966ES

The **cfsave -s** command will store the processor type configuration in the emulation probe's flash memory. The **cfsave -r** command will restore this configuration.

To configure the availability of DBGACK and DBGRQ

The Agilent Technologies emulation probe will make use of the DBGACK and DBGRQ signals if they are available on the debug port connector.

The DBGACK signal allows the emulation probe to quickly detect entry or exit from debug mode. Also, the emulation probe is able to start or stop the logic analyzer through the "TRIGGER OUT" of the emulation probe.

The DBGRQ signal is used to quickly enter debug mode after receiving a "BREAK IN" signal from the logic analyzer. This allows the logic analyzer triggering capability to be used for complex breakpoints.

To make use of these signals, the emulation probe must be configured correctly. The following cf commands allow the specification of whether each signal is connected or not.

Emulator configuration

Value	Emulator configured for	Built-in command
yes	The corresponding signal is connected and will be used by the emulator.	cf dbgack=yes cf dbgreq=yes
no	The corresponding signal is not connected and will not be used by the emulator. (Default)	cf dbgack=no cf dbgreq=no

To configure restriction to real-time runs

Real-time runs configuration

Value	Emulator configured for	Built-in command
no	Allows commands which break to the monitor. Examples include commands which display memory or registers. These commands break to the monitor to access the target processor, then resume the user program. (Default)	cf rrt=no
yes	No commands are allowed which break to the monitor, except "break," "reset," "run," or "step." The processor must be explicitly stopped before these commands can be performed.	cf rrt=yes

If your debugger allows displaying or modifying memory or registers while the processor is running, you must set rrt=no in order to use this feature.

To configure the JTAG clock speed (communication speed)

The emulation probe needs to be configured to communicate at a rate which is compatible with your target processor. The JTAG clock speed is independent of processor clock speed.

Some target systems that have additional loads on the JTAG lines, and some target systems do not quite meet the requirements (described in Chapter 5, "Designing a Target System for an Emulation Probe," beginning on page 55). In these cases, setting the speed to a slower setting may be required to allow the emulation probe to work.

The speed value is a number followed by either K, which indicates the value is in kHz, or M, which indicates the value is in MHz. The clock can be set to speeds in the range 391kHz to 40MHz. Not all values in this range are valid; if an invalid speed is entered, the next slower valid speed will be used. If you issue a break command and get the message "Unable to break," the speed may be set too high. Use the "cf speed=$value$" command to reduce the speed and break execution.

Entering **cf speed** without a value will display the current JTAG clock speed.

JTAG clock speed configuration

Value	Built-in command
391K - 40M	cf speed=$value$

JTAG clock speed - fastjtag parameter

An additional configuration item, "fastjtag", controls when TDO data is latched. When "fastjtag" is configured to "yes," the Agilent emulation probe does not comply with JTAG timing parameters; however, this allows communication with the target at greater clock speeds provided the target does not violate standard JTAG timing parameters. When "fastjtag" is set to "yes," the maximum clock speed is 40MHz.

Value	Meaning	Supported clock speeds	Built-in command
yes	TDO is latched late to allow maximum target clock speed.	391kHz - 40MHz	cf fastjtag=yes
no	Complies with JTAG timing parameters.	391kHz - 10MHz	cf fastjtag=no

When "fastjtag" is set to "no," 10MHz is the highest speed you should enter using the "cf speed" command. Entering a value greater than 10MHz will probably result in communication errors between the emulation probe and the target. Enter a speed of 10MHz or less to restore communication between the emulation probe and the target.

See Also   "Configuring the Emulation Probe for Maximum Performance" on page 94

To configure the endian mode of the target system

Because the ARM processor is capable of being configured as either big-endian or little-endian, the emulation probe must know which configuration the target system is configured for.

Processor endian configuration

Value	Emulator configured for	Built-in command
little	Little endian (Default)	cf endian=little
big	Big endian	cf endian=big

To configure the coprocessor register RAM address

Reading and writing coprocessor registers requires a small area of target system RAM. The contents of this RAM is saved before the RAM is used and the original contents is restored after it is used. The **cparea** configuration item specifies the starting address of an 80 byte block of target system memory that must be readable and writable by the emulation probe. The default address is 20.

For example:

`cfcparea=40`

will start the cparea at address 40.

To configure debug communications channel polling

Debug communication channel configuration

Value	Meaning	Built-in command
off	Disables polling for the debug communications channel.	cf comms=off
on	Enables polling for the debug communications channel.	cf comms=on

To set up the debug communication channel

Use the following commands to setup and use the debug communication channel.

Command	Action
comm -b	Binary data upload (max=64 values).
	Record format: The first 2 bytes indicate the record length in 32-bit words. A termination record (0x00, 0x00) follows.
	Example output for 10 words:
	0x000a (Data for 10 4-byte words)
	0x0000 (Termination record)
comm -c	Displays comms control register status.
	Example Output:
	control=0 Write and read registers are clear.
	control=1 Data written to the comms data read register.
	control=2 Data available in the comms data write register.
	control=3 Data available in both registers.
comm -d	Display comms data buffer (max=64 values) Example output:
	Count=2
	xxxxxxxx
	xxxxxxxx
comm -m *<count>, <value0>, <value1>...*	Modify comms data read register.
comm -m *<count>*	Number of values to be entered (max=64).
comm -r	Clear the write buffer.
comm -v	Enables verbose messages for data in comms data buffer.
comm -v enable	Enables verbose messages for data in comms data buffer. (Same as comm -v.)
comm -v disable	Disables verbose messages for data in comms data buffer.
comm -w	Display the number of words in the comms write buffer

See Also   See ARM's data sheet for more information on the debug communications channel.

To configure the emulation probe to work with a coprocessor

The firmware supports the description and access of coprocessors for the ARM core. Use the following commands to describe coprocessors.

```
cpdesc -d <CP#> <type> <reg> <size> <nbit> <rdbits>
cpdesc -r <CP#> R <reg> <size> <read0> <read1>
cpdesc -r <CP#> W <reg> <size> <write0> <write1>
cpdesc -r <CP#> B <reg> <size> <read0> <read1> <write0>
<write1>
```

cpreg [-r <read0>] <CP#> <reg> - displays coprocessor registration

cpreg -s [-w <write0>] <CP#> <reg> <value1> [<value2>]
                                    - sets the processor register

cpdesc <CP#> - displays the description for the specified CP

Parameter	Description
<CP#>	The coprocessor number
<type>	R, W, or B for read, write, or both
<reg>	A single register number or range (eg: 1 or 3...6)
<size>	The size of register in bytes (hex)
<nbit>	Bit 22 in an LDC or SDC instruction
<rdbits>	Bits 15..12 in an LDC or SDC instruction
<read0>	Bits 7..0 in an MRC instruction
<read1>	Bits 23..16 in an MRC instruction
<write0>	Bits 7..0 in an MCR instruction
<write1>	Bits 23..16 in an MCR instruction

NOTE: cpdesc for a register already specified will overwrite previous data.

Example usage of cpdesc and cpreg

To setup a description to read coprocessor 15 register 0 (ID register) for the ARM720T.

cpdesc -r 15 R 0 4 00 00   #ID register, read only
cpreg 15 0   #Reads CP15 r0

To configure the reset behavior

The reset configuration item controls what happens when a reset occurs.

Reset configuration

Value	Emulator configured for	Built-in command
auto	A RESET will break into monitor and restore watchpoint registers only when watchpoint registers are being used. (Default)	`cf reset=auto`
tomon (break)	A RESET will break into monitor. Watchpoint registers will be restored. The processor will remain in monitor until another command causes it to exit.	`cf reset=tomon`
touser (continue)	A RESET will not break into monitor. Watchpoint registers will not be restored.	`cf reset=touser`
restart	A RESET will break into monitor. Watchpoint registers will be restored and the user program will begin running.	`cf reset=restart`

Note that these actions occur only when the RESET signal is not asserted. Selecting the Reset button in the Emulation Control Interface (or using the built-in **rst** command) asserts RESET continuously until another command causes RESET to be un-asserted.

Agilent Technologies E5900B Emulation for ARM

To configure the vector catch register (ARM920T/922T/ /925T/940T/946T/966ES)

This configuration item sets and displays the vector catch register, which defines which conditions will cause the processor to enter debug mode.

Vector catch register configuration

Bit	Meaning	Built-in command
7	FIQ	`cf vcatch=`*value*
6	IRQ	
5		
4	D_Abort	
3	P_Abort	
2	SWI	
1	Undef	
0	Reset	

Example

To set the vector catch register for SWI and RESET, set it to binary 00000101:

```
cf vcatch=0x5
```

To configure the Monitor Mode (ARM946ES/966ES)

This configuration item controls the monitor mode bit in the debug control register.

Value	Meaning	Built-in command
no	Clears the monitor mode bit in the debug control register (Default).	cf monitor=no
yes	Sets the monitor mode bit in the debug control register.	cf monitor=yes

To configure the Trigger Out SMB (Emulation Probe only)

With an emulation module, this configuration item is always set to the default setting and cannot be changed with a cf command. The Intermodule window of the logic analyzer must be used instead.

Trigger out configuration

Value	The Trigger Out SMB will	Built-in command
fixhigh	Always be high	cf trigout=fixhigh
fixlow	Always be low	cf trigout=fixlow
monhigh	Go high when the processor is running in background (Default)	cf trigout=monhigh
monlow	Go low when the processor is running in background	cf trigout=monlow

To configure the Break In SMB (Emulation Probe only)

When the emulation probe is connected to an emulation module via the module/probe interconnect cable, this configuration item is always set to the default setting and cannot be changed with a cf command. The Intermodule window of the logic analyzer must be used instead. If you need to break on a falling edge, either trigger from the logic analysis system or use the emulation probe without the emulation module.

If you need to break on a falling edge, either trigger from the logic analysis sytem or use the the emulation probe without the emulation module.

Break in configuration

Value	The Break In SMB will	Built-in command
off	Inputs to the Break In SMB will be ignored.	cf breakin=off
rising	The emulator will cause a break on a rising edge. (Default)	cf breakin=rising
falling	The emulator will cause a break on a falling edge.	cf breakin=falling

To configure the voltage reference

The emulation probe uses the V_{ref} signal on the JTAG connector to determine logic high and logic low levels when driving the TDI and TCK signals.

Value	Meaning	Built-in command
external	The voltage reference is generated by the target system.(Default)	cf vref=external
value	The voltage reference of *value* is generated internally by the emulation probe. The value is a number followed by either mV, which indicates the value is in millivolts, or V, which indicates the value is in volts. CAUTION This option should only be used if the core voltage is different than that of the Vref signal on the JTAG connector. Use this option with extreme care, because it is possible to damage the target system if the voltage level is chosen incorrectly.	cf vref=*value*

To configure the voltage threshold

Threshold for voltage reference. Voltages above (vref*thresh) will be considered logic high and voltages below this level will be considered logic low.

Value	Built-in command
1/2 (Default)	cf thresh=1/2
2/3	cf thresh=2/3
1/3	cf thresh=1/3

Agilent Technologies E5900B Emulation for ARM 89

To configure the probe for hot plug

This configuration item allows the emulation probe to be connected to a target system without halting processor execution. Normally the nSRST line is held low, and connecting the JTAG connector to the target system causes the processor to reset. The cf hotplug configuration item holds the nSRST line at Vref when the emulation probe is hot plugged to the JTAG connector.

Value	Meaning	Built-in command
no	The probe works normally (Default).	cf hotplug=no
yes	The probe can be connected to a running target without causing the target to halt. The `cf vref=value` command must be issued to set emulation probe's internal voltage reference to the target's JTAG voltage reference before issuing the `cf hotplug=yes` command.	cf hotplug=yes

To disconnect the emulation probe while the processor is running

CAUTION: Connecting and/or disconnecting the emulation probe while the target processor is running is not recommended. Doing so may halt the target system.

The following procedure will minimize the risk of halting the processor when the emulation probe is disconnected.

1 Ensure that the emulation probe does not use the VTref pin on the JTAG connector for its voltage reference, since the connector will be disconnected. Use the **cf vref=*value*** command to set the emulation probe's internal voltage reference to the target's JTAG voltage reference instead of using the VTref pin.

2 Issue the **rcdis -c** command. This will disable all the run control signals, tristating the output drivers from the emulation probe. Now you may disconnect the probe.

The **rcdis -s** command will re-enable the signals.

Testing the emulation probe and target system

After you have connected and configured the emulation probe, you should perform some simple tests to verify that everything is working.

See Also   Chapter 13, "Troubleshooting the Emulation Probe," beginning on page 135, for information on testing the emulation probe hardware.

To test memory accesses

- Start the Emulation Control Interface and configure the emulation probe, if necessary.

1 Open the Memory window.

2 Write individual locations or fill blocks of memory with patterns of your choosing.

   The access size is the size of memory access that will be used to write or read the memory values.

3 Use the Memory I/O window to stimulate I/O locations by reading and writing individual memory locations.

To test with a running program

To more fully test your target, you can load simple programs and execute them.

1 Compile or assemble a small program and store it in a Motorola S-Record or Intel Hex file.

2 Use the Load Executable window to download the program into RAM or flash memory.

3 Use the Breakpoints window to set breakpoints. Use the Registers window to initialize register values.

The new register or breakpoint values are sent to the processor when you press the Enter key or when you move the cursor out of the selected register field.

4 In the Run Control window, click Run.

5 Use the Memory Mnemonic window to view the program and use the Memory window to view any output which has been written to memory.

Configuring the Emulation Probe for Maximum Performance

The performance of the emulation probe depends on the speed at which it communicates with the target system. Better performance is obtained with faster communication speeds.

Setting TCK speed

On JTAG debug ports the communication speed is controlled by the clock signal TCK. This signal is generated by the emulation probe. You can set the speed of TCK using the Emulation Control Interface in a 16700-series logic analysis system or by using the **cf speed** command through a telnet or debugger connection to the emulation probe.

To change TCK speed, send a **cf speed=x** command to the probe. To restore default, send an **init -c** command. For more information about cf speed, send a **help cf speed** command to the probe. Also note that some debuggers allow the speed to be set from within their GUI or from a command file.

When to decrease TCK speed

Emulation probes are configured at the factory with a default TCK speed. In most cases, this is equal to the maximum allowable speed as specified by the manufacturer (see the table). This speed is suitable for most applications. However, this speed is only valid if 1) the processor is running at it's full rated speed, 2) trace lengths from the processor to the JTAG connector are short (two inches or less), and 3) there are no stubs on the JTAG signals. If the emulation probe cannot communicate reliably with the target system using the factory default speed, TCK speed must be reduced.

When to increase TCK speed

Some target systems will allow TCK speeds greater than the default. The real maximum speed for a given target system can be determined empirically by increasing the speed and observing if the communication to the target is reliable. However, please note that speeds greater than the default are not officially supported by Agilent or the chip manufacturer.

Processor	Manufacturer Spec. Max TCK (MHz)	Emulation Probe Factory Default TCK (MHz)	Emulation Probe Max TCK (MHz)
ARM	-	10	40

8

Configuring for Multiple Processor Systems

The Agilent E5900B Option 300 emulation probe supports trace of multiple processors through a single JTAG scan chain. The emulation probe supports JTAG chain connections (TDO to TDI, not star) for up to 32 processors. The default configuration is for a single processor.

Known and Unknown Processors

In this chapter, "unknown" processor refers to processors in the JTAG scan chain which are not explicitly supported by the firmware (driver).

To configure the emulation probe for multiple processor trace

The jtagch command defines a list of processors for the JTAG scan chain. The firmware (driver) that has been loaded into the emulation probe supports a particular processor or a family of processors (e.g. ARM). The JTAG scan chain may contain processors both known and unknown by the emulation probe firmware.

Command Syntax

All processors must be specified in the JTAG scan chain (jtagch) list. The command syntax is as follows:

```
jtagch <driver link|IR length 1>,
       [driver link|IR length 2],
       [driver link|IR length 3]...
```

NOTE: Values enclosed in <angle brackets> are required, values enclosed in [square brackets] are optional. The "|" symbol indicates "or."

The first processor in the list is identified as processor 1, the next processor is identified as processor 2, etc. A maximum of 32 processors (known and unknown) can be specified in the jtagch command. The default setting is jtagch a.

Processors that are recognized by the emulation firmware are identified by driver link. Unknown processors are identified by IR length. Commas are used to separate processors in the jtagch list. The list of processors must contain at least one known processor.

The driver link for the ARM family of processors is "a".

The IR length is the processor Instruction Register (IR) length in number of bits.

To display the current list of valid processors, issue the command jtagch with no parameters.

To direct a command to a specific processor

The sp command allows you to direct commands and data to and from a specific processor. Initially, if an sp <processor identifier> command has not been issued, commands will be sent to the first known processor in the JTAG scan chain. Once the sp command has been used to address a particular processor, that choice will not change until another sp <processor identifier> command is issued or a system initialization occurs. The syntax for the sp command is:

```
sp <processor identifier>
```

The <processor identifier> must be set for a known processor in the JTAG scan chain list.

The sp command without the <processor identifier> will display the current processor identifier.

Numbering of processors for the <processor identifier> term includes all known and unknown processors.

Examples

Given the JTAG scan chain:

jtagch a, a

To read the registers and memory location 100 in the first processor in the list, issue the command sequence:

```
sp 1
reg
m 100
```

To read the registers and look at the emulation status in the second processor, issue the command sequence:

```
sp 2
reg
es
```

Given the JTAG scan chain:

jtagch 9, a, a

To read the registers and memory location 100 in the second processor, issue the command sequence:

```
sp 2
```

```
reg
m 100
```

To direct a command to all known (non-bypassed) processors

Some commands can be issued to all know processors. These commands are:

es all   Display the emulation status of all known processors
b all   Break into all known processors
r all   Run all known processors

Multiple processor system example — one known processor and one unknown

Consider a system of two processors in a serial JTAG chain configuration with a single LAN connection to the emulation probe. The JTAG chain contains one known processor while the other is an unknown processor (e.g. a DSP) which has a 9-bit instruction register (IR).
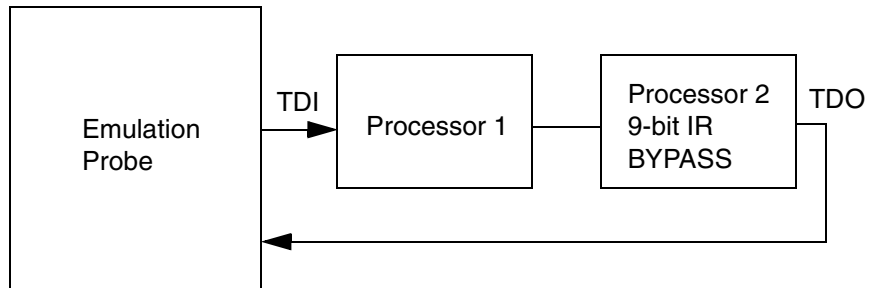
To setup this JTAG connection use the following command:

```
jtagch a,9
```

The above jtagch command says that the first processor is known by a driver and it is linked to driver "a." The next processor (Processor 2) is not known and has an instruction register length of 9 bits.

When the proper JTAG scan chain is set up, the emulation probe can issue commands and access resources for Processor 1 while Processor 2 is always placed in a bypass mode. The emulation probe will issue the proper JTAG scan chains so that the commands and data will be directed only to Processor 1. The connection will look just like a single processor connection.

To enable Processor 1 breakpoint:

```
bc -e swbp
```

To set a breakpoint for Processor 1 at address 0x1000:

```
bp 1000
```

Whenever the processor hits a breakpoint the following message is returned:

```
!ASYNC_STAT 615! Software breakpoint:  00001000
```

Multiple processor system example — two known processors, one unknown

Consider a system of two known processors and one unknown processor. The unknown processor has an IR length of 9 bits.
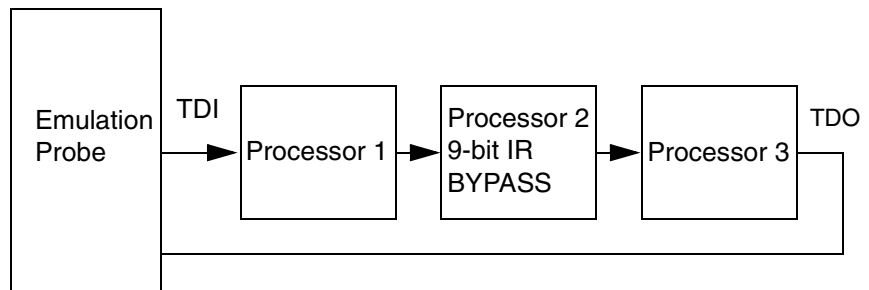
To setup this JTAG scan chain use the following command:

```
jtagch a,9,a
```

To issue commands to and receive data and messages from Processor 1 enter the command:
```
sp 1
```
then issue the desired commands.

To issue commands to and receive data and messages from Processor 3 enter the command:
```
sp 3
```
then issue the desired commands.

To enable Processor 1 breakpoints:

```
sp1
bc -e swbp
```

To set a breakpoint for Processor 1 at address 0x1000:

```
sp1
bp 1000
```

To set a breakpoint for Processor 3 at address 0x2000:

```
sp 3
bc -e swbp
```

```
bp 2000
```

When processor 1 hits a breakpoint the following message is returned:

```
!ASYNC_STAT 615! Software breakpoint:  00001000:
Processor 1
```

When processor 3 hits a breakpoint the following message is returned:

```
!ASYNC_STAT 615! Software breakpoint:  00002000:
Processor 3
```

NOTE:
Other asynchronous messages will display the processor number at the end of the message only when there is more than one known processor in the JTAG scan chain.

9

Using the Emulation Probe with a Debugger

Several prominent companies design and sell state-of-the-art source debuggers which work with the Agilent emulation modules and emulation probes.

Benefits of using a debugger

The debugger will enable you to control the execution of your processor from the familiar environment of your debugger. Using a debugger lets you step through your code at the source-code level.

With a debugger connection, you can set breakpoints, single-step through source code, examine variables, and modify source code variables from the debugger interface. The debugger can also be used to download executable code to your target system.

Using a debugger to connect to the emulation probe allows the entire design team to have a consistent interface from software development to hardware/software integration.

Debugger interfaces must be ordered directly from the debugger vendor.

Compatibility with other logic analysis system tools

You can use your logic analysis system to collect and analyze trace data while you use your debugger. You can use a web browser to display the logic analyzer windows right next to your debugger.

Minimum requirements

To use a debugger with the emulation probe, you will need:

- A debugger which is compatible with the emulation probe
- A LAN connection to the PC or workstation that is running the debugger
- A web browser or X windows or an X terminal emulator, such as Reflection X on a PC. This is required only if you wish to have the logic analysis system user interface displayed on your PC or workstation screen, along with the debugger.

Is your debugger compatible with the emulation probe?

Ask your debugger vendor whether the debugger can be used with an Agilent emulation module or emulation probe.

LAN connection

You will use a LAN connection to allow the debugger to communicate with the emulation probe.

Compatibility with the Emulation Control Interface

Do not use the logic analysis system's Emulation Control Interface and your debugger at the same time.

Connecting to an Emulation Module

If you are using an E5901B emulation module, configure your debugger to use the IP address of the E5900B emulation probe, not the logic analysis system.

You may need to tell the debugger which port number to use. The default port number for a debugger connection is 6470.

Do not use the Emulation Control Interface at the same time as a debugger.

Setting up Debugger Software

The instructions in this manual assume that your PC or workstation is already connected to the LAN, and that you have already installed the debugger software according to the debugger vendor's documentation.

To use your debugger with the emulation probe, follow these general steps:

- Connect the emulation probe to the LAN (see page 30).
- Connect the emulation probe to your target system (see page Chapter 6, "Connecting the Emulation Probe to Your Target System," beginning on page 65).
- If you are using a logic analysis system, export the logic analysis system's display to your PC or workstation (page "To export the logic analysis system's display to a workstation" on page 109).
- Configure the emulation probe (page "Configuring the Emulation Probe" on page 71).
- Begin using your debugger.

If you use the Emulation Control Interface to configure the emulation probe, remember to end the Emulation Control Interface session before you start the debugger.

CAUTION: Do not use the Emulation Control Interface at the same time as a debugger. The Emulation Control Interface and debuggers do not keep track of commands issued by other tools. If you use both at the same time, the tools may display incorrect information about the state of the processor, possibly resulting in lost data.

See Also Refer to the documentation for your debugger for more information on connecting the debugger to the emulation probe.

To export the logic analysis system's display to a web browser

You can export the display of an Agilent 16700-series logic analysis system to your PC or workstation using a web browser. See the online help in your logic analysis system for more information.

To export the logic analysis system's display to a workstation

By exporting the logic analyzer's display, you can see and use the logic analysis system's windows on the screen of your workstation. To do this, you must have telnet software and X window installed on your computer.

1 On the workstation, add the host name of the logic analysis system to the list of systems allowed to make connections:

```
xhost +<IP_address>
```

2 Use telnet to connect to the logic analysis system.

```
telnet <IP_address>
```

3 Log in as "hplogic".

The logic analysis system will open a Session Manager window on your display.

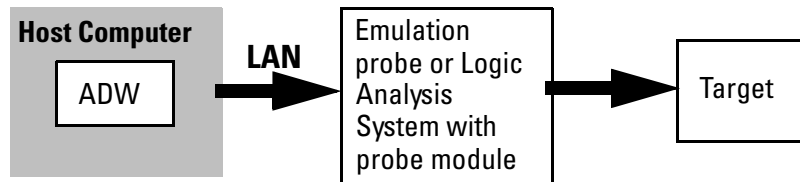**4** In the Session Manager window, click Start Session on This Display.

Example   On a UNIX workstation, you could use the following commands to export the display of a logic analysis system named "mylogic":

```
$ xhost +mylogic
$ telnet mylogic
Trying...
Connected to mylogic.mycompany.com.
Escape character is '^]'.
Local flow control on
Telnet TERMINAL-SPEED option ON

HP Logic Analysis System

Please Log in as: hplogic [displayname:0]

login: hplogic
Connection closed by foreign host.
```

To export the logic analysis system's display to a PC

By exporting the logic analyzer's display, you can see and use the logic analysis system's windows on the screen of your PC. To do this, you must have telnet software and an X terminal emulator installed on your computer. The following instructions use the Reflection X emulator from WRQ, running on Windows 95, as an example.

1 On the PC, start the X terminal emulator software.

To start Reflection X, click the Reflection X Client Startup icon.

2 Start a telnet connection to the logic analysis system.

Log in as "hplogic".

For Reflection X, enter the following values in the Reflection X Client Startup dialog:

a In the Host field, enter the LAN name or IP address of the logic analysis system.

b In the User Name field, enter "hplogic".

c Leave the Password field blank.

d Leave the Command field blank.

e Click Run to start the connection.

The logic analysis system will open a Session Manager window on your display.

3 In the Session Manager window, click Start Session on This Display.

Using the ARM Debugger for Windows

Compatibility

The ARM Debugger for Windows (ADW) and ARM Developer Suite v1.0 or greater are two of the debuggers that connect to the Agilent Technologies emulation probe. ADW is part of the Software Development Toolkit (SDT), available from ARM Ltd. Only versions of the SDT greater than v2.11a support the use of an Agilent Technologies emulation probe.

This section provides information that is specific to using ADW with the emulation probe. It should be used in conjunction with the more detailed SDT user documentation provided by ARM. In the case of any conflict between these two sources, the SDT documentation should be considered definitive.

Overview

```
┌─────────────────┐           ┌─────────────────┐           ┌─────────────┐
│ Host Computer   │   LAN     │ Emulation       │           │             │
│  ┌───────────┐  │  ──────▶  │ probe or Logic  │  ──────▶  │  Target     │
│  │   ADW     │  │           │ Analysis        │           │             │
│  └───────────┘  │           │ System with     │           │             │
│                 │           │ probe module    │           │             │
└─────────────────┘           └─────────────────┘           └─────────────┘
```

Getting Started

1 Connect and set up the emulation probe or logic analysis system as described in the Agilent Technologies documentation.

Ensure that the file 'gateway.dll' is placed in the 'bin' sub-directory of the ADW installation directory. Depending on the intended target system, one or more Gateway Configuration '.gcf' files should also be placed in this same directory. The relationship between target and configuration file is given in the following table:

Target	File
ARM 7TDMI	gate_arm7tdmi.gcf
ARM 710T	gate_arm710t.gcf
ARM 720T	gate_arm720t.gcf
ARM 740T	gate_arm740t.gcf
ARM 920T	gate_arm920t.gcf
ARM 940T	gate_arm940t.gcf
ARM 966ES	gate_arm966es.gcf

The list given in this table is not exhaustive. See the table on page 77 for a complete list of compatible processor types.

2 Configure the ARM Debugger for Windows.

The ARM Debugger for Windows must be configured prior to use with the emulation probe.

a Start ADW and allow it to initialize normally.

If no errors occur, choose **Options->Configure Debugger** from the ADW menu to display the configuration dialog for ADW.

If an initialization error does occur, then choose **Cancel** and enter Armulator mode (SDT versions prior to v2.50) then choose **Options->Configure Debugger** again, or simply click on the **Configure** button when this is presented as an option (SDT v2.50 and higher).

The configuration dialog actually consists of a number of tabbed pages, a particular page being chosen by clicking on the corresponding tab. Select

the **Target** tab of the dialog.

b Select gateway.

If gateway has been used previously, then click on the target environment combo box to display the list of known environments and ensure that gateway is selected.

If a version of gateway has not been installed previously, it must be added to the list of target environments supported by ADW. Do so by clicking on the **Add** button on the dialog and then opening the gateway.dll file. This automatically makes gateway the selected environment.

c Configure gateway.

Click on the **Configure** button to display the configuration parameters specific to gateway. These include the currently used network location of the emulation probe, the target processor type, and a list of channel viewers. Selecting a channel viewer involves checking the Enabled checkbox and highlighting the particular viewer in the list. There are also Add and Remove buttons to enable the list to be manipulated. Please see the relevant ARM documentation for details of channel viewers and their usage.

Click on the **Set** button to alter the network location and target type parameters. A further dialog is then displayed where the new address can be entered and a target selected from those supported by the emulation probe. Note that there may be a short delay before display of this dialog as a connection is made to the emulation probe.

Click **OK** to dismiss the gateway configuration dialog. Change parameters listed on other pages of the configuration dialog as appropriate. In particular, make sure that the target endian mode is set up correctly on the Debugger page. Finally click **OK** again to dismiss the ADW configuration dialog. ADW should restart without errors using the new configuration.

To Perform Common Debugger Tasks

To download an image, choose **File->Load Image** from the ADW
command menu. The Load Image file dialog is displayed and can be used to
locate and select the image file. During a download the number of bytes
written and read is displayed as a progress indicator. Once the operation is
complete, the execution window of ADW will show the start of the
disassembled code. If the image contains debug information and has been
compiled from 'C' sources a breakpoint is automatically inserted by ADW at
the start of the main() procedure.

To start execution of a downloaded image, choose **Execute->Go**
from the ADW menu. Note that the initial value of the PC will have been set
appropriately as a result of the download.

To stop the target, choose **Execute->Stop** from the ADW menu. A
subsequent **Execute->Go** will start the target running from the current value
of the PC.

To set or clear a breakpoint, select the line in the execution window
and choose **Execute->Toggle Breakpoint**. If no breakpoint exists at this
location it is added, while an existing breakpoint will be cleared. This can only
be done while the target is stopped.

To set a watchpoint, select **View->Variables** and choose either local or
global. This displays respectively the variables that are local to the current
procedure or global within the application. Selecting the value of interest and
choosing **Execute->Toggle Watchpoint** sets the watchpoint.

To display or modify registers, choose **View->Registers** and select
the desired register bank (that is, the set of registers for a particular ARM
processor mode). All of the registers in that bank are then displayed in a
separate window. To change the value of a register, double-click on the
displayed value in this window. A further dialog box is then displayed from
which a new value for that register can be set. These operations can only be
carried out when the target is stopped.

To step through code, choose **Execute->Step**. Various other stepping options are also available from the execute menu such as Step In, Step Out and Run to Cursor.

Note that the above operations can be carried out in a variety of other ways, for example shortcut keys or toolbar buttons. See ARM documentation for further details.

Error Conditions

The emulation probe can detect and report to ADW that the target power is switched off. However, if the emulation probe is not connected or powered down, ADW will appear to hang for approximately 1 minute during start-up. This is simply a network time-out. ADW will then report that it could not initialize the communications link. Under these circumstances, check all connections and ensure that the address of the emulation probe has been correctly specified. The behavior is similar if the TIM has been disconnected from the emulation probe. In this case, the error reported will be failure to enter monitor mode.

Starting up ADW after the target has been power cycled may result in repeated warnings that the probe cannot read memory. This is not a problem and occurs as a result of the debugger attempting to access memory around a non-valid value in the pc register. The debugger's execution window may be all or partially blank as a result of these errors.

If certain sensitive operations, such as downloading memory, are interrupted, subsequent attempts to start up ADW may result in an error message stating that the probe could not enter monitor mode. Under these circumstances it may be necessary to cycle power to the probe and target.

See Also   The ARM Web Site: **http://www.arm.com**

The *Software Development Toolkit User Guide*.

10

Updating Firmware

Firmware gives your emulation probe a "personality" for a particular processor or processor family.

After you have connected the emulation probe to your target system, you may need to update the firmware to give it the right personality for your processor.

Update the firmware if:

• You need to change the personality of the emulation probe for a new processor.

• You have an updated version of the firmware from Agilent Technologies.

Updating Firmware When You Do Not Have a Logic Analysis System

To display current firmware version information

- Use `telnet` to access the built-in "terminal interface" and use the `ver` command to view the version information for firmware currently in the emulation probe.

To update firmware from the web

To update the firmware, you must have access to the World Wide Web and a PC or a workstation connected to your emulation probe.

1 Download the new firmware from the following World Wide Web site:

http://www.agilent.com/find/emulator

The firmware will be in the "Emulator and Emulation Solutions Software" or "Technical Support" section of this web site.

2 Follow the instructions on the web site for installing the firmware.

To update firmware from a floppy disk

- Follow the instructions on the README file on the floppy disk.

The firmware can be installed using either a PC or a workstation which can read PC disks.

Updating Firmware When You Have a Logic Analysis System

Always update firmware by installing a processor support package. This will ensure that the version of the Emulation Control Interface software is compatible the version of the emulation probe firmware. Logic analysis system operating system CD-ROMS include the processor support packages; versions 1.51 and later will include firmware which is compatible with E5900B emulation probes.

To display current firmware version information

1 In the Update Firmware window, select Display Current Version.

There are usually two firmware version numbers: one for "Generics" and one for the personality of your processor.

To update firmware using the Emulation Control Interface

1 End any run control sessions which may be running.

2 Install the processor support package from the CD-ROM, if necessary.

3 Open the Update Firmware window.

For an emulation module: In the system window, select the emulation module and select Update Firmware….

```
Select -> 15.19.3.24        [icon]
E5901B Emulation Module
  Connect to Emulator...
  Modify Interconnected Probe LAN Addresses...
  Update Firmware...
  Performance Verification...
  Help...
```
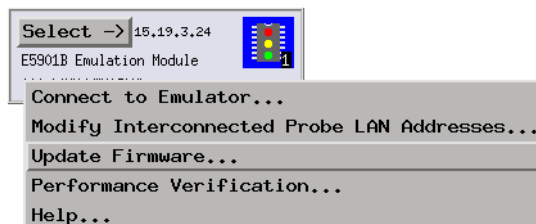
For an emulation probe: In the Workspace window, drag the emulation probe icon onto the workspace then select Update Firmware....

4 In the Update Firmware window, select the firmware to load into the emulation module.

5 Select Update Firmware.

In about 80 seconds, the firmware will be installed and the screen will update to show the current firmware version.

See also "Installing Software" beginning on page 50 for instructions on how to install the processor support package from the CD-ROM.

To update firmware for an emulation module using the Setup Assistant

The Setup Assistant is an online tool for connecting and configuring your logic analysis system for microprocessor and bus analysis. The Setup Assistant is available on Agilent 16700-series logic analysis systems.

This menu-driven tool will guide you through the connection procedures for connecting the logic analyzer to an analysis probe, an emulation module, or other supported equipment. It will also guide you through connecting an analysis probe to the target system.

1 Install the processor support package from the CD-ROM.

2 Start the Setup Assistant by selecting its icon in the system window.

3 Follow the instructions displayed by the Setup Assistant.

See also Page 50 for instructions on how to install a the processor support package from the CD-ROM.

11

Installing an Agilent E5902B
Emulation Migration

This chapter will tell you how to install an Agilent E5902B emulation migration so that you can use your emulation probe with a new processor family.

The E5902B emulation migration can be used with any E5900B emulation probe. It cannot be used with E5900A emulation probes.

To install the emulation migration

CAUTION: Electrostatic discharge can damage electronic components. Use grounded wrist straps and mats.

The tools necessary for this procedure are supplied with the emulation migration.

1 Turn off power to the emulation probe.

2 Disconnect all cables from the emulation probe, including the power cord, LAN cable, serial cable, module/probe interconnect cable, and target cable.

3 Remove the cover from the emulation probe:

   a Remove the 2 nuts and 2 screws from the front of the emulation probe.
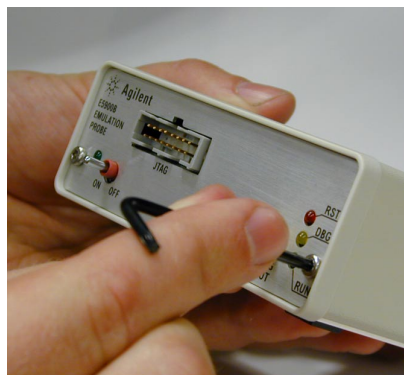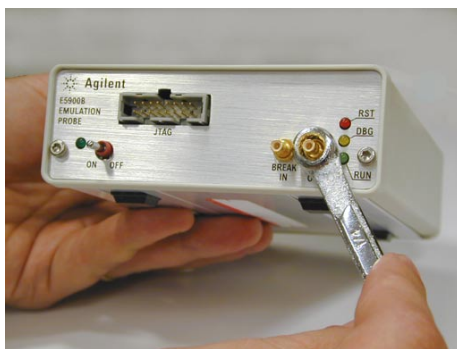
b Remove the front panel.

c Grasp the top cover with one hand. With the other hand, pull the plate on the bottom of the emulation probe, so that the top cover slides off.

4 Remove the 3 nylon screws from the emulation probe personality board.
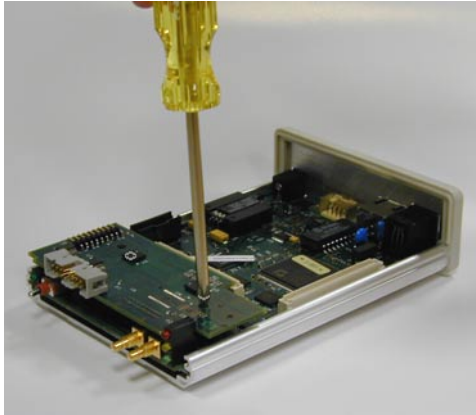
5 Carefully lift the emulation probe personality board from the main circuit board.
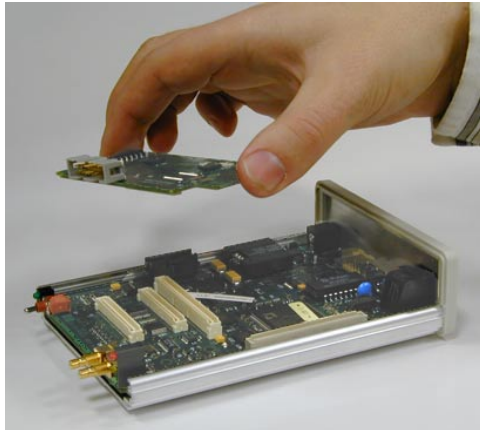
Do not turn on power to the emulation probe when no emulation probe personality board is installed.

You cannot run performance verification tests or make any measurements without a emulation probe personality board.

6 Install the new emulation probe personality board on the main circuit board.

Align both connectors and press down firmly.

7 Replace the 3 nylon screws.

8 Reinstall the cover on the emulation probe:

　　a Slide the top cover into place.

　　b Assemble the new front panel.
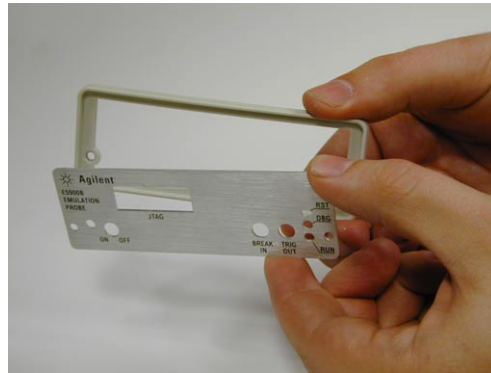
　　c Attach the front panel using the 2 screws and 2 nuts.

9 Connect the LAN cable, module/probe interconnect cable (if you will be using the emulation probe with an emulation module), and the LAN cable to the emulation probe. Do not connect a target cable yet.

10 Turn on power to the emulation probe.

11 Update the emulation probe's firmware.

See Chapter 10, "Updating Firmware," beginning on page 117 for instructions on how to update firmware.

12 Run the performance verification test.

See page 162 for instructions on testing the emulation probe.

13 Connect the emulation probe to your target system.

See Chapter 6, "Connecting the Emulation Probe to Your Target System," beginning on page 65, and your emulation or solution *User's Guide* for instructions on how to make this connection.

12

Specifications and Characteristics

The following operating characteristics are not specifications, but are typical operating characteristics for the Agilent Technologies E5900B emulation probe and E5901B emulation module.

Processor compatibility

The Agilent Technologies emulation probe supports the following processors:

Processor
ARM7TDMI
ARM7DI
ARM710T
ARM720T
ARM9TDMI
ARM740T
ARM 920T
ARM 922T
ARM 925T
ARM 940T
ARM 946ES
ARM 966ES

The emulation probe supports clock speeds up to 40 MHz.

The emulation probe supports operation from 1.2 V to 5.0 V.

Electrical Characteristics

Maximum Ratings

Characteristics for Agilent Technologies Emulation Probe	Symbol	Min	Max
TDO,DBGACK, RTCK	V_{ih}	0.8 x Vcc	
	V_{il}		0.2 x Vcc
	I_i		$\pm 1\ \mu A$
	C_{in}		15 pF
TDI,TCK,TMS,$\overline{TRST}$,DBGRQ	V_{oh} @ I_{oh} = -32 mA	0.8 x Vcc	
	V_{ol} @ I_{oh} = 64 mA; V_{CC} = 4.5 V		0.2 x Vcc
TDI,TMS,$\overline{TRST}$,DBGRQ	C_o		25 pF
TCK	C_o		45 pF
VTref[1]	V_{ih}	1.2 V	5.0 V
	V_{il}		0.8 V
$\overline{SRST}$[2]	V_{ol} @ 24 mA		0.5 V
	C_o		25 pF

[1] VTref is used only to determine target powered status. The emulation probe does not draw power from this source.

[2] Open collector output, pulled up to a generated voltage equivalent to the VTref voltage with a 2.61 k ohm pullup resistor.

Emulation probe electrical characteristics

Trigger Out SMB Port

With a 50 Ω load, a logic high is ≥ 2.0 V, and a low is ≤ 0.4 V. The output function is selectable (see "To configure the Trigger Out SMB (Emulation Probe only)" on page 87).

Break In SMB Port

Edge-triggered TTL level input, 20 pF, with 4.6 kΩ to ground in parallel. Maximum input: +5 V to -5 V when the trace port analyzer is powered OFF; +10 V to -5 V when the trace port analyzer is powered ON. Input function is selectable (see "To configure the Break In SMB (Emulation Probe only)" on page 88).

Communications

10BASE-T LAN Port. RJ-45 connector. IEEE 802.3 10BASE-T (StarLAN).

10BASE 2 LAN Port. 50-ohm BNC connector. IEEE 802.3 10BASE2 (ThinLAN). When using this connector, the Agilent Technologies emulation probe provides the functional equivalent of a Medium Attachment Unit (MAU) for ThinLAN.

Power Supply

Input. 100-240 V, 9.75 A, 50/60 Hz, IEC 320 connector.

Output. 12 V, 3.3 A

CAT I (Mains isolated).

Emulation probe environmental characteristics

Temperature   Operating, 0 C to +40 C (+32 to +104 F)
Nonoperating, -40 to +60 C (-40 to +140 F).

Altitude   Operating/nonoperating 4600 m (15 000 ft).

Relative Humidity   15% to 95%.

Pollution Degree   Pollution degree 2: Normally only dry non-conductive pollution occurs. Occasionally a temporary conductivity caused by condensation may occur.

For indoor use only.

Emulation module environmental characteristics

The Agilent E5901B emulation module meets the environmental characteristics of the logic analysis system in which it is installed.

Specifications and Characteristics

13

Troubleshooting the Emulation Probe

If you have problems with the emulation probe, your first task is to determine the source of the problem. Problems may originate in any of the following places:

- The connection between the emulation probe and your debugger
- The emulation module or emulation probe itself
- The connection between the emulation probe and the target system
- The target system

You can use several means to determine the source of the problem:

- The troubleshooting guide beginning on the next page
- The status lights on the emulation probe
- The emulation probe "performance verification" tests
- The emulation probe's built-in commands

Troubleshooting Guide

If you have trouble using the emulation probe, the following steps may help you identify the problem:

Step 1: Telnet to the emulation probe

Use telnet to connect to the emulation probe across the LAN. For instructions on how to do this, see "Verifying LAN Communications" on page 40.

The emulation probe must be reachable via LAN before you can use it.

If you cannot connect to the emulation probe

If you cannot ping or telnet to the emulation probe ("Verifying LAN Communications" on page 40):

- See "Problems with the LAN Interface" on page 156.

- If you need to change the LAN parameters of the emulation probe, see Chapter 2, "Connecting the Emulation Probe to a LAN," on page 27.

Step 2: Check the prompt

Once you have connected to the emulation probe, press the Enter key a few times and look at the prompt which is displayed.

If a telnet connection to the emulation probe displays the prompt "->"

The "->" prompt indicates that the firmware loaded into the emulation probe is not compatible with the "emulation probe personality board" which is located inside the emulation probe.

Try one of the following until you get a different prompt:

- Cycle power on the emulation probe. (Turn off your target power first.)

- Check that the proper firmware is installed for the emulation probe personality board or the type of emulation probe shown on the front panel of the emulation probe.

  The proper firmware is installed at the factory but it could accidentally be changed. A "ver" command will display the firmware which is currently loaded. Refer to "Updating Firmware" on page 117 if the firmware is incorrect.

- Run the performance verification tests. Refer to "To run the emulation probe performance verification tests" on page 162.

  Connection to the wrong target or connection to the target with the pins connected backward could potentially damage the emulation probe. Use the performance verification tests to validate that the emulation probe itself is working correctly.

If a telnet connection to the emulation probe displays the prompt "?>"

The "?>" prompt indicates that the emulation probe is having trouble talking to the target and it doesn't know what state the target is in.

- Validate that the emulation probe is connect to a powered up target.

  Refer to Chapter 6, "Connecting the Emulation Probe to Your Target System," beginning on page 65.

- Try initializing the emulation probe with the "init -c" command.

  Some emulation probes need to read the Processor Version Register of the target processor as the emulation probe is initialized.

- Check the emulation probe configuration settings.

  Enter the **cf** command to display the configuration settings. Note that some emulation probes must set the processor type with
  cf proc=*processor_type*.

- Decrease the JTAG communication speed. Some targets need slower speeds to properly communicate.

  Use the **cf speed** command.

- Check that the proper firmware is installed for this processor.

Some PowerPC chips require different firmware to be installed for different mask revs or other slight differences of the processor. For example, the PowerPC 603ev processor requires that the E3479 firmware be installed and the Motorola PowerPC 603ei requires that the E3477i firmware be installed.

Step 3: Try some simple commands to control the target

Examples of some commands are listed in "What to check first" on page 148.

If the emulation probe has problems controlling the target

The emulation probe might be having problems controlling the target if you see messages such as:

```
"Cannot break"
"Processor is checkstopped"
"Bad status code (0xff) received from the processor"
```

Or the prompt changes to "?>"

Problems controlling the target can be caused by a variety of conditions. Typically the problem is in the configuration of the emulation probe or the configuration of the target.

Try the following to better control your target:

• Decrease the JTAG communication speed. Some targets need slower speeds to properly communicate.

  If you are using a telnet connection or a debugger command file, use the **cf speed** command.

• Check the emulation probe configuration settings.

  If you are using a telnet connection, enter the **cf** command to display all of the configuration settings.

Pay particular attention to the **cf proc=*processor_type*** line of the output. Ensure the processor type is set correctly. See "To set the type of ARM processor" on page 77 for instructions on setting the processor type.

If your emulation probe does not have the correct firmware installed for the processor family that you are using (e.g. ARM7/9, MPC8260, PowerPC 7XX), you will need to load the appropriate firmware into the emulation probe. See "Updating Firmware" on page 117.

- Check that the emulation probe is not restricted to real-time runs.

If you are using a telnet connection or a debugger command file, use the **cf rrt=no** command.

Restrict to real time will not allow you to access memory or registers while the target is running. By setting this option to no, you will be able to access the memory and registers while the target is running.

- Check that the target processor is configured.

Some target require configuration registers on the processor to be initialized before the emulation probe can properly communicate with the target.

For example, the MPC860 requires memory chip selects to be defined before the target memory can be accessed. Other processors need their memory controllers initialized.

To initialize the target processor, either run your target from reset (if you have a BOOT ROM) or define a series of emulation probe commands to initialize the target.

Also refer to "Emulation Probe Built-in Commands" on page 145 for additional information about testing a target.

Step 4: Check the emulation module

If you are using an E5901B emulation module, select the emulation module icon and start the Emulation Control Interface.

If you have problems using the emulation probe as an emulation module in a 16700-series logic analysis system

To use the emulation probe as an emulation module in a 16700-series logic analysis system you must have installed an E5901B emulation module and you must connect the emulation probe to the emulation module using the module/probe interconnect cable. In addition, the emulation probe must be connected to the logic analysis system using a LAN.

- Check that the emulation probe and the logic analysis system are on the LAN.

  If you are using a site LAN you should be able to ping both the logic analysis system and the emulation probe.

  If you are using a point-to-point LAN connection you must use a special crossover LAN cable, such as the one supplied with the emulation module.

  The telnet window of the logic analysis system should be able to communicate with the emulation probe. This window can be found by selecting the "System Administration" icon in the main system window.

- Check that the emulation probe is connected to the emulation module with the module/probe interconnect cable.

  If this cable is connected, you should be able to display the firmware version from the "Update Firmware" window.

- Check that you have the proper processor support package installed.

  You can check this by selecting the System Administration icon in the main system window, then looking at the list of software packages installed.

- Test the emulation module. See page 161.

- Test the emulation probe. See page 162.

- Try using the Setup Assistant to configure your measurement setup.

Step 5: Check your debugger connection

If you are using a debugger, try connecting to the emulation probe.

If you have problems using the emulation probe with a debugger

Most problems are associated with not having the emulation probe and target properly configured or initialized.

Some debuggers have an initialization file that needs to be properly defined before a debugger can connect to the emulation probe.

- Make sure the PC or workstation where the debugger is running can ping the emulation probe. (See "Verifying LAN Communications" on page 40.)

- Initialize the emulation probe and target so that the debugger can connect. Refer to your debugger manual for proper initialization.

- Refer to your debugger manual for proper operation.

If you need to obtain help

If, after following the troubleshooting steps and looking through the other sections in this chapter, the emulation probe still is not working:

1 Write down the target processor version, the emulation probe firmware version, and the type of emulation probe (E5900A or E5900B).

2 Call your nearest Agilent Technologies sales or service office.

To locate a sales or service office near you, go to **http://www.tm.agilent.com** and select Assistance.

Status Lights

Emulation Probe Target Status Lights

The emulation probe uses status lights to communicate various modes and error conditions.

The following table gives more information about the meaning of the power and target status lights.

❍ = LED is off
● = LED is on

Power/Target Status Lights

Pwr/Target LEDs	Meaning
❍ RST ❍ DBG ❍ RUN	No target system power, or emulation probe is not connected to the target system
● RST ❍ DBG ❍ RUN	Target system is in a reset state
❍ RST ● DBG ❍ RUN	The target processor is in Debug Mode
❍ RST ❍ DBG ● RUN	The target processor is executing user code
❍ RST ● DBG ● RUN	Only boot firmware is good (other firmware has been corrupted)
● RST ● DBG ● RUN	The emulation probe can no longer control the target. Reset the target, then initialize the emulation probe.

Emulation Probe LAN Status Lights
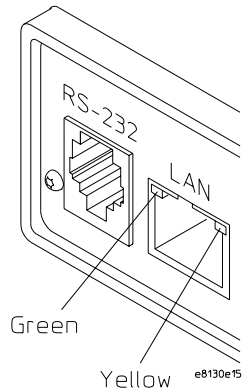
The yellow LED, on the right side of the connector, indicates LAN activity (receive or transmit).

The green LED, on the left side of the connector, is lit when the LAN interface is operating in 100Base-Tx mode.

Emulation Probe Power On Light
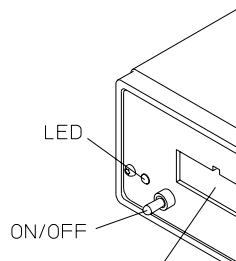
The green LED, to the left of the power switch, is lit when the emulation probe is connected to a power source and the power switch is on.

Emulation Probe Built-in Commands

The emulation probe has some built-in commands (sometimes called the "terminal interface") which you can use for troubleshooting.

You can enter the built-in commands using:

- A telnet (LAN) connection
- The Command Line window in the Emulation Control Interface
- A "debugger command" window in your debugger
- A serial connection (see page 32)

To telnet to the emulation probe

You can establish a telnet connection to the emulation probe if:

- A host computer and the probe are both connected to a local-area network (LAN), and
- The host computer has the telnet program (often part of the operating system or an internet software package).

To establish a telnet connection:

1 Find out the LAN address or LAN name of the emulation probe.

2 Start the telnet program.

If the LAN name of the emulation probe is "test2", the command might look like this:

```
telnet test2
```

3 If you do not see a prompt, press the <Return> key a few times.

To exit from this telnet session, type <CTRL>D at the prompt.

To use the built-in commands

Here are a few commonly used built-in commands:

Useful built-in commands

b	Break—go into the background monitor state
cf	Configuration—read or write configuration options
help	Help—display online help for built-in commands
init	Initialize—**init -c** re-initializes everything in the emulation probe except for the LAN software
lan	configure LAN address
m	Memory—read or write memory
reg	Register—read or write a register
mtest	Memory test—test target memory system
r	Run—start running user code
rep	Repeat—repeat a command or group of commands
rst	Reset—reset the target processor
s	Step—do a low-level single step
ver	Version—display the product number and firmware version of the emulation probe

Use **help *command_name*** to see the command syntax. For example, enter **help m** to get help on the memory command.

The prompt indicates the status of the emulation probe:

Emulation probe prompts

U	Running user program
M	Running in debug mode
p	No target power
R	Emulation reset
r	Target reset
?	Unknown state

Examples

To set register r0, and then view r0 to verify that it was set, enter:

```
R>rst -m
 M>reg r0=ffff
 M>reg r0
   reg r0=0000ffff
```

To break execution and then step a single instruction, enter:

```
M>b
 M>s
   PC=xxxxxxxx
 M>
```

To determine what firmware version is installed in the emulation probe, enter:

```
M>ver
```

See Also Use the **help** command for more information on these and other commands. Note that some of commands listed in the help screens are generic commands for Agilent emulation probes and may not be available for your product.

If you are writing your own debugger, contact Agilent Technologies for more information.

Problems with the Target System

What to check first

1 Try some basic built-in commands (using a serial or telnet connection):

```
U>rst
R>
```

This should reset the target and display an "R>" prompt.

```
R>b
M>
```

This should stop the target and display an "M>" prompt.

```
M>reg r1
  reg r1=007fd6a0
M>
```

This should read the value of the r1 register (the value will probably be different on your target system).

```
M>m 0..
  00000000    7c3043a6 7c2802a6 7c3143a6 4bf04111
  00000010    00000000 00000000 00000000 00000000
  00000020    00000000 00000000 00000000 00000000
  00000030    00000000 00000000 00000000 00000000
  00000040    00000000 00000000 00000000 00000000
  00000050    00000000 00000000 00000000 00000000
  00000060    00000000 00000000 00000000 00000000
  00000070    00000000 00000000 00000000 00000000
M>
```

This should display memory values starting at address 0.

```
M>s
```

This should execute one instruction at the current program counter.

Note that stepping can fail if memory at the current PC does not contain a valid instruction.

If any of these commands don't work, there may be a problem with the design

of your target system, a problem with the revision of the processor you are using, or a problem with the configuration of the emulation probe. The following steps will help you identify the problem.

2 Check that the emulation probe firmware matches your processor. To do this, enter:

```
M>ver
```

To check the debug port connector signals

- Check for the following logic levels on the target debug port. The signal names are for the ARM7.

Signal Levels with the emulation probe in default[1] reset state

Signal Name	ARM 14-pin	VLSI 14-pin	TI 14-pin	ARM/Agilent pin	Level
Vcc/VTref	1,13	13	5	1	1.2 V - 5.0 V[2]
TDI	5	5	3	5	Toggling
TDO	11	11	7	13	Toggling
TCK	9	9	11	9	~10 MHz signal
TMS	7	7	1	7	Toggling
nSYSRST	12	12	N/A	15	Low
DBGACK	N/A	N/A	N/A	19	Low
DBGREQ	N/A	N/A	N/A	17	Low
nTRST	3	3	2	3	High
PT	N/A	10	N/A	N/A	High
PN{3:0}	N/A	4,6,8	N/A	N/A	Low

All other pins should be low.

[1]Default cf settings.

[2]Target dependent.

To interpret the initial prompt

The initial prompt can be used to diagnose several common problems.

1 Connect the emulation probe to your target system.

2 Set the default configuration settings. Enter:

```
M>init -c
```

You can enter this command at any prompt. The emulation probe will respond with the same information as printed by the "ver" command.

If the response is "!ERROR 905! Driver firmware is incompatible with ID of attached device"

Make sure the target interface module is connected to the cable of the emulation probe, then try the "init -c" command again.

If the initial prompt is "p>"

Check pin 1 on header (if using the TI connector check pin 5 instead) 1.2V - 5V (VDD).

If the initial prompt is "M>"

The processor entered debug mode without the help of the emulation probe. Is another debugger connected?

If the initial prompt is "?>"

Check TCK, TDO, TDI, TMS, and TRST_L signals. Check the firmware revision.

If the initial prompt is "R>"

The emulation probe is scanning the JTAG correctly. Now you can do some more tests:

3 Enter the reset command:

```
R>rst
R>
```

The "R>" prompt is a good response that indicates that nRESET is working. Continue with "If the prompt after rst is R>".

4 Enter the break command:

```
R>b
M>
```

If the prompt after b is "U>" with error messages

If you see: "!ERROR 608! Unable to break", try resetting the target and/or cycling power on the target.

If the problem still persists, then try the sequence:

U>rst
R>r
M>b

Some ARM chips have problems if JTAG commands are issued while the chip is reset. Using the "rst", "r", "b" sequence avoids this problem.

If the prompt after b is "M>" with no error messages

Everything is still working correctly. Continue with more tests:

If you can get to the "M>" prompt

5 At the "M>" prompt, check register and memory access:

```
M>reg r0
   reg r0=xxxxxxxx
M>reg r0=12345678
M>reg r0
   reg r0=12345678
M>
```

If the returned value is equal to the written value, then the voltage level of the chip is probably correct.

Now enter:

```
M>m -d4 -a4 0=11111111,22222222,33333333,44444444
M>m -d4 -a4 0..
   00000000   11111111 22222222 33333333 44444444
   00000010   00000000 00000000 00000000 00000000
   00000020   00000000 00000000 00000000 00000000
   00000030   00000000 00000000 00000000 00000000
   00000040   00000000 00000000 00000000 00000000
   00000050   00000000 00000000 00000000 00000000
   00000060   00000000 00000000 00000000 00000000
   00000070   00000000 00000000 00000000 00000000
M>
```

- Returned value is equal to the written value implies that memory is working.
- Returned value is not equal to the written value implies that the memory controller may not be initialized. Be sure the memory controller for your target is setup correctly.

If you see memory-related problems

1 Set caches and translation off. Refer to your target documentation for doing this.

2 Now enter:

```
M>m -d4 -a4 0=11111111,22222222,33333333,44444444
M>m -d4 -a4 0..
  00000000    11111111 02222222 33333333 44444444
  00000010    00000000 00000000 00000000 00000000
  00000020    00000000 00000000 00000000 00000000
  00000030    00000000 00000000 00000000 00000000
  00000040    00000000 00000000 00000000 00000000
  00000050    00000000 00000000 00000000 00000000
  00000060    00000000 00000000 00000000 00000000
  00000070    00000000 00000000 00000000 00000000
M>
```

- Read value not equal to the written value implies that the memory controller is not setup correctly.
- Read value equal to the written value implies that the emulation probe firmware might not be working with cache.

3 Hand load the following small program:

```
M>m -d4 -a4 100=e2811001,00000000,eafffffc
M>reg r1=0
M>
```

This means: Add r1, r1, #1, NOP, b 100

Set the PC to this program:

```
M>reg pc=100
M>
```

Step, then check the register:

```
M>s
  pc=00000104
M>reg r1
  reg r1=0000 0001
M>
```

This should return "reg r1=00000001".

Step some more and verify that r1 increments after every three steps:

```
M>s 3
  pc=00000104
M>reg r1
  reg r1=00000002
M>
```

If this does not work as described, make sure "cf endian" is set correctly for your target, the memory at 100 is read/write memory, and that the memory controller is programmed correctly.

Problems with the LAN Interface

If you cannot verify LAN communication

If you cannot verify connection using the procedure in "To verify LAN communication", or if commands are not accepted by the emulation probe:

❏ Make sure that you have connected the emulation probe to the proper power source and that the power light is lit.

❏ Make sure that you wait for the power-on self test to complete before connecting.

❏ Check that the Emulation Control Interface or debugger was configured with the correct LAN address. If the emulation probe is on a different subnet than the host computer, check that the gateway address is correct.

❏ Make sure that the emulation probe's IP address is set up correctly. To do this, connect the emulation probe to a terminal or terminal emulator and enter the **lan** command. (See "To configure LAN parameters using a serial connection" on page 32.)

❏ Make sure that the gateway address is set up correctly. The default gateway address of 0.0.0.0 does not allow the emulation probe to communicate with computers on other subnets.

❏ If you have just changed the IP address of the emulation probe, leave the emulation probe powered on and connected to the LAN for a few minutes, then try again. Some hubs, routers, and hosts maintain tables of IP addresses and link-level addresses. It may take a while for these tables to be updated.

❏ Make sure that the proper LAN cable is connected.

- Use a Category 5 cable if your connection is running at 100 Mbps (100BASE-TX).
- For a point-to-point connection, use a crossover cable.
- For a LAN connection, use a regular LAN cable, not a crossover cable (the cable supplied with the emulation module, part number 5061-7342, is a crossover cable).

❏ Watch the LAN LED's to see whether the emulation probe is seeing LAN activity. The LED's are described on page 144. Refer to your LAN documentation for information on testing connectivity.

❏ It's also possible for there to be a problem with the emulation probe firmware while the LAN interface is still up and running. In this case, you must reboot the emulation probe by turning the emulation probe power switch off then on again.

If you have LAN connection problems

❏ Verify the IP address and gateway mask of the emulation probe. To do this, connect the emulation probe to a terminal or terminal emulator and enter the **lan** command. See "To configure LAN parameters using a serial connection" on page 32.

If it takes a long time to connect to the network

❏ Check the subnet masks on the other LAN devices connected to your network. All of the devices should be configured to use the same subnet mask.

Subnet mask error messages do not indicate a major problem. You can continue using the emulation probe.

If there are many subnet masks in use on the local subnet, the logic analysis system may take a very long time to connect to the network after it is turned on.

If you have problems setting the LAN parameters using a logic analysis system

❏ If the E5900B emulation probe is not connected to an E5901B emulation module, then make sure the emulation probe is on the same subnet as the logic analysis system during initial setup; otherwise,

probe LAN address setup will fail. After initial setup, you can modify the emulation probe's LAN parameters using the Emulation Control Interface before moving the probe to a different subnet.

❏ Another thing that will cause emulation probe LAN address setup to fail is a BOOTP daemon, running elsewhere on your network, that is configured to respond to the link-level address of the emulation probe.

Problems with the Serial Interface

If you cannot verify RS-232 communication

If the emulation probe prompt does not appear in the terminal emulator window:

❏ Make sure that you have connected the emulation probe to the proper power source and that the power switch is on.

❏ Make sure that you have properly configured the data communications parameters on the host computer.

❏ Verify that you are using the correct cable. Use the cable and adapter which are supplied with the emulation probe.

If you have RS-232 connection problems with the MS Windows Terminal program

❏ Use the "HyperTerminal" program (usually found in the Accessories windows program group) and set up the "Communications..." settings as follows:

- Baud Rate: 9600
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

When you are connected, hit the Enter key. You should get a prompt back.

❏ If you still don't get a prompt, make sure the serial cable is connected to the correct port on your PC.

❏ Make sure you are using the serial cable which was supplied with the emulation probe.

With certain RS-232 cards, connecting to an RS-232 port where the emulation

probe is turned off (or is not connected) will hang the PC. The only way to get control back is to reboot the PC. Therefore, we recommend that you always turn on the emulation probe before attempting to connect via RS-232.

Problems with the Emulation Module

Occasionally you may suspect a hardware problem with the emulation module. The procedure in this section describes how to test the emulation module hardware, and if a problem is found, how to repair or replace the broken component.

This procedure tests the hardware within the logic analysis system—the emulation module and its connection to the logic analysis system. To test the emulation probe, see page 162.

To test the emulation module

1 End any Emulation Control Interface or debugger sessions.

2 Disconnect the emulation probe from the target system.

3 In the system window, select the System Admin icon.

4 Select the Admin tab.

5 Select Self-Test....

6 Read the Question dialog and select Yes if you wish to run the self tests.

7 Select the Master Frame tab.

8 Select the E5901B Emulation Module.

9 Select Test All.

10 When you are finished running self tests, select Quit. Then restart your session from the Session Manager window.

Problems with the Emulation Probe

To run the emulation probe performance verification tests

In addition to the powerup tests, there are several additional performance verification (PV) tests available.

These tests can be performed through a 16700-series logic analysis system or via a serial or telnet connection.

Before running probe performance verification:

- Leave the emulation probe connected to the LAN and to the power supply or module/probe interconnect cable.
- Leave the emulation probe personality board installed inside the emulation probe.
- End any Emulation Control Interface or debugger sessions.
- Disconnect the target cable from the target system. (Power off the emulation probe while you do this.)
- Connect an SMB cable from the "Break In" connector to the "Trigger Out" connector on the emulation probe. (If you aren't concerned about these signals, you may omit this step and ignore any related test failures.)

To run the performance verification tests using the logic analysis system

1 End any Emulation Control Interface or debugger sessions.

2 Turn off the emulation probe and disconnect the emulation probe from your target system, then turn the emulation probe on again.

CAUTION: Disconnect the emulation probe from your target system before running the tests. Running the Target Board Adapter Feedback Test with the target system connected can damage components on the target system.

3 In the system window, select the emulation probe icon then select Performance Verification.

4 Select Start PV.

The results will appear on screen.

To run complete performance verification tests using a serial or telnet connection

1 Connect an SMB (f) cable (such as Agilent 16532-61601) between BREAK IN and TRIGGER OUT.

2 Disconnect the probe/module interconnect cable.

3 Turn off the emulation probe and disconnect the emulation probe from your target system, then turn the emulation probe on again.

CAUTION: Disconnect the emulation probe from your target system before running the tests. Running the Target Board Adapter Feedback Test with the target system connected can damage components on the target system.

4 Connect the emulation probe to your PC or workstation using a serial or LAN connection, as described in "Connecting the Emulation Probe to a LAN" on page 27.

5 Use a `telnet` or a terminal emulator to connect to the emulation probe.

6 Enter the `pv 1` command.

See Also Options available for the `pv` command are explained in the help screen displayed by typing `help pv` or `? pv` at the prompt.

> **Examples**
>
> Here are some examples of ways to use the pv command.
>
> To execute all of the tests one time:
>
> `pv 1`

To execute test 2 with maximum debug output repeatedly until a Ctrl-c is entered:

```
pv -t2 -v9 0
```

The results on a good system, with the trigger out and break in SMBs connected, should similar to the following.

```
U>pv 1

  Testing: HPE8130A Series Emulation System
    Test  1: Powerup PV Results                           Passed!
    Test  2: Emulation Module Port Feedback Test          Passed!
    Test  3: Run Control FPGA Test                        Passed!
    Test  4: Run Control Clock Test                       Passed!
    Test  5: Break In and Trigger Out SMB Feedback Test   Passed!
    Test  6: Target Board Adapter Feedback Test (FACTORY ONLY) Not Executed
  FAILED  Number of tests: 1          Number of failures: 0


        Copyright (c) Agilent Technologies, Inc. 1999
All Rights Reserved.  Reproduction, adaptation, or translation without
prior
written permission is prohibited, except as allowed under copyright laws.

  HPE8130A Series Emulation System
    Version:   A.01.00 Dec 30 1999
    Location:  Generics

  HP E3454A  PowerPC 700 JTAG Emulator
    Version:   A.05.00 Oct 26 1999
R>
```

The product numbers and version information will be different for your emulation probe. The product numbers displayed are for the various pieces of firmware and will be different from the product number you used to order the product.

If a performance verification test fails

There are some things you can do if a failure is found on one of the tests. Details of the failure can be obtained through using a -v value ("verbose level") of 9.

If the particular failure you see is not listed below, contact Agilent Technologies for assistance.

Test 1: Powerup PV Results

Failure of this test indicates a hardware problem with the emulation probe.

Contact Agilent Technologies for assistance.

Test 2: Emulation Module Port Feedback Test

Failure of this test indicates a hardware problem with the emulation probe. Contact Agilent Technologies for assistance.

This test exercises the hardware which drives the connection to the emulation module. It does not test the module/probe interconnect cable.

The test is not executed if the emulation probe is connected to an emulation module.

Test 3: Run Control FPGA Test
Test 4: Run Control Clock Test

Failure of these tests indicates a hardware problem with the emulation probe. Contact Agilent Technologies for assistance.

If the emulation probe fails one of these tests, it may have been damaged by electrostatic discharge through the target cable. To prevent such damage in the future, follow standard ESD preventive practices.

Test 5: Break In and Trigger Out SMB Feedback Test

Before returning to Agilent Technologies, check to ensure that you have connected a good cable between the two SMB connectors.

Test 6: Target Board Adapter Feedback Test

Failure of this test indicates a hardware problem with the emulation probe. Contact Agilent Technologies for assistance.

This test exercises the I/O circuitry. If the test passes, but the emulation probe seems to have trouble communicating with the target system, the problem is probably with the target system.

If this test was not executed, it means that the target board adapter you are using does not support the test.

Returning Parts for Service

The repair strategy for this emulation solution is board replacement.

Exchange assemblies are available when a repairable assembly is returned to Agilent Technologies. These assemblies have been set up on the "Exchange Assembly" program. This lets you exchange a faulty assembly with one that has been repaired, calibrated, and performance verified by the factory. The cost is significantly less than that of a new assembly.

To return a part to Agilent Technologies

1 Follow the procedures in this chapter to make sure that the problem is caused by a hardware failure, not by configuration or cabling problems.

2 In the U.S., call 1-800-403-0801. Outside the U.S., call your nearest Agilent sales office. Ask them for the address of the nearest service center.

To locate a sales or service office near you, go to **http://www.tm.agilent.com** and select Assistance.

3 Package the part and send it to the Agilent service center.

Keep any parts which you know are working. For example, if only a cable is broken, keep the emulation probe.

4 When the part has been replaced, it will be sent back to you.

The unit returned to you will have the same serial number as the unit you sent to Agilent.

In some parts of the world, on-site repair service is available. Ask an Agilent sales or service representative for details.

To obtain replacement parts

The following table lists some parts that may be replaced if they are damaged or lost. The part numbers are subject to change. Contact your nearest Agilent Technologies sales office for further information.

Exchange assemblies

Part number	Description
E3459-69501	Rebuilt assembly (for ARM)

Replacement assemblies

Part number	Description
0950-3043	Power supply for emulation probe (marked F1044B)
E3459-61601	20-pin high density cable
E3459-61605	20-pin low density cable
E8130-66505	ARM 14-pin cable adapter board
E8130-66513	ARM TI/VLSI cable adapter board
E3459-61602	14-pin JTAG cable
16700-61608	Expansion cable for emulation module
E8130-68702	Serial cable and adapter
E8130-61601	14-pin module/probe interconnect cable

To clean the instrument

If the instrument requires cleaning:

1 Remove power from the instrument.

2 Clean the instrument using a soft cloth that has been moistened in a mixture of mild detergent and water.

3 Make sure that the instrument is completely dry before reconnecting it to a power source.

Glossary

Analysis Probe A probing solution connected to the target microprocessor. It provides an interface between the signals of the target microprocessor and the inputs of the logic analyzer. Formerly called a "preprocessor."

Background Debug Monitor In Also called Debug Mode, In Background, and In Monitor. The normal processor execution is suspended and the processor waits for commands from the debug port. The debug port commands include the ability to read and write memory, read and write registers, set breakpoints and start the processor running (exit the Background Debug Monitor).

Debug Mode See *Background Debug Monitor*.

Debug Port A hardware interface designed into a microprocessor that allows developers to control microprocessor execution, set breakpoints, and access microprocessor registers or target system memory using a tool like the emulation probe.

Elastomeric Probe Adapter A connector that is fastened on top of a target microprocessor using a retainer and knurled nut. The

conductive elastomer on the bottom of the probe adapter makes contact with pins of the target microprocessor and delivers their signals to connection points on top of the probe adapter.

Emulation Migration The hardware and software required to use an emulation probe with a new processor family.

Emulation Module An emulation module is installed within the mainframe of a logic analysis system. An E5901A emulation module is used with a *target interface module* (TIM) or an analysis probe. An E5901B emulation module is used with an E5900B *emulation probe* and does not use a TIM.

Emulation Probe An emulation probe is a stand-alone instrument connected via LAN to the mainframe of a logic analyzer or to a host computer. It provides run control within an emulation and analysis test setup. Formerly called a "processor probe" or "software probe."

Extender A part whose only function is to provide connections from one location to another. One or more extenders might be stacked to raise a probe above a target microprocessor to avoid mechanical

Glossary

contact with other components installed close to the target microprocessor. Sometimes called a "connector board."

Flexible Adapter Two connection devices coupled with a flexible cable. Used for connecting probing hardware on the target microprocessor to the analysis probe.

Gateway Address An IP address entered in integer dot notation. The default gateway address is 0.0.0.0, which allows all connections on the local network or subnet. If connections are to be made across networks or subnets, this address must be set to the address of the gateway machine.

General-Purpose Flexible Adapter A cable assembly that connects the signals from an elastomeric probe adapter to an analysis probe. Normally, a male-to-male header or transition board makes the connections from the general-purpose flexible adapter to the analysis probe.

High-Density Adapter Cable A cable assembly that delivers signals from an analysis probe hardware interface to the logic analyzer pod cables. A high-density adapter cable has a single Mictor connector that is installed into the analysis probe, and two cables that are connected to corresponding odd and even logic analyzer pod cables.

High-Density Termination Adapter Cable Same as a High-Density Adapter Cable, except it has a termination in the Mictor connector.

In Background, In Monitor See *Background Debug Monitor*.

Inverse Assembler Software that displays captured bus activity as assembly language mnemonics. In addition, inverse assemblers may show execution history or decode control busses.

IP address Also called Internet Protocol address or Internet address. A 32-bit network address. It is usually represented as decimal numbers separated by periods; for example, 192.35.12.6.

Jumper Moveable direct electrical connection between two points.

JTAG (OnCE) port See *debug port*.

Label Labels are used to group and identify logic analyzer channels. A label consists of a name and an

Glossary

associated bit or group of bits.

Link-Level Address The unique address of the LAN interface. This value is set at the factory and cannot be changed. The link-level address of a particular piece of equipment is often printed on a label above the LAN connector. An example of a link-level address in hexadecimal: 0800090012AB. Also known as an LLA, Ethernet address, hardware address, physical address, or MAC address.

Mainframe Logic Analyzer A logic analyzer that resides on one or more board assemblies installed in a 16500, 1660-series, or 16600/700-series mainframe.

Male-to-male Header A board assembly that makes point-to-point connections between the female pins of a flexible adapter or transition board and the female pins of an analysis probe.

Monitor, In See *Background Debug Monitor*.

Pod A collection of logic analyzer channels associated with a single cable and connector.

Preprocessor See *Analysis Probe*.

Preprocessor Interface See *Analysis Probe*.

Probe Adapter See *Elastomeric Probe Adapter*.

Prototype Analyzer The 16505A prototype analyzer acts as an analysis and display processor for the 16500B/ C logic analysis system. It provides a windowed interface and powerful analysis capabilities. Replaced by 16600/700-series logic analysis systems.

Run Control Probe See Emulation Probe and Emulation Module.

Setup Assistant Wizard software which guides a user through the process of connecting and configuring a logic analyzer to make measurements on a specific microprocessor. The Setup Assistant icon is located in the main system window.

Shunt Connector. See *Jumper*.

Solution A set of tools for debugging your target system. A solution includes probing, inverse assembly, the B4620B Source Correlation Tool Set, and an emulation module.

State Analysis When the logic analyzer is configured to capture data

synchronously with a clock signal in the target system.

Subnet Mask A subnet mask blocks out part of an IP address so that the networking software can determine whether the destination host is on a local or remote network. It is usually represented as decimal numbers separated by periods; for example, 255.255.255.0.

Symbol Symbols represent patterns and ranges of values found on labeled sets of bits. Two kinds of symbols are available:
1) Object file symbols — Symbols from your source code, and symbols generated by your compiler. Object file symbols may represent global variables, functions, labels, and source line numbers.
2) User-defined symbols — Symbols you create.

Target Board Adapter A daughter board inside the E5900B emulation probe which provides an interface to the ribbon cable for a particular microprocessor family. Also called emulation probe personality board.

Target Control Port An 8-bit, TTL port on a logic analysis system that you can use to send signals to your target system. It does not function like a pattern generator or emulation

module, but more like a remote control for the target's switches.

Target Interface Module A small circuit board which connects the 50-pin cable from an E5901A emulation module or E5900A emulation probe to signals from the debug port on a target system. Not used with the E5900B emulation probe.

TIM See *Target Interface Module*.

Timing Analysis When the logic analyzer is configured to capture data at a rate determined by an internal sample rate clock, asynchronous to signals in the target system.

Transition Board A board assembly that obtains signals connected to one side and rearranges them in a different order for delivery at the other side of the board.

Trigger Specification A set of conditions that must be true before the instrument triggers. See the printed or online documentation of your logic analyzer for details.

1/4-Flexible Adapter An adapter that obtains one-quarter of the signals from an elastomeric probe adapter (one side of a target microprocessor) and makes them available for probing.

Index

Index

Index

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

Manufacturer's Name: Agilent Technologies, Inc. / Digital Design PGU

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

Declares, that the product

Product Name: Emulation Probe

Model Number(s): Agilent Technologies E5900B, E5902B

Product Option(s): All options based on the above

is in conformity with:

EMC IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998
CISPR 11:1990 / EN 55011:1991—Group 1 Class A[1]
IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)
IEC 61000-4-3:1995 / EN 61000-4-3:1995 (3 V/m 80% AM)
IEC 61000-4-4:1995 / EN 61000-4-4:1995 (0.5kV line-line, 1kV line-earth)
IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V 80% AM, power line)
Australia/New Zealand: AS/NZS 2064.1

Safety IEC 1010-1: 1990+A1:1992+A2:1995 / EN 61010-1: 1994+A2:1995
Canada: CSA-C22.2 No. 1010.1:1992
USA: UL 3111-1:1994

Additional Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE marking accordingly (European Union).

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

Date: 12/30/99

Ken Wyatt

Ken Wyatt / Product Regulations Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Product Regulations

EMC   IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998   Performance Criteria
CISPR 11:1990 / EN 55011:1991—Group 1 Class A

	Performance Criteria
IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)	D
IEC 61000-4-3:1995 / EN 61000-4-3:1995 (3 V/m 80% AM)	A
IEC 61000-4-4:1995 / EN 61000-4-4:1995 (EFT 0.5kV line-line, 1kV line-earth)	A
IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V 80% AM, power line)	A

Australia/New Zealand: AS/NZS 2064.1

Safety   IEC 1010-1: 1990+A1:1992+A2:1995 / EN 61010-1: 1994+A2:1995
Canada: CSA-C22.2 No. 1010.1:1992
USA: UL 3111-1:1994 {optional}

Additional Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE marking accordingly (European Union).

Performance Criteria:
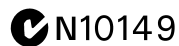A Pass - Normal operation, no effect.
B Pass - Temporary degradation, self recoverable.
C Pass - Temporary degradation, operator intervention required.
D Fail - Not recoverable, component damage.

Note:
Use standard ESD preventive practices while handling and connecting the E5900B to its target to avoid component damage.
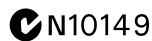
Sound   N/A
Pressure
Level

⊙N10149   CE
ISM 1-A

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

Manufacturer's Name: Agilent Technologies, Inc. / Digital Design PGU

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

Declares, that the product

   Product Name: Emulation Module

   Model Number(s):   Agilent Technologies E5901B

   Product Option(s):   All options based on the above

is in conformity with:

   EMC   IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998
              CISPR 11:1990 / EN 55011:1991—Group 1 Class A[1]
              IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)
              IEC 61000-4-3:1995 / EN 61000-4-3:1995 (3 V/m 80% AM)
              IEC 61000-4-4:1995 / EN 61000-4-4:1995 (0.5kV line-line, 1kV line-earth)
              IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V 80% AM, power line)
              Australia/New Zealand: AS/NZS 2064.1

   Safety   IEC 1010-1: 1990+A1:1992+A2:1995 / EN 61010-1: 1994+A2:1995
              Canada: CSA-C22.2 No. 1010.1:1992
              USA: UL 3111-1:1994

Additional Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE marking accordingly (European Union).

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

Date: 12/30/99

Ken Wyatt

Ken Wyatt / Product Regulations Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Product Regulations

EMC   IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998   Performance Criteria
           CISPR 11:1990 / EN 55011:1991—Group 1 Class A
           IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)   A
           IEC 61000-4-3:1995 / EN 61000-4-3:1995 (3 V/m 80% AM)   A
           IEC 61000-4-4:1995 / EN 61000-4-4:1995 (EFT 0.5kV line-line, 1kV line-earth)   A
           IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V 80% AM, power line)   A
           Australia/New Zealand: AS/NZS 2064.1

Safety   IEC 1010-1: 1990+A1:1992+A2:1995 / EN 61010-1: 1994+A2:1995
           Canada: CSA C22.2 No. 1010.1:1992
           USA: UL 3111-1:1994 {optional}

Additional Information:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE marking accordingly (European Union).

> Performance Criteria:
> A Pass - Normal operation, no effect.
> B Pass - Temporary degradation, self recoverable.
> C Pass - Temporary degradation, operator intervention required.
> D Fail - Not recoverable, component damage.

Sound   N/A
Pressure
Level

N10149   CE
                ISM 1-A

Safety Notices

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

Warnings

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

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

• If you energize this instrument by an auto transformer (for voltage reduction or mains isolation), the common terminal must be connected to the earth terminal of the power source.

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

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

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

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

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

• Do not use the instrument in a manner not specified by the manufacturer.

To clean the instrument

If the instrument requires cleaning: (1) Remove power from the instrument. (2) Clean the external surfaces of the instrument with a soft cloth dampened with a mixture of mild detergent and water. (3) Make sure that the instrument is completely dry before reconnecting it to a power source.

Safety Symbols

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

Hazardous voltage symbol.

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

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

CAUTION

A CAUTION notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a CAUTION notice until the indicated conditions are fully understood and met.