HEWLETT PACKARD

HP E5500B
Phase Noise Measurement System

Installation Guide

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What You'll Find in This Manual…

Chapter 1

- HP E5500B Installation

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For assistance, call your local Hewlett-Packard Sales and Service Office (refer to "Service and Support" on page -7).

Service and Support

Any adjustment, maintenance, or repair of this product must be performed by qualified personnel. Contact your customer engineer through your local HP Service Center. You can find a list of HP Service Centers on the web at `http://www.hp.com/go/tmdir`.

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United States:	Hewlett-Packard Company Test and Measurement Call Center PO Box 4026 Englewood, CO 80155-4026 (800) 452 4844 (toll-free in US)
Canada:	Hewlett-Packard Canada Ltd. 5150 Spectrum Way Mississauga, Ontario L4W 5G1 (905) 206 4725
Europe:	Hewlett-Packard European Marketing Centre Postbox 999 1180 AZ Amstelveen The Netherlands (31 20) 547 9900
Japan:	Yokogawa-Hewlett-Packard Ltd. Measurement Assistance Center 9-1, Takakura-Cho, Hachioji-Shi Tokyo 192, Japan (81) 426 56 7832 (81) 426 56 7840 (FAX)
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1 Welcome to the HP E5500B Phase Noise Measurement System Series of Solutions

What You'll Find in This Chapter...

Introduction

Preconfigured System
A preconfigured system includes a computer shipped from Hewlett-Packard with the hardware and software preinstalled.

This installation guide will take you though the process of installing both the hardware (if you did not order a **preconfigured system** from Hewlett-Packard) and the HP E5500 Phase Noise Software. A confidence test is also included as the last step in the installation procedure.

Table 1 Installation Steps

If you ordered a preconfigured system, do these steps:	If you ordered an Option 1FF (delete computer), do these steps:
Skip "System Requirements" on page 1-14	Read "System Requirements" on page 1-14
"Step 1. Unpacking Your System" on page 1-15	"Step 1. Unpacking Your System" on page 1-15
Skip Steps 2 to 8	"Step 2. Installing the Hardware" on page 1-16
	"Step 3. Installing the I/O Libraries" on page 1-26
	"Step 4. Installing the PC-Digitizer Software" on page 1-29
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	"Step 8. Entering the License Key for the Phase Noise Test Set" on page 1-42
"Step 9. Starting the Measurement Software" on page 1-45	"Step 9. Starting the Measurement Software" on page 1-45
"Step 10. Using Server Hardware Connections to Specify Assets for the Confidence Test" on page 1-46	"Step 10. Using Server Hardware Connections to Specify Assets for the Confidence Test" on page 1-46
"Step 11. Running the System Confidence Test" on page 1-48	"Step 11. Running the System Confidence Test" on page 1-48

System Requirements

The setup program in the HP E5500 Phase Noise Measurement Software makes installation easy. In case you want a quick review of the system requirements, we have listed them first.

NOTE

HP E5500 Option 1FF (delete computer) users are required to supply an HP 82341C HP-IB Interface Card for their computer.

The system requirements for the phase noise measurement software are:

- Pentium® microprocessor (100 MHz or higher recommended)
- 32 megabytes (MB) of memory (RAM)
- 1 gigabyte (GB) hard disk
- Super Video Graphics Array (SVGA)
- 2 additional 16-bit ISA slots available for the phase noise system hardware.
  - 1 for PC-Digitizer
  - 1 for HP-IB Interface Card
- Windows NT 4.0®
- Windows NT 4.0 Service Pack 3
- HP 82341C HP-IB Interface Card (required)

Step 1. Unpacking Your System

1. Unpack and inspect the shipping container and its contents thoroughly to ensure that nothing was damaged during shipment.

   If the container or packing material is damaged, the contents should be checked both mechanically and electrically. If the contents are damaged or defective, contact your nearest Hewlett-Packard Sales and Service office. Keep the shipping materials for the carrier's inspection.

2. Verify that all parts and materials were included in the shipping container:

- HP E5500 Phase Noise Measurement System CD-ROM
- HP E5500 Software Keyword Licence Certificate
- HP E5500 User's Guide
- HP E5500B Installation Guide
- HP 9300-1408 Disposable Grounding Strap (Option 1FF)
- HP 5957-4369 Electrostatic Discharge (ESD) Warning Pamphlet
- PC-Digitizer Card (Option 1FF)

Table 1-2 Connectors and Adapters

Part Number	Description	HP 70420A	HP 70420A Option 001	HP 70420A Option 201	HP 70422A
1250-0207	BNC, 50 ohm Termination	1	1	1	
1250-0780	Adapter, N(m) - BMC(f)	3	2	3	1
1250-1250	Adapter, N(m) - SMA(f)		1		2
1250-2015	Adapter, SMA(f) - BNC(m)				1
5061-5311	Adapter/Saver, 3.5mm(f) - 3.5mm(f)		2	2	
1250-1200	Adapter, SMA(m) - BNC(f)		2		

Step 2. Installing the Hardware

NOTE

If you have ordered a preconfigured phase noise system from Hewlett-Packard, skip this step and proceed to "Step 9. Starting the Measurement Software" on page 1-45.

Installing the phase noise hardware into your computer involves the following steps:

Step 2a - Removing your Computer's Cover, page 1-17

Step 2b - Accessing your Computer's ISA Slots, page 1-18

Step 2c - Taking ESD Precautions, page 1-19

Step 2d- Installing the Interface Cards, page 1-20

Step 2e - Replacing the Computer Cover, page 1-23

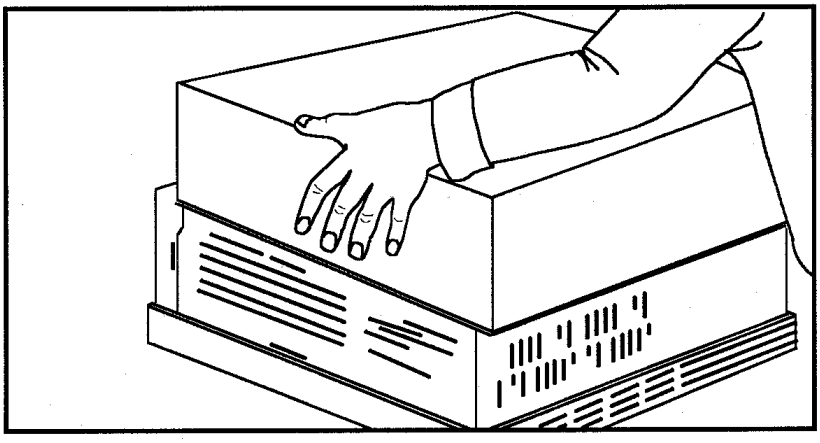
Step 2a - Removing your Computer's Cover

CAUTION

Refer to your computer's documentation for installation safety instructions and specific instructions for opening your computer.

Use the following steps to install the HP-IB and PC-Digitizer cards in your computer:

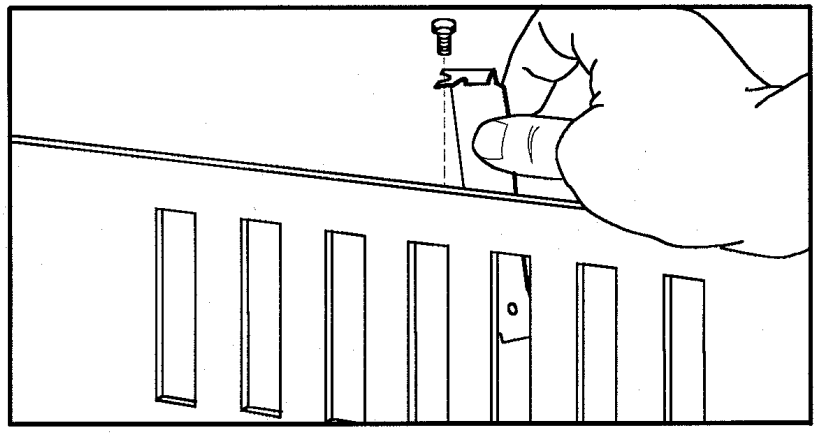
3. Power down the computer and all its peripherals
4. Disconnect the power cord from the computer
5. Unlock and remove the cover from the computer. This gives access to the I/O slots. (See your computer documentation for detailed instructions.)



Step 2b - Accessing your Computer's ISA Slots

6. Look for suitable ISA expansion slots for both the HP-IB and PC-Digitizer cards and remove the back panel's cover plates. Choose slots that give good access to the HP-IB and PC-Digitizer connectors.

   The following drawing shows a view of the ISA slots vertically mounted; your computer's ISA slots may be horizontally mounted, but the process is the same.



Step 2c - Taking ESD Precautions

CAUTION

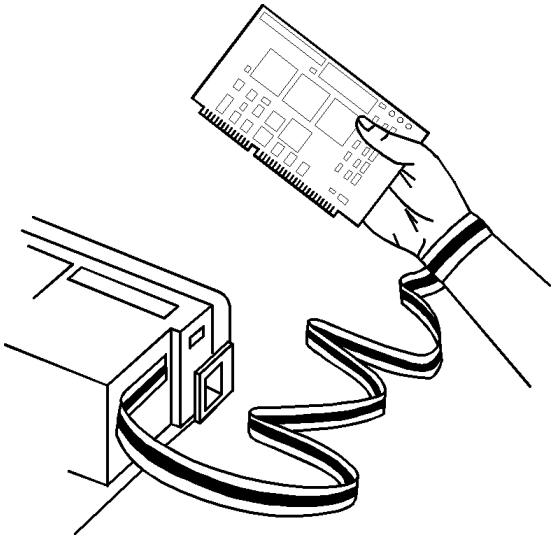
To prevent possible ESD damage, you must be properly grounded with a grounding wrist strap before touching the PC-Digitizer or HP-IB (customer supplied) Interface Cards. While inserting the cards, be sure to hold the cards by their edges.

7. Using the disposable grounding strap, supplied with the PC-Digitizer interface card, unwrap the first two folds of the wrist strap and wrap the exposed adhesive side firmly around your wrist.

CAUTION

Wear this grounding wrist strap before unpacking or touching the PC-Digitizer or HP-IB interface cards; it is provided for control of static electricity. Failure to use the grounding wrist strap properly can result in damage to electronic devices and assemblies

8. Unroll the rest of the wrist strap and peel the liner from the copper foil at the opposite end.
9. Attach the copper foil to a convenient and exposed electrical ground somewhere on the computer's chassis. This should be an unpainted surface of the computer cabinet.

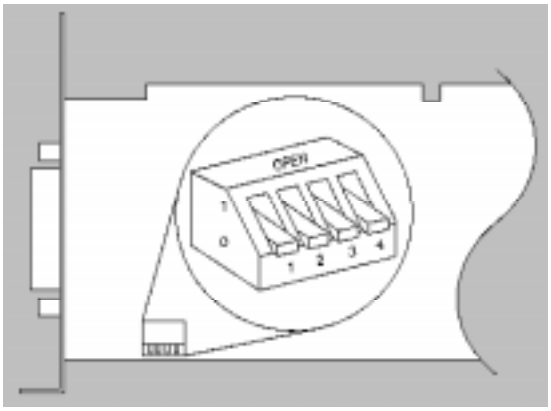


Step 2d- Installing the Interface Cards

Installing the HP-IB Interface Card

10. Verify that the HP-IB (HP 82341C HP-IB) Interface card is set to the following settings:

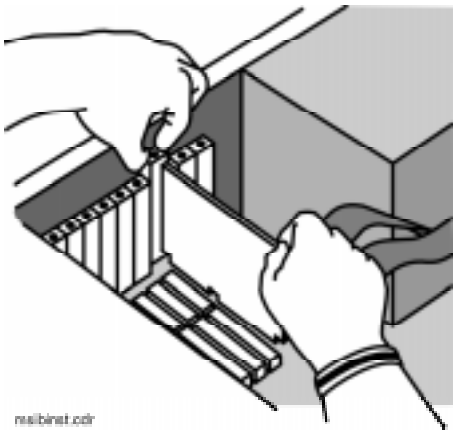
- switches 1-2-3 set the base port address
  - 0-0-0: 0x250-0x257 (default)
- switch 4 is not used



11. Insert the HP-IB interface edge connector into the expansion slot connector of the computer. Make sure the interface is fully seated by pushing firmly on the edge of the card with the palm of your hand. The HP-IB connector should extend through the back panel opening to allow cable installation.

NOTE

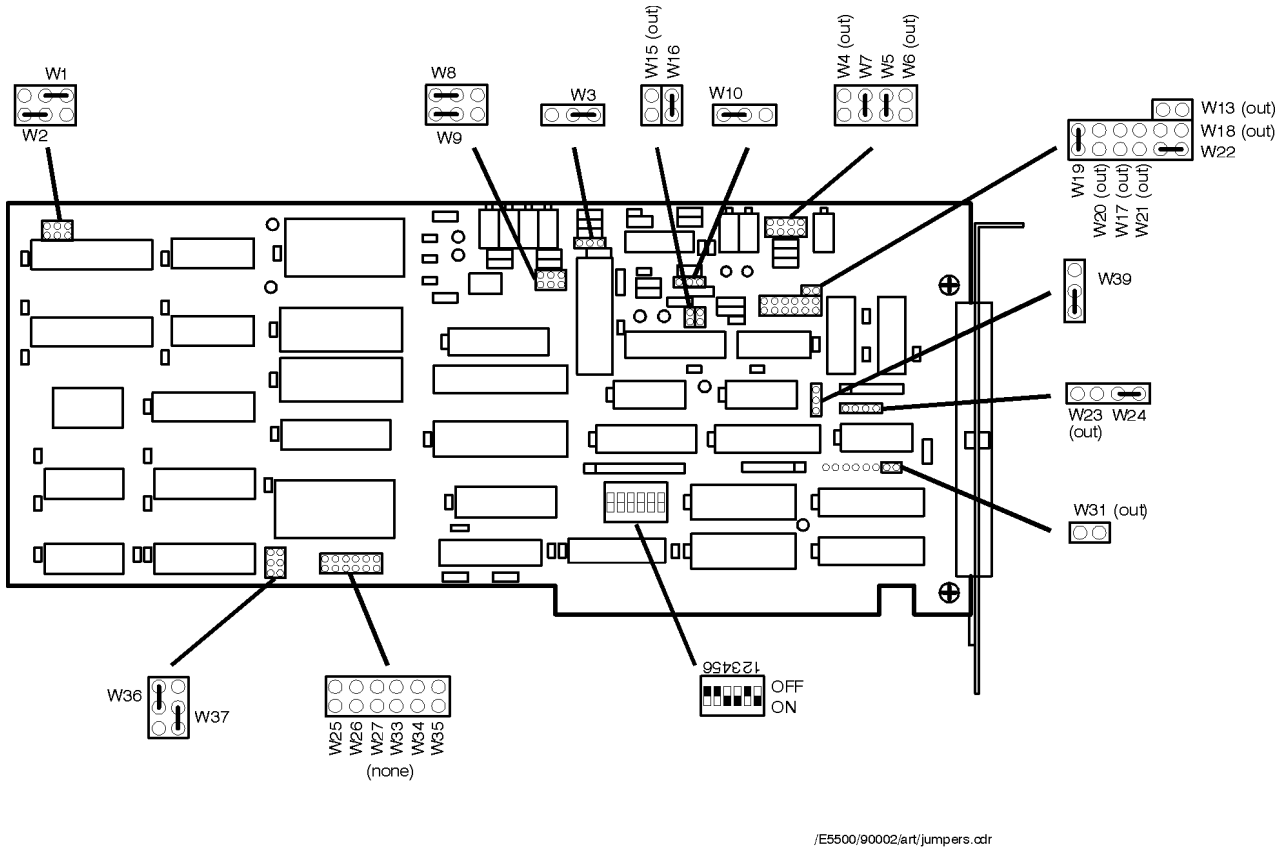
Use of a HP-IB connector extender may be necessary for adequate clearance between the HP-IB cable and the computer chassis.



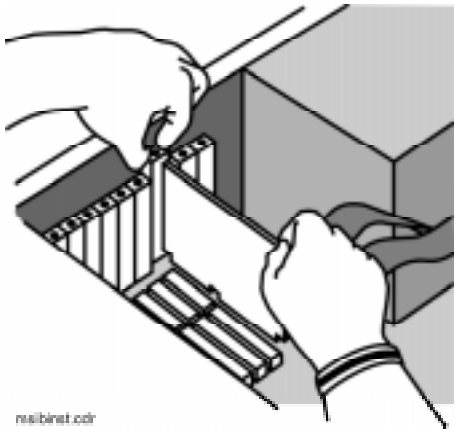
12. Replace the HP-IB back-panel cover plate screw to hold the interface in place. (Save the blank cover plate for use if the interface is removed later.

Installing the PC-Digitizer Interface Card

13. Verify the following jumper and DIP switch settings prior to installing the PC-Digitizer interface card.



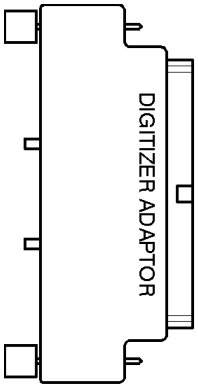
14. Insert the PC-Digitizer interface edge connector into the expansion slot connector of the computer. Make sure the interface is fully seated by pushing firmly on the edge of the card with the palm of your hand.



15. Replace the PC-Digitizer back-panel cover plate screw to hold the interface in place. (Save the blank cover plate for use if the interface is removed later.
16. Replace the computer's cover as described in you computer's documentation.

Installing the Digitizer Adapter.

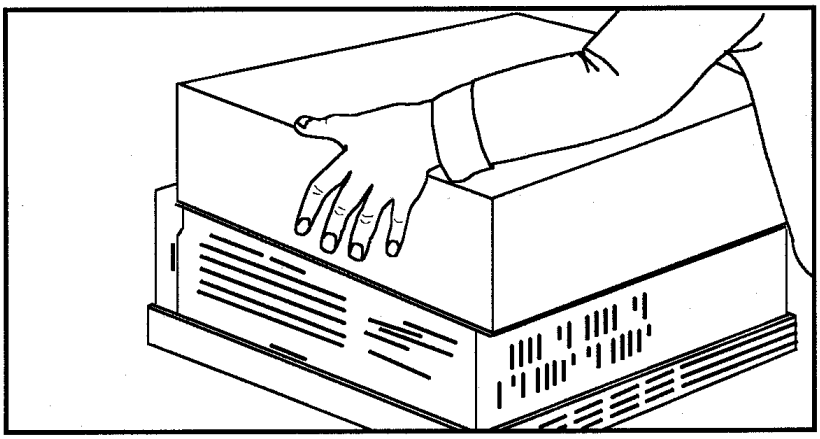
17. Connect the Digitizer Adapter to the back of the PC-Digitizer interface card.



adapter.cdr

Step 2e - Replacing the Computer Cover

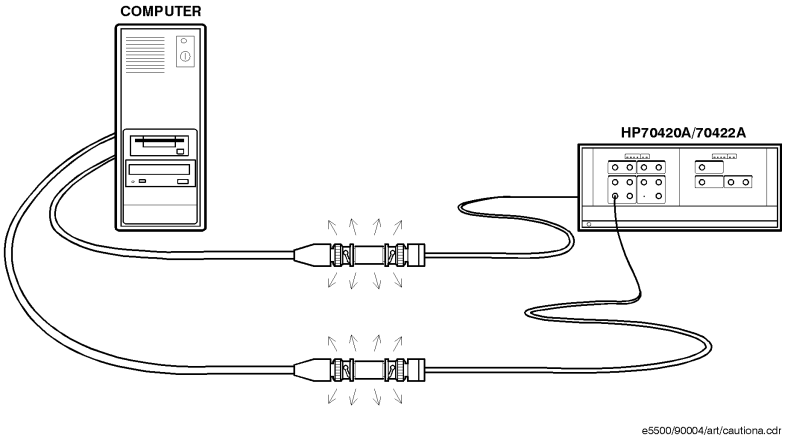
18. Replace the computer cover as described in your computer's documentation.



19. Connect the following cables between the PC digitizer and HP 70420A Test Set (refer to the connect diagrams examples on the next page):
    - SMB (f) to BNC (m) cable between the PC digitizer interface card adapter's input connector and the HP 70420A Test Set's front-panel <100 kHz output connector.
    - SMB (f) to BNC (m) cable between the PC digitizer interface card adapter's output connector and the HP 70420A Test Set's rear-panel Noise Source Input connector.

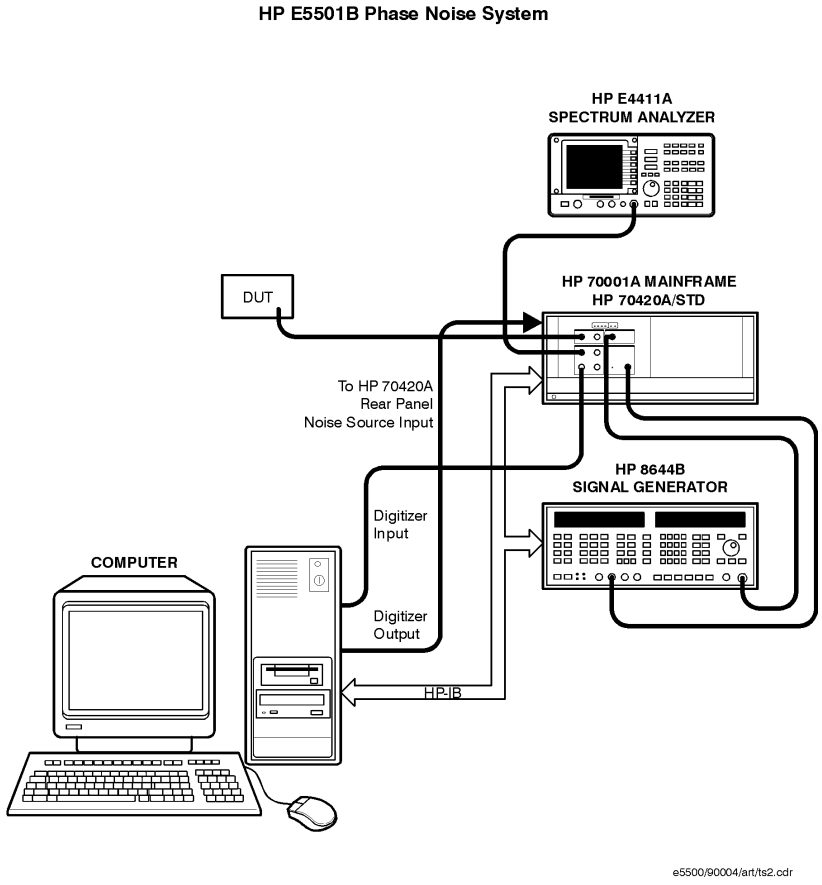
CAUTION

When using extender cables, do not allow the PC Digitizer input/output cables to touch. Shorting the PC Digitizer input/output cables together defeats the floating input circuit on the PC Digitizer's interface board, which may cause severe ground loops and unwanted spurs.

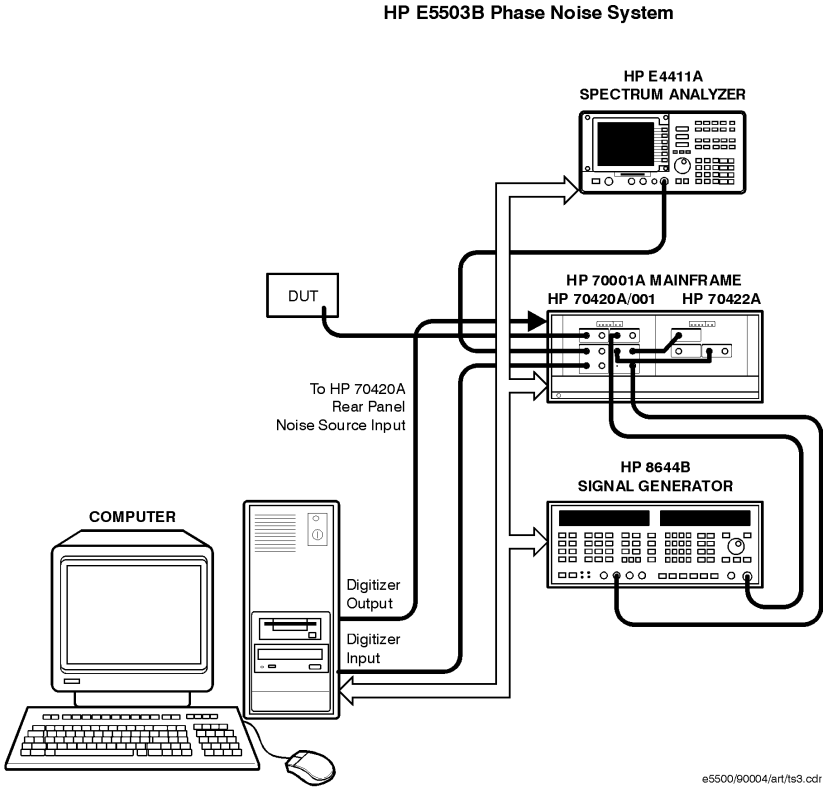


20. Refer to the following system connect diagram examples for more information about system interconnections:
    - “HP E5501B Connect Diagram Example” on page 1-24
    - “HP E5503B Connect Diagram Example” on page 1-25
    - “HP E5504B Connect Diagram Example” on page 1-25

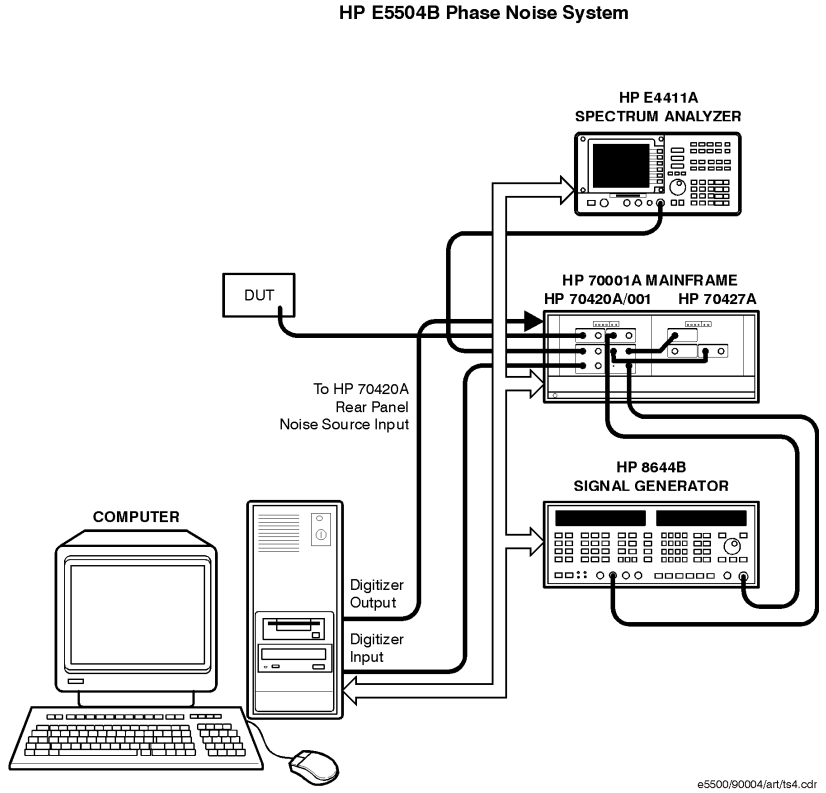
HP E5501B Connect Diagram Example



HP E5503B Connect Diagram Example



HP E5504B Connect Diagram Example



Step 3. Installing the I/O Libraries

NOTE

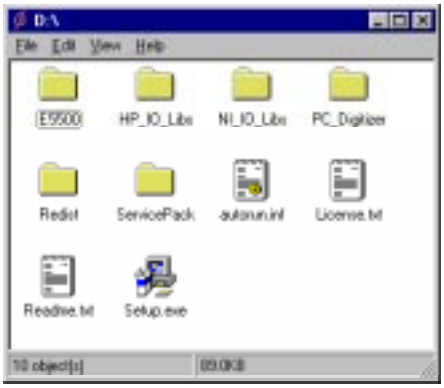
If you have ordered a preconfigured phase noise system from Hewlett-Packard, skip this step and proceed to “Step 9. Starting the Measurement Software” on page 1-45.

Installing the I/O libraries involves the following steps:

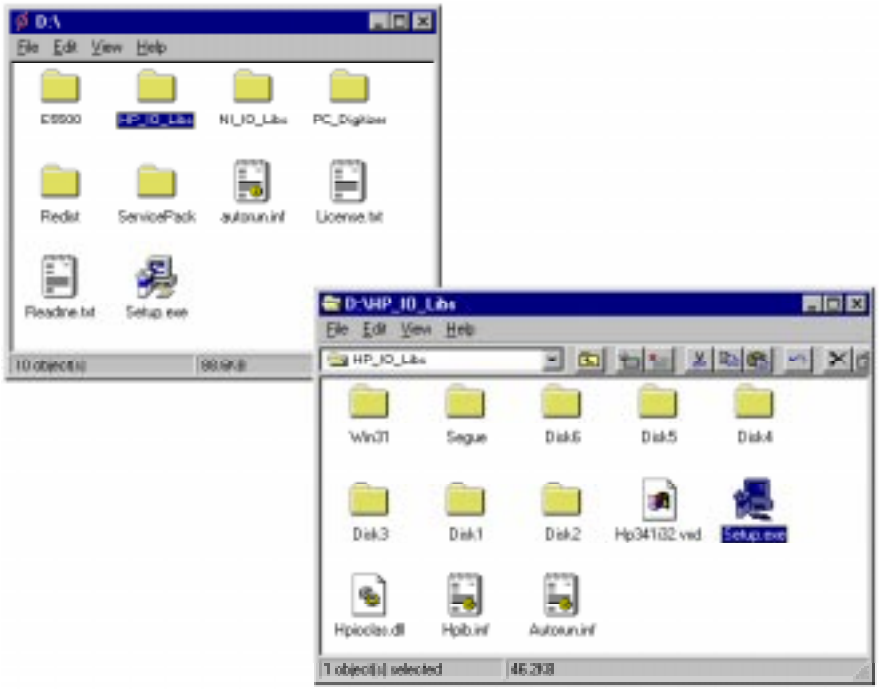
- **Step 3a - Installing the HP I/O Libraries**, page 1-26
- **Step 3b - Installing the HP I/O Library Upgrade**, page 1-28

Step 3a - Installing the HP I/O Libraries

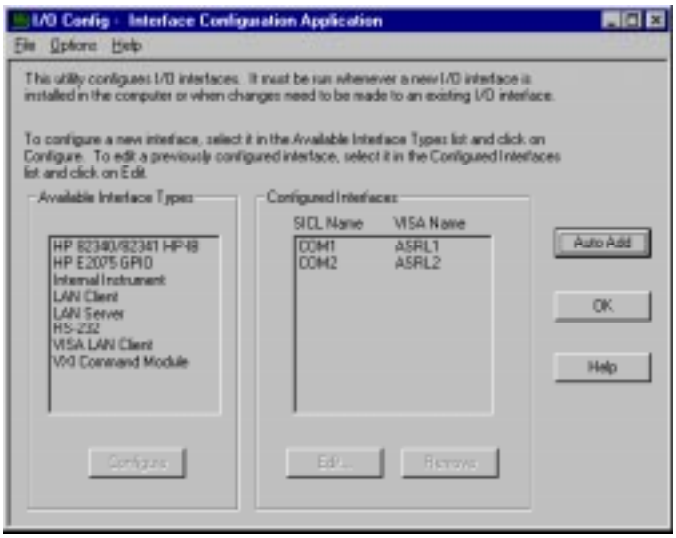
1. Make sure your computer and monitor are turned on.
2. Place the HP E5500 Phase Noise Measurement Software disk in the disc holder and insert in the CD-ROM drive.
3. The following dialog box will appear.



4. Double-click on **HP_IO_libs**, then on **Setup.exe** and follow the instructions (accept the default settings).



5. Click the **Auto Add** button to automatically configure the HP-IB Card.

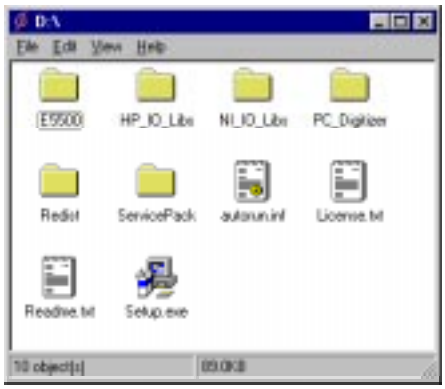


NOTE

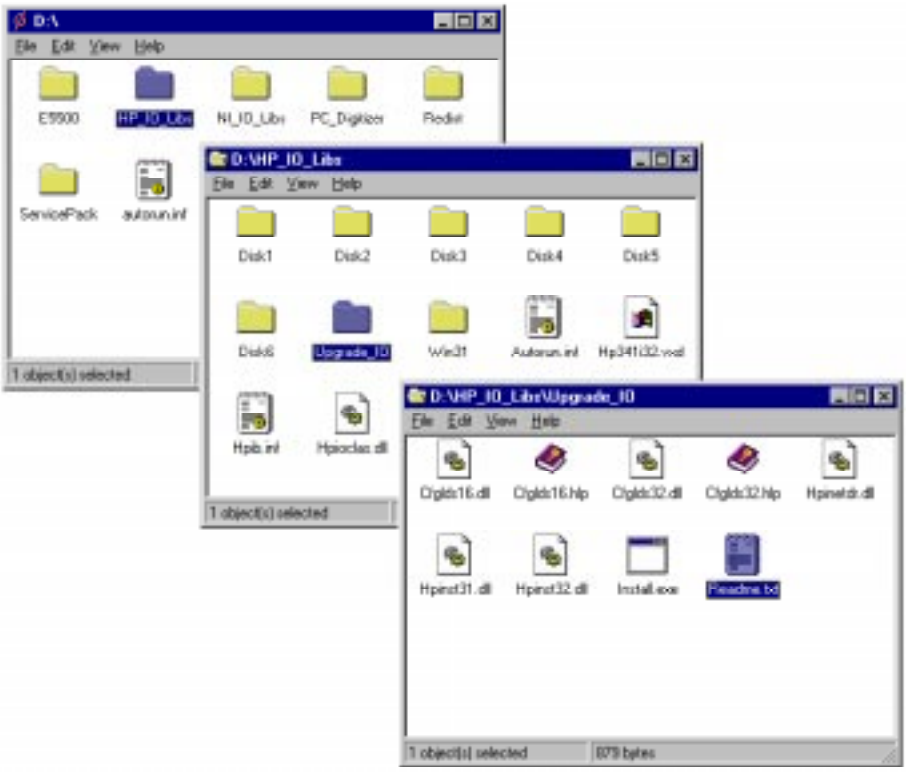
When offered the choice, do not restart your computer at this time.

Step 3b - Installing the HP I/O Library Upgrade

1. Make sure your computer and monitor are turned on.
2. Place the HP E5500 Phase Noise Measurement Software disk in the disc holder and insert in the CD-ROM drive.
3. The following dialog box will appear.



4. Double-click on **HP_IO_libs**, **Upgrade_IO**, then on **Readme.txt** and follow the instructions in the Readme.txt file.



NOTE

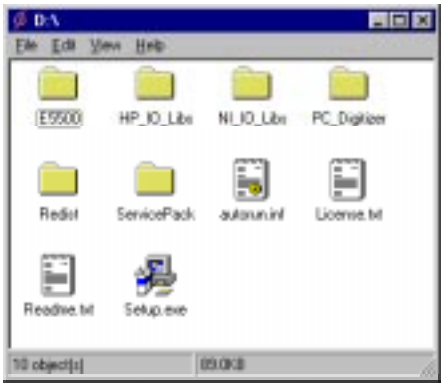
When offered the choice, do not restart your computer at this time.

Step 4. Installing the PC-Digitizer Software

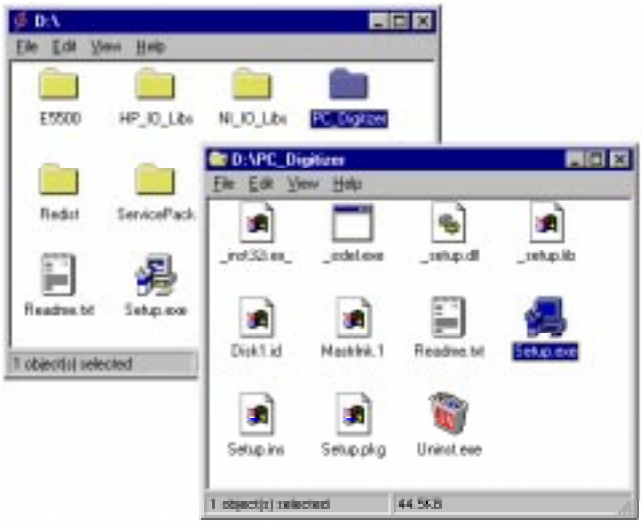
NOTE

If you have ordered a preconfigured phase noise system from Hewlett-Packard, skip this step and proceed to "Step 9. Starting the Measurement Software" on page 1-45.

1. Make sure your computer and monitor are turned on.
2. Place the HP E5500 Phase Noise Measurement Software disk in the disc holder and insert in the CD-ROM drive.
3. The following dialog box will appear.



4. Double-click on **PC_Digitizer,** then on **Setup.exe** and follow the instructions (accept the default settings).



NOTE

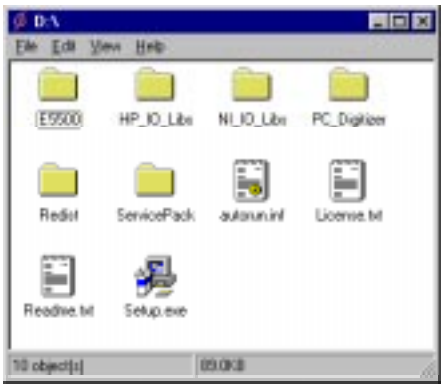
When offered the choice, do not restart your computer at this time.

Step 5. Installing the Windows NT 4.0® Service Pack

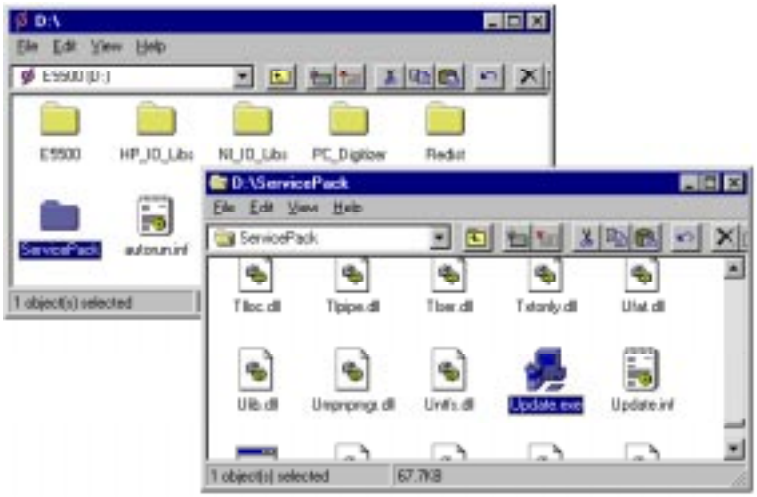
NOTE

If you have ordered a preconfigured phase noise system from Hewlett-Packard, skip this step and proceed to "Step 9. Starting the Measurement Software" on page 1-45.

1. Make sure your computer and monitor are turned on.
2. Place the HP E5500 Phase Noise Measurement Software disk in the disc holder and insert in the CD-ROM drive.
3. The following dialog box will appear.



4. Double-click on **Service Pack,** then on **Update exe** and follow the instructions (accept the default settings).



5. Reboot your computer at this time.

Step 6. Installing the Measurement Software

NOTE

If you have ordered a preconfigured phase noise system from Hewlett-Packard, skip this step and proceed to "Step 9. Starting the Measurement Software" on page 1-45.

1. Make sure your computer and monitor are turned on.
2. Place the HP E5500 Phase Noise Measurement Software disk in the disc holder and insert in the CD-ROM drive.
3. The following dialog box will appear. Double click on **Setup.exe** and follow the instructions (accept the default settings).

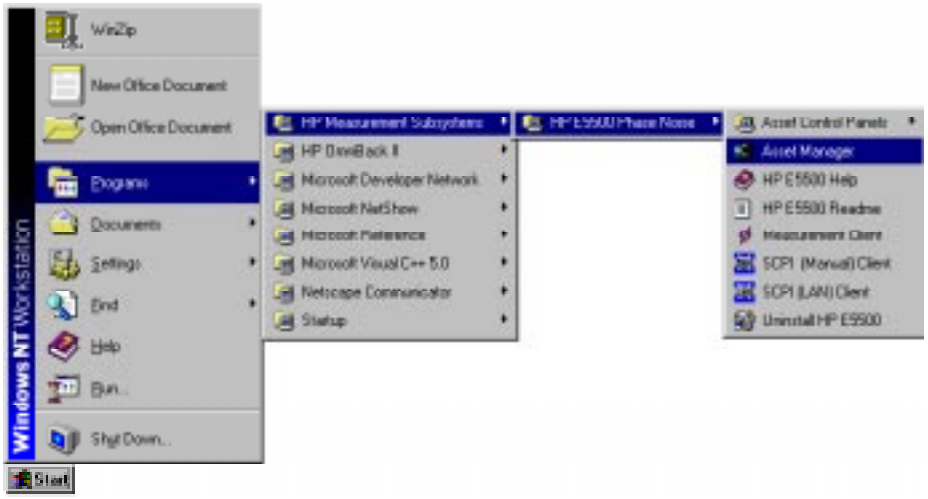
Step 7. Using the Asset Manager to Configure your System

The following procedure will configure both the HP 70420A Phase Noise Test Set and PC-Digitizer so they can be used the E5500A Phase Noise Measurement System to make measurements.

NOTE

If you have ordered a preconfigured phase noise system from Hewlett-Packard, skip this step and proceed to “Step 9. Starting the Measurement Software” on page 1-45.

1. Make sure your computer and monitor are turned on.
2. Place the HP E5500 Phase Noise Measurement Software disk in the disc holder and insert in the CD-ROM drive.
3. Click the **Start** button, point to **Programs**, point to **HP Measurement Systems**, point to **HP E5500 Phase Noise**, and then click **Asset Manager**.

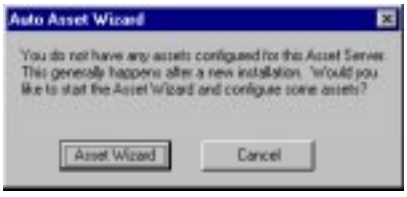


4. To place the Asset Manager in non-demo mode, click **Options,** and then click **Demo Mode** to unselect Demo Mode**.**

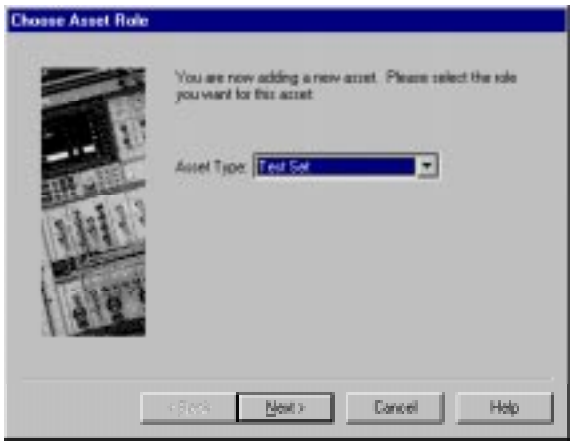
5. Click **OK.** The Asset Manager can be invoked from within the phase noise measurement software, and if that were the case you would need to restart the software for any changes made in the Asset Manager to take effect.

Configuring the HP 70420A Test Set

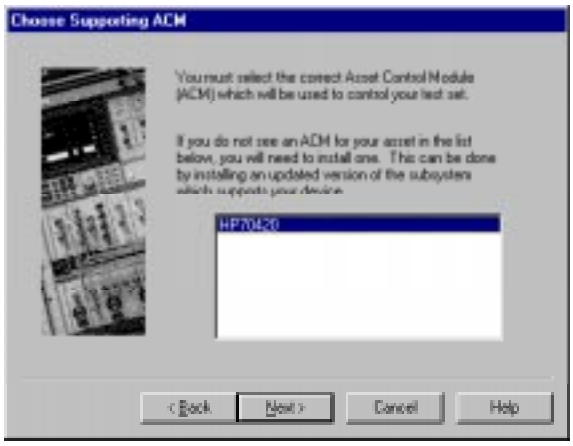
6. Click the **Asset Wizard** button to start configuring the HP 70420A Phase Noise Test Set using the Asset Manager Asset Wizard.



7. From the **Asset Type** pull-down list, select **Test Set,** then click the **Next** button.



8. Click on **HP70420,** then click the **Next** button.



9. From the **Interface** pull-down list, select **GPIB0**.

10. In the **Address** box, type **20.** 20 is the default address for the HP 70420A phase noise test set.

The following are default device addresses used by Hewlett-Packard.

Table 1-3 Default Device Addresses

Instrument	Address
HP 70420A Test Set	20
HP 70422A Downconverter	28
PC Digitizer	320
RF Analyzer	18
Source	19
Counter	3

CAUTION

If an address is a single digit address, for example the counter at address 3, do not add a leading zero (03) to the address. The phase noise software treats 3 and 03 as different addresses.

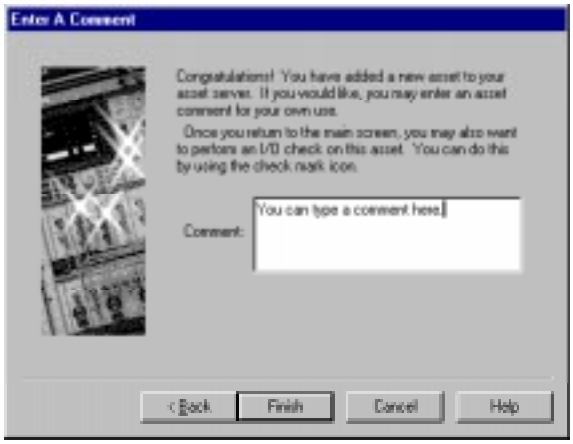
NOTE

The **Library** pull-down list does not apply to this example. It applies specifically to either the Hewlett-Packard HP-IB or the National GPIB

11. Click the **Next** button.

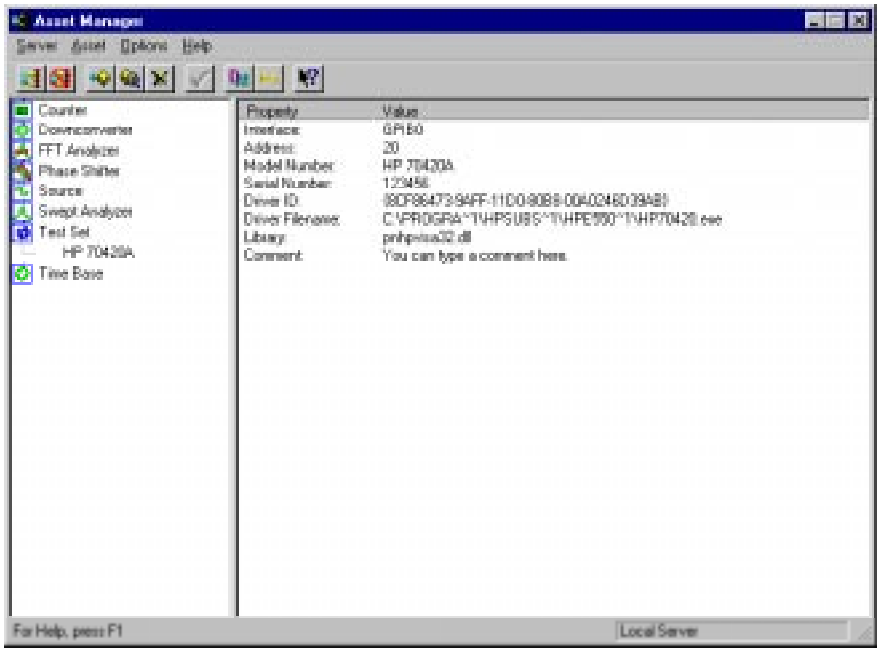
12. In the **Model Number** box, type **HP 70420A.**
13. In the **Serial Number** box, type the serial number for your HP 70420A test set**.** Click the **Next** button.

14. You may type a comment in this dialog box. The comment will associate itself with the asset you have just configured. Click the **Finish** button.



15. The following dialog box will appear.

    The left pane shows either the demo mode, or in this case, a list of assets or asset roles. An asset is any piece of hardware (HP 70420A) that you want configured for system use. An asset role is the general category for hardware (test sets, downconverters, counters, for example. The right pane is information only. The information can be changed by double-clicking a specific asset.



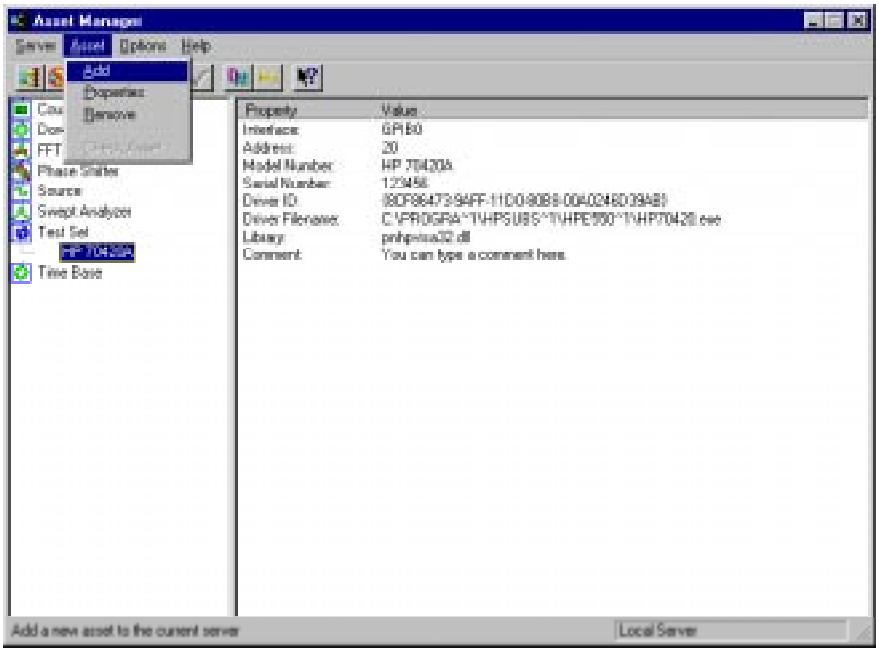
    You have just used the Asset Manager to configure the HP 70420A test set. The process for configuring any asset is essentially the same. As a second example, we will now configure the PC-Digitizer. Both the test

set and PC-digitizer are required to perform the confidence test at the end of this chapter.

Configuring the PC Digitizer

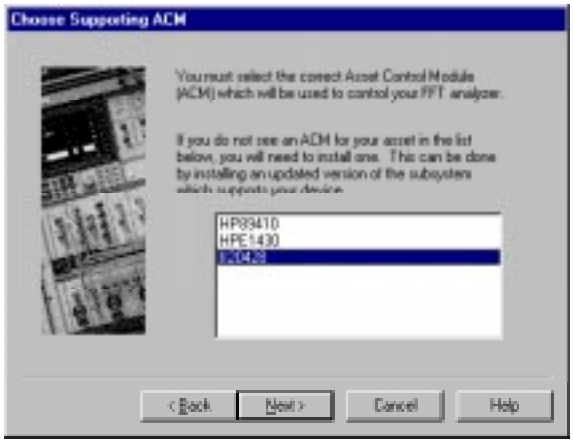
For this example we will use invoke the Asset Manager Wizard from within the Asset Manager. This is the most common way to add assets.

16. click **Asset,** and then click **Add**.



17. From the **Asset Type** pull-down list, select **FFT Analyzer,** then click the **Next** button.

18. Click on **II20428,** then click the **Next** button.



19. From the **Interface** pull-down list, select **PCI**.
20. In the **Address** box, type **320.** 320 is the default address for the II20428 PC-Digitizer.

The following are default device addresses used by Hewlett-Packard.

Table 1-4 Default Device Addresses

Instrument	Address
HP 70420A Test Set	20
HP 70422A Downconverter	28
PC Digitizer	320
RF Analyzer	18
Source	19
Counter	3

CAUTION

If an address is a single digit address, for example the counter at address 3, do not add a leading zero (03) to the address. The phase noise software treats 3 and 03 as different addresses.

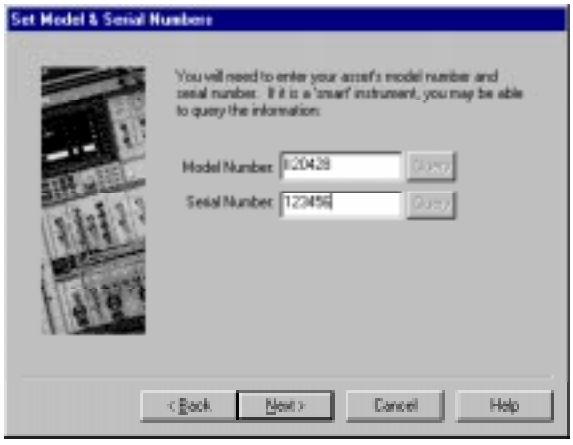
NOTE

The **Library** pull-down list does not apply to this example. It applies specifically to either the Hewlett-Packard HP-IB or the National GPIB interface cards.

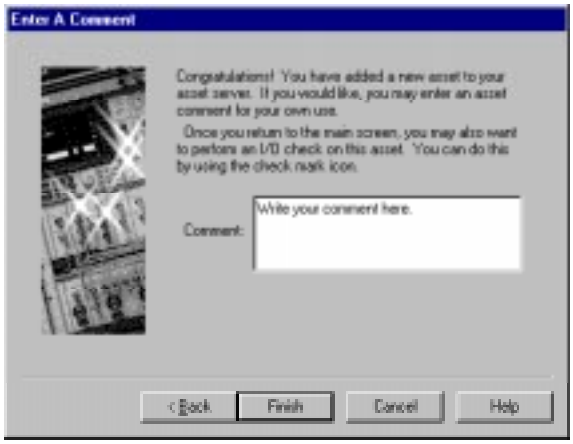
21. Click the **Next** button.

22. In the **Model Number** box, type **II20428.**

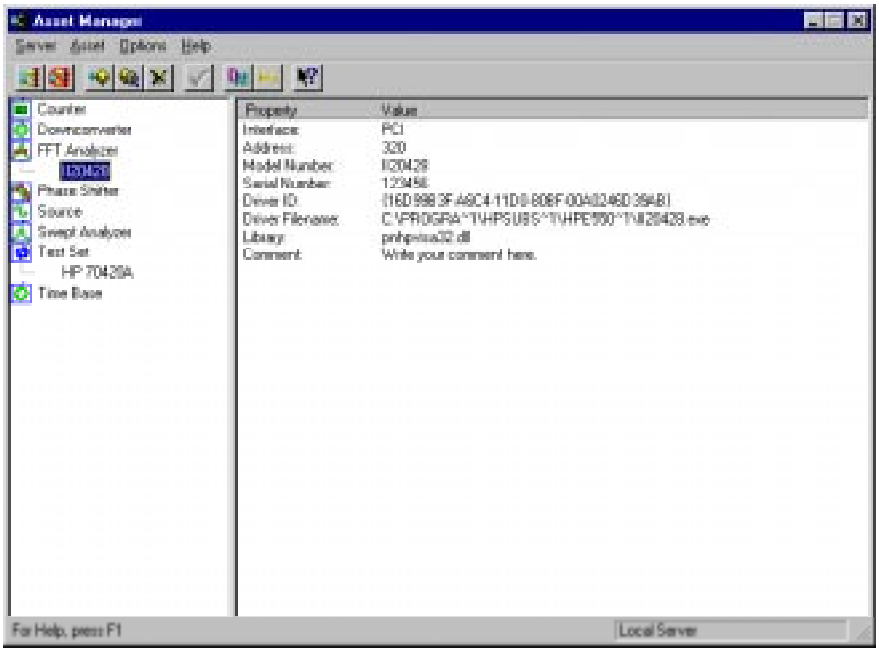
23. In the **Serial Number** box, type the serial number for your PC-digitizer**.** Click the **Next** button.



24. You may type a comment in this dialog box. The comment will associate itself with the asset you have just configured. Click the **Finish** button.



25. You have just used the Asset Manager to configure the PC-digitizer. The process you have used to configure both the HP 70420A and PC-digitizer is the same process you will use to add software controlled assets to the phase noise measurement software.



26. click **Server,** and then click **Exit** to exit the Asset Manager. Next we will enter the license key for the software.

Default Device Addresses

The following are default device addresses used by Hewlett-Packard.

Table 1-5 Default Device Addresses

Instrument	Address
HP 70420A Test Set	20
HP 70422A Downconverter	28
PC Digitizer	320
RF Analyzer	18
Source	19
Counter	3

CAUTION

If an address is a single digit address, for example the counter at address 3, do not add a leading zero (03) to the address. The phase noise software treats 3 and 03 as different addresses.

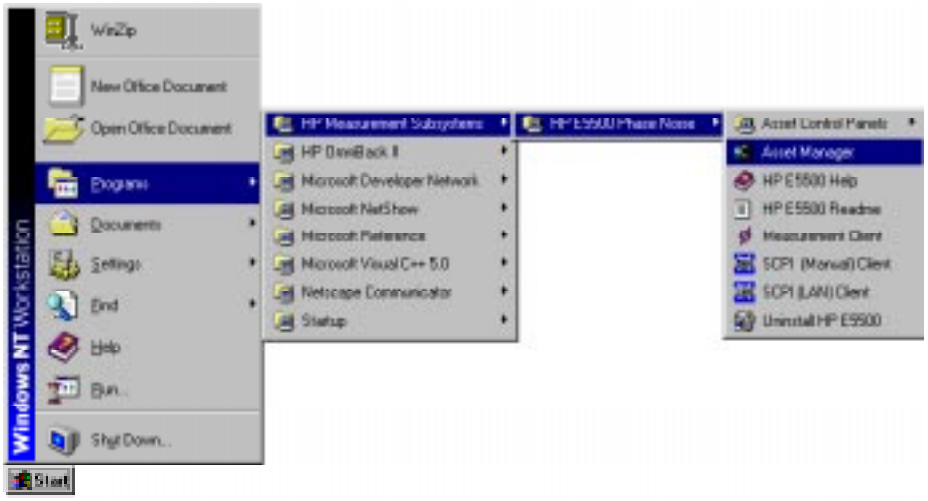
Step 8. Entering the License Key for the Phase Noise Test Set

Use the following procedure enter your keyword for your HP 70420A Phase Noise Test Set.

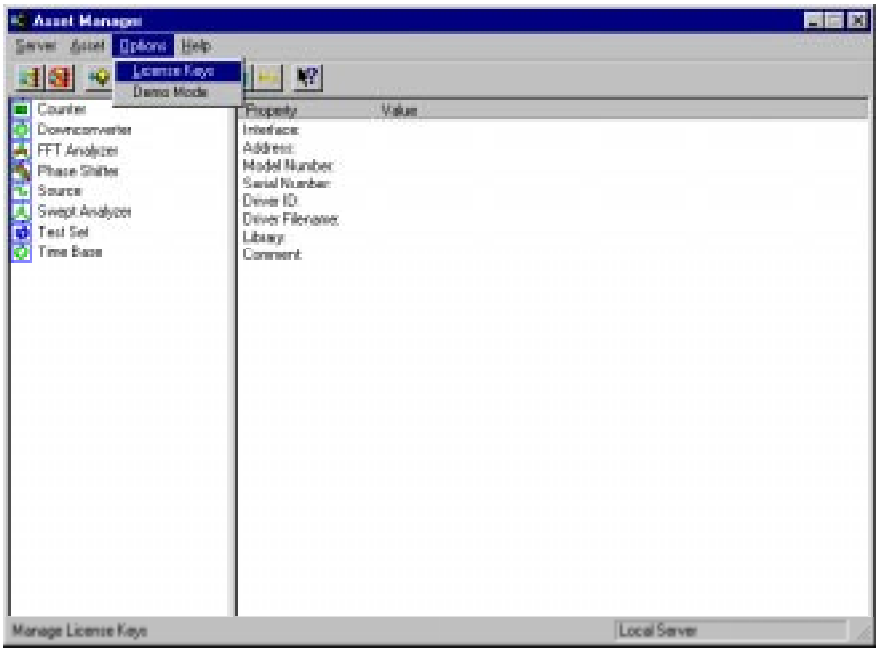
NOTE

If you have ordered a preconfigured phase noise system from Hewlett-Packard, skip this step and proceed to “Step 9. Starting the Measurement Software” on page 1-45.

1. Make sure your computer and monitor are turned on.
2. Click the **Start** button, point to **Programs**, point to **HP Measurement Systems**, point to **HP E5500 Phase Noise**, and then click **Asset Manager**.



3. click **Options,** and then click **License Keys.**



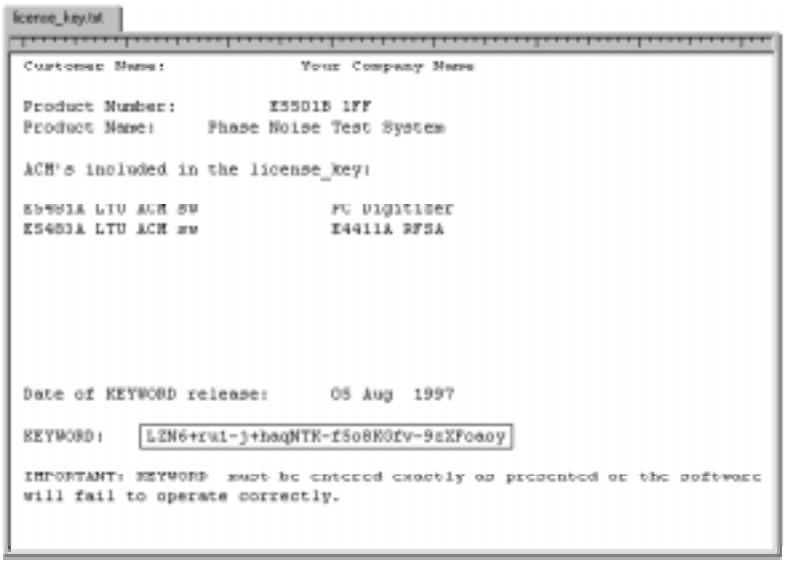
NOTE

The license key for your system is unique and may only be used with a specific HP 70420A Test Set serial number. The license key may be found both on your license-key document and in the file “license_key.txt” on the License_key floppy disk provided with your system.

4. Enter the license key for your HP 70420A Test Set and click the **Set** button. Use the Licence_key.txt file described in the next step to facilitate entering your license key into the licensing dialog box.

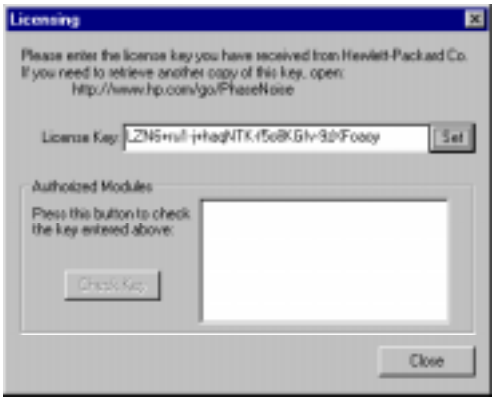
   a. Insert the HP E5500 License Key disk in the computer.

   b. Using Notepad, load **License_key.txt**.



   c. Highlight the keyword in the License_key.txt file and copy it to the dialog box show below, then click the **Set** button.

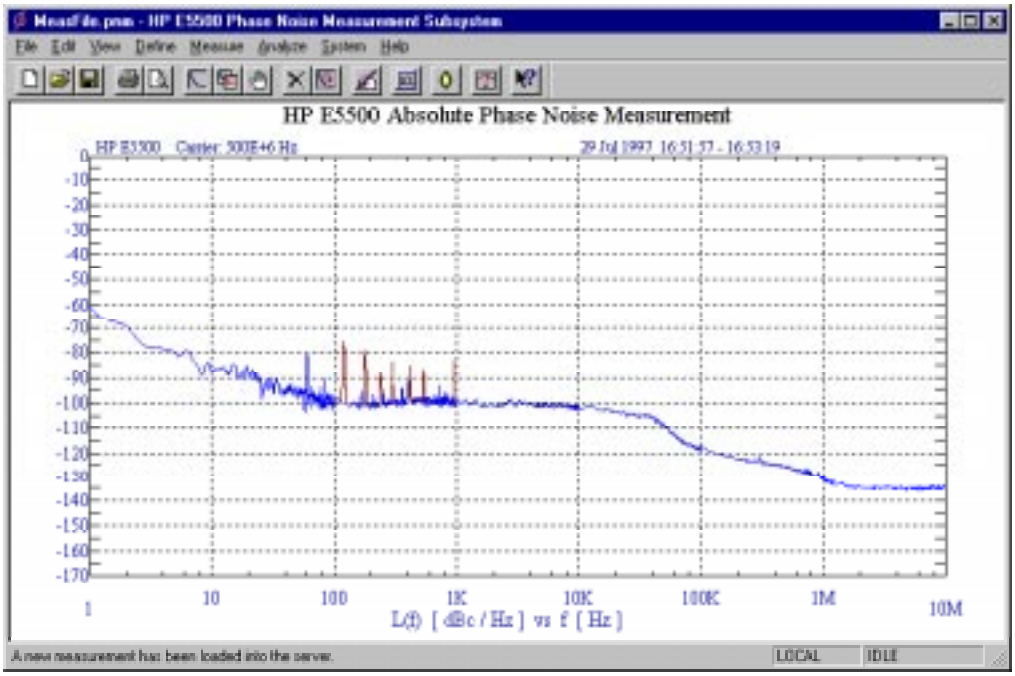
   For information about how to copy and paste information in Windows, refer to the Windows documentation or On-Line Help.



5. The next step is to start the measurement software.

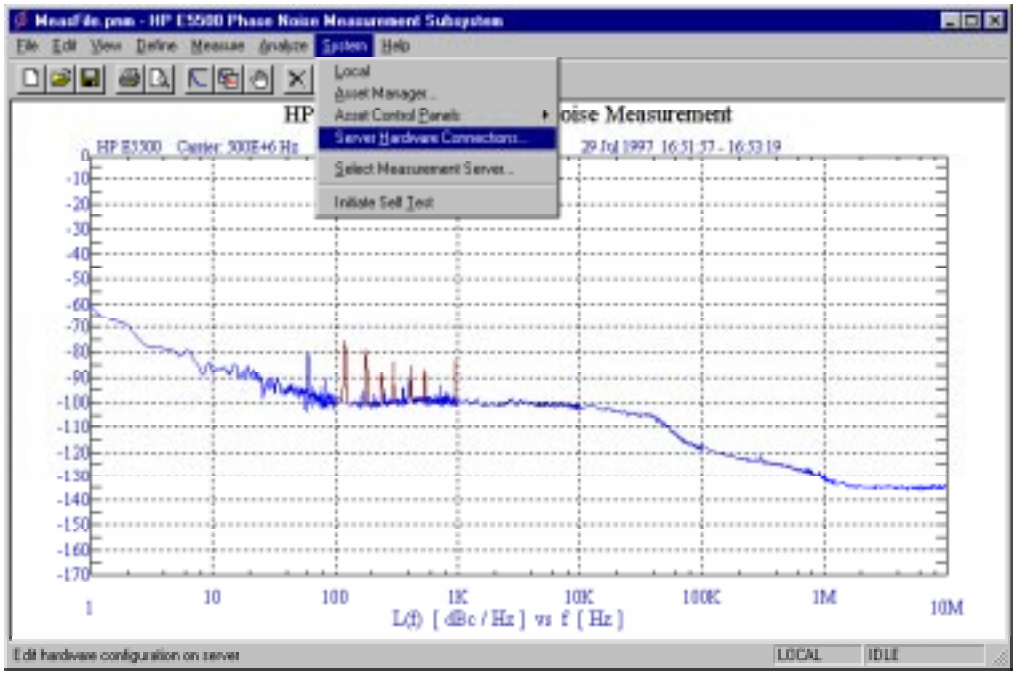
Step 9. Starting the Measurement Software

1. Make sure your computer and monitor are turned on.
2. Click the **Start** button, point to **Programs**, point to **HP Measurement Systems**, point to **HP E5500 Phase Noise**, and then click **Measurement Client**.

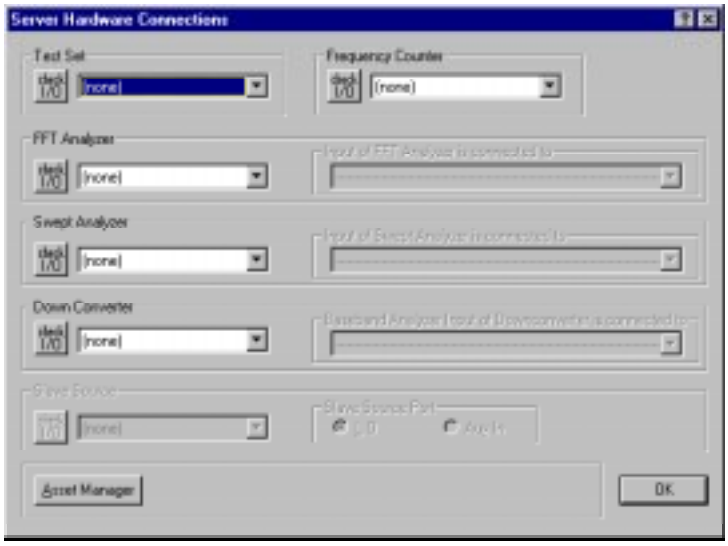


Step 10. Using Server Hardware Connections to Specify Assets for the Confidence Test

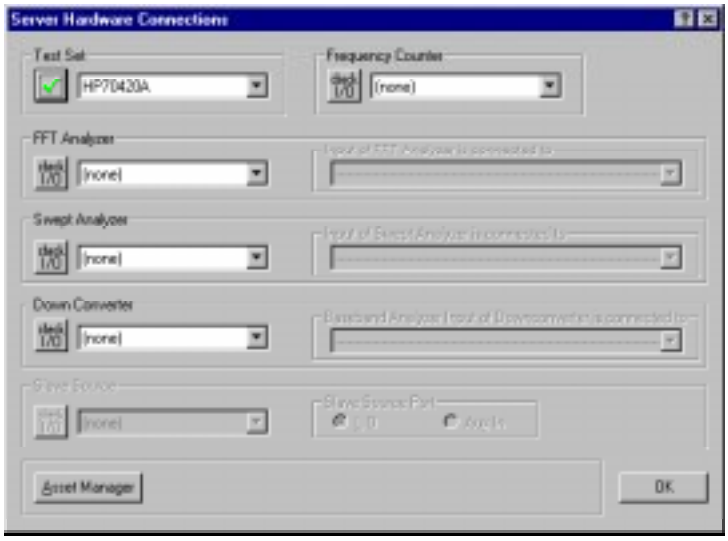
1. From the **System** menu, choose **Server Hardware Connections**.



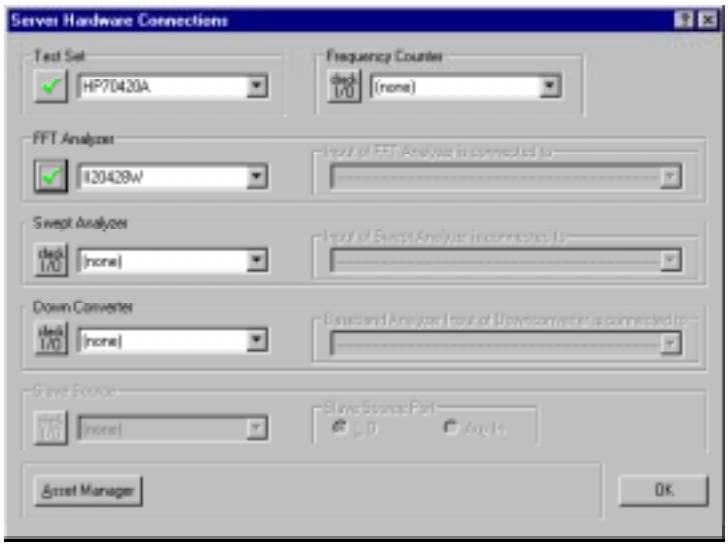
2. The following dialog box will appear.



3. From the **Test Set** pull-down list, select **HP 70420A.** Click the **Check I/O** button. A green check-mark will appear after the I/O check has been performed by the software. If a red circle with a slash appears, return to the Asset Manager (click the **Asset Manager** button) and verify that the HP 70420A and PC-Digitizer are configured correctly (check that the license key has been entered correctly). Also check your system hardware connections. Click the **Check I/O** button for a re-check.



4. From the **FFT Analyzer** pull-down list, select **II20428**. Click the **Check I/O** button. A green check-mark will appear after the I/O check has been performed by the software.



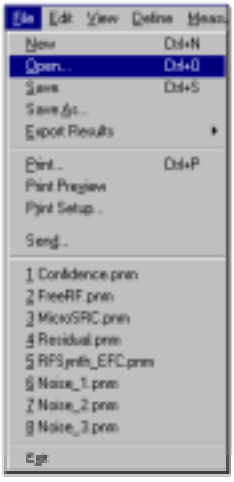
Selecting both the HP 70420A test set and the II20428 PC-digitizer will tie both of those assets to the confidence test we will be performing in the next step.

Step 11. Running the System Confidence Test

This measurement demonstration will introduce you to the system's operation by guiding you through an actual phase noise measurement.

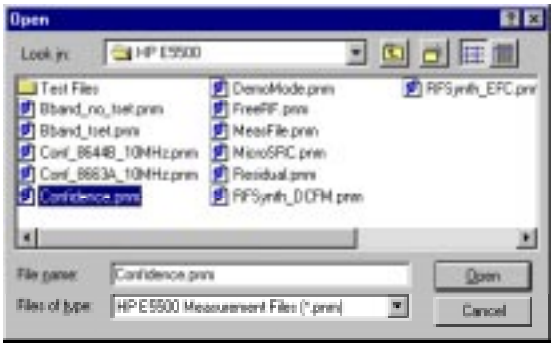
This first measurement tests the HP 70420A Test Set's phase-lock loop and low-noise amplifier circuitry. The phase detectors are not tested. This measurement will also confirm that the PC and test set are communicating with each other.

1. From the **File menu**, choose **Open**.



2. If necessary, choose the drive or directory where the file you want is stored.

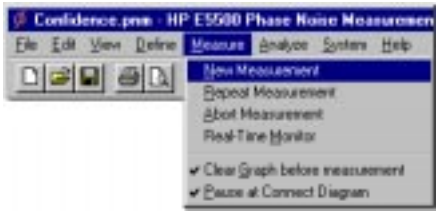
3. In the **File Name** box, choose **Confidence.pnm**.



4. Click the **Open** button.

The appropriate measurement definition parameters for this example have been pre-stored in this file. Table 1-6 on page 1-51 lists the parameter data that has been entered for the HP 70420A Internal Noise measurement example.Beginning the Measurement

1. From the **Measurement** menu, choose **New Measurement**.



2. When the **Perform a New Calibration and Measurement** dialog box appears, click **OK**.

3. When the **Connect Diagram** dialog box appears, connect the 50 Ω termination provided with your system to the HP 70420A Test Set's Noise Input connector.

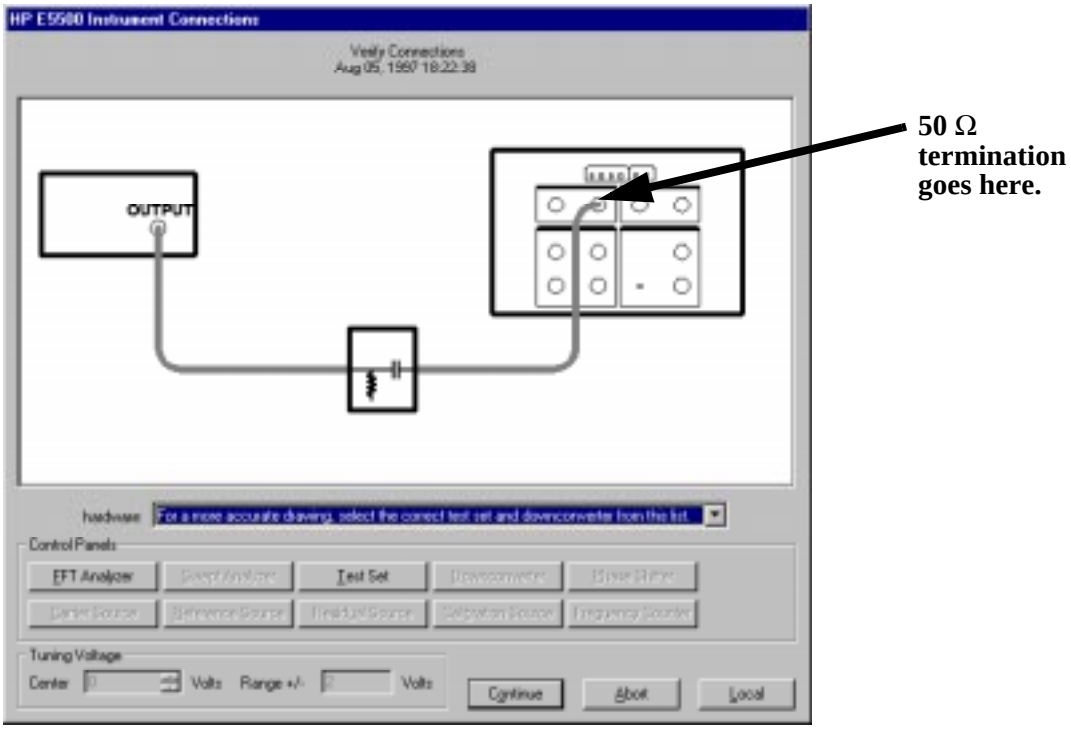


Figure 1-1 Software Confidence Test Connection Diagram.

Making the Measurement

1. Press the **Continue** key. Because you selected New Measurement to begin this measurement, the System starts by running the routines required to calibrate the current measurement setup.

Figure 1-2 shows a typical baseband phase noise plot for an HP 70420A Phase Noise Test Set.

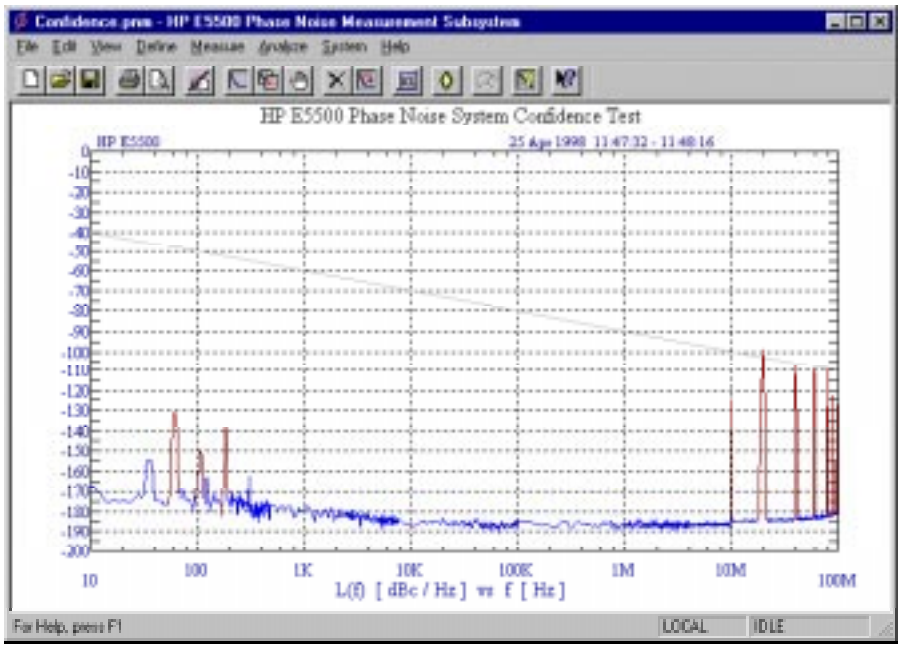


Figure 1-2 Typical Phase Noise Curve for a System Confidence Test.

Congratulations

You have completed a phase noise measurement. You will find that this measurement of the HP 70420A Phase Noise Test Set's phase-lock loop and low-noise amplifier circuitry provides a convenient way to verify that the System hardware and software are properly configured for making noise measurements.

Table 1-6 Parameter Data for the HP 70420A Confidence Test Example

Step	Parameters	Data
1	**Type and Range Tab**	
	Measurement Type	• Baseband Noise (using a test set)
	• Start Frequency	• 10 Hz
	• Stop Frequency	• 100E + 6 Hz (determined by analyzer used)
	• Minimum Number of Averages	• 4
	FFT Quality	• Fast
2	**Cal Tab**	
	• Gain preceding noise input	• 0 dB
3	**Block Diagram Tab**	
	• Noise Source	• Test Set Noise Input
4	**Test Set Tab**	
	Input Attenuation	• 0 dB
	LNA Low Pass Filter	• 20 MHz (Auto checked)
	• LNA Gain	• Auto Gain (Minimum Auto Gain - 14 dB)
	• DC Block	• Not checked
	• PLL Integrator Attenuation	• 0 dBm
5	**Graph Tab**	
	• Title	• HP E5500 Phase Noise System Confidence Test • Single-sideband noise(dBc/Hz)
	• Graph Type	• 10 Hz
	• X Scale Minimum	• 100 E + 6 Hz
	• X Scale Maximum	• 0 dBc/Hz
	• Y Scale Minimum	• - 200 dBc/Hz
	• Y Scale Maximum	• 1 Hz bandwidth
	• Normalize trace data to a:	
	• Scale trace data to a new carrier frequency of:	• 1 times the current carrier frequency • 0 dB
	• Shift trace data DOWN by:	• 0
	• Trace Smoothing Amount	• 0 dB
	• Power present at input of DUT	

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