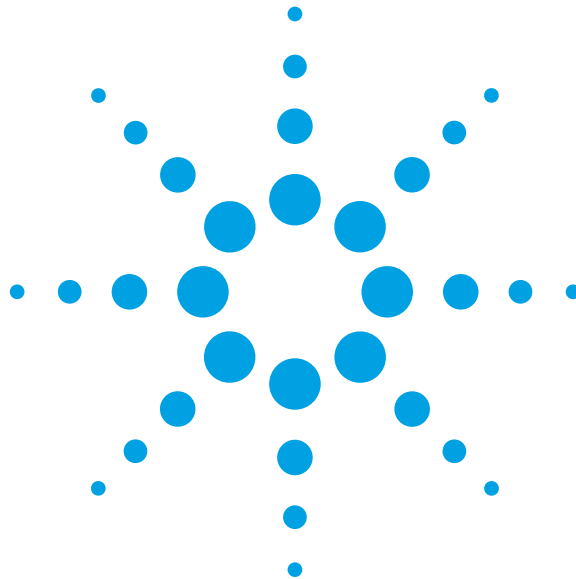


Agilent Technologies

Agilent 82350B PCI GPIB Interface



Installation and Configuration Guide



Agilent Technologies

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82350B Installation and Configuration Guide

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Installing and Configuring the 82350

Installing and Configuring the 82350

This *Agilent 82350B PCI GPIB Interface Installation and Configuration Guide* shows how to install and configure the Agilent 82350B PCI GPIB Interface (called the 82350 in this guide) and shows how to install the Agilent IO Libraries in PCs with Windows 98, Windows Me, Windows NT 4.0, Windows 2000, or Windows XP operating systems.

NOTE

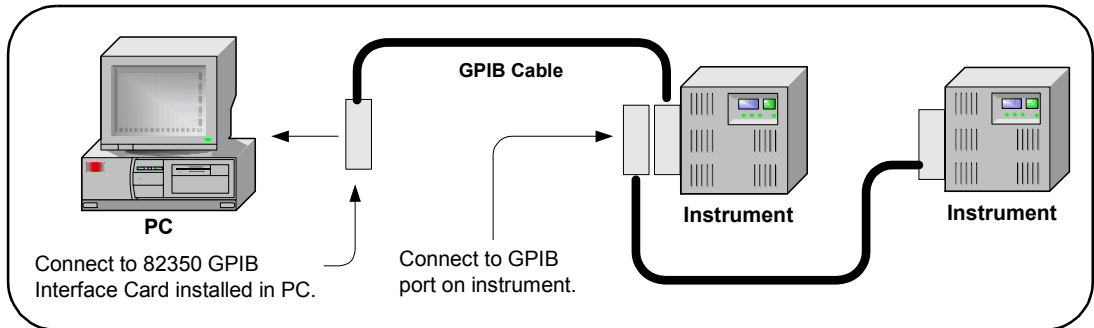
The 82350 interface is not supported on PCs with Windows 3.1 or Windows 3.51 operating systems. In case of difficulty in installing the 82350, see Chapter 2 - Troubleshooting Information.

This chapter shows suggested steps to install the 82350, configure the 82350 interface, and guidelines to begin programming via the 82350 interface, including:

- Getting Started
- Step 1 - Installing the Agilent IO Libraries
- Step 2 - Installing the 82350 in Your PC
- Step 3 - Connecting Instruments to the 82350
- Step 4 - Configuring the 82350
- Step 5 - Communicating with Instruments

Getting Started

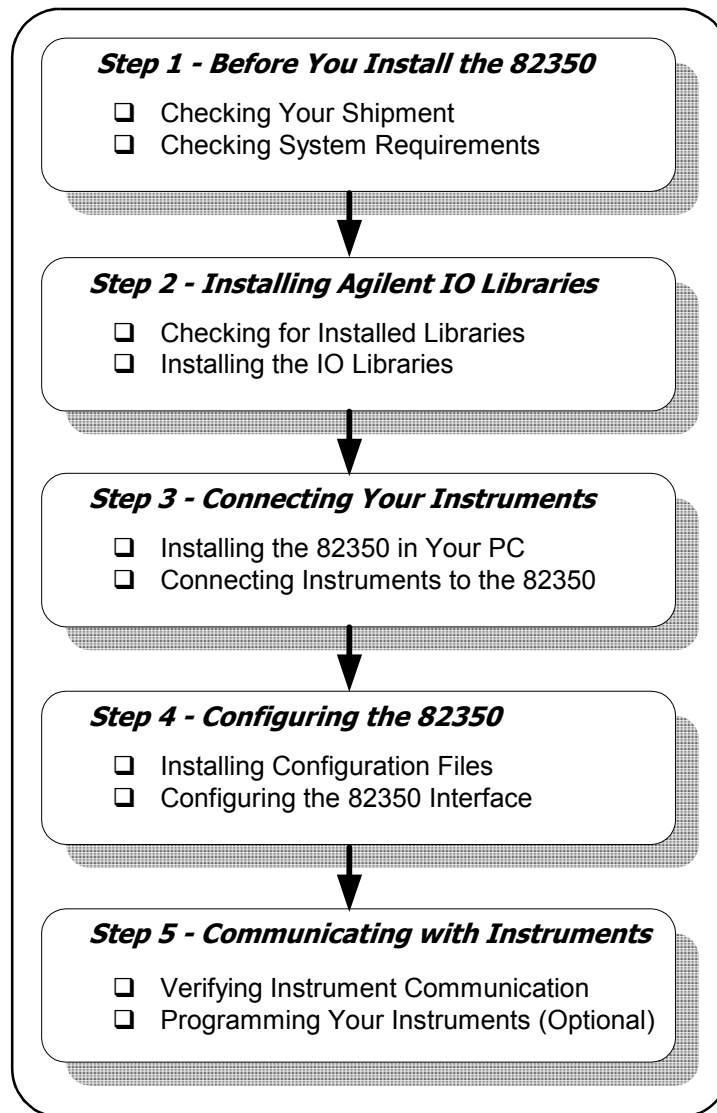
In this guide, an **82350 GPIB Interface System** is defined as a system in which GPIB instruments are connected via GPIB cables to an 82350 PCI GPIB Interface Card (called the 82350 in this guide) that is installed in a Windows 98/2000/NT 4.0/Me/XP PC. This figure shows a typical system.



The figure on the next page shows a suggested sequence of steps to install and configure the 82350 and to communicate between your PC and GPIB instruments via the 82350.

To get started, you may want to copy the figure to use as a guide as you set up your GPIB system. See the associated step if you need more details. See *Chapter 2 - Troubleshooting Guidelines* if you need additional information on setting up the 82350 or GPIB instruments.

Getting Started



Step 1 - Before You Install the 82350

Before you install the 82350, you should:

- Check Your Shipment
- Check System Requirements
- Create an Emergency Repair Disk

Check Your Shipment

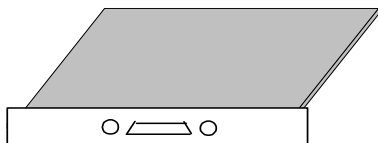
Your 82350 Interface shipment should include the items in the following figure. If any items are missing or damaged, keep the shipping materials and contact Agilent Technologies. See *Chapter 3 - 82350 Guide Information* for addresses/telephone numbers.

CAUTION

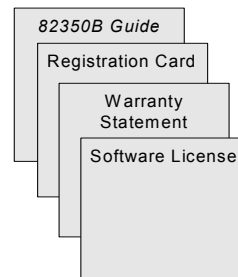
To reduce the risk of damaging the 82350 card, protect the card from static electricity. Leave the card in its anti-static bag until you are ready to install the card. Handle the card ONLY by the sheet metal frame or by the card edges. Never touch any other part of the card.

- Agilent Technologies 82350B PCI GPIB Interface Card
- Agilent IO Libraries for Instrument Control CD
- 82350B PCI GPIB Installation and Configuration Guide
- 82350B Registration Card
- 82350B Warranty Statement
- Software License Agreement

82350B PCI GPIB Interface Card



Agilent IO Libraries for Instrument Control CD



Check System Requirements

Before you install the Agilent IO Libraries, you should verify that your system meets the **minimum** hardware and software requirements listed to install and use the Agilent IO Libraries. Adding additional RAM may improve overall system performance.

Item	Minimum Requirements										
Hardware Requirements											
PC Operation/Memory	100 MHz operation and 64 MBytes RAM										
Hard Drive Space	At least 50 MBytes for VISA and SICL installation.										
PCI Bus Slot	At least one 5V PCI Bus Slot (to install 82350B). 82350B is a 5V card and will not fit in a 3.3V PCI slot.										
Software Requirements											
Operating System	Windows 95/98/Me/NT 4.0/2000/XP										
Agilent IO Libraries Installation Sizes	<table><tbody><tr><td>- Core Installation (LAN and ASRL only)</td><td>5 MB</td></tr><tr><td>- Runtime Installation (adds hw drivers)</td><td>9 MB</td></tr><tr><td>- Full Installation (without manuals)</td><td>14 MB</td></tr><tr><td>- Full Installation (with manuals)</td><td>34 MB</td></tr><tr><td>- Add Adobe Acrobat Reader (version 5.05)</td><td>11 MB addl</td></tr></tbody></table>	- Core Installation (LAN and ASRL only)	5 MB	- Runtime Installation (adds hw drivers)	9 MB	- Full Installation (without manuals)	14 MB	- Full Installation (with manuals)	34 MB	- Add Adobe Acrobat Reader (version 5.05)	11 MB addl
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- Full Installation (without manuals)	14 MB										
- Full Installation (with manuals)	34 MB										
- Add Adobe Acrobat Reader (version 5.05)	11 MB addl										

Create an Emergency Repair Disk

The Agilent IO Libraries include I/O drivers for various PCI plug-in cards. Extensive testing of these drivers and cards has revealed that early revisions of the BIOS code in several PCs are not completely PCI-compliant. This has caused problems when running the Agilent IO Libraries, whether or not the PCI card is installed. Problems can include system errors, operating system crashes, or card initialization failures.

For Windows NT operating systems, most PC manufacturers recommend that before installing any PCI card, you first create an EMERGENCY REPAIR DISK. If your PC exhibits any abnormal behavior following installation of the Agilent IO Libraries, we recommend a BIOS upgrade to the PC. BIOS upgrades are available from most PC manufacturers' websites.

Step 2 - Installing the Agilent IO Libraries

This step shows how to install a full version of the Agilent IO Libraries, using default settings, including:

- Checking for Installed Agilent IO Libraries
- Installing Full Agilent IO Libraries

NOTE

See the Agilent IO Libraries Installation and Configuration Guide for a complete description of the Agilent IO Libraries.

Checking for Installed Agilent IO Libraries

Before you begin installation, check for previously installed Agilent IO Libraries. If a version of the Agilent IO Libraries is installed on your PC, a blue IO icon may be displayed on the Windows taskbar (on the lower right-hand side of the screen).



- If the IO icon is displayed, click the icon and click **About Agilent IO Libraries Control** to display the version. The version must be L.01.00 or greater.
- If the IO icon is not displayed, a version may still be installed. To check this, click **Start | Programs** and look for the **Agilent IO Libraries** program group.
- If this group is displayed, click **Agilent IO Libraries | IO Control** to display the IO icon. Then, click the icon and click **About Agilent IO Libraries Control** to display the installed version (must be L.01.00 or greater).
- If neither the IO icon nor the Agilent IO Libraries program group is displayed, no Agilent IO Libraries are installed and you can use the steps in this chapter to install the libraries.

Step 2 - Installing the Agilent IO Libraries

- If a version of the libraries less than L.01.00 is installed, do **not** use the steps in this chapter. Instead, use the steps in *Agilent IO Libraries Installation and Configuration Guide*. Use these actions to access an electronic (.pdf) version of the *Agilent IO Libraries Installation and Configuration Guide for Windows*.
 - ❑ Insert the *Agilent IO Libraries for Instrument Control* CD (shipped with your 82350) into your CD-ROM drive. When the InstallShield Wizard appears, immediately click **Cancel**.
 - ❑ Use Windows Explorer to navigate to <drive> | *Manuals* and then double-click *install.pdf*, where <drive> is your CD-ROM drive letter. If Adobe Acrobat Reader 3.0 or greater is installed on your PC, the *Agilent IO Libraries Installation and Configuration Guide for Windows* appears.
 - ❑ If Acrobat Reader is not installed on your PC, from your Web browser search for Adobe Acrobat and then click **Adobe Acrobat Reader** to obtain a free download of Adobe Acrobat Reader.)

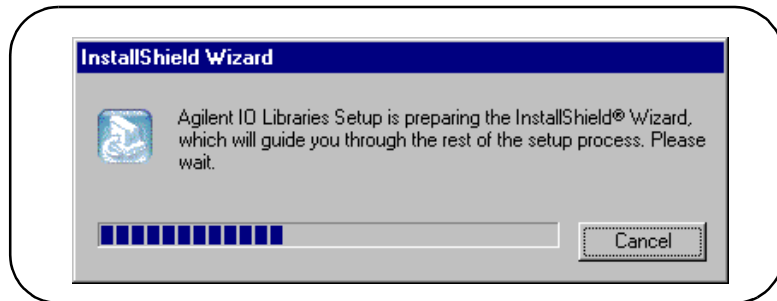
Installing Full Agilent IO Libraries

These steps show how to do a Full Installation of the Agilent IO Libraries in default directories and should be acceptable for most applications. To do a Runtime Installation or Custom Installation of the libraries or to install the libraries in a non-default directory, see the *Agilent IO Libraries Installation and Configuration Guide*.

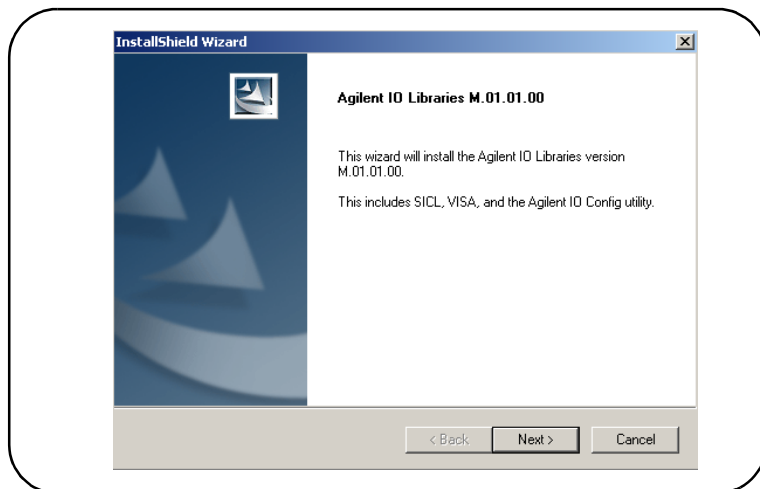
NOTE

A Full Installation allows you to run programs that use the Agilent IO Libraries to communicate with instruments and allows you to develop your own I/O programs. A Runtime Installation allows you to run existing programs on supported interfaces, but you cannot develop new programs that run on the Agilent IO Libraries.

- 1 Turn the PC ON and, as required, install application software such as C/C++, VEE, etc. on your PC.
- 2 Make sure no 82350s are connected to your system. Then, insert the *Agilent IO Libraries for Instrument Control* CD into the CD-ROM drive and wait a few seconds for the application to run.
- 3 The installer should automatically start when the CD is inserted. If not, select **Start | Run** and browse to and select **Setup.exe** on your CD-ROM. Click **Open** to run the application.
- 4 The InstallShield® Wizard appears to begin the installation.



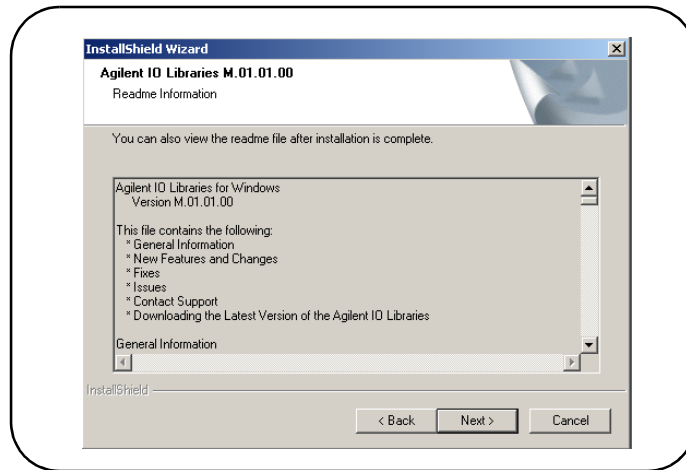
- 5 After a few seconds, the **Title Screen** appears.



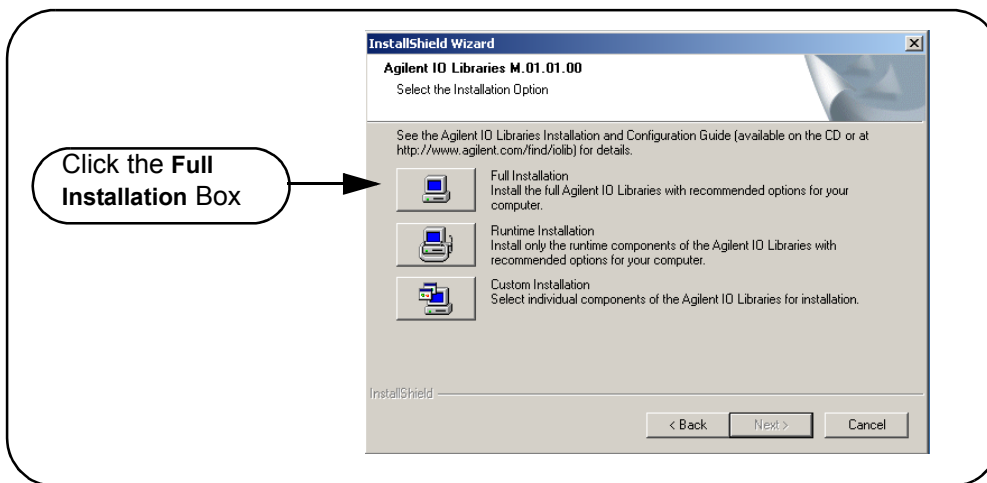
Installing and Configuring the 82350

Step 2 - Installing the Agilent IO Libraries

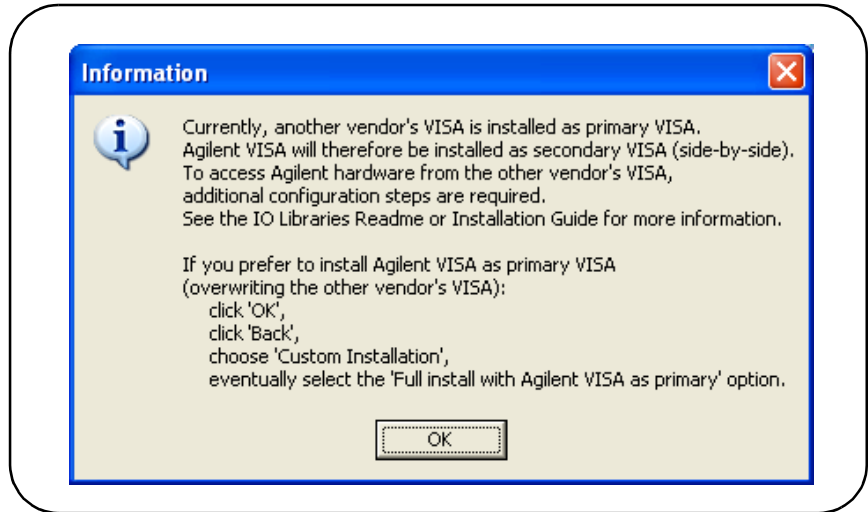
- From the **Title Screen**, click **Next>** to go to the **License Agreement** screen and then click **Yes** to accept the license terms and to display the **Readme Information** screen.



- Scroll through the **Readme Information** screen to display the latest Agilent IO Libraries information. When finished with the **Readme Information** screen, click **Next>** to display the **Select the Installation Option** screen. Click the **Full Installation** box and **Next>**.



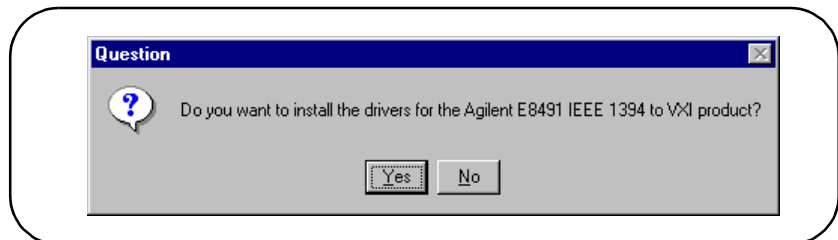
- a** If another vendor's VISA is currently installed, a side-by-side **Information** dialog box appears. If this dialog box appears, click **OK** to display the **Question** dialog box (for Windows NT 4.0 ONLY) (Step 7b) or to display the **Current Settings** dialog box (Step 8).



- b** For Windows NT 4.0 ONLY, the **Question** dialog box appears. Click **Yes** to install the drivers, **No** to not install the drivers. For other operating systems, the E8491 drivers are automatically installed, so this box does not appear.

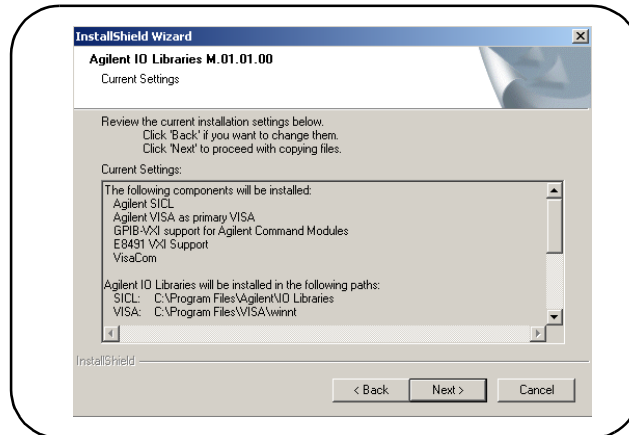
NOTE

*If an E8491 product is already installed in your system or if you plan to install and E8491 in the future, click **Yes** to install the latest driver. If an E8491 is not installed or you do not plan to install and E8491, click **No**.*



Step 2 - Installing the Agilent IO Libraries

- 8** The **Current Settings** dialog box appears. This box shows the (default) paths in which SICL and VISA will be installed and the components that will be installed.

**NOTE**

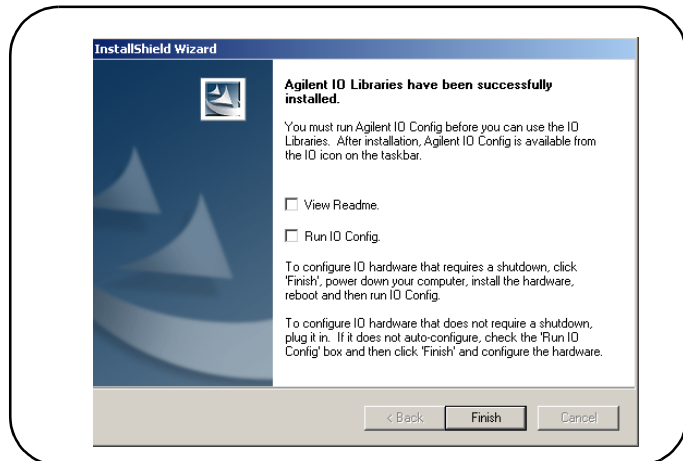
If the side-by-side Information dialog box appears AND you want to set Agilent VISA as primary VISA, or if you want to change the settings listed, follow the instructions in “To Change the Settings.” Otherwise, follow the instructions in “To Accept the Settings.”

- **To Accept the Settings.** To accept the settings shown, click **Next>**. Setup will then install the files and display the **Agilent IO Libraries have been successfully installed** screen (see Step 9).
- **To Change the Settings.** To change the settings shown, click **<Back** to re-display the **Select the Installation Option** screen (see Step 7). From this screen, click the **Custom Installation** box and then click **Next>** to proceed with a custom installation. See the *Agilent IO Libraries Installation and Configuration Guide* for details.

- 9 Click **Next>** to accept the settings. Setup will then install the files and display the **Agilent IO Libraries have been successfully installed** screen. For 82350A installation, do NOT check the **Run IO Config** box. (If desired, you can check the **View Readme** box.)

NOTE

*Even if you do not check the **View Readme** box, after installation is complete, you can view the Readme file by clicking the blue IO icon and clicking **View Documentation | IO Libraries Readme**.*



- 10 Click **Finish** to complete the installation of the Agilent IO Libraries. If you checked the **View Readme** box, the Agilent IO Libraries Readme file is also displayed.
- 11 Remove the *Agilent IO Libraries for Instrument Control* CD from the CD-ROM drive.

Step 3 - Connecting Your Instruments

This step shows how to install an 82350 in a PCI slot in your PC and how to connect GPIB instruments to the 82350, including:

- Installing the 82350 in Your PC
- Connecting Instruments to the 82350

NOTE

If you have not yet installed the Agilent IO Libraries, go to “Step 2 - Installing the Agilent IO Libraries” and install the libraries BEFORE you install the 82350 in your PC.

CAUTION

To reduce the risk of damaging the 82350, only handle the card by the sheet metal frame or by its edges. Never touch any other part of the card, including the PCI connector.

NOTE

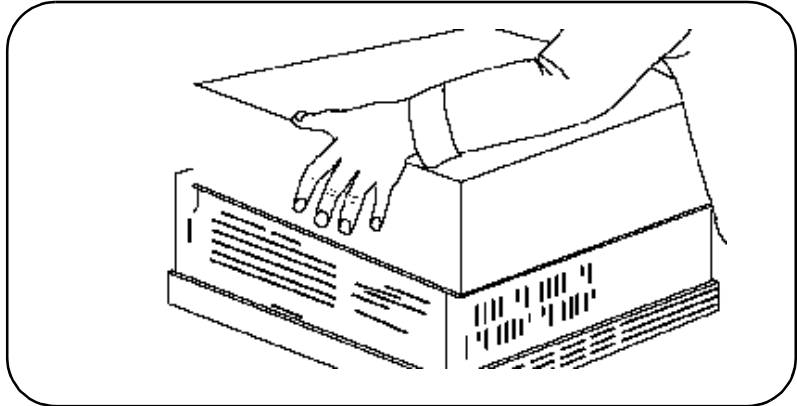
The 82350B is a 5V PCI card and will not fit in a 3.3V PCI slot. Also, the 82350 will not fit in an EISA or ISA slot.

Installing the 82350 in Your PC

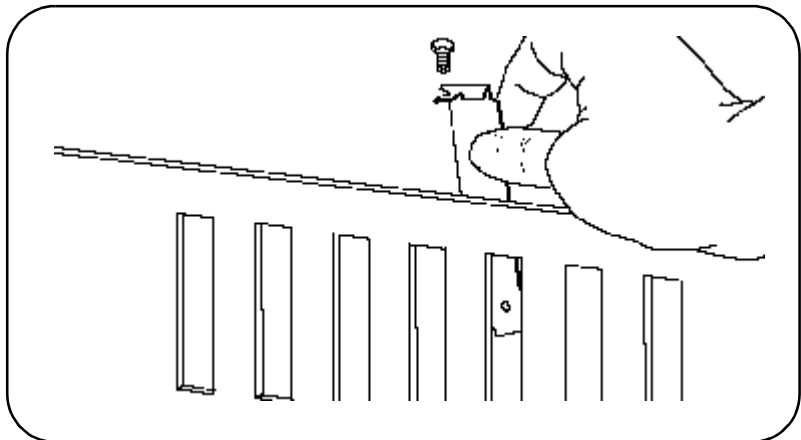
- 1 Record the Card Serial Number.** Remove the card from its anti-static bag and record the Serial Number for future reference. Save the anti-static bag so you can protect the card if you need to remove the card from the PC.

For example, the 82350 Serial Number is located on the white serial number label on the card. The label contains 24 characters, with the last 8 characters (plus US) being the 82350 Serial Number. Thus, if the numbers on the serial number label are 82350-66511-4224-01-42300113, since the last 8 characters are 42300113, the 82350 Serial Number is US42300113.

- 2 Remove PC Cover.** Remove power from the PC and from all of its peripherals. Then, remove the power cord from the PC. Unlock and remove the cover from the PC to allow access to the I/O slots. See your PC documentation for instructions.



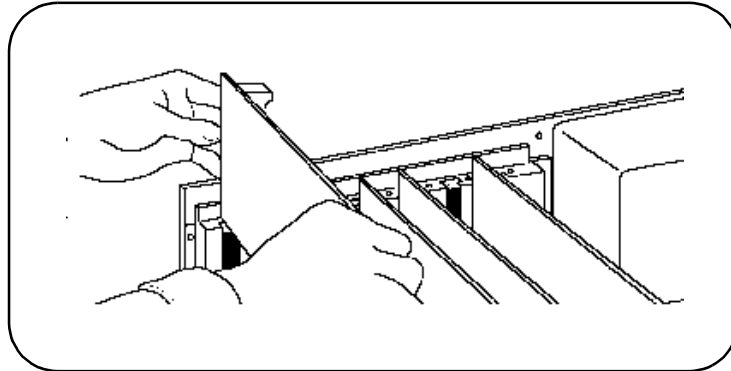
- 3 Remove a Cover Plate.** Remove one of the PC back panel cover plates. The 82350B is a 5V PCI card and will not fit in a 3.3V PCI slot or in an EISA or ISA slot. Choose a 5V PCI slot that will give adequate clearance for the GPIB connector.



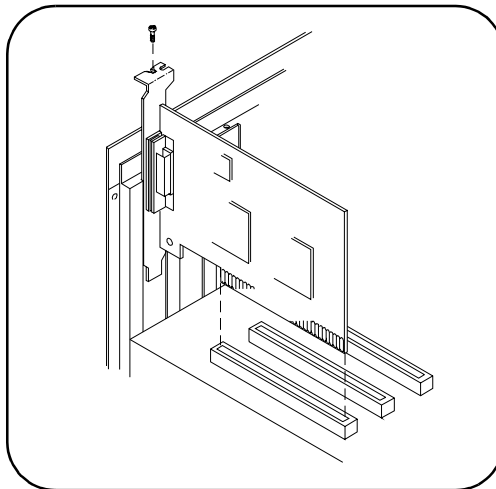
- 4 Install the 82350.** Insert the 82350 Interface Card edge connector into the PCI expansion slot connector of the PC. Make sure the interface is fully seated by pushing firmly on the top edge of the card with the palm of your hand. The GPIB connector should extend through the back panel opening to allow GPIB cable connection.

Step 3 - Connecting Your Instruments

If you install more than one 82350, you may want to install the cards so there is at least one empty slot between every two 82350s. When inserting the 82350, be sure to hold the card by its edges. Also, be careful with the metal faceplate around the GPIB connector as the faceplate can be bent.



- 5 Replace the Cover Plate Screw.** This will hold the 82350 in place. Save the blank cover plate for use if the 82350 is later removed. Replace the PC cover(s) as described in your PC documentation.



Connecting Instruments to the 82350

After the 82350 is installed in your PC, the next step is to connect your GPIB instruments to the installed 82350. Suggested steps follow. When you have made the connections, go to “Step 4 - Configuring the 82350”.

- 1 Review Connection Guidelines.** The recommended method for connecting a GPIB system is a linear arrangement with the system controller (PC) at one end of the system. However, a GPIB system can also be connected together in a star, linear, or a combination configuration as long as the total number of devices on the system is ≤ 15 and these guidelines are followed:
 - To minimize stress on connector mountings, no more than three cable connectors blocks should be stacked on top of one another. The GPIB connector screws should be finger-tightened only.
 - Minimize cable length as much as possible. All system devices must have tri-state drivers and must be powered on. Systems with devices not using tri-state drivers are limited to transfer rates < 250 Kbytes/sec. Turning devices on or off while a system is running may cause faulty operation.
 - For operation with data transfer rates < 500 Kbytes/sec, the total length of all GPIB cables is ≤ 2 meters times the number of devices connected together, up to a maximum of 20 meters.
 - For operation with data transfer rates > 500 Kbytes/sec, the total length of all GPIB cables is ≤ 1 meter times the number of devices connected together, up to a maximum of 15 meters.
 - The length between adjacent devices is not critical as long as the overall restriction is met. GPIB bus extenders are available that allow operation over much greater distances.

Step 3 - Connecting Your Instruments

- 2 Connect GPIB Cables to the 82350.** Connect a separate GPIB cable to each installed 82350 using one of the following cables. Tighten the GPIB connector screws finger-tight only. (The screwdriver slots are for removal purposes only.) Two example connections follow connect a single GPIB instrument or to connect multiple GPIB instruments.

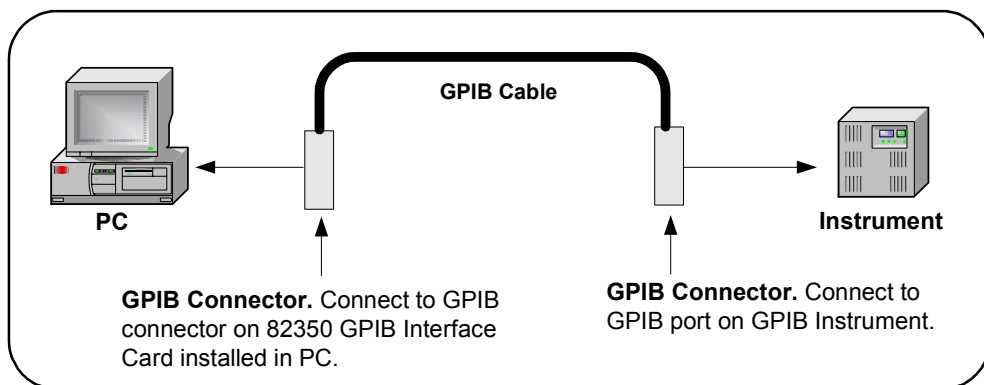
- 10833A (1 meter)
- 10833B (2 meters)
- 10833C (4 meters)
- 10833D (0.5 meter)
- 8120-3448 (6 meters)
- 8120-3449 (8 meters)
- Other IEEE-488 GPIB interface bus cables, as applicable

Example: Connecting a Single GPIB Instrument

This figure shows connections from a single GPIB instrument to the GPIB connector of an 82350 installed in your PC. You may want to record the primary GPIB address of the attached instrument for future programming use. After making the connections, reconnect the PC power cord and apply power to the PC and to attached peripherals/instruments.

CAUTION

To avoid damage to the connectors, only finger-tighten the connectors.



Example:
Connecting Multiple
GPIB Instruments

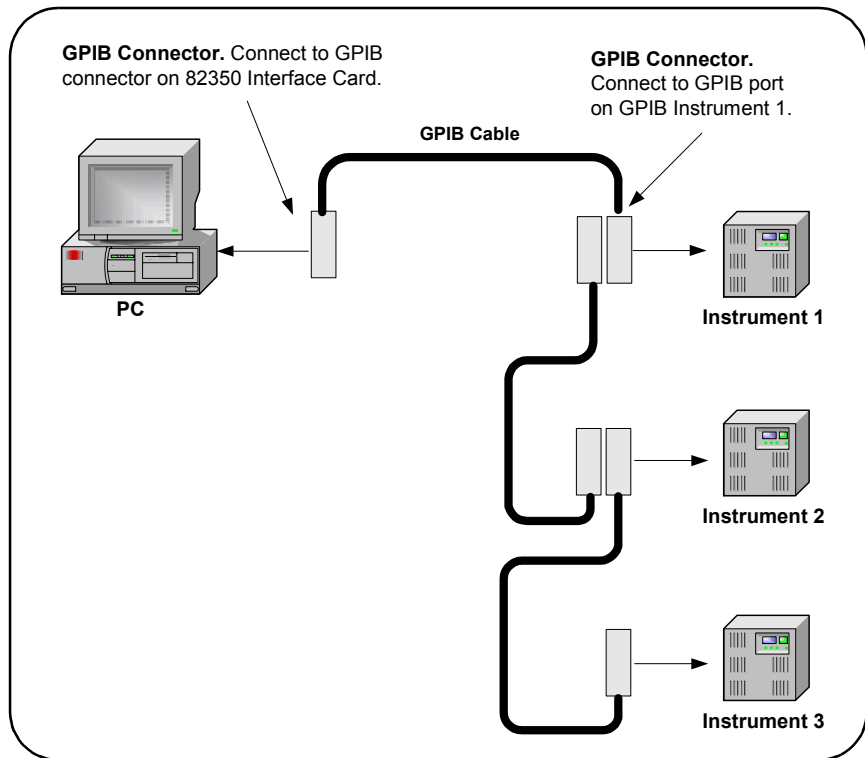
This figure shows one way to connect three GPIB instruments to an Agilent 82350 GPIB Interface Card. You may want to record the primary GPIB address of each attached instrument for future programming use. After making the connections, reconnect the PC power cord and apply power to the PC and attached peripherals/instruments.

CAUTION

To avoid damage to the connectors, only finger-tighten the connectors.

NOTE

Although the figure shows cable connections to GPIB Instrument 1, the connection can be to any GPIB instrument in the system.



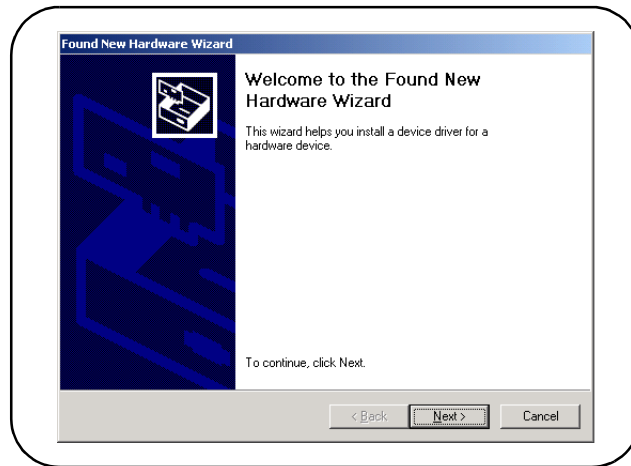
Step 4 - Configuring the 82350**Step 4 - Configuring the 82350**

This step shows how to configure a Windows 95/98/Me/2000/NT/XP operating system for a PC that has an 82350 installed, including:

- Installing Configuration Files
- Configuring the 82350 Interface

Installing Configuration Files

- 1 **Turn the PC ON.** As Windows 95/98/Me/2000/XP restarts, a **Found New Hardware Wizard** may start. This figure shows a typical Windows 2000 display. The display may be different for other operating systems.



- 2 **Install Configuration Files.** Use the following table for the actions to take for each operating system. Then, go to “Configuring the 82350 Interface”.

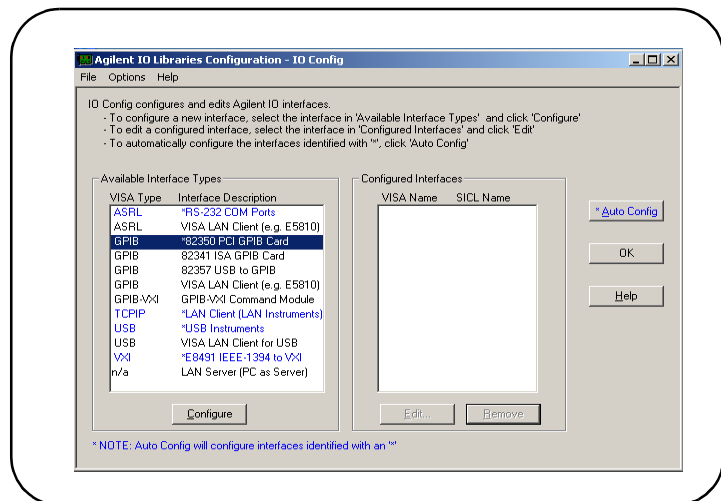
OS	Action
98/Me	<ul style="list-style-type: none"> ■ When the Wizard asks for the <i>Agilent IO Libraries</i> CD, click OK. When the Wizard asks for the <i>hpioclas.dll</i> file, browse to <i>C:\windows\system\</i> and click OK.
2000/XP	<ul style="list-style-type: none"> ■ Click Next> to accept the default suggestions. Click Finish to complete the installation.

Configuring the 82350 Interface

- 1 **Open IO Config.** Click the **Agilent IO Libraries Control** icon (blue **IO** icon on the Windows taskbar) and then click **Run IO Config**. When the main screen appears, highlight the **GPIB 82350 PCI GPIB Card** menu item and then click the **Configure** button to display the **82350 PCI GPIB Card Configuration** screen. (For an Agilent 82341 card, highlight **GPIB 82341 ISA GPIB Card** and then click **Configure**).

NOTE

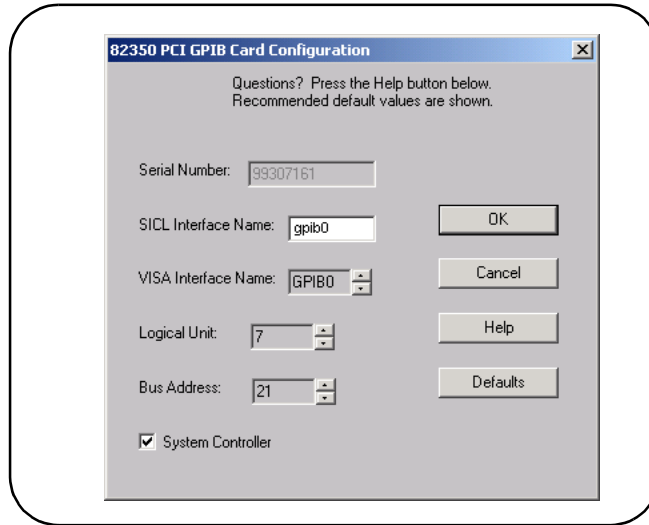
For a description of IO Config and the Agilent IO Libraries, see the Agilent IO Libraries Installation and Configuration Guide. This guide may be included on the instrument CD or is available on the Web.



- 2 **Configure GPIB Card Parameters.** When the **82350 PCI GPIB Card Configuration** screen appears, set the **VISA Interface Name**, **SICL Interface Name**, **Logical Unit** and **Bus Address** values as required.

Also, verify that this is the **System Controller** for the GPIB to which it is attached (this is the typical operating mode). (See the System Controller discussion.) Then, click the **OK** button. Some guidelines to set these values follow.

Step 4 - Configuring the 82350



NOTE

*After the system is configured, this screen may also display an **Edit VISA Config...** button. Clicking this button allows you to manually configure the interface as desired.*

82350 GPIB Interface Card Configuration Parameters

<p>SICL Interface Name</p>	<p>Symbolic name that SICL uses to uniquely identify this GPIB interface. The default Interface Name is gpib0. The SICL Interface Name must be a unique string of alphanumeric characters, starting with a letter. Remember this value and the Logical Unit number to properly address GPIB devices in your SICL applications.</p>
<p>VISA Interface Name</p>	<p>Symbolic name that VISA uses to uniquely identify this GPIB interface. The default VISA Interface Name is GPIB0. The 82350 Interface Name for VISA must begin with the string GPIB and have an integer appended to it, such as GPIB0, GPIB1, GPIB2, etc. Remember this value to properly address GPIB devices in your VISA applications.</p>

82350 GPIB Interface Card Configuration Parameters	
Logical Unit	Number that SICL uses to uniquely identify this 82350 interface. The Logical Unit number is an integer in the range of 0 - 10000. Remember this value and the SICL Interface Name to properly address the GPIB interface in your SICL applications.
Bus Address	address of this GPIB interface controller on the GPIB bus. It is usually 21 if the GPIB interface is a System Controller or 20 if the GPIB interface is a non-System Controller (see System Controller, following). These addresses are chosen by convention but any address in the range 0 - 30, inclusive, may be used.
System Controller	Determines if this interface controls which bus devices talk and which bus devices listen. If several devices exist on a bus, be sure each has a unique GPIB bus address and only one device is the System Controller (it is usually the device installed in the computer). Each GPIB interface has its own independent bus. Thus, each interface may be a System Controller as long as it is not chained together with other GPIB interfaces. However, two or more System Controllers on the same bus will cause the bus to be inoperative.

- 3 Change/Accept the Configuration Values.** If the configuration values displayed are acceptable to you, click the **OK** button. Otherwise, you can change the configuration values by clicking the arrows next to the values. If there are no arrows, you can change the configuration values by typing in the values you want.

At any time, you can click the **Defaults** button to return the dialog box to its default configuration values for the GPIB interface. When you have changed the desired values, either click the **OK** button to accept the changes or click the **Cancel** button to cancel the changes and return to the previous configuration values for the GPIB interface.

- 4 Repeat Steps for Other Cards.** If you have installed more than one 82350 in your PC, repeat these steps for the remaining cards. Then, go to "Step 5 - Communicating with Instruments".

Step 5 - Communicating with Instruments

After the 82350 has been configured and you have connected your GPIB instruments to the 82350, the next step is to establish communication between your PC and the instruments using *VISA Assistant*. After communication has been established, you can begin programming the instruments using VISA, SICL, or SCPI commands. This section includes:

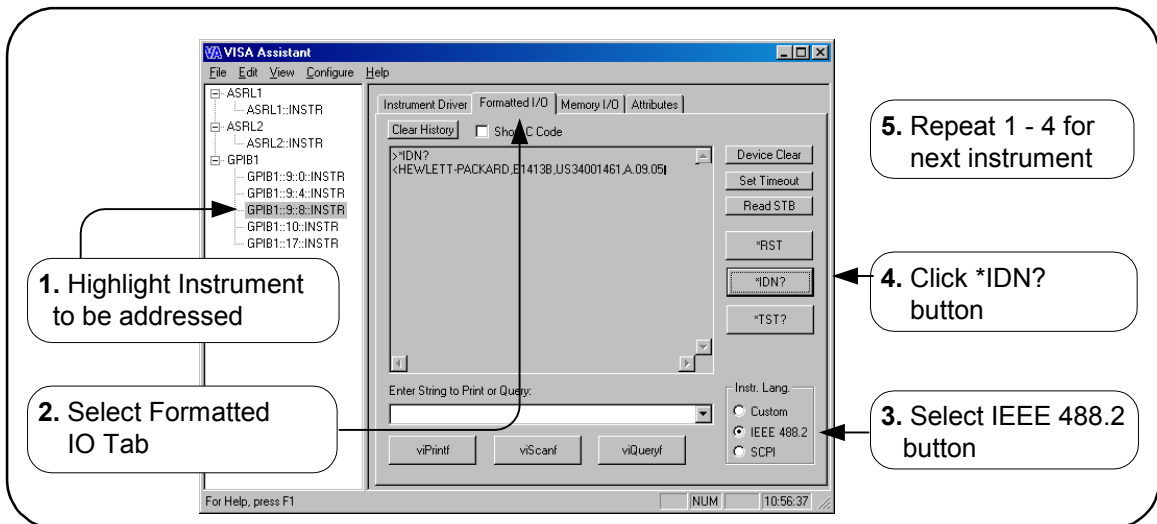
- Verifying Instrument Communication
- Programming Your Instruments (Optional)

Verifying Instrument Communication

When the Agilent IO Libraries were installed on your PC, an IO configuration utility called **VISA Assistant** was also installed. You can use VISA Assistant to verify communication between your PC and connected GPIB instruments.

To use VISA Assistant for IEEE-488.2 or SCPI instruments, click the blue **IO** icon on the Windows taskbar (on the lower right-hand corner of the screen). Then, click **Run VISA Assistant** to display the VISA Assistant main screen. For example, this figure shows steps you can use to return the ID string for an IEEE-488.2-compliant instrument.

When communication has been verified with each GPIB instrument, you can begin to program the instruments using VISA or SICL commands. See the next section “Programming Your Instruments” for an introduction.



Programming Your Instruments

This section provides an introduction to programming GPIB instruments via the 82350 PCI GPIB interface using the Agilent VISA and SICL IO Libraries. You can program in various languages/applications, including Visual Basic, Visual C++, Agilent IntuiLink and Agilent VEE.

See the applicable User's Guide, such as the *Visual Basic User's Guide*, for programming guidelines. You can also find additional programming examples using *VXIplug&play* drivers in the instrument *User's Guide*. After the 82350 is successfully installed and configured, the interface should act as a transparent interface for programming GPIB instruments.

For information on programming using Agilent VISA, see the *Agilent VISA User's Guide*. Also, see the *Agilent IO Libraries Installation and Configuration Guide* for further information on the Agilent IO Libraries.

Accessing VISA and SICL Manuals

You can access .pdf copies of the *Agilent VISA User's Guide* and the *Agilent SICL User's Guide for Windows* from the blue **IO** icon on the Windows taskbar. Adobe Acrobat Reader is required to view these manuals.

To access the *Agilent VISA User's Guide*, click the IO icon and then click **View Documentation | VISA Users Guide**. To access the *Agilent SICL User's Guide for Windows*, click the IO icon and then click **View Documentation | SICL Users Guide**.

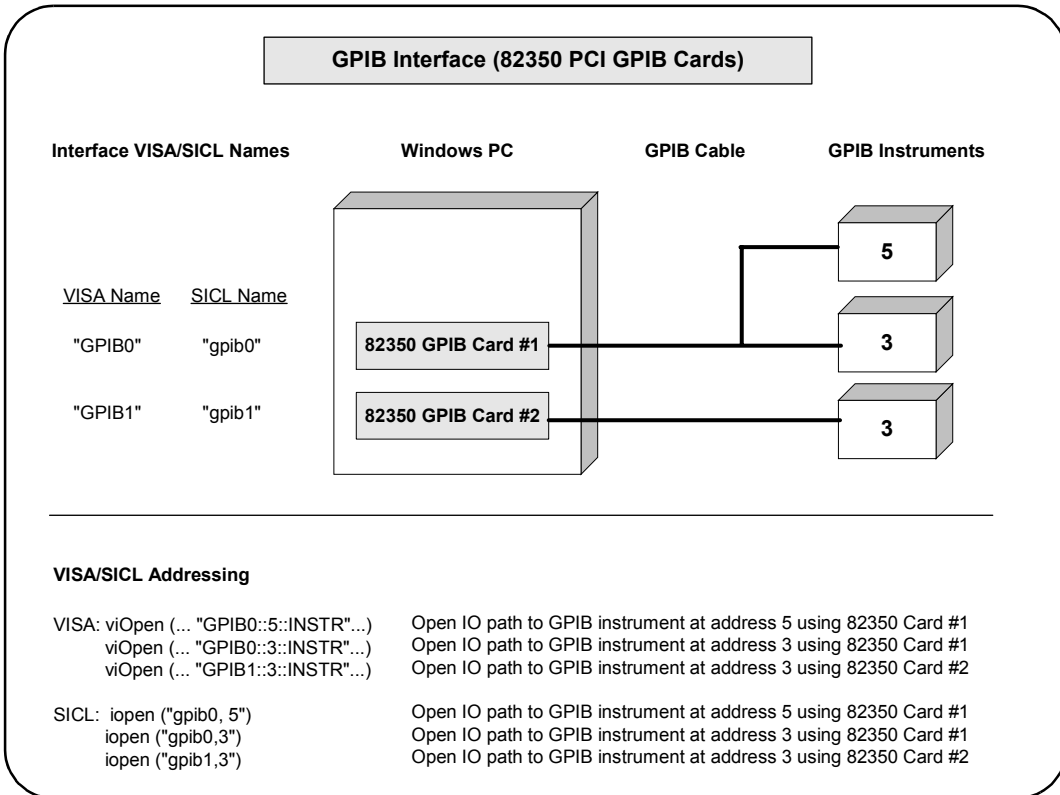
Example: GPIB Interface Configuration

An **IO interface** consists of a hardware interface and a software interface. The purpose of the IO Config utility is to associate a unique software interface name with a hardware interface. The Agilent IO Libraries use an **Interface Name** or **Logical Unit Number** to identify an interface. This information is passed in the parameter string of the **viOpen** function call in a VISA program or in the **iOpen** function call in a SICL program.

For example, the GPIB interface system in this figure consists of a Windows PC with two 82350 GPIB cards connected to three GPIB instruments via GPIB cables. For this system, the IO Config utility has been used to assign GPIB card #1 a VISA name of "GPIB0" and a SICL name of "gpib0".

IO Config has also been used to assign GPIB card #2 a VISA name of "GPIB1" and a SICL name of "gpib1". With these names assigned to the interfaces, the VISA/SICL addressing is as shown in the figure. Since unique names have been assigned by IO Config, you can use the VISA **viOpen** command to open the I/O paths to the GPIB instruments. Or, you can use the SICL **iOpen** command to open the I/O paths shown.

Installing and Configuring the 82350
Step 5 - Communicating with Instruments



Troubleshooting Guidelines

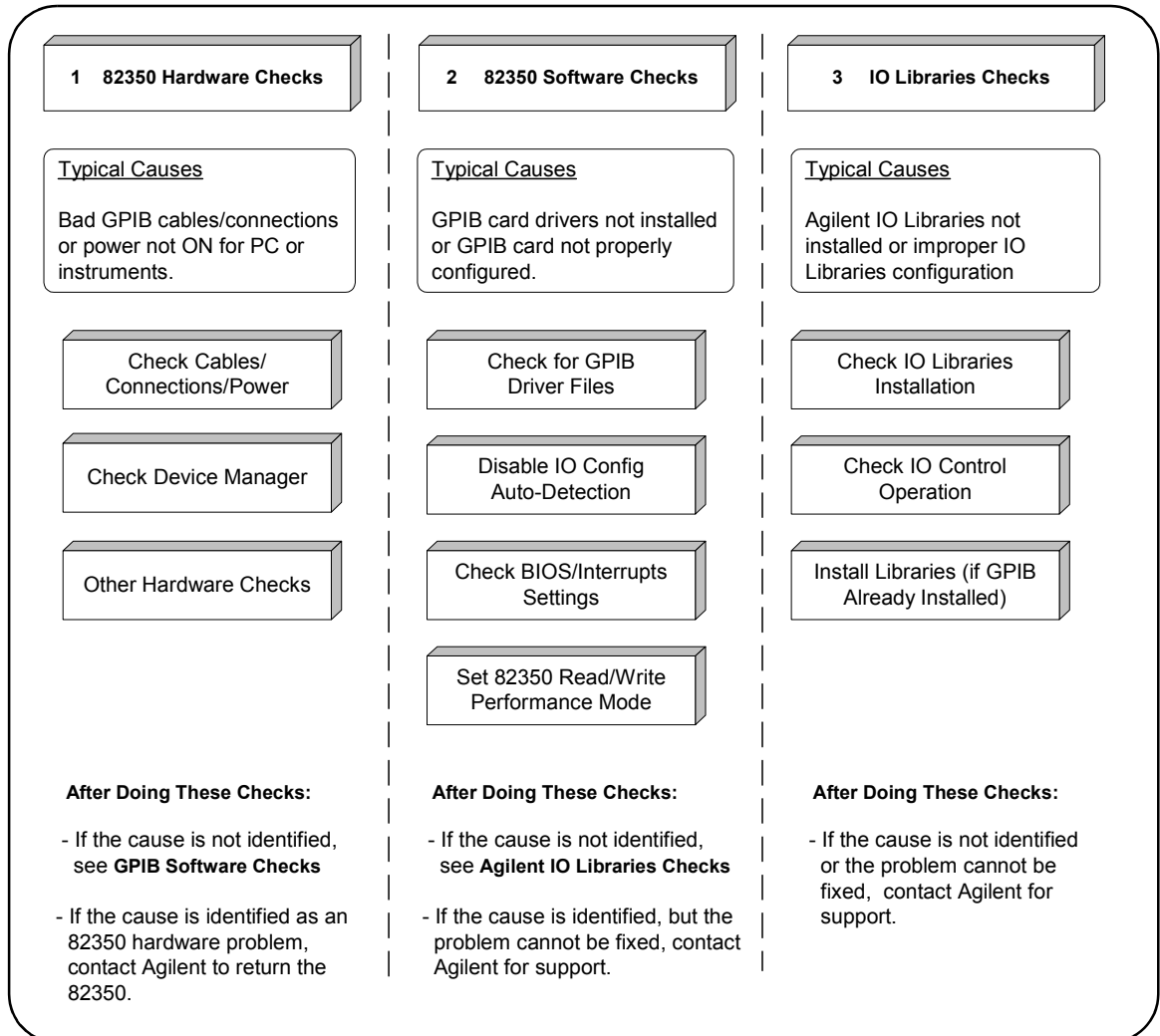
Troubleshooting Guidelines

This chapter shows suggested troubleshooting steps for an Agilent 82350 GPIB interface, including:

- Troubleshooting Overview
- 82350 Hardware Checks
- 82350 Software Checks
- Agilent IO Libraries Checks

Troubleshooting Overview

A suggested troubleshooting flowchart for the 82350, installed instruments, and the Agilent IO Libraries follows. We suggest you start at Step 1 and then go to Step 2 and then to Step 3, as required.



82350 Hardware Checks

This section gives guidelines to make hardware troubleshooting checks for the 82350, including:

- Check Cables/Connections/Power
- Check Device Manager
- If Sound Card Does Not Work
- If Data Transfers to Devices Fail
- If IO Config Finds 82350 Card with Serial Number fffffff

Check Cables/ Connections/Power

We suggest you start your troubleshooting sequence by performing the following hardware checks. If the hardware checks do not solve the problem, see 82350 Software Checks.

NOTE

There are no user-servicable parts for the 82350. If you suspect a hardware failure for the 82350, contact Agilent for instructions to return the unit.

- 1 Check GPIB Cable Connections.** Check all GPIB cables for good connection to the GPIB connector on the 82350 installed in your PC and the GPIB cable connections between all connected GPIB instruments. An improperly attached GPIB connector can cause the bus to malfunction.
- 2 Check GPIB Cables for Damage.** Check all GPIB cables for cuts/damage and check for bent/misaligned/crushed connector pins. Replace cables as required.
- 3 Disconnect/Reconnect GPIB Cables.** If Steps 1 and 2 do not solve the problem, try disconnecting and reconnecting (or replacing) GPIB cables.
- 4 Check PC/Instrument Power-on.** Verify that the PC and all connected GPIB instruments are functional and are powered ON. Verify that host computer is not in a Suspended power management state.

- 5 Reboot Your PC.** If doing Steps 1, 2, 3 or 4 does not solve the problem, reboot the PC. If this does not solve the problem, go to “Check Device Manager”.

Check Device
Manager

You can use the Windows Device Manager to reinstall the 82350 or equivalent, as required. For example, with Windows 2000, go to **Control Panel** by selecting **Start | Settings | Control Panel**.

Then, select **System | Hardware | Device Manager**. From Device Manager, select **82350** and then **Properties**. Tab to **Driver** and click **Reinstall Driver**. This will allow the Windows Plug and Play Manager to begin searching for a driver for the 82350. Since Device Manager may have disabled the 82350 device, click **Enable** to restart the 82350. If this does not resolve the problem, go to “82350 Software Checks”.

If Sound Card Does
Not Work

If your sound card stops working after configuring interfaces, disable the auto-detection process in IO Config. The auto-detection process in IO Config can cause sound and other cards to stop responding. To disable the auto-detection process, edit *c:\Program Files\agilent\IO Libraries\intfcfg\intfcfg.txt* and follow the instructions to set all GPIB cards to be manually detected by IO Config.

If Data Transfers to
Devices Fail

If devices attached to your ISA (82341) GPIB card are detected, but data transfers to those devices fail, this is usually caused either by an IRQ conflict with another card or by your system having no IRQs available for this card. If no IRQs are available, the IRQ value shown in IO Config will be -1.

For Windows NT/2000/XP: Try changing the IRQ setting to other values. You must reboot after changing the value to test it. If none work, you will have to free up other IRQs by disabling devices such as serial ports or sound cards.

For Windows 98/Me: You will have to free up other IRQs by disabling devices such as serial ports or sound cards. This is usually done in the BIOS setup for your computer.

82350 Hardware Checks

If IO Config Finds
82350 Card with
Serial Number fffffff

If IO Config reports finding an 82350 card with serial number fffffff, this is typically caused by getting into a situation where PCI cards are not properly configuring. Try the following:

- 1 Check BIOS Setting.** For Windows NT, make sure the BIOS **Operating System** setting is set to **Not PnP OS** or to **Running Windows NT** or to **Other**. It should not be set to **Running Windows 95**, **Running Windows 98**, **Running Windows 2000**, or **PnP O/S**
- 2 Upgrade your system BIOS to the latest version.** Note that even brand new computers tend to have new BIOSs available.
- 3 If your computer locks up or freezes after installing.** Typically, this is mostly interrupt conflicts with other drivers in the system. PCI allows sharing of IRQs, but this also means that the drivers for cards with which we are sharing an IRQ must be handling interrupt chaining properly.

Both NT and Windows 9x allow multiple drivers to install interrupt service routines (ISRs) for a single IRQ. The OS will keep a list of all the ISRs installed for each IRQ. When the IRQ is asserted, the OS will call each ISR in turn until one of them returns TRUE (meaning that it handled the interrupt). The ISR's responsibility is to correctly return TRUE if its device was interrupting, or FALSE if not.

- 4 Perform Driver Work-Arounds.** Here are some ways to work around drivers that are not behaving properly:
 - Upgrade the drivers for devices sharing an IRQ with Agilent, including but not limited to, your video drivers, your LAN drivers, Agilent IDE and/or SCSI drivers, and your sound drivers.
 - Try to force the Agilent driver to be installed earlier in the ISR chain.
 - For Windows NT, Click **Control Panel | Devices**. Select the **HP350i32**. Select **Startup...** and set to **System** instead of the default **Automatic**. (Running IO Config will set this back to **Automatic**.)
 - For Windows 9x, change your BIOS **Installed OS** setting. Try all the different values and use the one that works.

- For Windows 9x, make sure all devices sharing an IRQ with our card have drivers installed. Right-click **My Computer** and select **Properties**, then **Device Manager**. Highlight **Computer** and click **Properties**. Find the 82350 card and check that all other cards on the same IRQ have a valid driver, not the big yellow question-mark.
- 5 Re-Configure Your PC.** Configure your PC so as to not share IRQ lines. Many PCI cards have bugs when sharing IRQ lines. You may or may not be able to do this on all PCs. Many PCs can be configured using the setup option when the PC is first booting.
- 6 Upgrade your system BIOS.** Note that even new computers may have a newer BIOS available.
- Make sure the BIOS **Installed O/S** setting is set correctly. This determines what software will configure all the *VXIplug&play* cards in your system. Either the BIOS or the O/S can perform the task of querying all the cards to determine their resource needs, picking a valid configuration for all these cards, and telling the cards what their actual resource settings are.
 - If the BIOS **Installed O/S** is set to **Windows 95, Windows 98, Windows 2000** or **Running a PnP O/S**, the BIOS will not perform this task and will leave it to the O/S to do this. If the **Installed O/S** is set to **Windows NT, NOT PnP O/S**, or **Other**, the BIOS will perform this task.
 - For NT version 4.0 or earlier, the BIOS must perform this task as the O/S does not know how to do this. For Windows 9x, either the BIOS or the O/S can do this task, so try both. If you are running Windows NT, set to **Running Windows NT, Not VXIplug&play OS** or **Other**.

82350 Software Checks

This section provides guidelines for 82350 software checks, including:

- Check for 82350 Driver Files
- Disable IO Config Auto-Detection
- Check BIOS/Interrupts Settings
- Set 82350 Read/Write Performance Mode

Check for 82350 Driver Files

After installing the Agilent IO Libraries, check for installed 82350 driver files.

- 1 Check for 82350 Driver Files.** Files are listed in their default directories.

Windows 2000	
Program Files	<i>C:/Program Files/Agilent/IO Libraries/drivers/ag350i32.dll</i>
Driver Files	<i>C:/Winnt/system32/drivers/agt82350.sys</i>
.inf Files	<i>C:/Winnt/inf/agt350.inf</i>
Windows 98 (SE)/Me/XP	
Program Files	<i>C:/Program Files/Agilent/IO Libraries/drivers/ag350i31.dll</i>
Driver Files	<i>C:/Windows/system32/drivers/agt82350.sys</i>
.inf Files	<i>C:/Windows/inf/agt350.inf</i>

- 2 Uninstall/Reinstall the Agilent IO Libraries.** If the driver files are not found, uninstall the Agilent IO Libraries by inserting the *Instrument CD* and following the instructions to remove the libraries. Then, follow the instructions to re-install the libraries.

Disable IO Config Auto-Detection

If your PC sound card stops working after configuring interfaces, disable the auto-detection process in IO Config, as the auto-detection process in IO Config can cause sound and other cards to stop responding. To disable the auto-detection process, edit *C:\Program Files\agilent\IO Libraries\intfcfg\intfcfg.txt* and follow the instructions (comments in the *intfcfg.txt* file) to set all GPIB cards to be manually detected by IO Config.

Check BIOS/ Interrupts Settings

If IO Config reports finding an 82350 card with Serial Number fffffff, this is typically caused by PCI cards not properly configuring. Try the following steps. If these steps do not work, remove and re-install the 82350 and then reconfigure the card.

- 1 Check BIOS Setting.** For Windows NT, make sure the BIOS **Operating System** setting is set to **Not PnP OS** or to **Running Windows NT** or to **Other**. It should not be set to **Running Windows 95**, **Running Windows 98**, **Running Windows 2000**, or **PnP O/S**
- 2 Upgrade your system BIOS to the latest version.** New computers oftentimes have newer BIOSs available.
- 3 If your computer locks up or freezes after installing.** This is typically caused by interrupt conflicts with other drivers in the system. PCI allows sharing of IRQs, but this also means the drivers for cards which share an IRQ must be handling interrupt chaining properly. Both NT and Windows 9x allow multiple drivers to install interrupt service routines (ISRs) for a single IRQ. The OS keeps a list of all the ISRs installed for each IRQ.

When the IRQ is asserted, the OS calls each ISR in turn until one of them returns TRUE (meaning that it handled the interrupt). The ISR's responsibility is to correctly return TRUE if its device was interrupting or FALSE if not. Drivers that return TRUE, even though they did not service the interrupt, will cause problems. Try the following steps to perform driver workarounds:

- Upgrade the drivers for devices sharing an IRQ with Agilent, including, but not limited to, your video drivers, your LAN drivers, Agilent IDE and/or SCSI drivers, and your sound drivers.
- For Windows NT, Click **Control Panel | Devices**. Select the **HP350i32**. Select **Startup...** and set to **System** instead of the default **Automatic**. (Running IO Config will set this back to **Automatic**.)
- For Windows 9x, change your BIOS **Installed OS** setting. Try all the different values and use the one that works. For Windows 9x, make sure all devices sharing an IRQ with your card have drivers installed.

82350 Software Checks

Right-click **My Computer** and select **Properties**, then **Device Manager**. Highlight **Computer** and click **Properties**. Find the 82350 card and check that all other cards on the same IRQ have a valid driver, not the big yellow question-mark.

- 4 Re-Configure Your PC.** Configure your PC so as to not share IRQ lines. Many PCI cards have bugs when sharing IRQ lines. You may or may not be able to do this on all PCs. Many PCs can be configured using the setup option when the PC is first booting.
- 5 Upgrade your system BIOS.** New computers may have a newer BIOS available. When installing a new system BIOS:
 - Make sure the BIOS **Installed O/S** setting is set correctly. This determines what software will configure all the *VXIplug&play* cards in your system. Either the BIOS or the O/S can perform the task of querying all the cards to determine their resource needs, picking a valid configuration for all these cards, and telling the cards what their actual resource settings are.
 - If the BIOS **Installed O/S** is set to **Windows 95**, **Windows 98**, **Windows 2000** or **Running a PnP O/S**, the BIOS will not perform this task and will leave it to the O/S to do this. If the **Installed O/S** is set to **Windows NT**, **NOT PnP O/S**, or **Other**, the BIOS will perform this task and the system may not work properly.
 - For NT version 4.0 or earlier, the BIOS must perform this task as the O/S does not know how to do this. For Windows 9x, either the BIOS or the O/S can do this task, so try both. If you are running Windows NT, set to **Running Windows NT**, **Not VXIplug&play OS** or **Other**.

Set 82350 Read/ Write Performance Mode

The 82350 card read and write calls use one of two modes:

- ❑ **Polling.** Bytes are transferred to/from the card, one at a time. Polling mode is advantageous for transferring a small number of bytes because the setup overhead is very low, but it does require CPU involvement for each byte transferred.
- ❑ **Interrupt.** An entire buffer is transferred to/from the card without CPU involvement. Interrupt mode is advantageous for transferring large buffers because the higher per byte transfer rate more than compensates for the relatively long interrupt setup overhead.

The default behavior of the 82350 driver is to use **Polling** mode for transfers of 256 bytes or less and to use **Interrupt** mode for larger transfers. You can modify this default behavior by doing the following:

SICL: The SICL `ihint(id, hint)` function can be called to modify the read/write behavior for on a SICL session. The `hint` values allowed are:

- **I_HINT_DONTCARE** (default value) Use Interrupt mode for transfer requests larger than 256 bytes, otherwise, use Polling mode.
- **I_HINT_USEPOLL** Use the Polling mode.
- **I_HINT_IO** Use the Interrupt mode.

VISA: The VISA `viSetAttribute(vi, VI_ATTR_DMA_ALLOW_EN, attrValue)` function can be called to modify the read/write behavior for a VISA session. The `VI_ATTR_DMA_ALLOW_EN` values allowed are:

- **VI_TRUE** (default value) Use Interrupt mode for transfer requests larger than 256 bytes, otherwise, use Polling mode.
- **VI_FALSE** Use the Polling mode.

Some additional factors to consider are:

- The settings discussed above are per session. This means you can open multiple sessions to a device and set different transfer modes for different sessions. The actual mode used will then depend on which session you are using for the read/write calls.
- In both SICL (with `hint = I_HINT_DONTCARE`) and VISA (with `VI_ATTR_DMA_ALLOW_EN = VI_TRUE`), the size of the read request (as specified by `bufsize` in a SICL `iread()` or `count` in a VISA `viRead()` function call) will determine the mode used even if the number of bytes actually read is less.

82350 Software Checks

- The default formatted IO read buffer size is 4096 so when using this default size, formatted reads in SICL (with `hint = I_HINT_DONTCARE`) and VISA (with `VI_ATTR_DMA_ALLOW_EN = VI_TRUE`) will use Interrupt mode even when a small number of bytes are expected.
- The default formatted IO write buffer size is 128 so when using this default size, formatted writes in SICL (with `hint = I_HINT_DONTCARE`) and VISA (with `VI_ATTR_DMA_ALLOW_EN = VI_TRUE`) will use Polling mode even when a large number of bytes are being sent.
- In SICL, Polling mode will always be used for the `iread()`, `ifread()` and `iscanf()` regardless of the above settings, when a `termchr` is set (`itermchr()` is not set to -1).
- In VISA, Polling mode will always be used for `viRead()`, `viBufRead()` and `viScanf()` regardless of the above settings, when `VI_ATTR_TERM_CHAR_EN = VI_TRUE`.

The **crossover point** at which the Interrupt mode becomes faster than the Polling mode depends on the CPU speed, with a faster CPU having a higher crossover point.

Agilent IO Libraries Checks

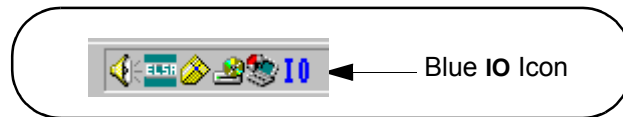
This section gives guidelines to make troubleshooting checks for the Agilent IO Libraries, including:

- Check IO Libraries Installation
- Check IO Control Operation
- Install IO Libraries (if 82350 Was Installed First)

Check IO Libraries Installation

Start your Agilent IO Libraries troubleshooting sequence by verifying IO Libraries installation. If the IO Libraries are installed, go to Check IO Control Operation.

- 1 Check Agilent IO Libraries Version.** If a version of the Agilent IO Libraries has been installed, a blue **IO** icon is normally displayed on the Windows taskbar (on the lower right-hand side of the screen).



- If the **IO** icon is displayed, click the icon and click **A**bout **Agilent IO Libraries Control** to display the version. The version must be L.01.00 or greater.
- If the **IO** icon is not displayed, a version may still be installed. To check this, click **Start | Programs** and look for the *Agilent IO Libraries* program group.
- If this group is displayed, click **Agilent IO Libraries | IO Control** to display the **IO** icon. Then, click the icon and click **A**bout **Agilent IO Libraries Control** to display the installed version (must be L.01.00 or greater).
- If neither the **IO** icon nor the Agilent IO Libraries program group is displayed, no Agilent IO Libraries are installed. In this case, or if the installed version is not L.01.00 or greater, you must install the newer version (see Step 2, following).

Agilent IO Libraries Checks

- 2 Install Agilent IO Libraries (as Required).** If Version L.01.00 or greater of the Agilent IO Libraries is not installed on your PC, install the libraries. Otherwise, go to “Check IO Control Operation”.

Check IO Control Operation

When the Agilent IO Libraries were installed, an IO Control was created. When the IO Control is active, it is displayed as a blue **IO** icon on the Windows taskbar. If the IO Control is deactivated, SICL/VISA applications that are running with the 82350 will be unable to open sessions.

By default, the IO Control is always active after the Agilent IO Libraries are installed and the blue **IO** icon is displayed. However, the IO Control may be active even though the blue **IO** icon is not displayed. There are two ways that the blue **IO** icon can be hidden:

- Clicking Hide Agilent IO Libraries Control.** Clicking the blue **IO** icon and then clicking **Hide Agilent IO Libraries Control** hides the **IO** icon, but does **not** deactivate the IO Control.
- Clicking Exit.** Clicking the blue **IO** icon and then clicking **Exit** causes a dialog box to appear that asks you if you want to terminate the Agilent IO Libraries Control. Clicking **Yes** hides the blue **IO** icon **and** deactivates the IO Control.

If the blue **IO** icon is not displayed, either the blue **IO** icon display has been turned off and/or the IO Control (and associated **iprocsvr.exe**) is not active. In this case, click **Start | Programs | Agilent IO Libraries** and then click **IO Control** to re-start the IO Control and to display the blue **IO** icon.

Install IO Libraries (if 82350 was Installed First)

If you installed the 82350 before installing the Agilent IO Libraries software, use the applicable step for your operating system to install the Agilent IO Libraries. After the drivers for all new cards are installed, you can run **Setup** from the *Instrument* CD to install and configure the Agilent IO Libraries.

NOTE

On older operating systems, you may be asked insert the 'HP I/O Libraries' CD. You should use the CD that contains the Agilent IO Libraries in this case. The card will be identified as a Hewlett-Packard card. This is necessary for backward compatibility.

- ❑ **Windows 2000:** The **Found New Hardware Wizard** will identify this card as a **PCI Simple Communications Controller**. The driver is typically located in the *Windows 2000* directory on the *Instrument CD*.
- ❑ **Windows NT 4.0:** Since Windows NT is not a *VXIplug&play* OS, all necessary driver installation and configuration is performed when you install the Agilent IO Libraries.
- ❑ **Windows 98:** The **Add New Hardware Wizard** will identify this card as a **PCI Communication Device**. The files needed for this device are typically located at the root of the *Instrument CD*.

Notes:

82350 Guide Information

82350 Guide Information

This chapter provides general information for the *82350 Installation and Configuration Guide*, including:

- Guide Contents
- Guide General Information
- Contacting Agilent

Guide Contents

What's in This
Guide?

The following table shows the contents of this guide.

Chapter	Description
<i>Chapter 1 - Installing and Configuring the 82350</i>	Shows how to install the 82350 and the Agilent IO Libraries on your Windows PC.
<i>Chapter 2 - Troubleshooting Guidelines</i>	Gives guidelines to troubleshoot the 82350 and the Agilent IO Libraries.
<i>Chapter 3 - 82350 Guide Information</i>	Shows the contents of this guide and provides general information for the guide.

Accessing an
Electronic Copy of
This Guide

There are three ways you can access an electronic (.pdf) version of this guide, as follows. You will need Adobe Acrobat Reader Version 3.0 or later to view the electronic version.

- **Access from the IO Control.** After the Agilent IO Libraries are installed, a blue IO icon appears on the right hand side of the Windows toolbar. To access an electronic version of this guide, click the IO icon, then click **View Documentation** and then click **82350 PCI GPIB Users Guide**.
- **Access from the Web.** On your Web browser address line, type: www.agilent.com/find/techsupport and navigate to the 82350 manual.
- **Access from the IO Libraries CD.** You can access an electronic copy of this guide from the Agilent *IO Libraries for Instrument Control* CD that shipped with the 82350. See "Accessing the User's Guide" in *Chapter 1 - Installing the 82350* for details.

Guide Contents**Related
Documentation**

Suggested documentation you can use for 82350 operation follows. After the Agilent IO Libraries have been installed on your PC, .pdf files of the Agilent IO Libraries, *VISA User's Guide*, and *SICL User's Guide* are available. Click the blue IO icon on the Windows taskbar and then click **View Documentation**.

Product	Related Documentation
Agilent IO Libraries	For additional information on the Agilent IO Libraries, see the <i>Agilent IO Libraries Installation and Configuration Guide for Windows</i> .
VISA	To develop and use VISA applications, see the <i>Agilent VISA User's Guide</i> .
SICL	For SICL I/O applications, see the <i>Agilent SICL User's Guide for Windows</i> .
Programmer's Toolkit	To develop programs in Visual Studio.Net, see the <i>Agilent T&M Programmer's Toolkit for Visual Studio.NET</i>

Guide General Information

General Information for this guide follows, including:

- Notice
- U.S. Government Restricted Rights
- Warranty Information
- Trademark Information
- Printing History
- Copyright Information
- Declaration of Conformity
- Radio and Television Interference
- Contacting Agilent

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Warranty Information

A copy of the specific warranty terms applicable to your Agilent Technologies product and replacement parts can be obtained from Agilent Technologies, Inc.

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Edition 2 - March 2003

Copyright Information

*Agilent Technologies 82350B PCI GPIB Interface
Installation and Configuration Guide*
Copyright © 2002, 2003 Agilent Technologies, Inc.
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Declaration of Conformity

See the next page for the Declaration of Conformity for the 82350B PCI GPIB Interface.

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

Manufacturer's Name: Agilent Technologies, Incorporated
Manufacturer's Address: 815 - 14th St. SW
 Loveland, Colorado 80537
 USA

Declares, that the product

Product Name: PCI GPIB Interface
Model Number: 82350B
Product Options: This declaration covers all options of the above product(s).

Conforms with the following European Directives:

The product herewith complies with the requirements of the Low Voltage Directive 73/23/EEC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly.

Conforms with the following product standards:

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

Supplemental Information

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

[2] This ISM device complies with Canadian ICES-001-1998.

Cet appareil ISM est conforme a la norme NMB-001-1998 du Canada.

26 Jul 2002

Date



Ray Corson
 Product Regulations Program Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor.

Radio and Television Interference

This device has been verified to comply with FCC Rules Part 15. Operation is subject to these two conditions: (1) this device may not cause radio interference, and (2) this device must accept any interference received (including interference that may cause undesired operation).

This equipment generates and uses radio frequency energy. If not installed and used in accordance with this manual, it can cause interference to radio and television communications. The rules with which it must comply afford reasonable protection against such interference when it is used in most locations. However, there can be no guarantee that such interference will not occur in a particular installation. If you think your computer is causing interference, turn off the system. If the radio or television reception does not improve, your computer is probably not causing the interference.

If your computer does cause interference to radio and television reception, you are encouraged to try to correct the interference by one or more of the following measures:

- Relocate the radio or television antenna.
- Move the computer away from the radio or television.
- Plug the computer into a different electrical outlet, so that the computer and radio or television are on separate electrical circuits.
- Make sure you use only shielded cables to connect peripherals to your computer.
- Consult your dealer, Agilent Technologies, or an experienced radio/television technician for other suggestions.
- Order the FCC booklet *How to Identify and Resolve Radio-TV Interference Problems* from the U.S. Government Printing Office, Washington DC, 20402. The stock number of this booklet is 004-000-00345-4.

Contacting Agilent

You can reach Agilent Technologies at these telephone numbers:

Americas Call Center: 1-800-452-4844
Canada Call Center: 1-877-894-4414
European Call Center: +31-20-547-9900
Japan Call Center: +81-426-56-7832

For other countries, contact your country's Agilent support organization. A list of contact information for other countries is available on the Agilent Internet site:

www.agilent.com/find/assist

A list of other Agilent Websites follows.

URL	Description
www.agilent.com/find/assist	Agilent Technologies "Contact Us" page
www.agilent.com/find/iolib	Update the Agilent IO Libraries software
www.agilent.com/find/iolib_support	The latest customer support information
www.agilent.com/find/ADN	Connectivity resources all in one place
www.agilent.com/find/techsupport	Technical support information, including manuals, application notes, FAQs, and software and firmware downloads
www.agilent.com/find/connectivity	For connection, communication and control of test instruments from your computer, you can find out the latest in connectivity.

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