Agilent 82351A PCIe GPIB Interface

User's Guide

Agilent Technologies

Notices

Manual Part Number

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Edition

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Safety Notices

CAUTION

A **CAUTION** notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in damage to the product or loss of important data. Do not proceed beyond a **CAUTION** notice until the indicated conditions are fully understood and met.

WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Safety Symbols

The following symbols on the instrument and in the documentation indicate precautions which must be taken to maintain safe operation of the instrument.

	Direct current
	Alternating current
	Both direct and alternating current
	Three-phase alternating current
	Earth (ground) terminal
	Protective conductor terminal
	Frame or chassis terminal
	Equipotentiality
	Off (supply)
	On (supply)
	Equipment protected throughout by double insulation or reinforced insulation.

	Caution, risk of electric shock.
	Caution, risk of danger (refer to this manual for specific Warning or Caution information.
	Caution, hot surface.
	Out position of a bi-stable push control.
	In position of a bi-stable push control.

General Safety Information

The following general safety precautions must be observed during all phases of operation, service and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

WARNING

- **Do not use the device if it appears damaged or defective.**
- **Observe all markings on the device before connecting any wiring to the device.**
- **Do not operate the device in the presence of flammable gases or fumes.**
- **Do not install substitute parts or perform any unauthorized modification to the device.**

CAUTION

- Use the device with the cables provided.
- Repair or service that this not covered in this manual should only be performed by qualified personnels.

Environment Conditions

This instrument is designed for indoor in the area with low condensation. Table 1 shows general environment requirements.

Table 1 Environment Requirements

Environment Conditions	Requirements
Operating environment	– 5 °C to 60 °C
Operating humidity	Up to 90% at 40 °C non-condensing
Storage environment	– 40 °C to 70 °C
Storage humidity	Up to 90% at 65 °C non-condensing

CAUTION

The Agilent 82351A PCIe GPIB Interface complies with the following safety and EMC requirements:

- IEC 61010-1:2001 / EN61010-1:2001
- Canada: CSA C22.2 No. 61010-1:2004
- IEC 61326:2002 / EN61326:1997+A1:1998+A2:2001+A3:2003

Regulatory Markings

CE ISM 1-A	The CE mark is a registered trademark of the European Community. This CE mark shows that the product complies with all the relevant European Legal Directives.
ICES/NMB-001	ICES/NMB-001 indicates that this ISM device complies with Canadian ICES-001.
CSA ®	The CSA mark is a registered trademark of the Canadian Standards Association. A CSA mark indicates that the product is certified for Canadian markets, to the applicable Canadian standards.
N10149	The C-tick mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australia EMC Framework regulations under the terms of the Radio Communication Act of 1992.
	This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.

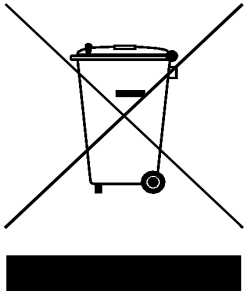
Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

This instrument complies with the WEEE Directive (2002/96/EC) marking requirement. This affixed product label indicates that you must not discard this electrical/electronic product in domestic household waste.

Product Category:

With reference to the equipment types in the WEEE directive Annex 1, this instrument is classified as a “Monitoring and Control Instrument” product.

The affixed product label is shown as below:



Do not dispose in domestic household waste

To return this unwanted instrument, contact your nearest Agilent office, or visit:

www.agilent.com/environment/product

for more information.

Agilent Technologies	**DECLARATION OF CONFORMITY** According to EN ISO/IEC 17050-1:2004	CE

Manufacturer's Name: Agilent Technologies Microwave Products (M) Sdn. Bhd
Manufacturer's Address: Bayan Lepas Free Industrial Zone,
11900, Bayan Lepas, Penang, Malaysia

Declares under sole responsibility that the product as originally delivered

Product Name: Agilent PCIe-GPIB Interface Card
Models Number: 82351A
Product Options: This declaration covers all options of the above product(s)

complies with the essential requirements of the following applicable European Directives, and carries the CE marking accordingly:

Low Voltage Directive (2006/95/EC)
EMC Directive (89/336/EEC, amended by 93/68/EEC)

and conforms with the following product standards:

	Standard	Limit
EMC	IEC 61326:2002 / EN 61326:1997+A1:1998+A2:2001+A3:2003	
	CISPR 11:1990 / EN55011:1990	Class A Group 1
	IEC 61000-4-2:1995 / EN 61000-4-2:1995	4 kV CD, 8 kV AD
	IEC 61000-4-3:1995 / EN 61000-4-3:1996	3 V/m, 80-1000 MHz
	IEC 61000-4-4:1995 / EN 61000-4-4:1995	0.5 kV signal lines, 1 kV power lines
	IEC 61000-4-5:1995 / EN 61000-4-5:1995	0.5 kV line-line, 1 kV line-ground
	IEC 61000-4-6:1996 / EN 61000-4-6:1996	3 V, 0.15-80 MHz
	IEC 61000-4-11:1994 / EN 61000-4-11:1994	1 cycle / 100%

Canada: ICES-001:2004
Australia/New Zealand: AS/NZS CISPR11:2004

The product was tested in a typical configuration with Agilent Technologies test systems.

Safety IEC 61010-1:2001 / EN 61010-1:2001
Canada: CAN/CSA-C22.2 No. 61010-1-04

206349

This DoC applies to above-listed products placed on the EU market after:

20-April-2007
Date

Mack Soh
Quality Manager

For further information, please contact your local Agilent Technologies sales office, agent or distributor,
or Agilent Technologies Deutschland GmbH, Herrenberger Straße 130, 71034 Böblingen, Germany.

Template: A5971-5302-2, Rev. D.00 82351A DoC Revision 1.0

Product Regulations

EMC

	Performance Criteria
IEC 61326-1:2002 / EN 61326-1:1997+A1:1998+A2:2001+A3:2003	
CISPR 11:1990 / EN 55011:1990 – Group 1 Class A	
IEC 61000-4-2:1995 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)	A
IEC 61000-4-3:1995 / EN 61000-4-3:1996 (3V/m, 80% AM)	A
IEC 61000-4-4:1995 / EN 61000-4-4:1995 (EFT 0.5kV line-line, 1kV line-earth)	A
IEC 61000-4-5:1995 / EN 61000-4-5:1995 (Surge 0.5kV line-line, 1kV line-earth)	A
IEC 61000-4-6:1996 / EN 61000-4-6:1996 (3V, 0.15~80 MHz, 80% AM, power line)	A
IEC 61000-4-11:1994 / EN 61000-4-11:1994 (Dips 1 cycle, 100%)	A
Canada: ICES-001:2004	
Australia/New Zealand: AS/NZS CISPR11:2004	

Safety IEC 61010-1:2001 / EN 61010-1:2001
Canada: CAN/CSA-C22.2 No. 61010-1-04

Additional Information:
The product herewith complies with the essential requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive 89/336/EEC (including 93/68/EEC) and carries the CE Marking accordingly (European Union).

[1]Performance Criteria:
A Pass - Normal operation, no effect.
B Pass - Temporary degradation, self recoverable.
C Pass - Temporary degradation, operator intervention required.
D Fail - Not recoverable, component damage.
N/A – Not applicable

Notes:

Regulatory Information for Canada
ICES/NMB-001:2004
This ISM device complies with Canadian ICES-001.
Cet appareil ISM est confomre à la norme NMB-001 du Canada.

Regulatory Information for Australia/New Zealand
This ISM device complies with Australian/New Zealand AS/NZS CISPR11:2004
N10149

In This Guide...

This guide provides step-by-step setup and configuration instructions that get you familiarized with the operations of the Agilent 82351A interface. This guide also contains troubleshooting guidelines that helps to resolve your problems during installations and configurations.

1 Installing and Configuring the 82351

Chapter 1 provides detailed steps to install and configure the Agilent 82351A PCIe GPIB interface, and guidelines to begin programming via the 82351A interface.

2 Troubleshooting Guidelines

Chapter 2 contains hardware and software verification steps to troubleshoot the connectivity and functionality of the Agilent 82351A PCIe GPIB interface.

3 Specifications and Characteristics

Chapter 3 lists specifications and characteristics of the Agilent 82351A PCIe GPIB interface.

4 General Information

Chapter 4 contains general information for the Agilent 82351A PCIe GPIB, including warranty information, related documentation and Agilent contacts.

Contents

Figures

Figures

Table

1
Installing and Configuring the 82351

This *Agilent 82351A PCIe GPIB Interface User's Guide* guides you the steps to install and configure the Agilent 82351A PCIe GPIB interface (called the 82351 in this guide) and shows you how to configure the 82351 PCIe GPIB interface card using Agilent IO Libraries Suite in Windows 2000 or Windows XP operating systems.

NOTE In case of difficulty in installing the 82351, see Chapter 2 Troubleshooting Guidelines.

Getting Started

In this guide, an 82351 GPIB Interface System is defined as a system in which GPIB instruments are connected via GPIB cables to an 82351 PCIe GPIB interface card (called the 82351 in this guide) that is installed in a Windows PC. The Figure 1-1 shows a typical system.

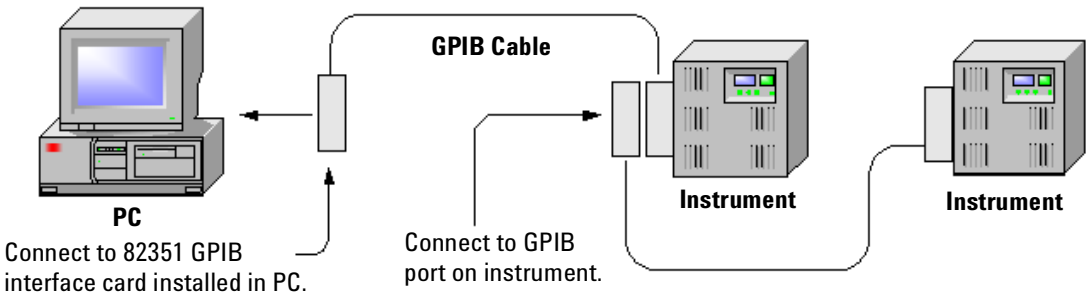


Figure 1-1 Typical configuration system

The Figure 1-2 shows a suggested sequence of steps to install and configure 82351 and to communicate between your PC and GPIB instruments via 82351.

To get started, you may use the Figure 1-1 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 82351 or GPIB instruments.

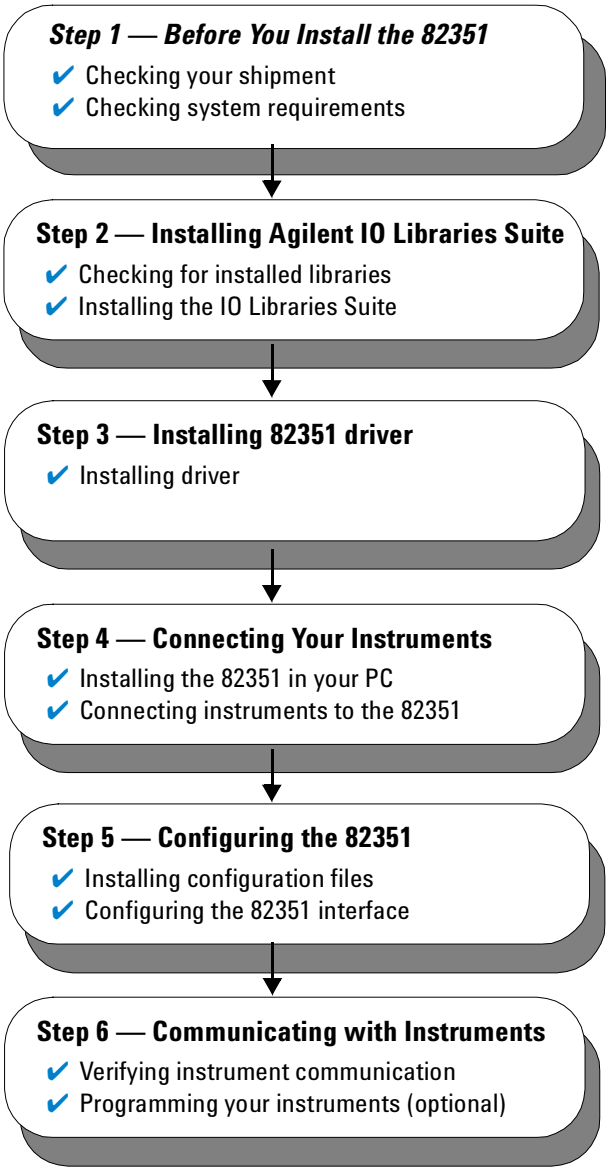


Figure 1-2 Steps to install and configure the 82351 Interface

Step 1 – Before You Install the 82351

Before you install the 82351, you should:

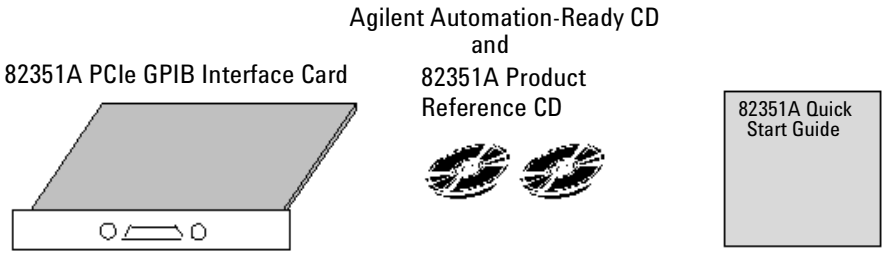
- ✔ Check Your Shipment
- ✔ Check System Requirements
- ✔ Create an Emergency Repair Disk

Checking Your Shipment

Your 82351 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 4 General Information for addresses and telephone numbers.

CAUTION To reduce the risk of damaging the 82351 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 82351A PCIe GPIB Interface Card
- ✔ Agilent Automation-Ready CD with IO Libraries Suite
- ✔ Agilent 82351A Product Reference CD
- ✔ Agilent 82351A Quick Start Guide



Checking System Requirements

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

Table 1-1 System requirement for installing 82351 interface card

Item	Minimum Requirements
Hardware Requirements	
PC Operation/Memory	Pentium® IV (with PCIe slot supported) 128 MB RAM (256 MB or greater is recommended)
Hard Drive Space	225 MB for installation: • 160 MB for Microsoft .NET Framework, • 65 MB for Agilent IO Libraries Suite 175 MB for operation: • 110 MB for Microsoft .NET Framework, • 65 MB for Agilent IO Libraries Suite
PCIe Bus Slot	At least one 3.3 V PCIe Bus Slot (to install 82351). 82351 is a 3.3 V card and can be fit in PCIe 1x, PCIe 4x or PCIe 8x slot.
Software Requirements	
Operating System	Windows 2000/XP

Creating an Emergency Repair Disk

The Agilent IO Libraries Suite includes I/O drivers for various PCIe 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 PCIe-compliant. This has caused problems when running the Agilent IO Libraries, whether or not the PCIe card is installed. Problems can include system errors, operating system crashes, or card initialization failures.

Step 2 – Installing Agilent IO Libraries Suite

This step shows how to install the Agilent IO Libraries Suite software, using default settings, including:

✔ Checking for Agilent IO Libraries Suite

✔ Installing Agilent IO Libraries Suite

NOTE

- See the *Agilent IO Libraries Getting Started Guide* on your *Automation-Ready CD* for a full description of installation options and installation troubleshooting information.
- You must have Administrator privileges to install the IO Libraries Suite and to run the Connection Expert utility.

Checking for Installed Agilent IO Libraries

Before you begin installation, check for previously installed Agilent IO Libraries software. If a version of the Agilent IO Libraries or Agilent IO Libraries Suite is installed on your PC, an **IO** icon may be displayed on the Windows task bar (on the lower right-hand side of the screen as shown in Figure 1-3).

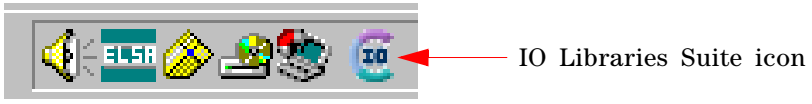


Figure 1-3 IO Libraries Suite icon

- If either **IO** icon is displayed, click the icon and click **About Agilent IO Control** to display the version. The version must be 14.2.8931.1 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 or Agilent IO Libraries Suite program group.

- If this group is displayed, click **Agilent IO Libraries Suite > Utilities > IO Control** to display the **IO** icon. Then, click the icon and click **About Agilent IO Control** to display the installed version (must be 14.2.8931.1 or greater).
- If neither the **IO** icon nor the Agilent IO Libraries program group is displayed, it means no Agilent IO Libraries are installed yet. You can use the steps in this chapter or in the *Agilent IO Libraries Suite Getting Started Guide* to install the libraries.
- If the version of the Agilent IO Libraries is less than 14.2.8931.1, you must install the newer version included on your *Automation-Ready CD* to support the 82351A.
- If your version of the Agilent IO Libraries is above 14.2.8931.1, but less than the version on your *Automation-Ready CD*, you may want to install the newer version to take advantage of new features and greater ease of use of the more recent Agilent IO Libraries Suite.

NOTE Agilent IO Libraries Suite 14.0 is the revision immediately following Agilent IO Libraries M.01.01, so you should consider revision "14.0" to be a greater version number than "L" or "M". Configuration instructions in this manual make use of Agilent IO Libraries Suite 14.2.

Installing Agilent IO Libraries Suite

To install the Agilent IO Libraries Suite software,

1. First, disconnect any USB instruments, USB/GPIB converters, and FireWire-VXI interfaces that are connected to your PC.
2. Insert the *Automation-Ready CD* in your CD-ROM drive. Wait a few seconds until the Agilent IO Libraries Suite auto-run window appears.
3. If the auto-run window does not appear automatically, click **Start > Run...** and type `<drive>:autorun\auto.exe`, where <drive> is your CD drive letter.
4. When the Agilent IO Libraries Suite auto-run window appears, follow the directions in this window to install the Agilent IO Libraries Suite. See the *Agilent IO Libraries Getting Started Guide* on your *Automation-Ready CD* for a full description of installation options and installation troubleshooting information.

Step 3 – Installing 82351 Driver

After the Agilent IO Libraries Suite (version 14.2.8931.1 or greater) has been installed, insert the *Agilent 82351A Product Reference CD* for installation.

1. Insert the *Agilent 82351A Product Reference CD* into your CD-ROM drive. Wait for a few seconds until the auto-run window appears.
2. If the installer is not automatically activated, click **Start > Run** and type `<drive>:autorun\auto.exe`, where `<drive>` is your CD drive letter.
3. When the auto-run window appears, follow the instruction on that window to install the 82351A driver.

Step 4 – Connecting Your Instruments

This step shows how to install an 82351 in a PCIe slot in your PC and how to connect GPIB instruments to the 82351, including:

- ✔ Installing the 82351 in Your PC
- ✔ Connecting Instruments to the 82351

NOTE If you have not yet installed the Agilent IO Libraries Suite and 82351 driver, go to Step 2 – Installing Agilent IO Libraries Suite and install the software BEFORE you install the 82351 in your PC. To install 82351 driver, go to Step 3 – Installing 82351 Driver.

CAUTION To reduce the risk of damaging the 82351, only handle the card by the sheet metal frame or by its edges. Never touch any other part of the card, including the PCIe connector.

NOTE The 82351A is a 3.3 V PCIe card and will only fit in a PCIe 1x, PCIe 4x or PCIe 8x slot.

Installing the 82351 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.

The 82351 serial number is located on the white serial number label on the card. The serial number contains 10 characters that encodes the country of manufacture, Agilent year, workweek of manufacture and a unique sequential number. The last four digits indicate a unique serial number assigned sequentially to a 82351.

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.

NOTE Take precautions against static discharge when handling and installing cards.

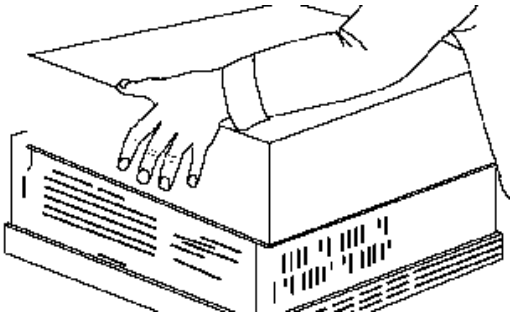


Figure 1-4 Remove PC cover

3 **Remove a cover plate.** Remove one of the PC back panel cover plates. The 82351A is a 3.3 V PCIe card and will only fit in a PCIe 1x, PCIe 4x or PCIe 8x slot. Choose a 3.3 V PCIe slot that will give adequate clearance for the GPIB connector.

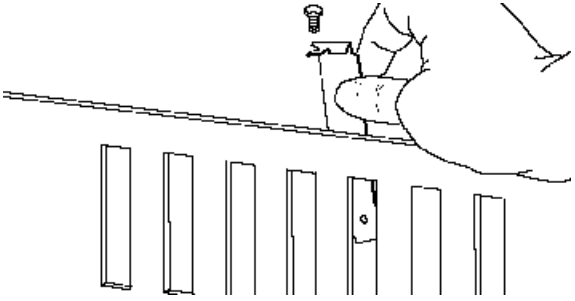


Figure 1-5 Remove cover plate

4 **Install the 82351.** Insert the 82351 interface card edge connector into the PCIe 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.

If you install more than one 82351, you may want to install the cards so there is at least one empty slot between every two 82351s. When inserting the 82351, 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.

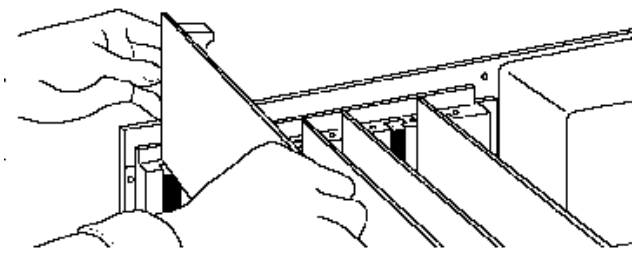


Figure 1-6 Install 82351 interface card

5 **Replace the cover plate screw.** This will hold the 82351 in place. Save the blank cover plate for use if the 82351 is later removed. Replace the PC cover(s) as described in your PC documentation.

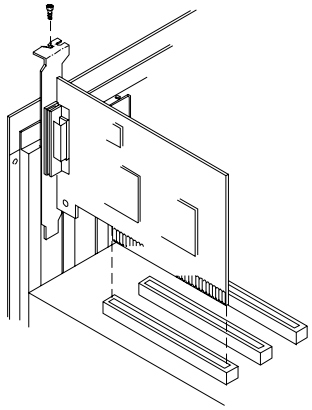


Figure 1-7 Replace the cover plate screw

Connecting Instruments to the 82351

After the 82351 is installed in your PC, the next step is to connect your GPIB instruments to the installed 82351. See the following suggested steps for the connection. When you have made the connections, go to Step 5 – Configuring the 82351.

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 ≤ 14. See the following guidelines:

- 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. For systems with devices that not using tri-state drivers, the transfer rate is limited to < 250 kilobytes/sec. Turning devices on or off while a system is running may cause faulty operation.
- For operation with data transfer rates < 500 kilobytes/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.

2 **Connect GPIB Cables to the 82351.** Connect a separate GPIB cable to each installed 82351. Tighten the GPIB connector screws finger-tight only. (The screwdriver slots are mainly for removal purposes only.) Two example connections follow connect a single GPIB instrument or to connect multiple GPIB instruments.

For information or to purchase Agilent GPIB cables, see www.agilent.com/find/gpibcables

Example: Connecting a single GPIB instrument

This Figure 1-8 shows connections from a single GPIB instrument to the GPIB connector of an 82351 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 or instruments.

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

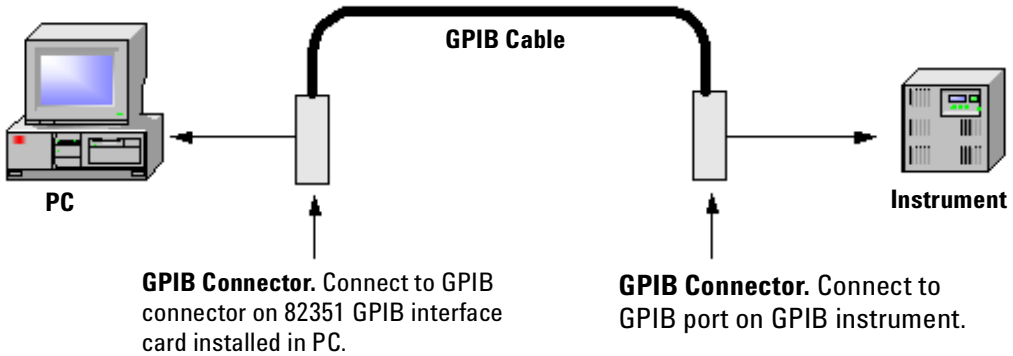


Figure 1-8 Connection from a single GPIB instrument to an 82351 GPIB interface card

Example: Connecting multiple GPIB Instruments

This Figure 1-9 shows one way to connect three GPIB instruments to an 82351. 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 or instruments.

NOTE Although the Figure 1-9 shows cable connections to GPIB Instrument 1, the connection can be to any GPIB instrument in the system.

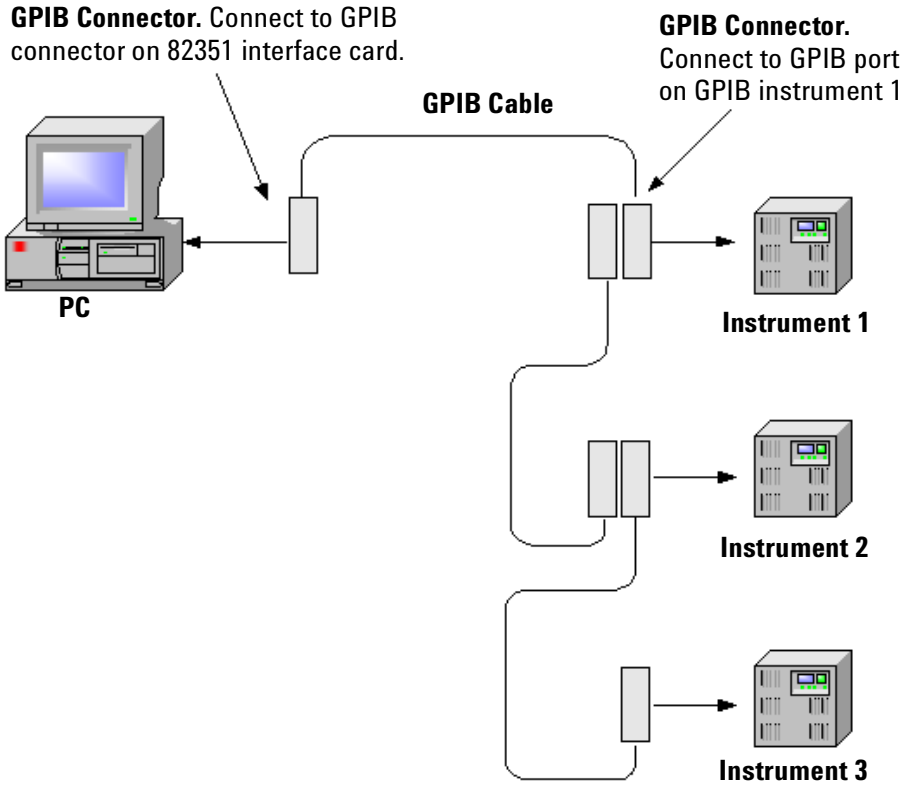


Figure 1-9 Connection from multiple GPIB instruments to 82351 GPIB interface card

Step 5 – Configuring the 82351

This step shows how to configure a Windows 2000/XP operating system in a PC that has an 82351 installed, including:

- ✔ Installing Configuration Files
- ✔ Configuring the 82351 Interface

Installing Configuration Files

1 **Turn the PC ON.** As Windows restarts, the system will detect the new hardware and **Found New Hardware Wizard** will appear. This Figure 1-10 shows a typical Windows 2000 display. The display may be different for other operating systems.

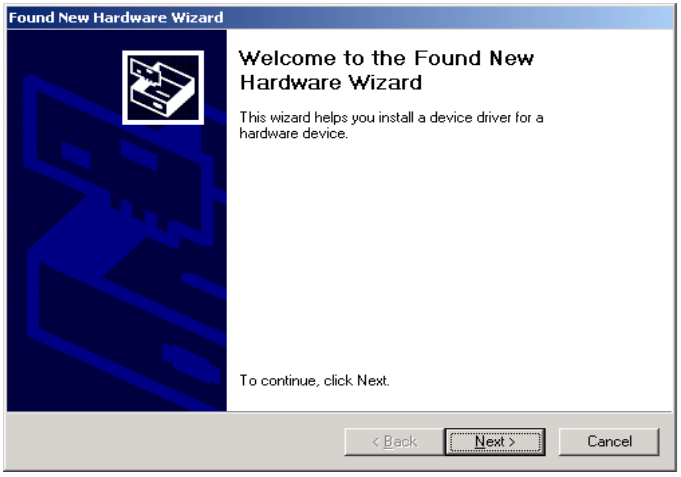


Figure 1-10 Found New Hardware Wizard window

2 **Install Configuration Files.** Click **Next >** to accept the default suggestions. Click **Finish** to complete the installation. Then, go to Configuring the 82351 Interface.

Configuring the 82351 Interface

1 **Open Connection Expert.** Click the **IO** icon on the Windows taskbar, the Agilent Connection Expert window will appear as shown in Figure 1-11. Highlight the GPIB interface in the explorer view (tree view at the center of the window) and click **Change Properties...** to display the Agilent 82351 PCIe GPIB Interface dialog box as shown in Figure 1-12.

NOTE For a description of Connection Expert and the Agilent IO Libraries Suite, see the Agilent IO Libraries Suite Online Help. To access this Help file, click the IO Control and select Documentation > IO Libraries Suite Help.

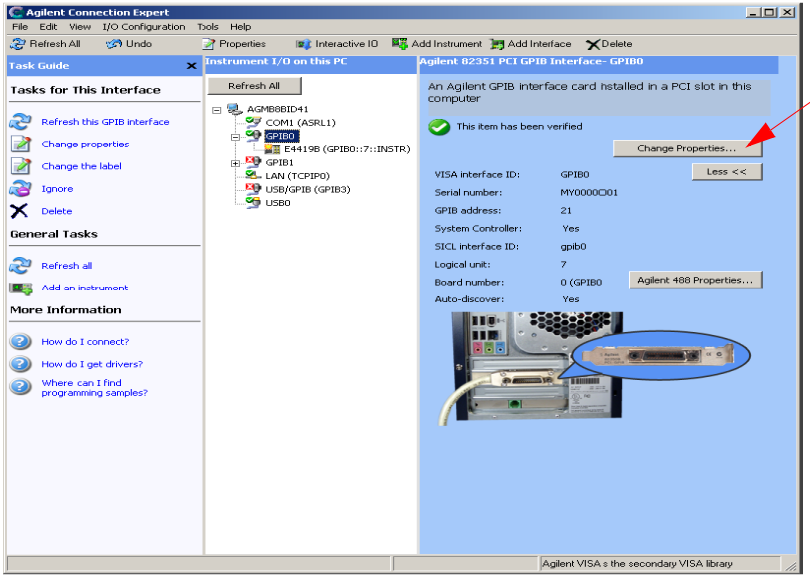


Figure 1-11 Agilent Connection Expert window

2 **Configure GPIB Card Parameters.** When the Agilent 82351 PCIe GPIB Interface dialog box (Figure 1-12) appears, set the **VISA interface ID, SICL interface ID, Logical unit** and **GPIB 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). Then, click **OK**. See Table 1-2 for description of each settings and guidelines to set these values.

NOTE

Changes to certain properties of the 82351, including:

- GPIB address
- System controller flag
- SICL interface ID
- Logical unit

will not take effect until you reboot your PC. If you choose not to reboot immediately, Connection Expert will display a warning icon until you reboot.

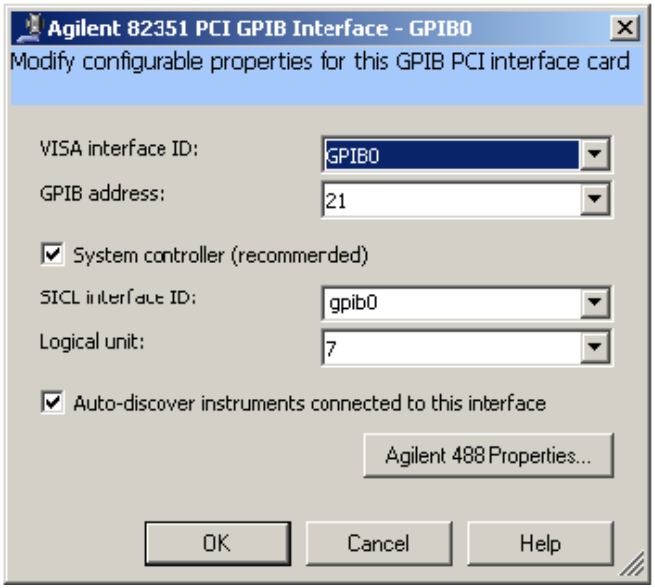


Figure 1-12 Agilent 82351 PCIe GPIB Interface dialog box

Table 1-2 82351 GPIB interface card configuration parameters

82351 GPIB Interface Card Configuration Parameters	
VISA Interface ID	Symbolic name that VISA uses to uniquely identify this GPIB interface. The default VISA interface ID is GPIB0. The 82351 interface ID 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.
GPIB 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. 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.
SICL Interface ID	Symbolic name that SICL uses to uniquely identify this GPIB interface. The default Interface ID is gpib0. The SICL interface ID 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.
Logical Unit	Number that SICL uses to uniquely identify this 82351 interface. The logical unit number is an integer in the range of 0 - 10000. Remember this value and the SICL interface ID to properly address the GPIB interface in your SICL applications.

3 **Repeat steps for other cards.** If you have installed more than one 82351 in your PC, repeat these steps for the remaining cards. Then, go to Step 6 – Communicating with Instruments.

Step 6 – Communicating with Instruments

After the 82351 has been configured and you have connected your GPIB instruments to the 82351, the next step is to establish communication between your PC and the instruments using the **Interactive IO** utility. After communication has been established, you can begin to program the instruments using VISA, VISA COM, SICL, or SCPI commands. This section includes:

- ✔ Verifying Instrument Communication
- ✔ Programming Your Instruments (Optional)

Verifying Instrument Communication

When the Agilent IO Libraries Suite is installed on your PC, an I/O utility called Interactive IO is also installed. You can use Interactive IO to verify communication between your PC and the connected GPIB instruments. This section shows you how to verify instrument communication using **Interactive IO**.

NOTE Once your GPIB interface has been configured in Connection Expert, if you can see the attached GPIB instrument(s) in the Connection Expert explorer and the respective IDN string information in the detail pane, it means the communication has been established. Interactive IO allows you to manually verify communication and send specific commands to your instruments.

To use **Interactive IO** to send a `*IDN?` (identification) query to an instrument, see the steps below:

1. Select the instrument by clicking its icon in the Connection Expert explorer view.
2. Right-click the instrument and click **Send Commands To This Instrument** to display the **Interactive IO** window as shown in Figure 1-13. For information of the **Interactive IO**, including a list of common commands and the commands' description, click **Help > Help Topics**.

3 `*IDN?` is the default command. Click **Send & Read** to send the identification query to the instrument and display its reply in the **Interactive IO** window.

4 To send other commands, click **Commands>** to select from a list of common commands, or type a command into the **Command:** field. If you experience time-out errors for some commands, click **Options** to change the time-out value.

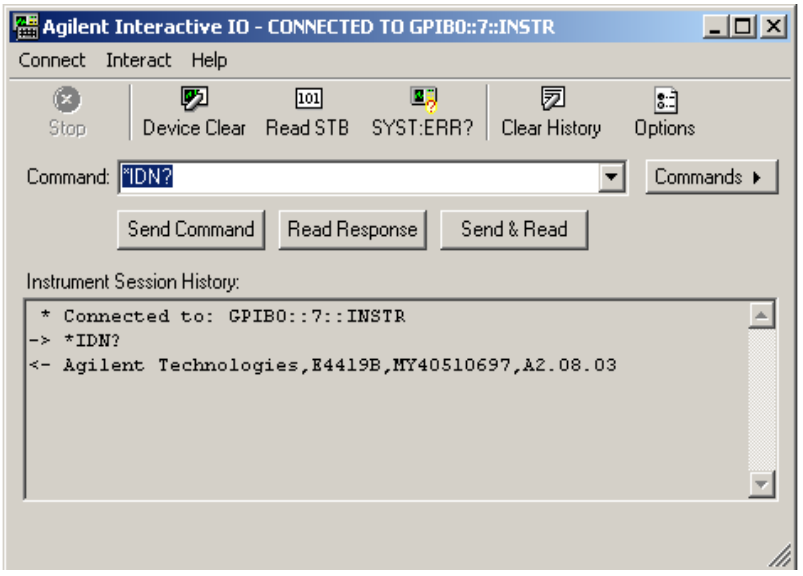


Figure 1-13 Agilent Interactive IO window

Programming Your Instruments

This section provides an introduction to programming GPIB instruments via the 82351 PCIe GPIB interface using the Agilent VISA and SICL IO Libraries. You can program in various languages and applications, including Visual Basic, Visual C++, 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 various IO Libraries and instrument drivers in the instrument user's guide. After the 82351 is successfully installed and configured, it should act as a transparent interface for programming GPIB instruments.

For information on programming using Agilent VISA, see the *Agilent VISA User's Guide*. For information on VISA COM and for function references for VISA, VISA COM, and SICL, see the *IO Libraries Suite Online Help*.

Accessing Programming Manuals and Help

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

To access the *Agilent VISA User's Guide*, click the **IO** icon and then click **Documentation > VISA Users Guide**. To access the *Agilent SICL User's Guide* for Windows, click the **IO** icon and then click **Documentation > SICL Users Guide.** To access VISA COM information, and function references for VISA, VISA COM, and SICL, click the **IO** icon and then click **Documentation > IO Libraries Suite Help**.

Example: GPIB Interface Configuration

An I/O interface consists of a hardware interface and a software interface. One purpose of the Connection Expert utility is to associate a unique software interface ID with a hardware interface. The Agilent IO Libraries Suite uses an interface ID 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 the Figure 1-14 consists of a Windows PC with two 82351 GPIB cards connected to three GPIB instruments via GPIB cables. For this system, the Connection Expert utility has been used to assign GPIB card #1 a VISA interface ID of "GPIB0" and a SICL interface ID of "gpib0".

Connection Expert has also been used to assign GPIB card #2 a VISA interface ID of "GPIB1" and a SICL interface ID of "gpib1". With these names assigned to the interfaces, the VISA/SICL addressing is as shown in the Figure 1-14. Since unique names have been assigned by Connection Expert, 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.

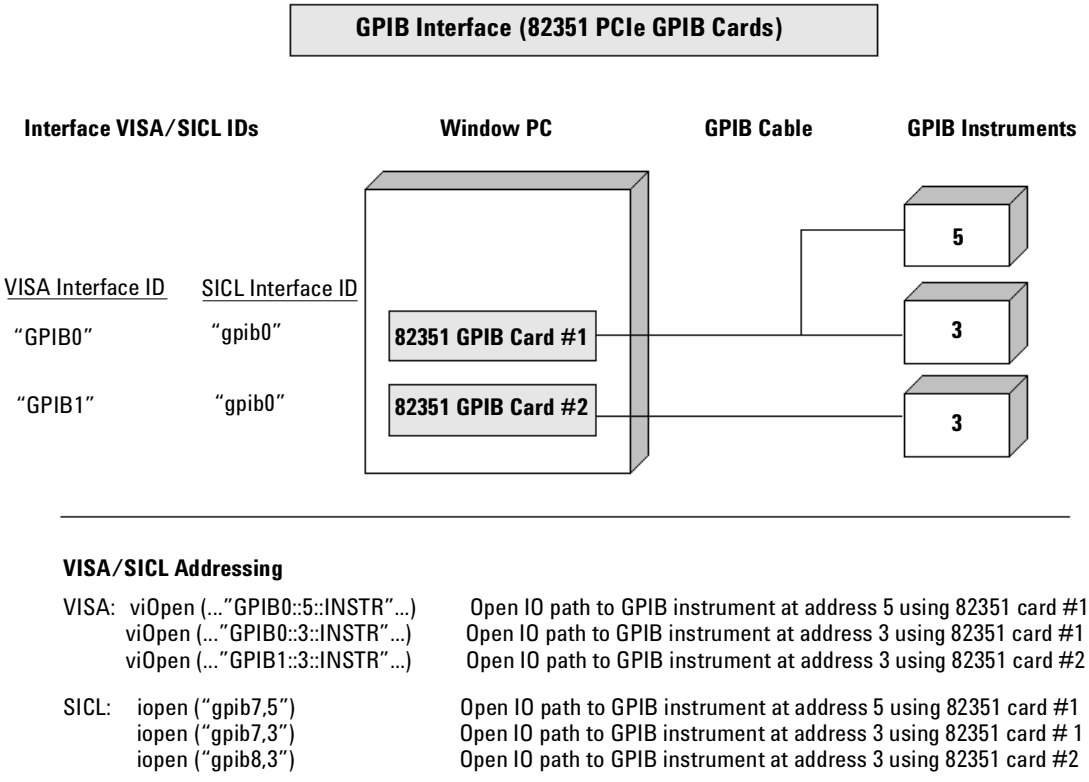


Figure 1-14 Example of GPIB interface configuration

2
Troubleshooting Guidelines

This chapter shows suggested troubleshooting steps when you encounter communication failure during 82351 installation.

NOTE Additional troubleshooting information appears in the Agilent IO Libraries Suite Online Help and on the Web at http://www.agilent.com/find/iolib

Troubleshooting Overview

A suggested troubleshooting flow chart for the 82351, installed instruments, and the Agilent IO Libraries Suite follows. We suggest you start at Step 1 and then go to Step 2 and then to Step 3, as required.

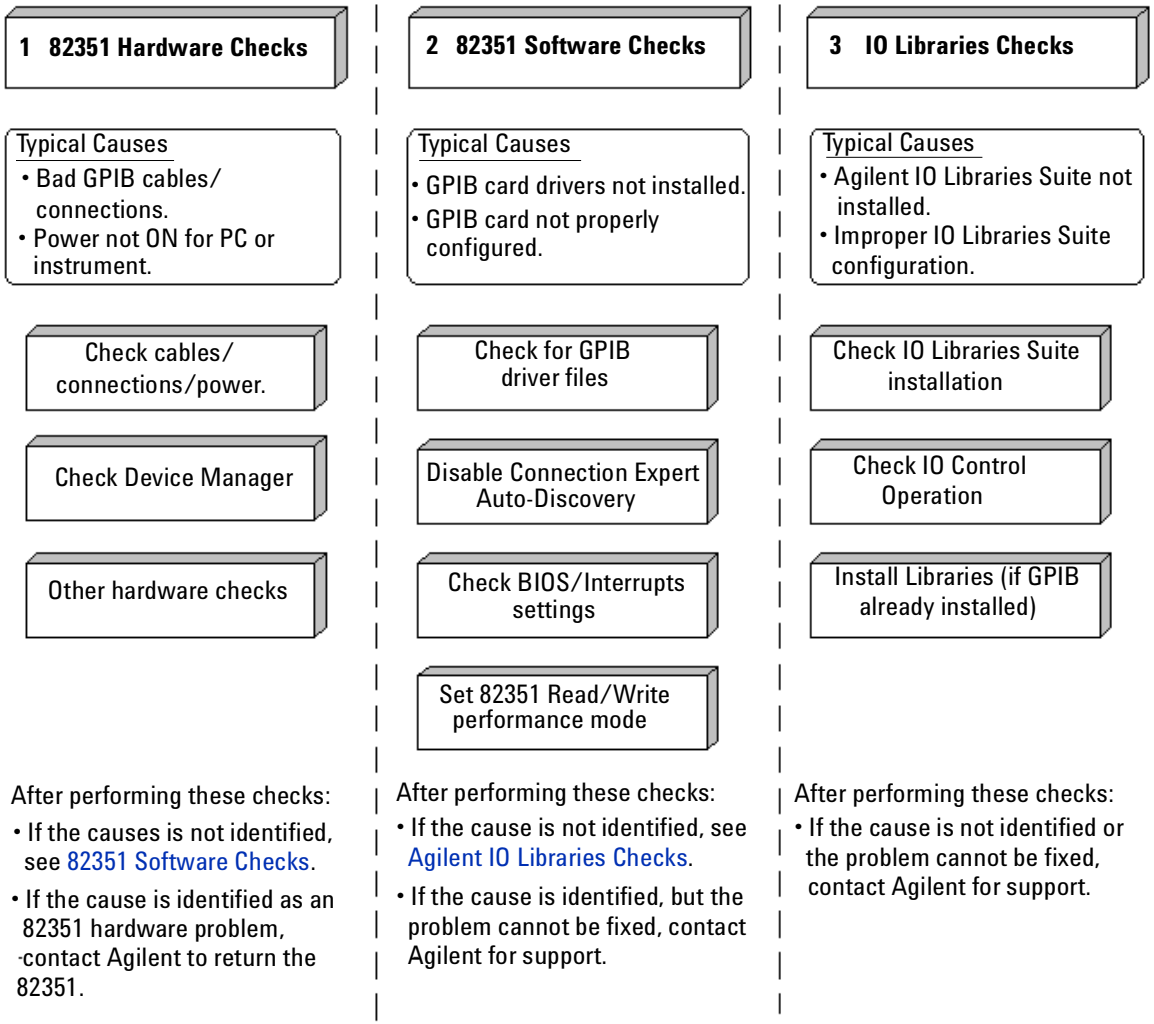


Figure 2-1 Troubleshooting flow chart

82351 Hardware Checks

This section provides you guidelines to make hardware troubleshooting checks for the 82351, including:

- ✔ Check Cables, Connections and Power
- ✔ Check Device Manager
- ✔ If Sound Card Does Not Work
- ✔ If Data Transfers to Devices Fail
- ✔ If Connection Expert Finds 82351 Card with Serial Number ffffffff

Check Cables/Connections/Power

We suggest you to start troubleshooting sequence by performing hardware checks. If the hardware checks do not solve the problem, see 82351 Software Checks.

NOTE There are no user-serviceable parts for the 82351. If you suspect a hardware failure for the 82351, 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 82351 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 re-install the 82351 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 82351 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 82351. Since **Device Manager** may have disabled the 82351 device, click **Enable** to restart the 82351. If this does not resolve the problem, go to 82351 Software Checks.

If Sound Card Does Not Work

If your sound card stops working after configuring interfaces, disable the auto-discovery process in Connection Expert. The auto-discovery process can cause sound and other cards to stop responding. To disable the auto-discovery process, run Connection Expert, select **Tools > Options**, and clear the check boxes labeled **Automatic discovery** or **refresh of I/O resources** and **Automatic configuration of unconfigured interfaces**. Close Connection Expert and restart your PC.

If Connection Expert Finds 82351 Card with Serial Number ffffffff

If Connection Expert reports finding an 82351 card with serial number `ffffffff`, this is typically caused by getting into a situation where PCIe cards are not properly configuring. Try the following:

1. **Upgrade your system BIOS to the latest version.** Note that new computers often have newer BIOSs available. When installing new BIOS, ensure the BIOS Installed O/S setting is set correctly. This determines what software will configure all the Plug and Play cards in your system. Either the BIOS or the operating system 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.
2. **If your computer locks up or freezes after installing.** Typically, this is caused by interrupt conflicts with other drivers in the system. PCIe allows sharing of IRQs, but this also means that the drivers for cards with which the 82351 shares an IRQ must handle interrupt chaining properly.
3. **Perform driver workarounds.** Here are some ways to work around drivers that are not behaving properly:
   - Upgrade the drivers for devices sharing an IRQ with the 82351, 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.
4. **Reconfigure Your PC.** Configure your PC so as to not share IRQ lines. Many PCIe cards have bugs when sharing IRQ lines. You may or may not be able to do this on your PC; many PCs can be configured using the setup option when the PC is first booting.

82351 Software Checks

This section provides guidelines for 82351 software checks, including:

- ✔ Check for 82351 Driver Files
- ✔ Disable Connection Expert Auto-Discovery
- ✔ Check BIOS/Interrupts Settings
- ✔ Set 82351 Read/Write Performance Mode

Check for 82351 Driver Files

After installing Agilent IO Libraries Suite, check for installed 82351 driver files.

1 Check for 82351 driver files. Files are listed in their default directories.

Table 2-1 Directories of the 82351 driver files

Windows 2000	
Program Files	C:\Program Files\Agilent\IO Libraries Suite\drivers\ag350i32.dll
Driver Files	C:\Winnt\system32\drivers\agt82350.sys
.inf Files	C:\Winnt\inf\agtgpib.inf
Windows XP	
Program Files	C:\Program Files\Agilent\IO Libraries Suite\drivers\ag350i32.dll
Driver Files	C:\Windows\system32\drivers\agt82350.sys
.inf Files	C:\Windows\inf\agtgpib.inf

NOTE If the "inf" folder is not found in C:\WINDOWS, on the WINDOWS folder, go to **Tools > Folder Options > View**. Scan the list of settings for **Show hidden files and folders** option and click to enable this setting. Click **Apply** then **OK** for the setting to take effect.

2 **Driver files not found.** If any of the driver files cannot be found, re-install the 82351A driver from the *82351A Product Reference CD* and repeat step 1. If problem persists, proceed to step 3.

3 **Uninstall Agilent IO Libraries Suite.** If the driver files cannot be found, uninstall the Agilent IO Libraries Suite. Go to **Control Panel > Add or Remove Programs**, select Agilent IO Libraries Suite and click **Remove**. Follow the instructions to remove the libraries.

4 **Re-install the Agilent IO Libraries Suite.** Insert the *Automation-Ready CD* into CD-ROM, follow the instructions in Chapter 1, Step 2 – Installing Agilent IO Libraries Suite to re-install the libraries. If you do not have the *Automation-Ready CD*, you can download the Agilent IO Libraries Suite from www.agilent.com/find/iolib.

5 Re-install the 82351A driver. Re-install the 82351A driver from the accompanying *82351A Product Reference CD*.

Disable Connection Expert Auto-Discovery

If your PC sound card stops working after configuring interfaces, disable the auto-discovery process in Connection Expert, as the auto-discovery process can cause sound and other cards to stop responding.

To disable the auto-discovery process, run Connection Expert, select **Tools > Options**, and clear the check boxes labeled **Automatic discovery or refresh of I/O resources** and **Automatic configuration of unconfigured interfaces.** Close Connection Expert and restart your PC.

Check BIOS/Interrupts Settings

If Connection Expert reports finding an 82351 card with Serial Number `ffffffff`, this is typically caused by PCIe cards not properly being configured. Try the following steps. If these steps do not work, remove and re-install the 82351 and then reconfigure the card.

1. **Upgrade your system BIOS to the latest version.** New computers often have newer BIOSs available. When installing new BIOS, ensure the BIOS Installed O/S setting is set correctly. This determines what software will configure all the Plug and Play cards in your system. Either the BIOS or the operating system 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.
2. **If your computer locks up or freezes after installing**. This is typically caused by interrupt conflicts with other drivers in the system. PCIe allows sharing of IRQs, but this also means the drivers for cards which share an IRQ must handle interrupt chaining properly.

   To validate the driver of 82351 card, right-click on **My Computer** and select **Properties**. Click the **Device Manager** in the **Hardware** tab, find the 82351 card and check that all other cards on the same IRQ have a valid driver, not the big yellow question mark.

   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.

   To perform driver workarounds, you can 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.

3 **Reconfigure Your PC.** Configure your PC so as to not share IRQ lines. Many PCIe 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 booting.

Set 82351 Read/Write Performance Mode

The 82351 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 82351 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 buffer size 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.
- 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 used 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 Suite Checks

This section provides guidelines to troubleshoot problems involving the Agilent IO Libraries Suite, including:

- ✔ Check IO Libraries Suite Installation
- ✔ Check IO Control Operation
- ✔ Install IO Libraries Suite (if 82351 was Installed First)

Check IO Libraries Suite Installation

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

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

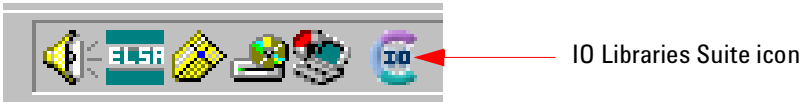


Figure 2-2 IO Libraries Suite icon

- If the **IO** icon is displayed, click the icon and click **About Agilent IO Control** to display the version. The version must be 14.2.8931.1 or greater.

NOTE Agilent IO Libraries Suite 14.0 was the revision immediately following Agilent IO Libraries M.01.01, so you should consider revision "14.0" to be a greater version number than "L" or "M". Configuration instructions in this manual make use of Agilent IO Libraries Suite 14.2.

- 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 or Agilent IO Libraries Suite program group.
- If this group is displayed, click **Agilent IO Libraries Suite > Utilities > IO Control** to display the **IO** icon. Then, click the icon and click **About Agilent IO Control** to display the installed version (must be 14.2.8931.1 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 14.2.8931.1 or greater, you must install the newer version (see Chapter 1, Step 2 – Installing Agilent IO Libraries Suite).

2 Install Agilent IO Libraries Suite (as required). If version 14.2.8931.1 or greater of the Agilent IO Libraries is not installed on your PC, install the IO Libraries Suite. Otherwise, go to Check IO Control Operation.

Check IO Control Operation

When the Agilent IO Libraries Suite is installed, an IO Control is created. When the IO Control is active, it is displayed as an **IO** icon on the Windows taskbar. If the IO Control is deactivated, SICL/VISA applications that are running with the 82351 will be unable to open sessions.

By default, the IO Control is always active after the Agilent IO Libraries Suite is installed and the **IO** icon is displayed. However, there may be times when IO Control can get deactivated and the **IO** icon is not displayed. There are two ways to hide the **IO** icon:

- **Hide Agilent IO Control**. Click the **IO** icon and select **Hide Agilent IO Control** from the drop down menu. Alternately, you can uncheck the **View > Agilent IO Control** in Connection Expert. This will hide the **IO** icon, but will not deactivate the IO Control.
- **Click Exit.** Click the **IO** icon and select **Exit** from the drop down menu. A dialog box explaining the consequences of removing the IO appears, click **Yes** to hide the **IO** icon and deactivate the IO Control.

If the **IO** icon is not displayed, either the **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 Suite > Utilities > IO Control** to re-start the IO Control and display the **IO** icon.

Install IO Libraries Suite (if 82351 was installed first)

If you installed the 82351 before installing the Agilent IO Libraries Suite software, follow these steps to install and configure the IO Libraries Suite and the necessary drivers for your card.

1. Install the Agilent IO Libraries Suite as described in Chapter 1, Step 2 – Installing Agilent IO Libraries Suite.
2. If the Connection Expert utility does not recognize your 82351 and display it as a **PCIe GPIB Interface**, you may need to use **Windows Device Manager** to associate the correct drivers with your card. Follow the steps below:
   a. Start the **Windows Device Manager** as follows: Right-click on **My Computer**, select **Properties**, then the **Hardware** tab, then **Device Manager**.
   b. Find the **PCI Simple Communications Controller** in the **Device Manager**, and select **Update Driver...**
   c. Allow Windows to find and install the driver automatically. You are not require to insert a CD.

3
Specifications and Characteristics

This chapter describes product technical specifications that include general requirement, general characteristics and environmental specifications for Agilent 82351A PCIe GPIB interface card.

General Requirements

Before installing Agilent 82351A PCIe GPIB interface card, ensure your PC meets the following requirements. Table 3-1 shows the general requirements for installing Agilent 82351A PCIe GPIB interface card.

Table 3-1 General requirements

Software/Hardware	Requirement
Minimum system requirements	Windows 2000/XP
Software required	Agilent IO Libraries Suite 14.2 and above
PCIe BUS slot	3.3 V PCIe, 32 bits
Support standards	PCIe rev. 1.0a IEEE 488.1 and IEEE 488.2 compatible

General Characteristics

All characteristics are typical performance value and are not warranted. Table 3-2 shows the general characteristics of Agilent 82351A PCIe GPIB interface card.

Table 3-2 General characteristics

General characteristics	Requirement
Power	Backplane +3.3 V PCIe
Connectors	Standard 24-pin (IEEE-488) +1.5 V PCIe
PCIe Slot	PCIe 1x, PCIe 4x, PCIe 8x
GPIB transfer rate	1.4 MB/s or better
Maximum instrument connection	14 instruments – daisy chain via GPIB
Buffering	Built-in
Configuration	Plug and Play
Dimension (Width x Depth x Height)	158.3 mm (W) x 120.8 mm (D) x 21.6 mm (H)
Weight	0.082 kg
Warranty	1 year
Safety and EMC	IEC 61010-1:2001 / EN61010-1:2001 Canada: CSA C22.2 No. 61010-1:2004 IEC 61326:2002/EN61326:1997+A1:1998+A2:2001+A3:2003 Pollution Degree 2 This product is rated for indoor use only.

Environmental Conditions

This instrument is designed for indoor in the area with low condensation. Table 3-3 shows the general environment specifications of Agilent 82351A PCIe GPIB interface card.

Table 3-3 Environmental conditions

Environmental Conditions	Requirement
Operating environment	– 5 °C to 60 °C
Operating humidity	Up to 90% at 40 °C non-condensing
Storage environment	– 40 °C to 70 °C
Storage humidity	Up to 90% at 65 °C non-condensing

4
General Information

This chapter provides general information for the *Agilent 82351A PCIe GPIB Interface User's Guide* and guides you how to access the related documentation for 82351.

Accessing an Electronic Copy of This Guide

There are two 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 Suite is installed, an **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 **Documentation** and then click *82351 PCIe GPIB Users Guide*.

- **Access from the Web.** On your Web browser address line, type www.agilent.com/find/82351A and navigate to the 82351 manual. The web version of the manual will always be the latest revision.

Related Documentation

Suggested documentation you can use for 82351 operation follows. After the Agilent IO Libraries Suite has been installed on your PC, .pdf files of the *Agilent IO Libraries Suite Getting Started Guide, VISA User's Guide, and SICL User's Guide* are available. Click the **IO** icon on the Windows taskbar and then click **Documentation**.

Product	Related Documentation
Agilent IO Libraries Suite	For additional information on the Agilent IO Libraries Suite, see the *Agilent IO Libraries Suite Getting Started Guide* and the *Agilent IO Libraries Suite Online Help*.
VISA	To develop and use VISA applications, see the *Agilent VISA User's Guide* and the *VISA Online Help*.
VISA COM	To develop and use VISA COM applications, see the *VISA COM Online Help*.
SICL	For SICL I/O applications, see the *Agilent SICL User's Guide for Windows* and the *SICL Online Help*.
Agilent T&M Toolkit	To develop test and measurement programs in Visual Studio .NET quickly and easily, use the *Agilent T&M Toolkit* product (Web site at www.agilent.com/find/toolkit).

Warranty Services

Standard Warranty (Worldwide)

1. Agilent warrants that this Agilent hardware, accessories, and/or supplies will be free from defects in materials and workmanship for the period specified above. If Agilent receives notice of such defects during the warranty period, Agilent will, at its option, either repair or replace products that prove to be defective. Replacement products may be either new or equivalent in performance to new.
2. Agilent warrants that Agilent software will not fail to execute its programming instructions for the period specified above, due to defects in material and workmanship when properly installed and used. If Agilent receives notices of such defects during the warranty period, Agilent will replace software that does not execute its programming instructions due to such defects.
3. Agilent does not warrant that the operation of Agilent products will be uninterrupted or error free. If Agilent is unable, within a reasonable time, to repair or replace any product to a condition as warranted, you will be entitled to a refund of the purchase price upon prompt return of the product.
4. Agilent products may contain remanufactured parts equivalent to new in performance or may have been subject to incidental use.
5. The warranty period begins on the date of delivery or on the date of installation if installed by Agilent. If customer schedules or delays Agilent installation more than 30 days after delivery, warranty begins on the 31st day after delivery.
6. This warranty does not apply to defects resulting from
   - improper or inadequate maintenance, repair, or calibration
   - software, interfacing, parts, or supplies not supplied by Agilent
   - unauthorized modification, or misuse
   - operation outside of the published environmental specifications for the product
   - improper site preparation or maintenance.

7 Agilent makes no other express warranty, whether written or oral, with respect to this product.

8 TO THE EXTENT ALLOWED BY LOCAL LAW, THE ABOVE WARRANTIES ARE EXCLUSIVE AND NO OTHER WARRANTY OR CONDITION, WHETHER WRITTEN OR ORAL, IS EXPRESSED OR IMPLIED. AGILENT SPECIFICALLY DISCLAIMS ANY IMPLIED WARRANTIES OR CONDITIONS OF MERCHANT – ABILITY, SATISFACTORY QUALITY, AND FITNESS FOR A PARTICULAR PURPOSE. Some countries, states, or provinces do not allow limitations on the duration of an implied warranty, so the above limitation or exclusion might not apply to you. This warranty gives you specific legal rights and you might also have other rights that vary from country to country, state to state, or province to province.

9 TO THE EXTENT ALLOWED BY LOCAL LAW, THE REMEDIES IN THIS WARRANTY STATEMENT ARE YOUR SOLE AND EXCLUSIVE REMEDIES EXCEPT TO THE EXTENT PROHIBITED BY LOCAL LAW, IN NO EVENT WILL AGILENT OR ITS SUBSIDIARIES, AFFILIATES OR SUPPLIERS BE LIABLE FOR DIRECT, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR OTHER DAMAGES (INCLUDING LOST PROFIT, LOST DATA, OR DOWNTIME COST), ARISING OUT OF THE USE, INABLITITY TO USE, OR THE RESULTS OF USE OF THE PRODUCT, WHETHER BASED IN WARRANTY, CONTRACT, TORT, OR OTHER LEGAL THEORY, AND WHETHER OR NOT ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Your use of product is entirely at your own risk. Some countries, states, and provinces do not allow the exclusion or limitation of liability for incidental or consequential damages, so the above limitation may not apply to you.

EXCEPT TO THE EXTENT ALLOWED BY LOCAL LAW, THESE WARRANTY TERMS, DO NOT EXCLUDE, RESTRICT OR MODIFY, AND ARE IN ADDITION TO, THE MANDATORY STATUTORY RIGHTS APPLICABLE TO THE SALE OF THIS PRODUCT TO YOU.

Accessories Warranty

Agilent offers warranty for product's accessories for up to 3 months from the end-user acceptance date.

Returning Instrument for Service

Before shipping your instrument for repair or replacement, Agilent recommends that you acquire the shipping instructions from the Agilent Technologies Service Center. A clear understanding of the shipping instructions is necessary to secure your product for shipment.

1 Write the following information on a tag and if attach to the instrument.

- Name and address of owner
- Instrument model number
- Instrument serial number
- Description of the service required or failure indications

2 Remove all accessories from the instrument

Do not include accessories unless they are associated with the failure symptoms.

3 Protect the instrument by wrapping it in plastic or heavy paper.

4 Pack the instrument in foam or other shock absorbing material and place it in a strong shipping container.

You are recommended to use the original shipping material or order materials from an Agilent Technologies Sales Office. If both options are not available, place 8 to 10 cm (3 to 4 inches) of shock-absorbing and static-free packaging material around the instrument to avoid movement during shipping.

5 Seal the shipping container securely.

6 Mark the shipping container as FRAGILE.

In the ensuing correspondence, refer to the instrument by its model number and full serial number.

Agilent suggests that you always insure your shipments.

Contacting Agilent

You can reach Agilent Technologies at this telephone number in the Americas:

Americas Call Center: 1-800-829-4444

For other locations, contact your country's Agilent support organization.

A list of contact information for other countries is available on the Agilent Web site at:

www.agilent.com/find/assist

URL	Description
www.agilent.com/find/assist	Agilent Technologies "Contact Us" page
www.agilent.com/find/iolib	Update the Agilent IO Libraries Suite software
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.

Index

www.agilent.com

Contact us
To obtain service, warranty or technical support assistance, contact us at the following phone numbers:

United States:
(tel) 800 829 4444 (fax) 800 829 4433
Canada:
(tel) 877 894 4414 (fax) 800 746 4866
China:
(tel) 800 810 0189 (fax) 800 820 2816
Europe:
(tel) 31 20 547 2111
Japan:
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Taiwan:
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Other Asia Pacific Countries:
(tel) (65) 6375 8100 (fax) (65) 6755 0042

Or visit Agilent worldwide web at:
www.agilent.com/find/assist

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