Agilent U2781A
USB Modular
Instrument Chassis

User's Guide

Agilent Technologies

Notices

Manual Part Number

U2781-90003

Edition

Warranty

Technology Licenses

Restricted Rights Legend

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. If the equipment is used in a manner not specified by the manufaturer, the protection provided by the equipment may be impaired.

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 Information

The following general safety precautions must be observed during all phases 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, Inc. assumes no liability for the customer's failure to comply with these requirements.

Safety Symbols

The following symbols indicate that precautions must be taken to maintain safe operation of the instrument.

	Direct current
	Warning

Regulatory Markings

	The CE mark shows that the product complies with all the relevant European Legal Directives (if accompanied by a year, it signifies when the design was proven).
	The CSA mark is a registered trademark of the Canadian Standards Association. A CSA mark with the indicators "C" and "US" means that the product is certified for both the U.S. and Canadian markets, to the applicable American and Canadian standards.
	The UL Mark is a registered trademark of Underwriters Laboratories Inc. UL listing mark with the indicators "C" and "US" indicates the product compliance with both Canadian and U.S. requirements.
	The C-tick mark is a registered trademark of the Spectrum Management Agency of Australia. This signifies compliance with the Australian EMC Framework regulations under the terms of the Radio Communications Act of 1992.
ICES/NMB-001	This ISM device complies with the Canadian ICES-001.

General Safety Information

<div style="color:#c00;">**WARNING**</div>

- Do not use the device if it is damaged.Before you use the device, inspect the case. Look for cracks or missing plastic. Do not operate the device around explosive gas, vapor or dust.
- Do not apply more than the rated voltage (as marked on the device) between terminals, or between terminal and external ground.
- Always use the device with the cables provided.
- Observe all markings on the device before connecting to the device.
- Turn off the device and application system power before connecting to the I/O terminals.
- When servicing the device, use only specified replacement parts.
- Do not operate the device with the removable cover removed or loosened.
- Do not connect any cables and terminal block prior to performing self-test process.

CAUTION

- Do not load the output terminals above the specified current limits. Applying excessive voltage or overloading the device will cause irreversible damage to the circuitry.
- Applying excessive voltage or overloading the input terminal will damage the device permanently.
- If the device is used in a manner not specified by the manufacturer, the protection provided by the device may be impaired.
- Always use dry cloth to clean the device. Do not use ethyl alcohol or any other volatile liquid to clean the device.
- Do not permit any blockage of the ventilation holes of the device.

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:
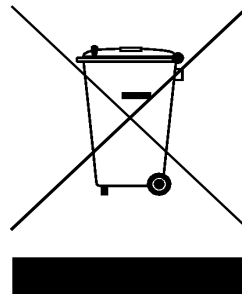
Do not dispose in domestic household waste

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

http://www.agilent.com/environment/product

for more information.

In This Guide...

1 **Getting Started** provides an overview of the U2781A USB modular instrument chassis, the product outlook and dimension. This chapter also contains instructions on how to get started with the U2781A USB modular chassis.

2 **Features and Functions** provides information for better understanding of the features and functions of U2781A USB modular instrument chassis.

3 **Characteristics and Specifications** specifies the characteristics, environment conditions, and specifications of the U2781A USB modular instrument chassis.

<table>
<tr><td>**Agilent Technologies**</td><td>**DECLARATION OF CONFORMITY**
According to ISO/IEC Guide 22 and CEN/CENELEC EN 45014</td><td>CE</td></tr>
</table>

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: USB Modular Instrument Chassis (USB Card cage)
Models Number: U2781A
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 (73/23/EEC, amended by 93/68/EEC)
> EMC Directive (89/336/EEC, amended by 93/68/EEC)

and conforms with the following product standards:

EMC

Standard	Limit
IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998	
CISPR 11:1990 / EN55011:1991	Class A Group 1
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	0.5 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-001:1998
> Australia/New Zealand: AS/NZS 2064.1

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

Safety   IEC 61010-1:2001 / EN 61010-1:2001
             Canada: CSA C22.2 No. 61010-1:2004
             USA: UL 61010-1: 2004

Supplementary Information:
U2781A is USB Modular Instrument chassis with 6 USB modules slot.

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

19-Dec-2006	
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, D 71034 Böblingen, Germany.

Template: A5971-5302-2, Rev. B.01	U2781A	Rev 1.0

Product Regulations

EMC		Performance Criteria
	IEC 61326-1:1997+A1:1998 / EN 61326-1:1997+A1:1998	
	CISPR 11:1990 / EN 55011:1991 – Group 1 Class A	
	IEC 61000-4-2:1995+A1:1998 / EN 61000-4-2:1995 (ESD 4kV CD, 8kV AD)	B
	IEC 61000-4-3:1995 / EN 61000-4-3:1995 (3V/m, 80% AM)	A
	IEC 61000-4-4:1995 / EN 61000-4-4:1995 (EFT 0.5kV line-line, 1kV line-earth)	B
	IEC 61000-4-5:1995 / EN 61000-4-5:1995 (Surge 0.5kV line-line, 1kV line-earth)	B
	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%)	C
	Canada: ICES-001:1998 Australia/New Zealand: AS/NZS 2064.1	
Safety	IEC 61010-1:2001 / EN 61010-1:2001 Canada: CSA C22.2 No. 61010-1:2004 USA: UL 61010-1: 2004	

Additional Information:

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

[1]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-001:1998
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 2064.1

Ⓒ N10149

Contents

List of Tables

List of Figures

1

Getting Started

This chapter provides an overview of the U2781A USB modular instrument chassis, the product outlook and dimension. This chapter also contains instructions on how to get started with the chassis from the installation of modules to the chassis to the installations of hardware and software to the start-up and configurations of Agilent Measurement Manager application software.

:··: Agilent Technologies

1

Introduction

The U2781A USB modular instrument chassis is a 4U height chassis with six USB module slots. It is a portable chassis with high performance added value. It targets a wide range of applications in both industrial and scientific environments. It helps you lower your cost of test and accelerate your test system integration and development.

The Agilent U2781A is equipped with USB plug-and-play connectivity. The USB interface that is compliant with the TMC-488.2 Standards works seamlessly with Agilent Measurement Manager software and can be controlled remotely via industry standard SCPI commands. In addition, the U2781A modular instrument chassis comes with Agilent IO Libraries Suite 14.2.

The U2781A modular instrument chassis comes with star trigger bus, which offers precise synchronization between USB modules and the external trigger signal. The star trigger bus is a dedicated trigger lines between the external trigger input and USB slots.

The Agilent U2781A USB modular instrument chassis can be applied to nearly any industrial data acquisition, industrial automation and education environment. The primary advantage is its synchronization capability between modules.

Product Overview

Product Outlook
Front View

Module
L-Mount Kit

Bumper

ON/OFF
switch

Rear View

Trigger In

USB Port

Trigger Out

Ext 10 MHz

AC Input

Dimension

197.00 mm

270.00 mm

271.20 mm
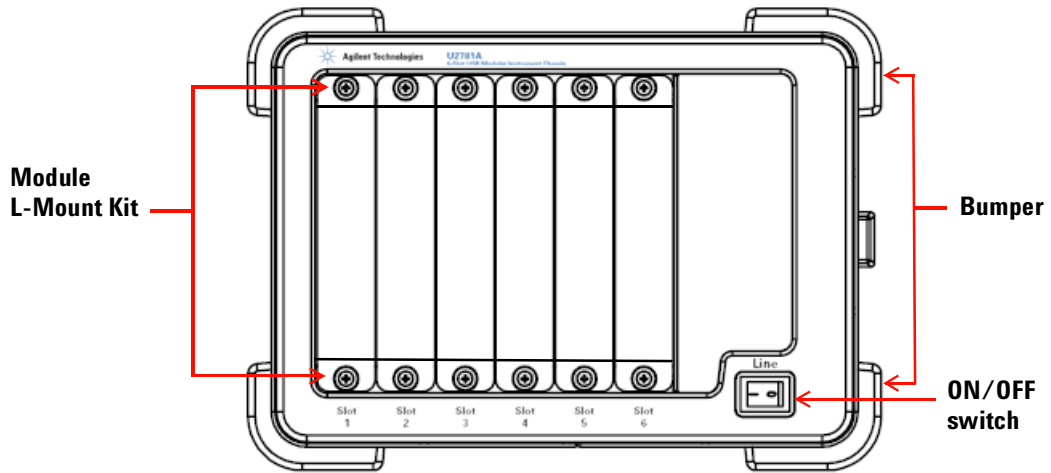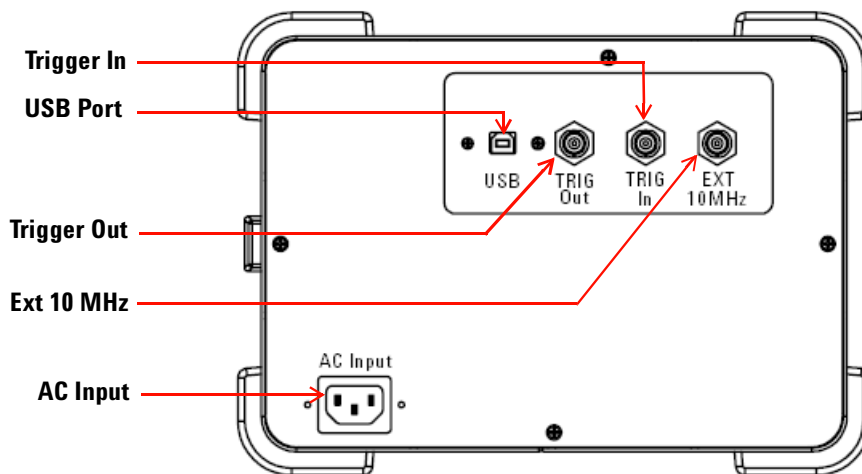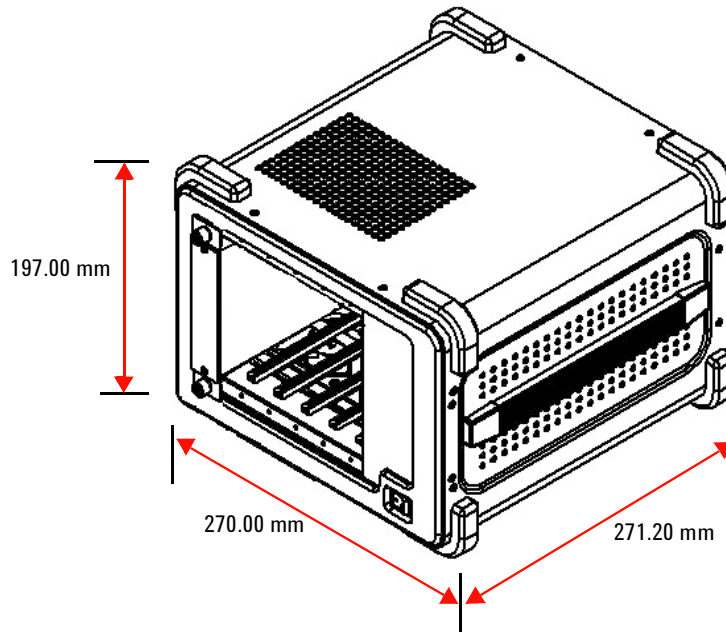
Standard Purchase Items Checklist

Inspect and verify the following items for the standard purchase of U2781A USB modular instrument chassis. If there are missing items, contact the nearest Agilent Sales Office.

✔ Power cord

✔ USB Extension Cable

✔ Agilent U2781A USB Modular Instrument Chassis Quick Start Guide

✔ Agilent USB Modular Instrument U2300A & U2700A Series Product Reference CD-ROM

✔ Agilent Automation-Ready CD (contains the Agilent IO Libraries Suite)

✔ Functional Test Certificate

Installations and Configurations

If you are using the U2781A USB modular instrument chassis with the Agilent Measurement Manager, follow the step-by-step instructions as shown in the following flowchart.

NOTE
- If you do not wish to specifically use the U2781A USB modular instrument chassis with the Agilent Measurement Manager software, and use the USB module with Agilent VEE, LabVIEW, or Microsoft Visual Studio only, you can skip steps F and H in the following flowchart.
- You need to install IVI-COM driver before using the U2781A Series with Agilent VEE, LabVIEW or Microsoft Visual Studio.

A. Instrument Setup

B. Check Your System Requirements

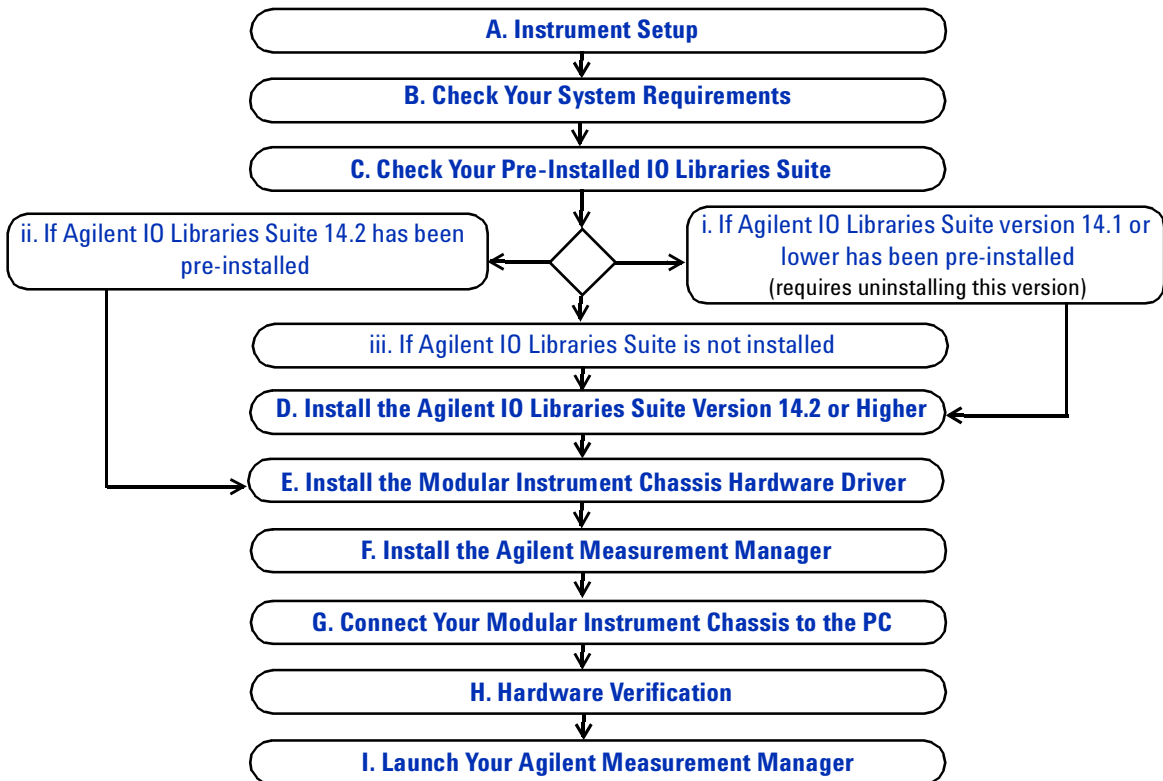C. Check Your Pre-Installed IO Libraries Suite

ii. If Agilent IO Libraries Suite 14.2 has been pre-installed

i. If Agilent IO Libraries Suite version 14.1 or lower has been pre-installed
(requires uninstalling this version)

iii. If Agilent IO Libraries Suite is not installed

D. Install the Agilent IO Libraries Suite Version 14.2 or Higher

E. Install the Modular Instrument Chassis Hardware Driver

F. Install the Agilent Measurement Manager

G. Connect Your Modular Instrument Chassis to the PC

H. Hardware Verification

I. Launch Your Agilent Measurement Manager

A. Instrument Setup

L-Mount Kit Installation and Chassis Setup

In order to slot in the USB modular instrument into the U2781A USB modular instrument chassis, you are required to install the L-Mount kit to any of your USB modular instrument. The L-Mount kit is a standard shipped item of USB modular instrument.

Follow the simple procedures below to install the L-Mount kit to a USB modular instrument.
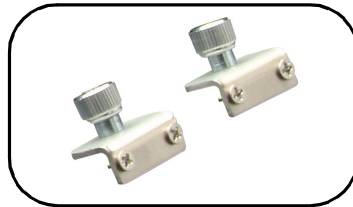
1 Unpack the L-Mount kit from the packaging.
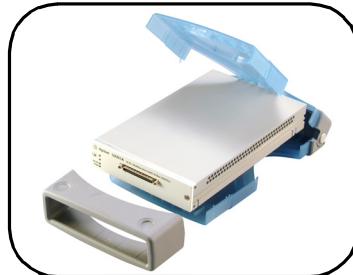
2 Remove your USB module from its plastic casing by pulling the bumper (front end of the casing) outward direction. Then, lift the plastic body casing and remove it from your USB module.
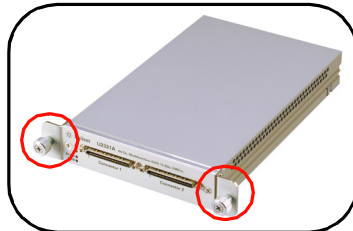
3 Using the Philip screw driver, screw the L-Mount kit to your USB module.
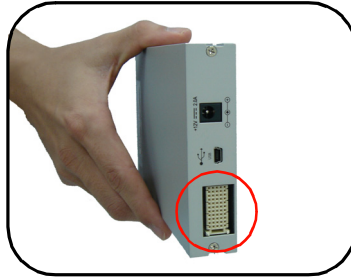
4   To slot in the USB module to your chassis, turn your USB module perpendicularly and ensure that the 55-pin backplane connector is at the bottom side of the USB module.

5   Your USB module is now ready to be plug into an instrument chassis.

B. Check Your System Requirements

Before installing the Agilent Measurement Manager software and the hardware driver, make sure your PC meets the following minimum system requirements for installation and data acquisition.

Processor   1.6 GHz Pentium IV or higher

Operating system   One of the following Microsoft Windows versions: Windows XP Professional or Home Edition (Service Pack 1 or later), Windows 2000 Professional (Service Pack 4 or later)

Browser   Microsoft Internet Explorer 5.01 or higher

Available RAM   512 MB or higher recommended

Hard disk space   1 GB

Pre-requisite   Agilent IO Libraries Suite 14.2 or higher, Agilent T&M Toolkit 2.1 Runtime version, Microsoft .NET Framework version 1.0 and 2.0

NOTE	• The Agilent T&M Toolkit 2.1 Runtime, and Microsoft .NET Framework 1.0 and 2.0 are bundled with the Agilent Measurement Manager software installer.

• If you do not have Agilent T&M Toolkit 2.1 Runtime, or Microsoft .NET Framework 1.0 and 2.0 installed in your PC, launching the Agilent Measurement Manager software installation, as instructed in **F. Install the Agilent Measurement Manager**, will prompt for installation of these tools.

C. Check Your Pre-Installed IO Libraries Suite

To check the version of your pre-installed IO Libraries Suite follow the instructions below.

1 Right-click IO Control icon on your taskbar notification area and the context menu will appear as shown below. Select **About Agilent IO Control**.
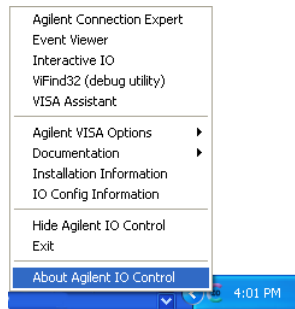
2 Agilent IO Control window will appear and the version of installed IO Libraries Suite will be displayed as shown below.
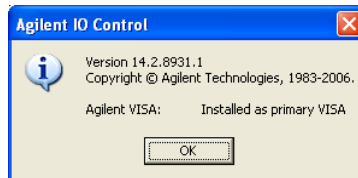
| NOTE | If the Agilent IO Control icon is not visible on the taskbar notification area it may indicates that,
• you do not have the Agilent IO Libraries installed, or
• you have hidden the Agilent IO Control icon from the taskbar notification area.
To activate the icon, go to **Start > All Programs > Agilent IO Libraries Suite > Utilities > IO Control**. You will now see the Agilent IO Control icon appear on your taskbar notification area. |
|---|---|

i. If Agilent IO Libraries Suite version 14.1 or lower has been pre-installed

If you have Agilent IO Libraries Suite version 14.1 or lower installed on your PC, you are required to uninstalling the IO Libraries Suite.

1   To perform uninstallation, go to **Start > Control Panel > Add or Remove Programs**. The Add or Remove Programs window will appear select Agilent IO Libraries Suite 14.1 or lower version.

2   Click **Change/Remove** and select **Remove** when the instructions on the screen prompted to proceed uninstalling the IO Libraries Suite version 14.1 or lower from your PC.

3   Proceed to **D. Install the Agilent IO Libraries Suite Version 14.2 or Higher**.

ii. If Agilent IO Libraries Suite 14.2 has been pre-installed

If you have the IO Libraries Suite 14.2 pre-installed on your PC, skip Step C and proceed to **E. Install the Modular Instrument Chassis Hardware Driver**.

iii. If Agilent IO Libraries Suite is not installed

If you do not have IO Libraries Suite installed on your PC, go to **D. Install the Agilent IO Libraries Suite Version 14.2 or Higher**.

D. Install the Agilent IO Libraries Suite Version 14.2 or Higher

The Agilent IO Libraries Suite 14.2 is available in the *Agilent Automation- Ready CD* that comes with the standard purchase of U2781A USB modular instrument chassis.

<table>
<tr>
<td>**NOTE**</td>
<td>

- If you do not have the *Agilent Automation-Ready CD*, obtain the Agilent IO Libraries Suite 14.2 or higher at http://www.agilent.com/find/iolib.

- Ensure that you do not have any USB module connected to your PC during installation of the Agilent IO Libraries Suite.

</td>
</tr>
</table>

1 Disconnect any USB module that is connected to your PC and close all other applications on your PC.

2 Insert the *Agilent Automation- Ready CD* into your CD- ROM drive, and follow the instructions on your screen.

3 If the installation does not start automatically, go to **Start > Run** (on the Windows start menu) and type `<drive>:\autorun\ auto.exe` where `drive` is your CD- ROM drive.

4 If you obtain the Agilent IO Libraries Suite from the web, save the self- extracting zip file (*.exe) to any location on your hard disk.

5 Double- click the installation file to launch the installation.

6 Follow the instructions on your screen to proceed with the installation.

7 After the installation is completed, you will see the IO Control icon on the Windows taskbar notification area as shown below.


<table>
<tr>
<td>**NOTE**</td>
<td>For detailed installation instructions, refer to the *Agilent IO Libraries Suite Getting Started Guide* at http://www.agilent.com/find/iolib.</td>
</tr>
</table>

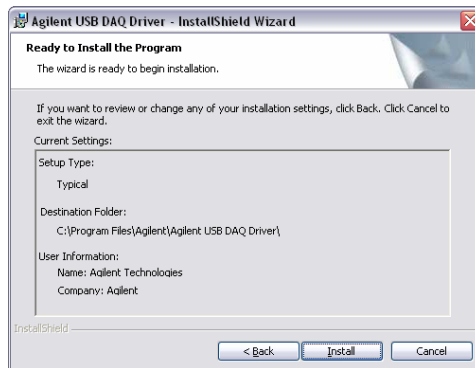# E. Install the Modular Instrument Chassis Hardware Driver

1 Verify that your PC meets the minimum system requirements as stated in **B. Check Your System Requirements**.

2 Insert the product reference CD-ROM into your CD-ROM drive.

3 Installer will automatically launch the Agilent U2300 Series Installation Menu. Click **Hardware Driver** to begin the installation of the hardware driver.
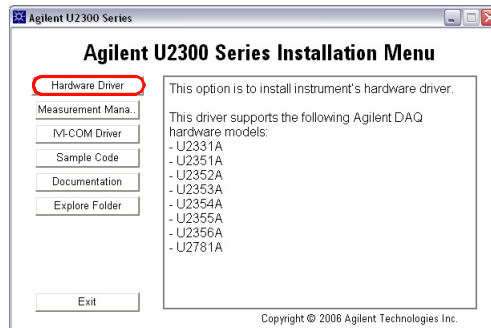
4 If the menu does not launch automatically, go to **Start > Run** (on the Windows Start menu) and type `<drive>:\Driver\ Hardware\setup_hw.exe`, where `drive` is your CD-ROM drive. Click **OK** to begin installation.

5 The Agilent USB DAQ Driver dialog box will appear as shown below. Click **Next** to proceed.

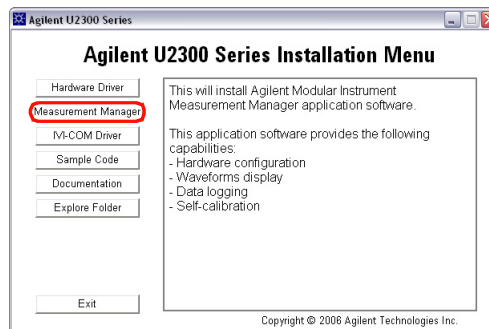**6** Click **Install** to begin installation.

**7** Click **Finish** when the installation has completed.

F. Install the Agilent Measurement Manager

1 If you have done **E. Install the Modular Instrument Chassis Hardware Driver**, proceed to Step 2. If not, close all other applications on your PC and insert the product reference CD-ROM into your CD-ROM drive.

2 Click **Measurement Manager** on the Agilent U2300 Series Installation Menu to begin the installation.

3 If the installation menu does not appear after a few seconds, go to **Start > Run** and type `<drive>:\Application\Modular Instruments Measurement Manager\setup.exe`, where `drive` is your CD-ROM drive.

4 Click **OK** to begin installation.

5 If you do not have the Agilent T&M Toolkit 2.1 Runtime version and/or Microsoft .NET Framework version 1.0 and 2.0 installed, the InstallShield Wizard software pre-requisite will appear as shown below.
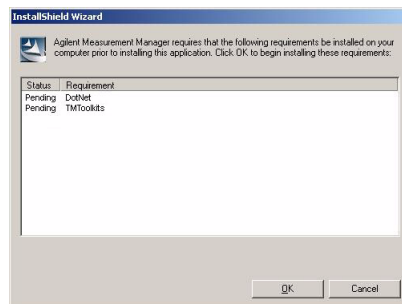
6 Click **OK** to begin installation of the listed missing software.

7 Once the above installation is completed, installation of the Agilent Measurement Manager software will proceed as normal.

8 The Agilent Measurement Manager InstallShield Wizard dialog box will appear as shown below. Click **Next** to begin.

9 Read the License Agreement and select **I accept the terms in the License Agreement** to proceed. You may click **Print** to print a hardcopy of the Agilent License Terms for reference. Click **Next** to proceed.

10 Fill in the Customer Information form, as shown below, accordingly and click **Next**.

11 Click **Next** to install to the folder specified or click **Change** to install to a different folder.

12 Click **Install** to begin the installation of Agilent Measurement Manager.

13 Click **Finish** when the installation has completed.
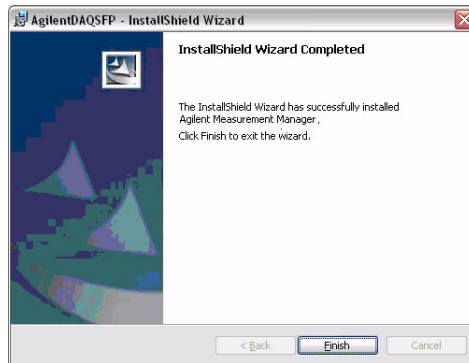
14 A shortcut to this software will be created on your desktop.

NOTE	USING THE LICENSED MATERIALS INDICATES YOUR ACCEPTANCE OF THE LICENSE TERMS. IF YOU DO NOT AGREE TO ALL OF THESE TERMS, YOU MAY RETURN ANY UNOPENED LICENSED MATERIALS FOR A FULL REFUND. IF THE LICENSED MATERIALS ARE BUNDLED OR PRE-LOADED WITH ANOTHER PRODUCT, YOU MAY RETURN THE ENTIRE UNUSED PRODUCT FOR A FULL REFUND.

G. Connect Your Modular Instrument Chassis to the PC

1 After all installations have successfully completed, connect the power cord to the AC input of the chassis device you have set up in Step A. The AC input requirement is 110 V/240 VAC, 50/60 Hz.

2 Connect the modular instrument chassis to any USB ports on your PC with the bundled USB cable.

3 Your PC will automatically detect the connected chassis and the Found New Hardware Wizard window will appear as shown below.

4 Select **Yes, this time only** and click **Next** to proceed.

5 Select **Install the software automatically (Recommended)** and click **Next**.
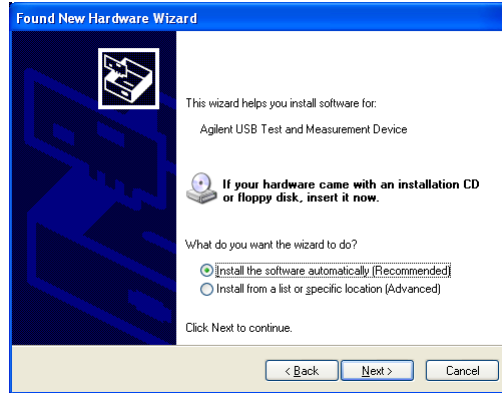
6 A warning message will appear in the Hardware Installation window, as shown below. Click **Continue Anyway** to proceed with the installation of the driver.

> **NOTE** If you do not wish the receive similar warning message in future, follow the instructions below.
> **1** Go to **Start > Control Panel** and double-click System.
> **2** Select Hardware tab, on the Drivers panel click **Driver Signing** and the Driver Signing Options dialog box will appear.
> **3** Select **Ignore** to disable the warning message.

7 Click **Finish** when the installation has completed.
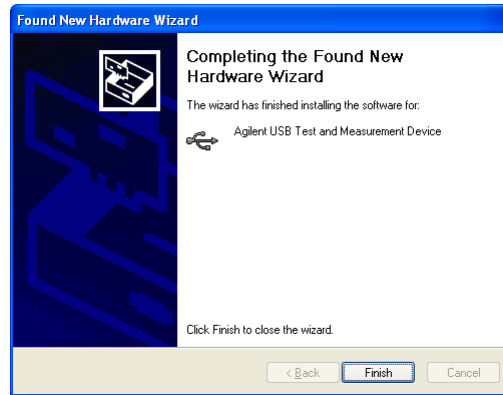
8 When the installation has completed, the Assign USB device alias window will appear as shown below. Each time a USB device is plugged in, this dialog will be shown. To configure or disable this dialog, select an options in the Show this dialog panel and click **OK**.
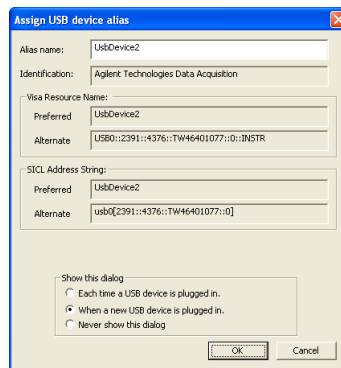
9 The modular instrument chassis is now ready for usage.

NOTE	• Before proceeding, you may verify your connected modular instrument chassis using Agilent Connection Expert.
	• For more information on hardware verification, refer to **Hardware Verification** in *Agilent U2781A USB Modular Instrument Chassis User's Guide*.

H. Hardware Verification

Agilent Connection Expert is one of the utility of the Agilent IO Libraries. The Connection Expert configures connected instruments and enables communication. Connection Expert will be able to automatically detect the USB modules plugged into the PC.

1 Go to **Start > All Programs > Agilent IO Libraries Suite > Agilent Connection Expert** to launch the Agilent Connection Expert.

2 The connected USB modules will be visible in the **Instrument I/O on this PC** panel as indicated below. Click on the USB module connection interface and right-click.
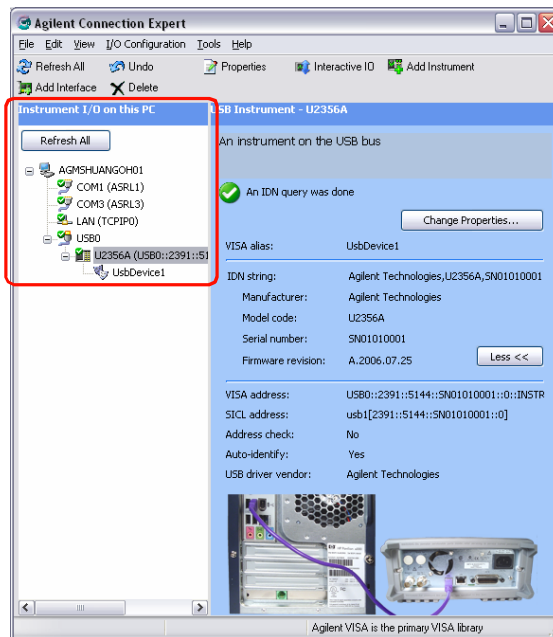
3 A context menu will appear as shown below and select **Send Commands To This Instrument**.
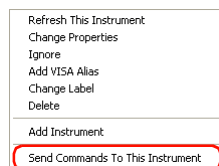
4 The Agilent Interactive IO dialog box will appear as shown below. Click **Send & Read** to send the *IDN? default command. The instrument's response should appear in the **Instrument Session History** panel.
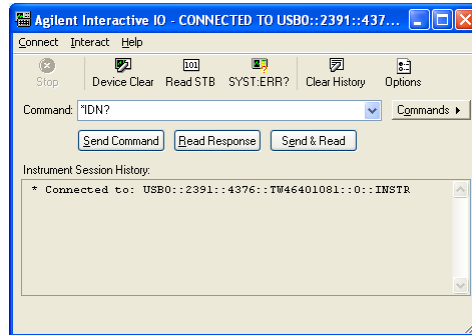
5 Successful communication between the Agilent Connection Expert and the connected hardware indicate successful hardware installation and connection establishment.

I. Launch Your Agilent Measurement Manager

1 Double-click the Agilent Measurement Manager software icon on your desktop or go to **Start > All Programs > Agilent > Modular Instruments > Measurement Manager** to launch the software.

2 The Agilent Measurement Manager welcome screen will appear as shown below.

3 The Select USB Device dialog box will appear. It will show all USB modules that are connected to your PC as shown below.
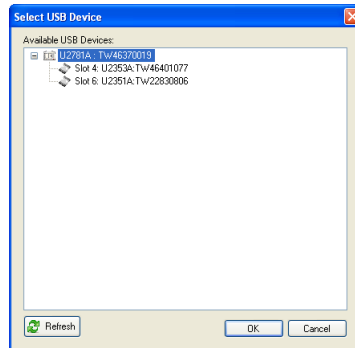
4 If an empty chassis is connected to your PC, slot in at least one USB module into your chassis and click **Refresh**.

5 To start the application, click **OK** to establish the connection.

6 The Agilent Measurement Manager window will appear as shown in the following figure. On the Cardcage Explorer panel, you will see a list of devices that are connected to your PC.
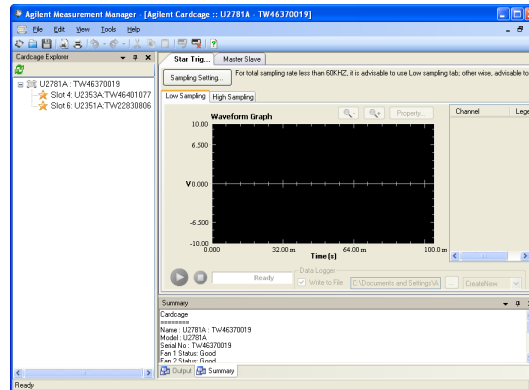
7 The connected chassis trigger mode must be configured for synchronization display and data logging. To configure the trigger mode, right-click a module in the Cardcage Explorer and a context menu will appear as shown below. Select the desired trigger mode—Star Trigger[1], Master or Slave[2]—for the selected module.
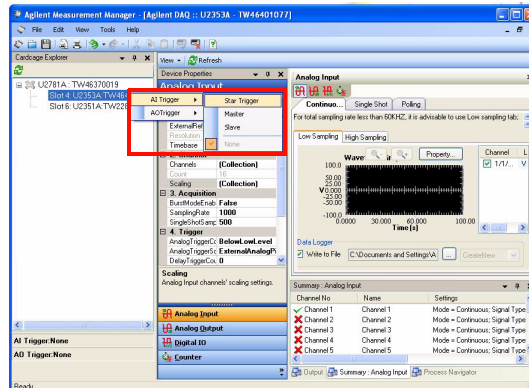
[1] U2781A offers star trigger bus that aims to provide ultra high performance synchronization features that can be configured via Agilent Measurement Manager.

[2] Master/Slave trigger mode allows one of the modules to be set as the trigger source (Master), while other modules are configured to listen to the trigger bus for the trigger signal (Slave).

8 Once the trigger mode has been set, go to each module Analog Input (AI) function to configure the AI signal acquisition settings. For more help on AI settings configurations, refer to *Agilent Measurement Manager Help File*.

9 After each AI function has been configured, select the chassis by clicking on the chassis listed in the Cardcage Explorer.

10 On the right panel of the application software, select the trigger mode tab—Star Trigger or Master Slave.

11 In the selected trigger mode tab, click **Sampling Setting...** to validate the sampling rate for the connected modules.

12 Key in the sampling rate (default value is 1000) in the Sampling Rate (per channel) text box and click **Validate**, as shown in the following figure.
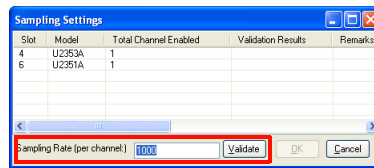
13 The results of the validation will be displayed, as shown in the following figure, on the Validation Results column to show whether the sampling rate used is within range.
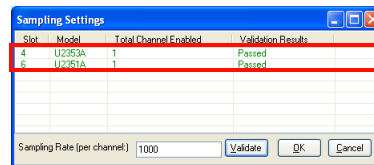
14 Once validation is successful, click **OK** to proceed.

15 The connected U2781A and Agilent Measurement Manager are ready for usage and you may proceed to perform data acquisition.

| **NOTE** | For more information on how to use Agilent Measurement Manager, refer to *Agilent Measurement Manager Help File*. |

General Maintenance

NOTE   Repair or service which are not covered in this manual should only be performed by qualified personnel.

To remove the dirt or moisture in the chassis panel, the cleaning steps are as follows:

1 Power off the chassis device and remove the power cord and I/O cable from the chassis.

2 Shake out any dirt that may have accumulated inside the chassis device.

3 Wipe the chassis with a dry cloth.

1   Getting Started

2

Features and Functions

This chapter provides information for better understanding of the features and functions of U2781A USB modular instrument chassis.

Agilent Technologies

Introduction

The Agilent U2781A USB modular instrument chassis provides six USB modular slots and equipped with 200 W universal AC power supply and built-in over current protection circuit. A 10MHz system reference clock is supplied to each modules slots. There are two temperature sensors and a monitoring fan control circuit to monitor the internal temperature and speed of the fans. The fans are mainly used for heat dissipation.

The chassis also provides external 10MHz reference clock, external trigger in and trigger out functions via BNC connectors at the rear panel.

The key function for the chassis is to provide users with flexibility when using the U2781A modular instrument chassis. The modular chassis allocates housing for six USB modules with built-in power supply. The USB backplane provides a means to synchronize the modules.

The key features of the U2781A USB modular instrument chassis are as follows:

- Simultaneous Synchronization (SSI)
- Star trigger
- Internal and external 10 MHz reference clock
- Trigger in and trigger out signals
- SCPI commands
- IVI-COM driver compatibility
- USBTMC 488.2 compliant
- Hi-Speed USB 2.0 interface

The key functions of the Agilent U2781A USB modular instrument chassis will be elaborated in the following sections.

USB Backplane

55-Pin Backplane Connector Pins Configuration

11	GND	+12V	+12V	GND	USB_D+	USB_D-	GND
10	GND	+12V	+12V	+12V	GND	GND	GND
9	GND	+12V	+12V	+12V	GND	USB_VBUS	GND
8	GND	LBL0	BRSV	GND	TRIG0	LBR0	GND
7	GND	LBL1	GA0	TRIG7	GND	LBR1	GND
6	GND	LBL2	GA1	GND	TRIG1	LBR2	GND
5	GND	LBL3	GA2	TRIG6	GND	LBR3	GND
4	GND	LBL4	STAR TRIG	GND	TRIG2	LBR4	GND
3	GND	LBL5	GND	TRIG5	GND	LBR5	GND
2	GND	LBL6	CLK10M	GND	TRIG3	LBR6	GND
1	GND	LBL7	GND	TRIG4	GND	LBR7	GND
	Z	A	B	C	D	E	F

Table 2-1   Pin information of SSI connector

SSI timing signal	Functionality
+12V	+12 V power from backplane
GND	Ground
BRSV	Reserved pin
TRIG0~TRIG7	Trigger bus 0 ~ 7
STAR_TRIG	Star trigger
CLK10M	10MHz reference clock
USB_VBUS	USB bus power, +5 V
USB_D+, USB_D-	USB differential pair
LBL <0..7> and LBR <0..7>	Reserved pin
GA0, GA1, GA2	Geographical address pin
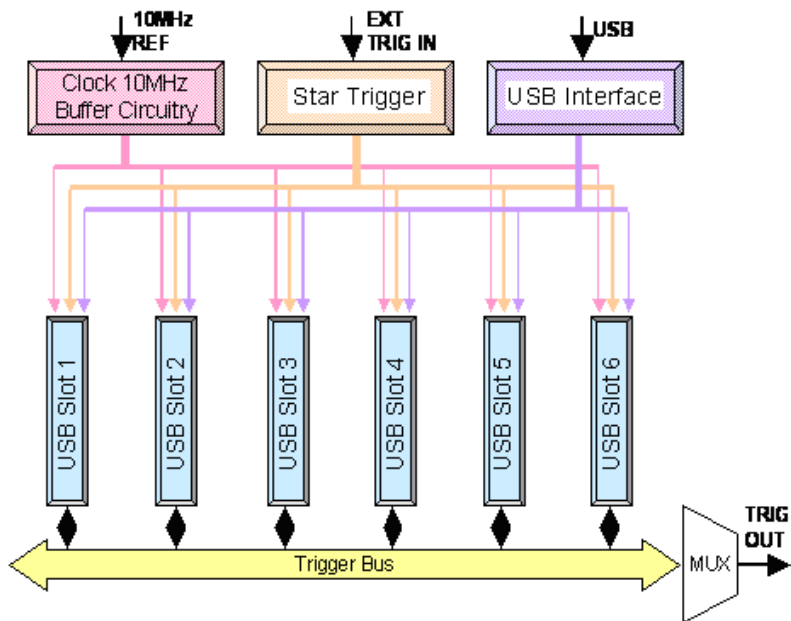
Figure 2-1   USB backplane block diagram

Trigger Bus [0...7]

Trigger Bus [0...7] is an 8-bit digital bus connected from slot 1 to slot 6 to synchronize different USB modules. This trigger bus enables the USB modules of passing trigger signals to one another.

To have one of the modules to control the operation of the other modules, set the particular module as MASTER and the rest as SLAVE (refer to **Simultaneous Synchronization (SSI)** for more details). The control signal is sent from the MASTER module to the SLAVE modules through this trigger bus. See following figure for the bus architecture.
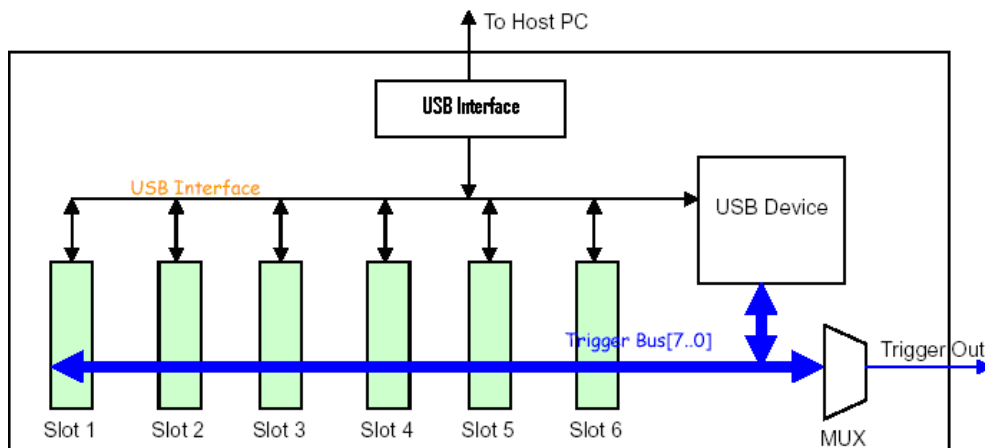
Figure 2-2   Block diagram of Trigger Bus[0...7] and Trigger Out

In addition, the trigger bus can also be used to carry out the pre-configuration of the chassis and modules before any triggering activities. Refer to **Identifying Modules Location** for more information.

Trigger Out

Trigger Out selects one of the trigger bus bit [0...7] for external trigger. The USB device illustrated in Figure 2-2 controls the multiplexer switching for the trigger out selection.

The SCPI command below is used to set one of the trigger bus [0...7] as external trigger source:

TRIGger:OUT {0|1|2|3|4|5|6|7}

Trigger Out	Function
Bit-0	Time base
Bit-1	Reserved
Bit-2	Reserved
Bit-3	A/D trigger
Bit-4	Reserved
Bit-5	Reserved
Bit-6	Reserved
Bit-7	D/A trigger

External Trigger In (Star Trigger)

The star trigger bus offers a very high performance or precise synchronization between modules.The star trigger bus is a dedicated trigger line between the External Trigger Input and USB slots. This trigger signal is sent from external to each slot through a 1-to-6 CLK buffer. The slot-to-slot skews are minimized to ensure that trigger signal reaches all six slots simultaneously. Refer the following figure for the star trigger bus architecture illustration.

To set star trigger as the module trigger source, the following SCPI command is sent to the modules:

OUTP:TRIG:SOUR STRG
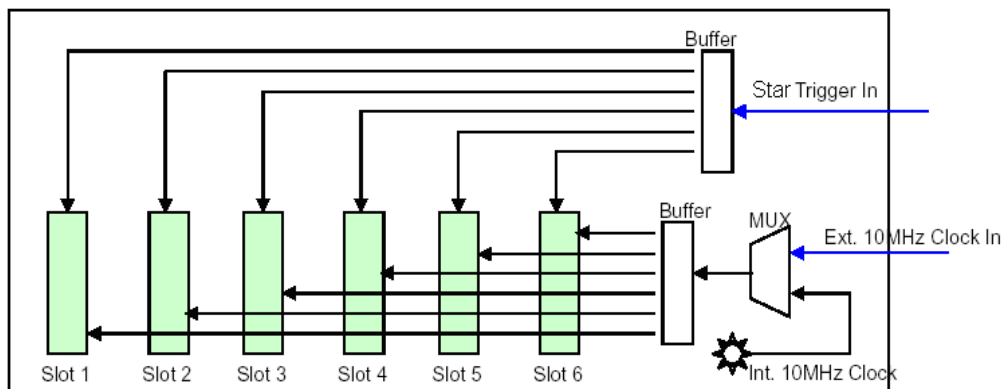
Figure 2-3   Block diagram of the 10 Mhz Reference Clock and External Trigger In

System Reference Clock

The 10 MHz reference clock can come from two sources; internal backplane oscillator and external clock source.

The internal oscillator on the USB backplane supplies an independent 10 MHz system reference clock to each of the USB slot. This 10 MHz reference clock is driven through an independent buffer. Refer to Figure 2-3 for the block diagram. Every clock trace is in equal distance to ensure that the slot to slot skew is at minimum. Users can use this common reference clock signal to synchronize multiple modules in a measurement or control system.

The default SCPI command of `ACQuire:RSIGnal AUTO` will scan through and detect if there is any valid clock source from the external BNC connector. If none is found, then the internal 10 MHz clock source will be used.

The SCPI command below will direct the reference clock source to the internal 10 MHz:

```
ACQuire:RSIGnal INT
```

Chassis Temperature Monitoring

The chassis contains a temperature control circuitry. It has two thermistor sensors to sense the inner temperature of the chassis. The temperature control circuitry communicates with backplane USB device through an I^2C interface as illustrated in following figure.
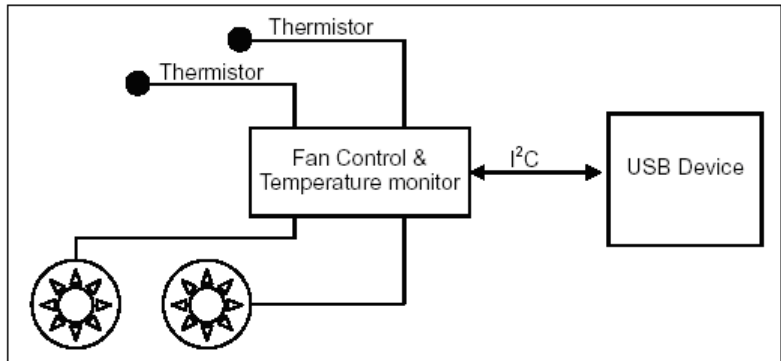
Figure 2-4   Block diagram of temperature monitoring and fan control

The SCPI command below queries the temperature reading from the sensors in degree Celsius (°C):

```
SYSTem:TEMPerature? {1|2}
```

Fan Speed Monitoring

The U2781A USB modular instrument chassis is also integrated with a fan speed control circuit. It is used to monitor the fan status and speed. The control circuit communicates with backplane USB device via I^{2}C interface. Refer to Figure 2-4.

To query the fan status, send the SCPI command below:

        SYSTem:FSTATus? {1|2}

To query the fan speed in revolutions per minute (rpm), send the SCPI command below:

        SYSTem:FSPeed? {1|2}

Identifying Modules Location

Geographical Address

Each slot in the chassis is designed with a 3-bit address pin, which is designated as a location identity for USB modules. The address for all six slots are as below:

| Slot	Address
1	001
2	010
3	011
4	100
5	101
6	110

The USB modules are able to read this 3-bit data and know which slot the module is plugged in. To read the geographical address of each module, the SCPI command below is used:

```
SYSTem:CDEScription?
```

Modules Identification

You may have more than one module or chassis connected to the same host PC. The following figure illustrates an example of the connection.
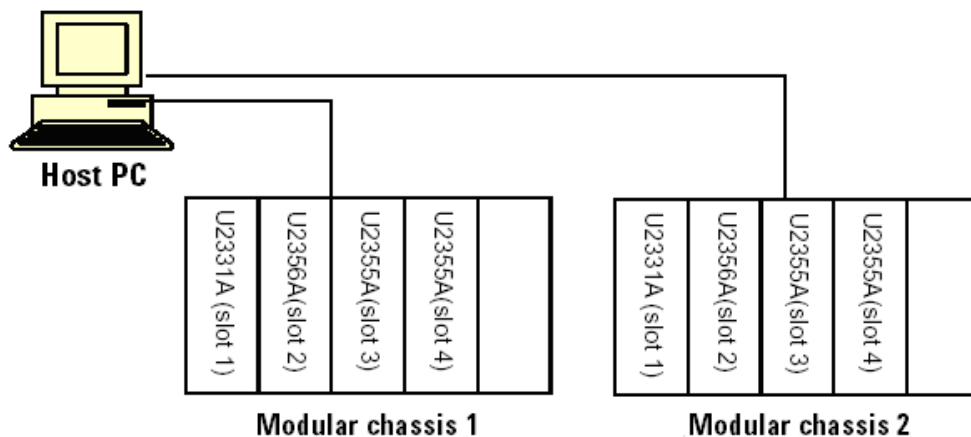
Figure 2-5   Identifying modules location

In order to identify the location of the modules, a pre-configuration setting is needed before the synchronization or triggering event begins. Follow the steps below:

1 Send the following command to the modular chassis to trigger it. This command will be used to transmit the number to all USB modules via Trigger Bus [0...7]. You can choose from 1 to 255 for your chassis number.

```
SYSTem:IDentity {1|2|3…|255}
```

2 Send the following command to every module in the chassis to query each of the slot and chassis numbers.

```
SYST:CDES?
```

3 You may need to perform some sorting routine to determine which slot it is at and what is the assigned number of its host chassis. If a chassis has six modules in it, then there will be a total of seven SCPI commands to send to chassis and modules.

4 During this identification operation, the trigger bus is used. Hence, any triggering activities on the backplane would be blocked.

5 Prior to any triggering activities, you must stop the configuration activity by sending the following command:

SYSTem:IDentity {0|OFF}

NOTE	• Do not execute the above mentioned steps when the USB modules are in the process of acquiring data.
	• You do not need to perform the above pre-configuration if you are using the Agilent Measurement Manager software. You are only required to press the "Refresh" button.

Simultaneous Synchronization (SSI)

Simultaneous Synchronization (SSI) provides synchronization between the USB modules. Figure 2-6 illustrates an example of SSI.

SSI allows you to set one of the modules as MASTER and others as SLAVE. MASTER module sends the SSI signal to the slave modules via the backplane trigger bus. SLAVE modules will then receive the signal and begin synchronization with MASTER module.

The SCPI command below is used to set the module as MASTER:

CONF:SSI MAST

Send the SCPI command below to set the module as SLAVE:

CONF:SSI SLAV

NOTE	Only ONE master is assigned.
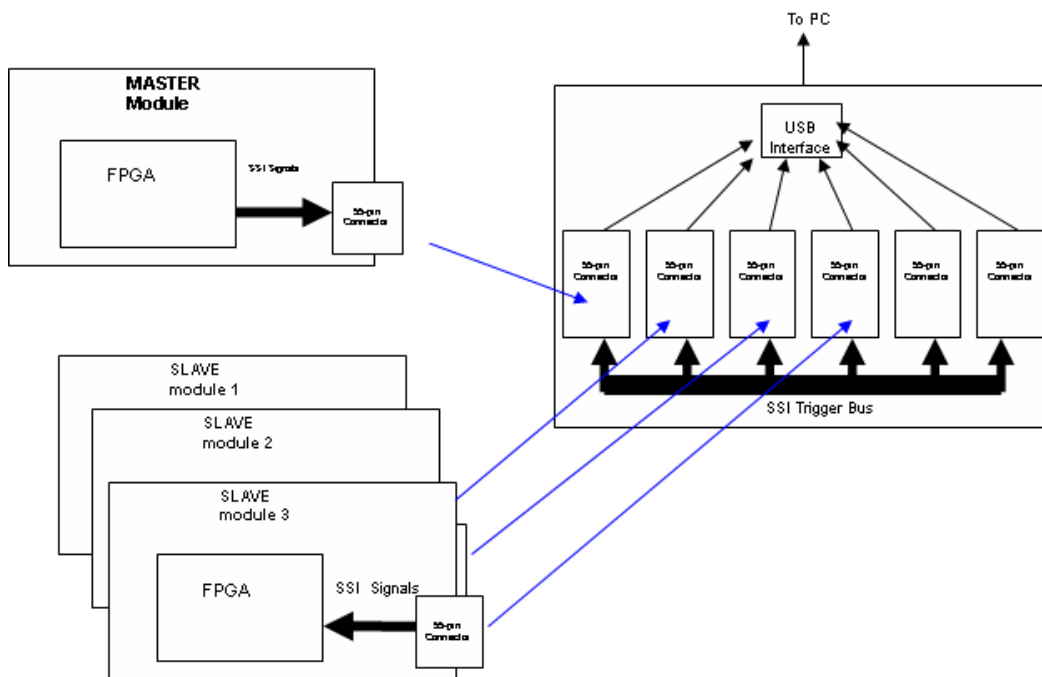
Figure 2-6   Synchronization between modules in the chassis

2 Features and Functions

3
Characteristics and Specifications

This chapter specifies the characteristics, environment conditions, and specifications of the U2781A USB modular instrument chassis.

Agilent Technologies

Product Characteristics

REMOTE INTERFACE
- Hi-Speed USB 2.0
- USBTMC Class Device

POWER CONSUMPTION
- 400 VA maximum
- Installation Category II

OPERATING ENVIRONMENT
- Operating temperature from 0 °C to +55 °C
- Relative humidity at 15% to 85% RH (non-condensing)
- Altitude up to 2000 meters
- Pollution Degree 2
- For indoor use only

STORAGE COMPLIANCE
- –20 °C to 70 °C

SAFETY COMPLIANCE
Certified with:
- IEC 61010-1:2001/EN 61010-1:2001 (2nd Edition)
- USA: UL61010-1: 2004
- Canada: CSA C22.2 No.61010-1:2004

EMC COMPLIANCE
- IEC/EN 61326-1 1998
- CISPR 11: 1990/EN55011:1991, Class A, Group 1
- CANADA: ICES-001: 1998
- Australia/New Zealand: AS/NZS 2064.1

ACOUSTIC EMISSION
- Sound pressure level: 45.5 dB(A)
- Sound power level: 56.6 dB(A)

SHOCK & VIBRATION
- Tested to IEC/EN 60068-2

DIMENSION (WxDxH)
- 270.00 mm x 271.20 mm x 197.00 mm

WEIGHT
- 3.7 kg (without any modules slotted in)
- 6.0 kg (with maximum six modules slotted in)

WARRANTY
- Three years

Electrical Specifications

Power Supply AC Input	
Input voltage range	100 to 240 VAC
Input frequency range	50 to 60 Hz
Power consumption	400 VA maximum
Efficiency	75%
Power Supply DC Output	
Output rated voltage	12 VDC
Max output rated current	16.7 A
Max output rated power	200 W
Over voltage protection	13.2 to 16.2 V

Internal 10 MHz Reference Clock	
Accuracy	25 ppm for operating range
Slot to slot skew	350 ps
External 10 MHz Reference Clock	
Auto detection level	Yes
Input frequency range	10 MHz
Input magnitude	100 mVpp to 5 Vpp (sine/square wave)
Input impedance	$50\,\Omega \pm 5\,\Omega$
Damage level	10 Vrms
External Trigger In	
Compatibility	TTL
V_{IH} (Positive threshold voltage)	2.0 V
V_{IL} (Negative threshold voltage)	0.8 V
Hold time	8 ns pulse width
Input voltage range	0 to 5.0 V
Slot to slot skew	350 ps
External Trigger Out	
V_{OH}	2.9 V
V_{OL}	0.1 V
Output voltage range	0 to 3.3 V

Mechanical Specifications

Physical Layout	
Number of USB module slots	6
Dimension of each module slot	25.40 mm (W) x 174.54 mm (D) x 105.00 mm (H)
Dimension of chassis	270.00 mm (W) x 271.20 mm (D) x 197.00 mm (H)
Weight	3.7 kg
Power LED	ON/OFF type
USB Backplane	
Connector	55 pins Ernet male type C
Input signals	External 10 MHz clock in (BNC connector)
	External trigger in (BNC connector)
Output signal	Trigger out (BNC connector)
Cooling Fan	
Number of fans	2
Fan speed	3300 rpm ±10%
Noise	37 dB(A)
Power (each fan)	2.52 W

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:
(tel) (81) 426 56 7832 (fax) (81) 426 56
7840
Korea:
(tel) (080) 769 0800 (fax) (080) 769 0900
Latin America:
(tel) (305) 269 7500
Taiwan:
(tel) 0800 047 866 (fax) 0800 286 331
Other Asia Pacific Countries:
(tel) (65) 6375 8100 (fax) (65) 6755 0042

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

Product specifications and descriptions in
this document subject to change without notice.

Printed in Malaysia
Second Edition, April 30, 2007

U2781-90003

Agilent Technologies