Agilent U2600A Series USB Isolated Digital Input/Output Modules

User's Guide

Agilent Technologies

Notices

Manual Part Number

U2651-90011

Edition

First Edition, September 5, 2007

Printed in Malaysia

Agilent Technologies, Inc.
Bayan Lepas Free Industrial Zone,
11900 Penang, Malaysia

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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 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.

Regulatory Markings

	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 that this ISM device complies with Canadian ICES-001.
	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.
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	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.

Safety Symbols

	Direct current
	Alternating current
	Both direct and alternating current
	Three-phase alternating current
	Earth (ground) terminal
	Protective conductor terminal
	Frame or chassis terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	Equipment protected throughout by double insulation or reinforced insulation
	Caution, risk of electric shock
	Caution, hot surface
	Caution, risk of danger (See note.)
	In position of a bi-stable push control
	Out position of a bi-stable push control

General Safety Information

WARNING

- 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.
- Use only the power adapter supplied by the manufacturer to avoid any unexpected hazards.

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.

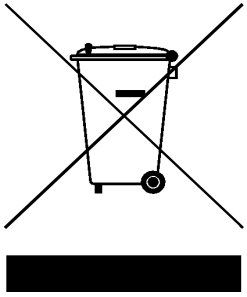
Waste Electrical and Electronic Equipment (WEEE) Directive 2002/96/EC

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

This chapter provides an overview of the U2600A Series USB Isolated Digital Input/Output (DIO) modules, product outlook and product layout. This chapter also contains instructions on how to get started with U2600A Series Isolated DIO modules that begins from system requirements checking to installations of hardware and software.

2 Connector Pins Configuration

This chapter describes the connector pins configuration of all the U2600A Series Isolated DIO modules.

3 Features and Functions

This chapter includes information for better understanding on the features and functions of U2600A Series Isolated DIO modules. This includes the operations of the digital input/output, group function, interrupt function and trigger function.

4 Product Characteristics and Specifications

This chapter specifies the characteristics, and specifications of the U2600A Series DIO modules.

5 Dismantle Procedures

This chapter describes the step-by-step disassemble procedures and list the available replacement parts for U2600A Series DIO modules,

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 U2600A Series USB Isolated Digital Input/Output Modules
Models Number:	U2651A, U2652A, U2653A
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 (2004/108/EC)

and conforms with the following product standards:

EMC

Standard	Limit
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
USA: ANSI/UL 61010-1:2004

c UL us SP® 206349

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

19 Oct 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. E.00 U2600A series 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)	B
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%)	B
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
USA: ANSI/UL 61010-1:2004

Additional Information:

The product herewith complies with the essential requirements of the Low Voltage Directive 2006/95/EC and the EMC Directive (2004/108/EC) 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 due to the product is a battery operated device

Models Description:
U2651A: Isolated 32-bit Digital Input (DI) and 32-bit Digital Output (DO).
U2652A: Isolated 64-bit Digital Input (DI).
U2653A: Isolated 64-bit Digital Output (DO).

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

Contents

Figures

Tables

1 Getting Started

This chapter contains instructions on how to get started with U2600A Series USB Digital IO modules that begins from system requirements checking to installations of hardware and software to the launching of the Agilent Measurement Manager application software.

Introduction to U2600A Series USB Isolated Digital IO Modules

The Agilent U2600A Series USB isolated digital input/output (DIO) are high performance and user friendly modules. It can be used as a standalone unit or modular unit. However, if used as modular unit, the module needs to be installed in the chassis (U2781A). The U2600A Series DIO consists of three models:

- U2651A: Isolated 32-bit DI and 32-bit DO
- U2652A: Isolated 64-bit DI
- U2653A: Isolated 64-bit DO

All three models have up to eight channels with 64-bit high density isolated DIO. The high digital I/O lines will increase the utility of the product and offer flexibility to the users.

The U2600A Series DIO modules also equipped with high voltage isolation protection up to 1250 Vrms. This feature can protect the instrument from severe damage to the internal circuit. The product recognizes a wide range of digital input (10 V to 24 V) as logic high. Therefore, it provides the users with more choices in choosing the external sensors with different dc output level.

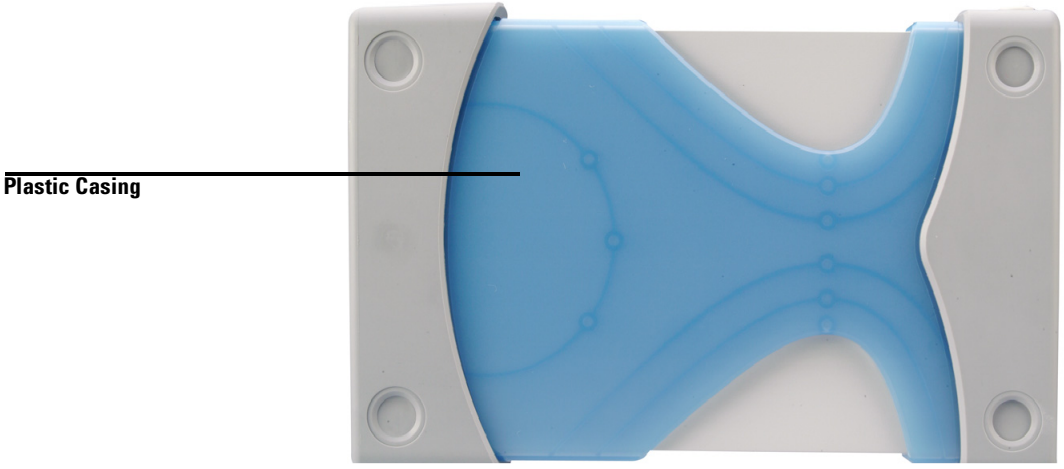
In addition, the U2600A Series DIO modules has high output driving capability of up to 35 V, which makes it capable to drive most actuators in industrial automation applications. With the Hi-speed USB connection of 480 Mbps, it is quick and easy to setup the instrument.

The U2600A Series DIO modules is compatible with wide range of Application Development Environment (ADE), such as Agilent VEE, LabVIEW, MATLAB and Microsoft Visual Studio. Besides, a special software (Agilent Measurement Manager) is bundled with the U2600A Series DIO modules for free.

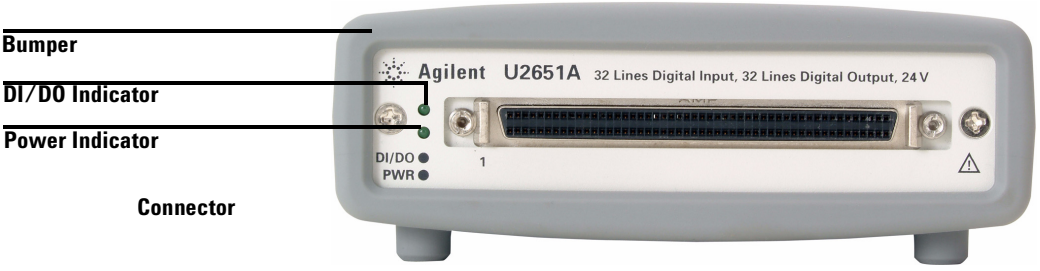
Product Overview

Product Outlook

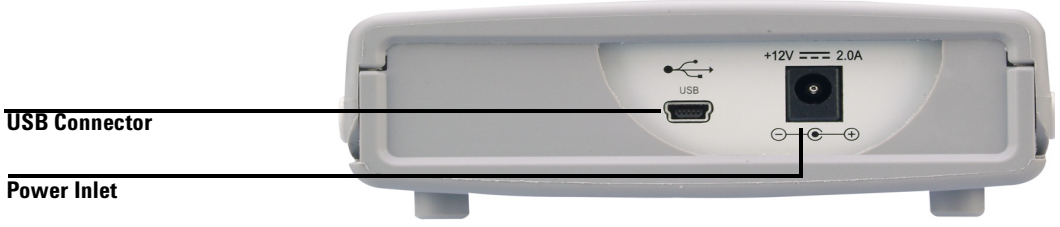
Top View



Front View



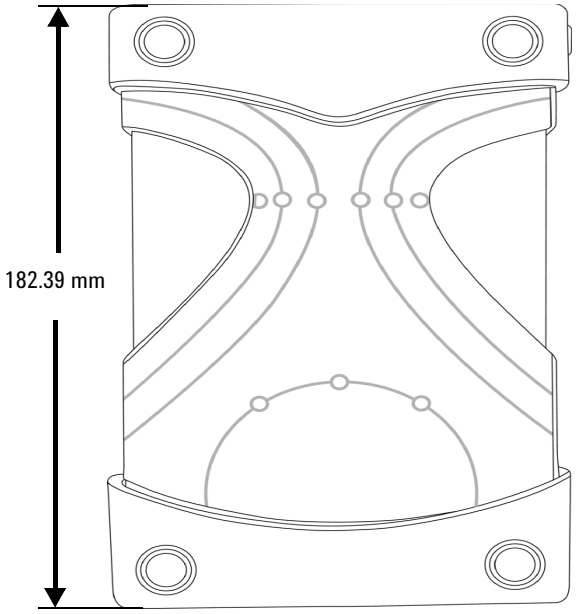
Rear View



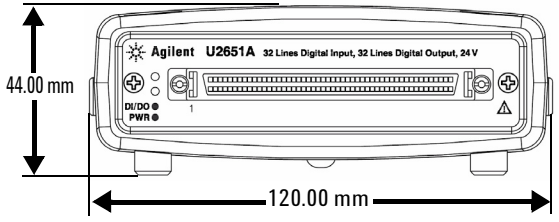
Product Dimension

With Plastic Casing

Top View

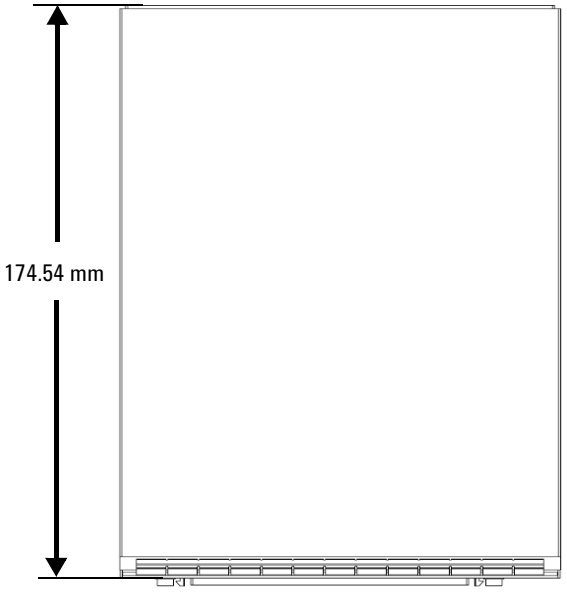


Front View

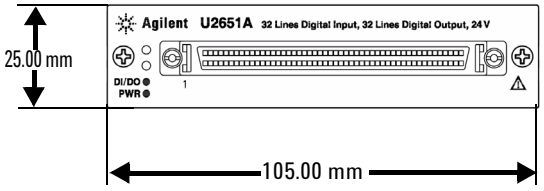


Without Plastic Casing

Top View



Front View



Standard Purchase Items Checklist

Inspect and verify that you have all the following items upon standard purchase of U2600A Series USB isolated DIO modules. If there are missing items, contact the nearest Agilent Sales Office.

- ✔ DC Power Adapter
- ✔ Power Cord
- ✔ USB Extension Cable
- ✔ L–Mount Kit (used with Agilent U2781A modular instrument chassis)
- ✔ Agilent U2600A Series USB Isolated Digital IO Modules Quick Start Guide
- ✔ Agilent Measurement Manager for U2600A Series Quick Start Guide
- ✔ Agilent USB Modular Instrument Product Reference CD-ROM
- ✔ Agilent Automation-Ready CD (contains the Agilent IO Libraries Suite)
- ✔ Certificate of Calibration

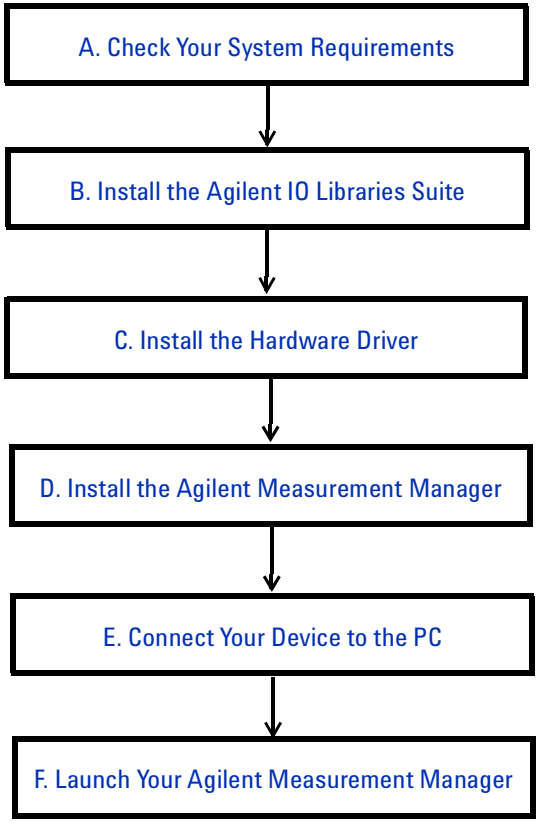
WARNING **Use only power adaptor provided by manufacturer to avoid unexpected hazard.**

Software Installations

If you would like to use the U2600A Series DIO modules with the Agilent Measurement Manager application software, follow the step-by-step instructions as shown in the following flowchart.

NOTE

- If you do not wish to specifically use the device with the Agilent Measurement Manager software but to use it on other ADE (e.g. Agilent VEE, LabVIEW, MATLAB or Microsoft Visual Studio), you can skip steps D and F in the following flowchart.
- You may require to install IVI-COM driver before using the U2600A Series DIO modules with other ADE.



A. Check Your System Requirements

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

Processor	1.6 GHz Pentium IV or higher
Operating system	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
Prerequisite	• Agilent IO Libraries Suite 14.2[1] or higher • Agilent T&M Toolkit 2.1 Runtime version[2] • Microsoft.NET Framework version 1.0 and 2.0[2] • Agilent T&M Toolkit Redistributable Package 2.1 patch[2]
Video	Super VGA (800x600) 256 colors or higher

1 Available in Agilent Automation-Ready CD.

2 Bundled with Agilent Measurement Manager application software installer

B. Install the Agilent IO Libraries Suite

It is recommended to install the latest version of Agilent IO Libraries.

NOTE You must have Administrator privileges to install Agilent IO Libraries Suite and to run Connection Expert.

1. Verify that your PC meets the minimum system requirements. (See "A. Check Your System Requirements" on page 7.)
2. If you are upgrading to IO Libraries Suite from a previous version of IO Libraries, you must remove the instruments and interfaces listed below before you upgrade your software. This step is necessary in order for these devices to obtain the correct drivers to work with Agilent IO Libraries Suite.
   a. Disconnect any USB instruments from your PC.
   b. Disconnect any Agilent 82357 USB/GPIB interface converters from your PC.
   c. Disconnect any Agilent E8491 IEEE 1394 PC Link to VXI interfaces from your PC.
3. Close all other applications on your PC.
4. Insert the *Agilent Automation-Ready CD* with Agilent IO Libraries Suite into the CD-ROM drive of your PC. Wait a few seconds for the auto-run window to appear. 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.
5. When the auto-run window appears, click **Install Software** once, and wait for the InstallShield Wizard to appear.
6. When the InstallShield Wizard appears, click **Next** > to begin the IO Libraries Suite software installation. Follow the instructions in the InstallShield Wizard and choose the options according to your preferences.
7. For more information to install the Agilent IO Libraries Suite, refer to *Agilent Technologies USB/LAN/GPIB Interfaces Connectivity Guide* available in the *Agilent Automation-Ready CD* with the file name called "**connectivity_guide.pdf**".

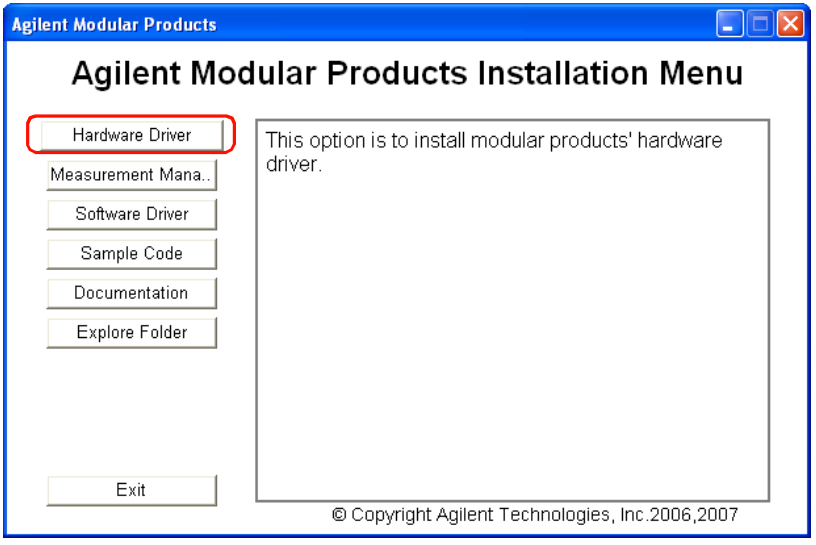
C. Install the Hardware Driver

NOTE

- Ensure that the USB device is disconnected from your PC before installing the driver.
- Ensure that the Agilent IO Libraries Suite version 14.2 or higher is installed before proceeding.

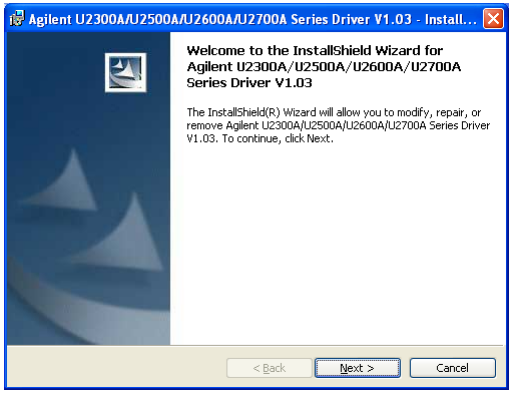
1 Insert the *Agilent USB Modular Instrument Product Reference CD-ROM* into the CD-ROM drive of your PC.

2 The installer will automatically launch the Agilent Modular Products Installation Menu. Select **Hardware Driver** to begin the hardware driver installation.

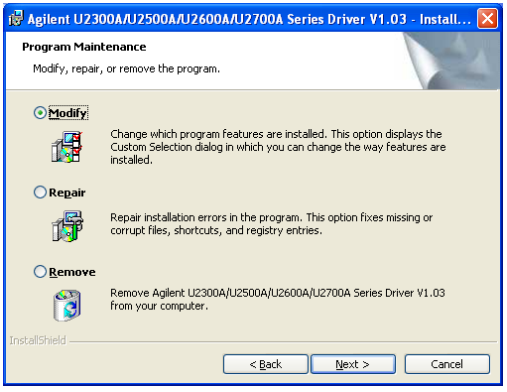


3 If the menu does not launch automatically, go to **Start > Run** (on the Windows Start menu) and type `<drive>:\Driver\Hardware\setup_hw.exe`, where `drive` is your CD-ROM drive. Click **OK** to begin installation.

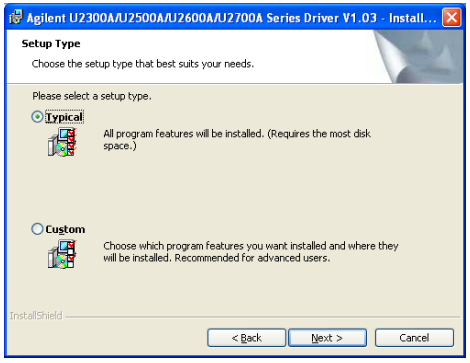
4 The following dialog will appear. Click **Next >** to begin the installation.



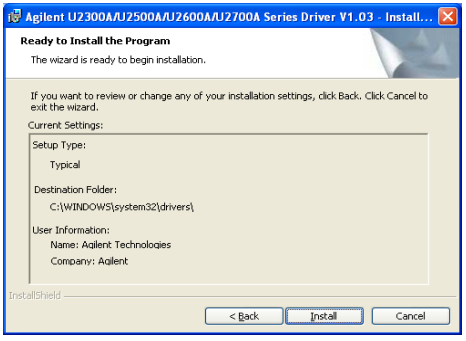
5 If you have previous hardware driver version, the dialog box will have the Modify, Repair and Remove options as shown below. Choose the option you like and click **Next >** to proceed.



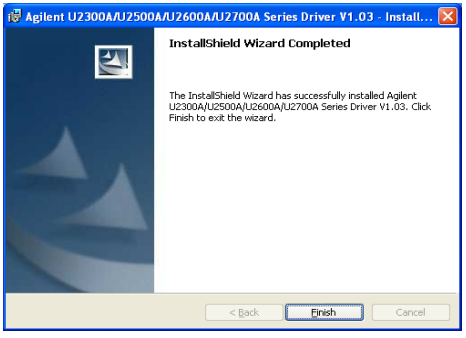
6 If you do not previously install any hardware driver, the following dialog box will be shown. Select **Typical** to install the all the features, otherwise select **Custom** to choose which program features you want to install. Click **Next >** to proceed.



7 Choose the option you like and the following dialog will appear showing all the components that will be installed. Click **Install** to begin installation.



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



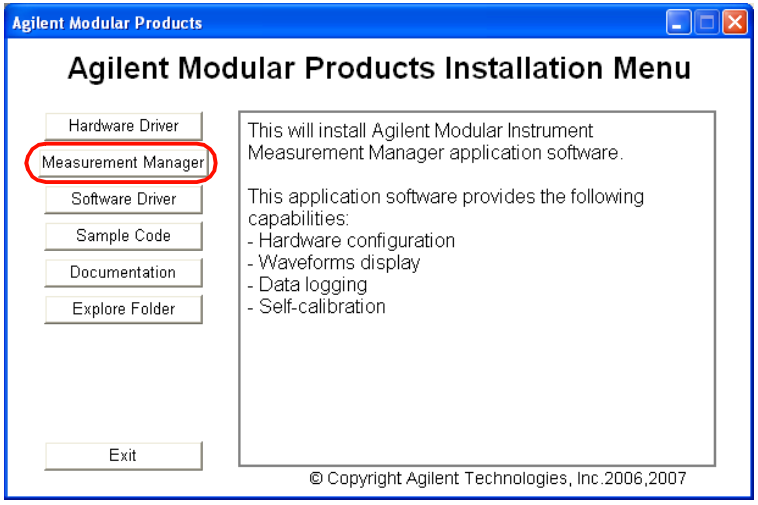
D. Install the Agilent Measurement Manager

NOTE

- Ensure that the Agilent IO Libraries Suite version 14.2 or higher is installed before proceeding.
- You must have Administrator privileges to install Agilent IO Libraries Suite and to run Connection Expert.

1 Verify that you have the hardware driver installed.

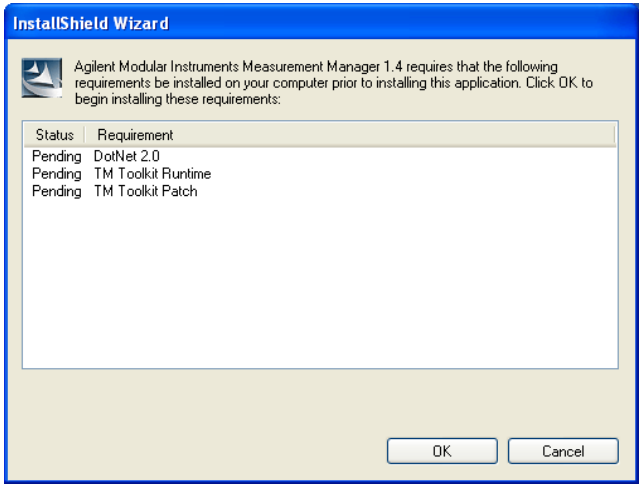
2 Select **Measurement Manager** on the Agilent Modular Products Installation Menu to begin the installation.



3 If the installation menu does not appear after a few seconds, go to **Start > Run** (on the Windows Start menu) 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, Microsoft .NET Framework version 1.0 and 2.0, and Agilent T&M Toolkit Redistributable Package 2.1 patch installed, the InstallShield Wizard software pre-requisite will appear as shown in the following figure.



6 Click **OK** to begin installation of the listed missing software.

NOTE

If you have Agilent VEE installed, you may need to install the Agilent T&M Toolkit 2.1 Runtime version manually.

- Click **Start** > **Run...**
- Type `<drive>:Utilities\Agilent T&M Toolkit Redistributable Package 2.1\setup.exe`, where `<drive>` is your CD drive letter.

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

8 Follow the instructions on your screen to proceed with the Agilent Measurement Manager software installation.

9 When the InstallShield Wizard appears, click **Next >** to begin the Agilent Measurement Manager installation.

10 Read the License Agreement carefully. If you accept the terms, select the radio button that labeled **I accept the terms in the license agreement** and click **Next >** to continue.

11 Type in your user name in the User Name text box and organization name in the Organization text box. If there are more than one person using the same computer, select the radio button that labeled **Anyone who uses this computer**, otherwise select radio button labeled **Only for me.**

12 The default location to install the software is `C:\Program Files\Agilent\Measurement Manager 1.4\`. If you prefer to install the software to other location, click **Change...** to change the destination of the folder. When you are done, Click **Next >** to continue.

13 If you are ready to install the Agilent Measurement Manager, click **Install** to begin installation.

14 Click **Finish** when the installation has completed. A shortcut for 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.

E. Connect Your Device to the PC

1. After all installations have been successfully completed, connect the power cord to the AC/DC power adapter. The AC/DC power adapter requirements are 110 V/240 VAC, 50/60 Hz, with output voltage of +12 VDC.
2. Insert the DC output plug from the AC/DC power adapter to the power jack on the rear panel of the USB device.
3. Connect any of the U2600A Series instrument to any USB ports on your PC with the USB cable.
4. If this is the first time you connect the instrument to your PC, the Found New Hardware Wizard window will appear as shown below. 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 Hardware Installation window, as shown below. Click **Continue Anyway** to proceed with the installation of the driver.

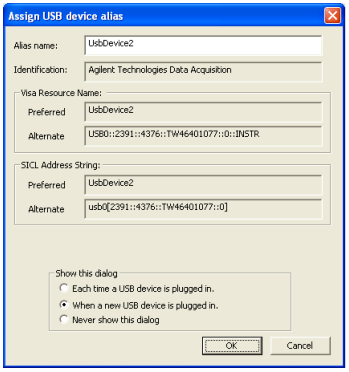
NOTE

If you do not wish to receive similar warning message in future, follow the instructions below.

1 Go to **Start > Control Panel** and double-click **System**.
2 Select **Hardware** tab and on the Drivers panel click **Driver Signing**. The Driver Signing Options dialog box will appear.
3 Select **Ignore** to disable the warning message.

7 Click **Finish** to complete the installation.

8 When installation has been completed, the Assign USB device alias window will appear. Each time a USB device is plugged in, this dialog box will appear. To configure or disable this dialog, select an option in the **Show this dialog** panel and click **OK**.



9 The USB device is now ready for usage.

NOTE

Before proceeding, you may verify your connected device using Agilent Connection Expert.

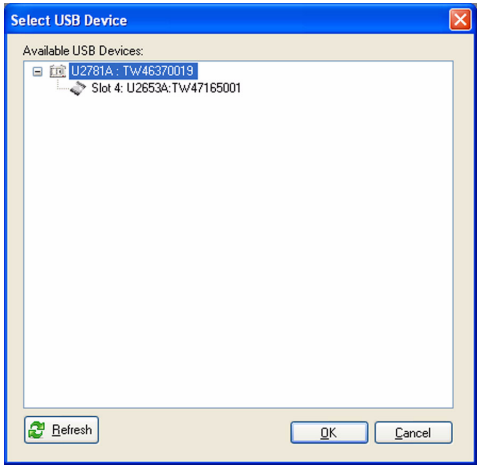
F. Launch Your Agilent Measurement Manager

NOTE

- Agilent IO Control will launch automatically when you start your PC.
- Launching Agilent Measurement Manager without Agilent IO Control running will cause Agilent Measurement Manager to fail from detecting or establishing any connection with the USB device connected to your PC.
- To launch Agilent IO Control, go to **Start > All Programs > Agilent IO Libraries Suite > Agilent Connection Expert**.

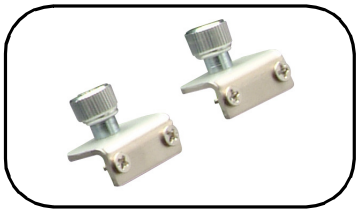
1 Double-click the Agilent Measurement Manager software icon on your desktop or go to **Start > All Programs > Agilent > Modular Instruments > Measurement Manager** to launch the software.

2 The Select USB Device dialog box will appear. It will show all the DIO modules that are connected to your PC. To start the application, select a DIO module and click **OK** to establish the connection.

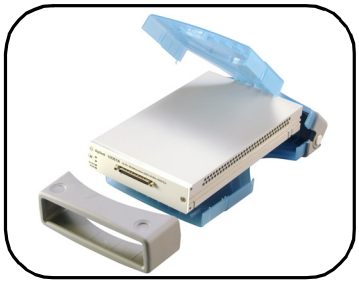


L-Mount Kit Installation

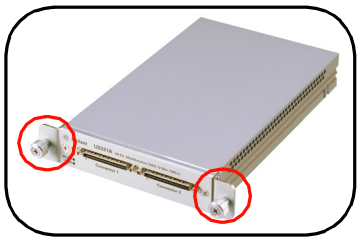
The L-Mount kit is to be used with Agilent U2781A USB modular instrument chassis.The following instructions describes simple procedures of installing the L-Mount kit to a U2600A USB modules.



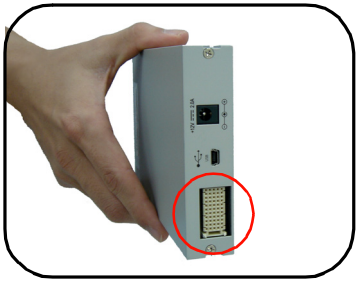
1 Unpack the L-Mount kit from the packaging.



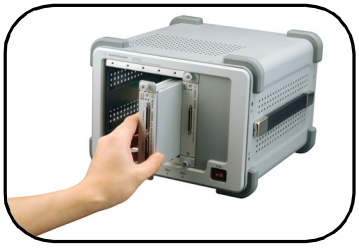
2 Remove your USB device from its plastic casing by pulling the bumper (front end of the casing) outward direction. Then, lift the plastic body casing and remove it from your USB device.



3 Using the *Philip* screw driver, screw the L-Mount kit to your USB device.



4 To slot in the USB module to your chassis, turn your 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.

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 the USB device, follow the instructions below.

1. Power off the USB device and remove the AC/DC adapter cord and USB cable from your device.
2. Remove your USB device from its plastic casing by pulling at the bumper (front end of the casing) outward direction. Then, lift the plastic body casing and remove it from your USB device.
3. Holding your USB device, shake out any dirt that may have accumulated on the panel of your USB device.
4. Wipe your USB device with a dry clean cloth.

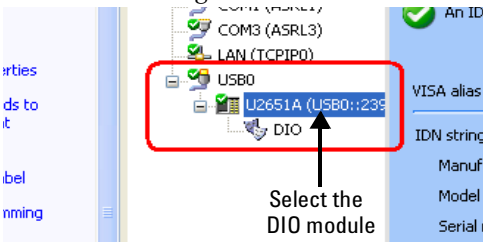
Additional Information

Hardware Verification

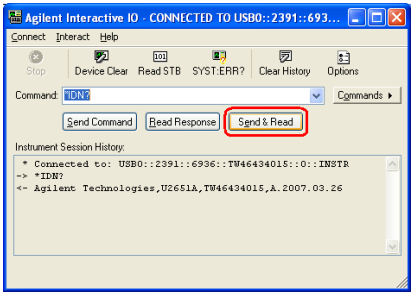
Agilent Connection Expert is one of the utilities of Agilent IO Libraries. It can automatically detects the USB devices that were connected to the PC and enables the communication between the USB device and the PC. To verify that your USB device has established a connection with your PC, do the following steps.

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

2 The connected USB device will be visible in the **Instrument I/O on this PC** panel as indicated in the following. Select the DIO connection interface and right-click.



3 A context menu will appear. Click **Send Commands To This Instrument**. The Agilent Interactive IO dialog box will appear as shown below. Click **Send & Read** to send the `*IDN?` default SCPI command. The instrument's response will be displayed in the **Instrument Session History** panel.



4 Successful communication between the PC and the connected hardware indicate successful hardware installation and connection establishment.

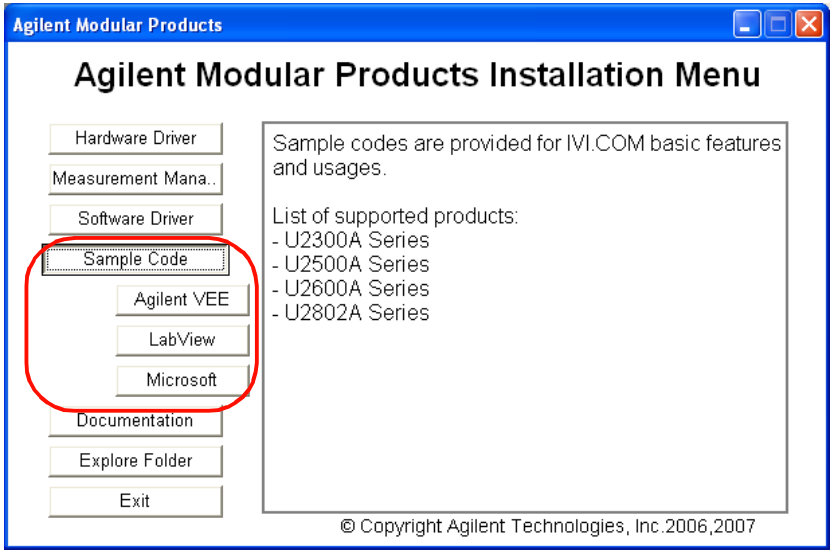
Sample code

Sample codes for Agilent VEE, LabView and Microsoft (C#, C++, VB7 and VB6) are provided to help you get started and familiarized with the instrument. The sample codes provided for each language are as follows.

- **Example1**: Demonstrates the initialization of the instrument
- **ReadWriteChannel:** Read data from instrument and write data to instrument
- **Interrupt:** Demonstrates how the interrupt function works
- **Trigger:** Demonstrates how the trigger function works. An error will be shown if user tries to write the value after the trigger has been executed.
- **Custom channel:** User can group eight DI bits to form a new DI channel or group eight DO bits to form a new DO channel. The new DI or DO channels can then be used to perform normal DIO operation.

To view the sample code

Select **Sample Code** on the Agilent Modular Products Installation Menu and choose the type of language. See the following figure.



1 Getting Started

2
Connector Pins Configuration

This chapter describes the U2600A Series USB Isolated DIO devices pins configuration and the theory operation of isolated DIO.

Introduction

The U2600A Series USB Isolated Digital I/O modules were equipped with 100-pin SCSI-II connector. The connector pins configuration for all of the U2600A Series DIO modules are provided in this chapter. When the DIO module is used in a modular instrument chassis (U2781A), see Figure 2-1 for the pins numbering. When the DIO module is used as a standalone unit, see Figure 2-2.

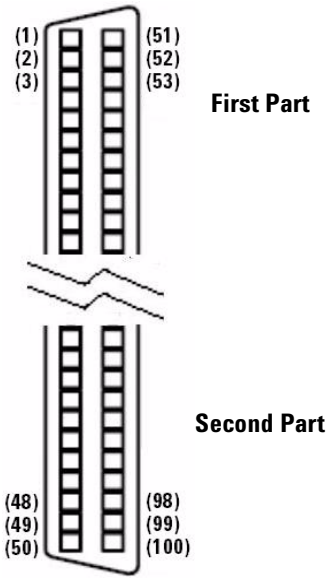


Figure 2-1 Connector in vertical view

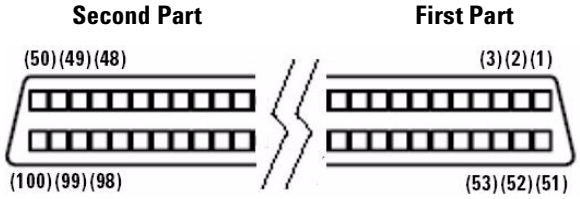


Figure 2-2 Connector in horizontal view

Connector Pins Configuration for U2651A

First Part				Second Part			
DI_101.0/301	1	51	DI_102.0	DO_201.0	26	76	DO_202.0
DI_101.1/302	2	52	DI_102.1	DO_201.1	27	77	DO_202.1
DI_101.2	3	53	DI_102.2	DO_201.2	28	78	DO_202.2
DI_101.3	4	54	DI_102.3	DO_201.3	29	79	DO_202.3
DI_101.4	5	55	DI_102.4	DO_201.4	30	80	DO_202.4
DI_101.5	6	56	DI_102.5	DO_201.5	31	81	DO_202.5
DI_101.6	7	57	DI_102.6	DO_201.6	32	82	DO_202.6
DI_101.7	8	58	DI_102.7	DO_201.7	33	83	DO_202.7
COM_101	9	59	COM_102	VDD_201	34	84	VDD_202
COM_101	10	60	COM_102	DO_GND	35	85	DO_GND
COM_101	11	61	COM_102	DO_GND	36	86	DO_GND
COM_101	12	62	COM_102	DO_GND	37	87	DO_GND
DI_103.0	13	63	DI_104.0	DO_203.0	38	88	DO_204.0
DI_103.1	14	64	DI_104.1	DO_203.1	39	89	DO_204.1
DI_103.2	15	65	DI_104.2	DO_203.2	40	90	DO_204.2
DI_103.3	16	66	DI_104.3	DO_203.3	41	91	DO_204.3
DI_103.4	17	67	DI_104.4	DO_203.4	42	92	DO_204.4
DI_103.5	18	68	DI_104.5	DO_203.5	43	93	DO_204.5
DI_103.6	19	69	DI_104.6	DO_203.6	44	94	DO_204.6
DI_103.7	20	70	DI_104.7	DO_203.7	45	95	DO_204.7
COM_103	21	71	COM_104	VDD_203	46	96	VDD_204
COM_103	22	72	COM_104	DO_GND	47	97	DO_GND
COM_103	23	73	COM_104	DO_GND	48	98	DO_GND
COM_103	24	74	COM_104	DO_GND	49	99	DO_GND
NC	25	75	NC	+5 V	50	100	+5 V

Figure 2-3 Pins configuration for U2651A

Table 2-1 Pins legend for U2651A

Pin	Descriptions
DI_10n.0...7	Isolated digital input channel “n” and bit 0 to 7; n = 1, 2, 3, 4
DO_20n.0...7	Isolated digital output channel “n” and bit 0 to 7; n = 1, 2, 3, 4
COM_101	Common junction for input channel 1
COM_102	Common junction for input channel 2
COM_103	Common junction for input channel 3
COM_104	Common junction for input channel 4
VDD_201	VDD pin for output channel 1
VDD_202	VDD pin for output channel 2
VDD_203	VDD pin for output channel 3
VDD_204	VDD pin for output channel 4
DO_GND	Ground return path of isolated channels
+5 V	On board +5 V regulated power supply
NC	No connection

Connector Pins Configuration for U2652A

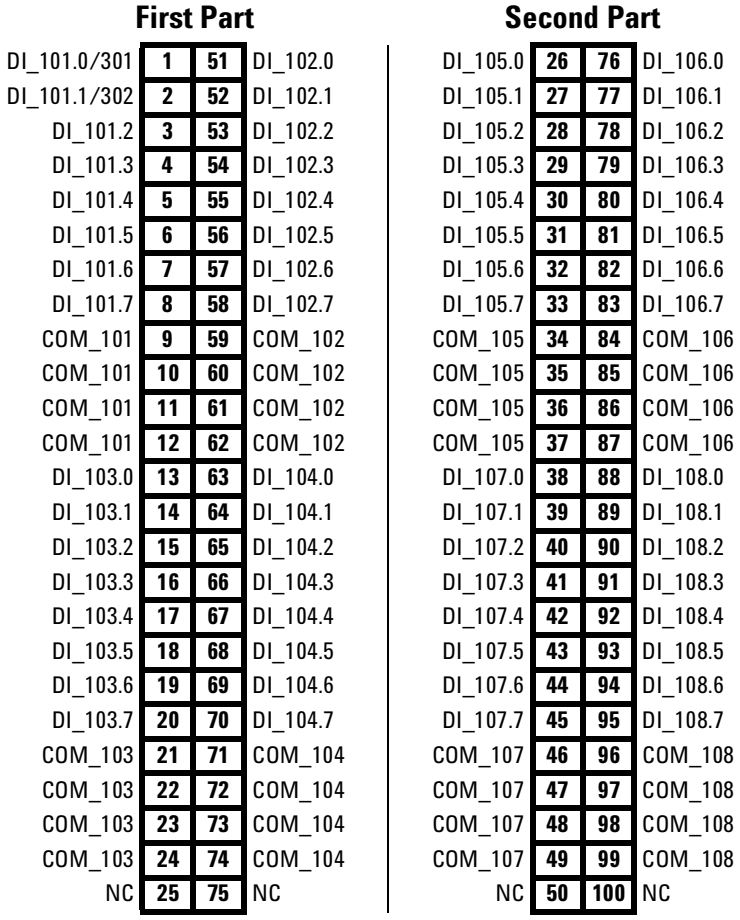


Figure 2-4 Pins configuration for U2652A

Table 2-2 Pins legend for U2652A

Pin	Descriptions
DI_10n.0...7	Isolated digital input channel “n” and bit 0 to 7; n = 1 to 8
COM_101	Common junction for input channel 1
COM_102	Common junction for input channel 2
COM_103	Common junction for input channel 3
COM_104	Common junction for input channel 4
COM_105	Common junction for input channel 5
COM_106	Common junction for input channel 6
COM_107	Common junction for input channel 7
COM_108	Common junction for input channel 8
NC	No connection

Connector Pins Configuration for U2653A

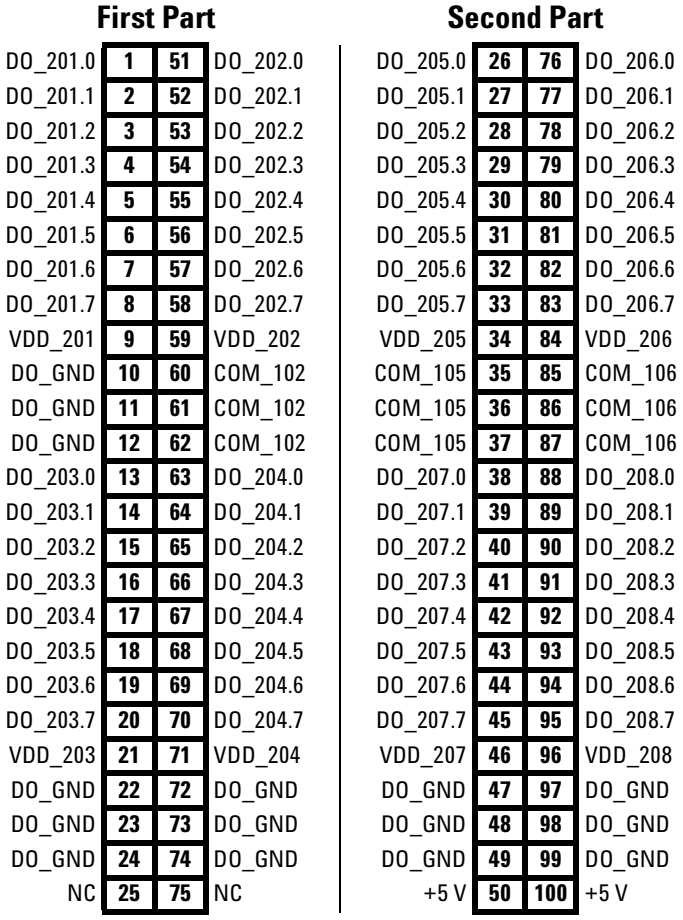


Figure 2-5 Pins configuration for U2653A

Table 2-3 Pins legend for U2653A

Pin	Descriptions
DO_20n.0...7	Isolated digital output channel “n” and bit 0 to 7; n = 1 to 8
VDD_201	VDD pin for output channel 1
VDD_202	VDD pin for output channel 2
VDD_203	VDD pin for output channel 3
VDD_204	VDD pin for output channel 4
VDD_205	VDD pin for output channel 5
VDD_206	VDD pin for output channel 6
VDD_207	VDD pin for output channel 7
VDD_208	VDD pin for output channel 8
DO_GND	Ground return path of isolated channels
+5 V	On board +5 V regulated power supply
NC	No connection

55-pin Connector (J1) Pins Configuration

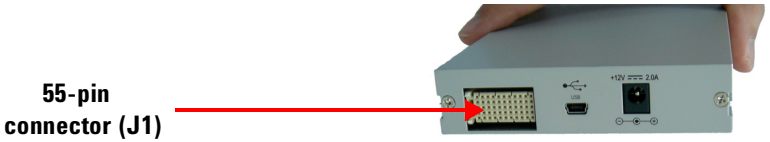


Figure 2-6 Connector (J1) 55-pin

Table 2-4 U2600A Series J1 connector pin assignment

11	GND	+12 V	+12 V	GND	USB_D+	USB_D-	GND
10	GND	+12 V	+12 V	+12 V	GND	GND	GND
9	GND	+12 V	+12 V	+12 V	GND	USB_VBUS	GND
8	GND	NC	BRSV	GND	NC	NC	GND
7	GND	NC	GA0	NC	GND	NC	GND
6	GND	NC	GA1	GND	NC	NC	GND
5	GND	NC	GA2	NC	GND	NC	GND
4	GND	NC	STAR_TRIG	GND	NC	NC	GND
3	GND	NC	GND	NC	GND	NC	GND
2	GND	NC	NC	GND	NC	NC	GND
1	GND	NC	GND	NC	GND	NC	GND
	Z	A	B	C	D	E	F

Table 2-5 U2600A Series J1 connector legend

Pin	Descriptions
+12 V	+12 V power from backplane
GND	Ground
BRSV	Reserved pin
STAR_TRIG	Star trigger
USB_VBUS	USB bused power, +5 V
USB_D+, USB_D-	USB differential pair

2 Connector Pins Configuration

3
Features and Functions

This chapter describes the features and functions of the Agilent U2600A Series DIO modules. This includes the operations of the isolated digital input/output, group function, interrupt function and trigger function.

Digital Input/Output

The U2600A Series Digital IO modules provide up to 64-bit of high density opto-isolated digital input and output for USB 2.0 interface-based industrial applications.

The 32-bit U2651A DIO model are segmented into eight channels with four channels as digital input (CH101 to 104) and four channels as digital output (CH201 to 204). Each channel consists of eight data bit. Refer to “Connector Pins Configuration for U2651A” on page 25 for information on pins configuration.

The 64-bit U2652A Digital Input model are segmented into eight channels with all of them as digital input (CH101 to 108). Each channel consists of eight data bit. Refer to “Connector Pins Configuration for U2652A” on page 27 for information on pins configuration.

The 64-bit U2653A Digital Output model are segmented into eight channels with all of them as digital output (CH201 to 208). Each channel consists of eight data bit. Refer to “Connector Pins Configuration for U2653A” on page 29 for information on pins configuration.

Isolated Digital Input Channels

The Agilent U2600A Series DIO modules are equipped with up to 64-bit of opto-isolated digital input, which provide electrical isolation protection to the inner DIO circuitry. The circuit diagram of an isolated input bit is shown in Figure 3-1. The maximum and minimum allowable input voltage at DI_{in} and DI_{COM} are 24 V and –24 V regardless of its polarity as follows:

1. 24 V at DI_{in} and –24 V at DI_{COM} or
2. 24 V at DI_{COM} and –24 V at DI_{in} .

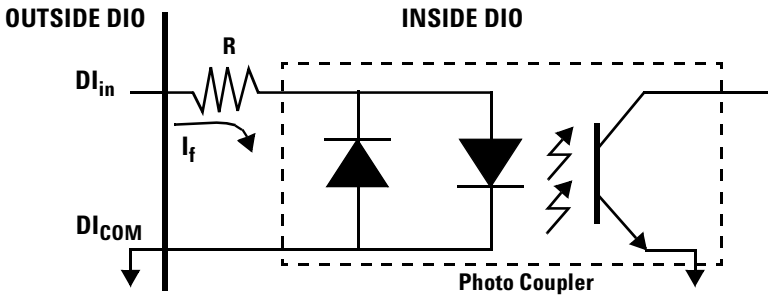


Figure 3-1 Isolated digital input bit through a photo coupler

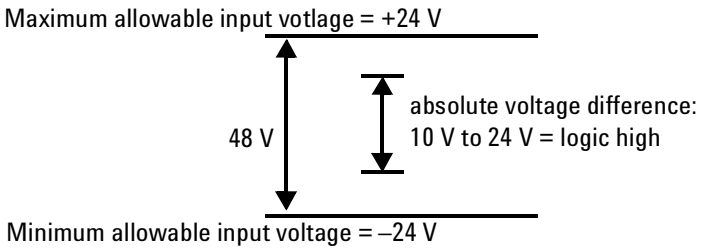


Figure3-2 The maximum and minimum allowable input voltage at DI_{in} and DI_{COM} and the absolute voltage range for DIO to see a logic high

For the DIO module to read the digital input as logic high, the absolute input voltage range (regardless of its polarity) across the DI_{in} and DI_{COM} should be in the range from 10 V to 24 V (see Figure 3-2.). For example, the voltage at DI_{in} should be greater than DI_{COM} by at least 10 V (up to 24 V)

or the voltage at DI_{COM} should be greater than DI_{in} by at least 10 V (up to 24 V). As long as there is an absolute potential difference of more than 10 V (up to 24 V) across DI_{in} and DI_{COM}, DIO module will see a logic high at that bit.

CAUTION Do not supply excessive voltage to the digital input bits as it will cause excessive heating on the resistor and damage the instrument. The maximum absolute voltage difference is 24 V.

Isolated Digital Output Channels

The common ground connection of isolated digital output is shown in the Figure 3-3. When the isolated digital output is switched **ON**, the current will conduct on the power MOSFET (see Figure 3-3) and the current will flow as indicated by the arrow. When the isolated digital output is switched **OFF**, the current will not conduct through the load (see Figure 3-4).

CAUTION When the load is of an inductance nature such as relay, coil or motor, the VDD pin should be connected to an external power source.

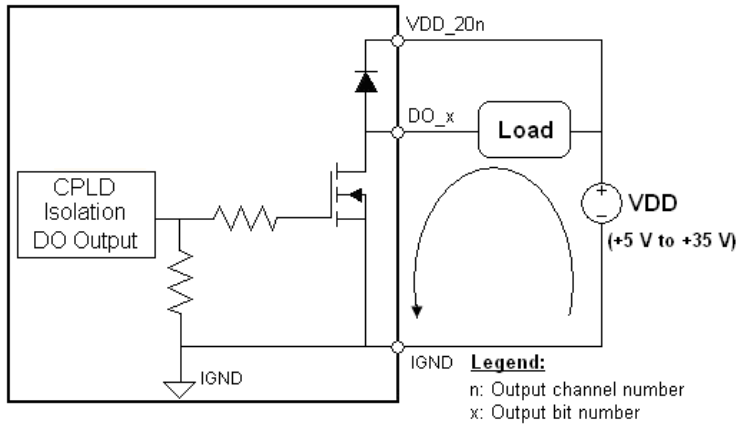


Figure3-3 Isolated digital output is switched on with load

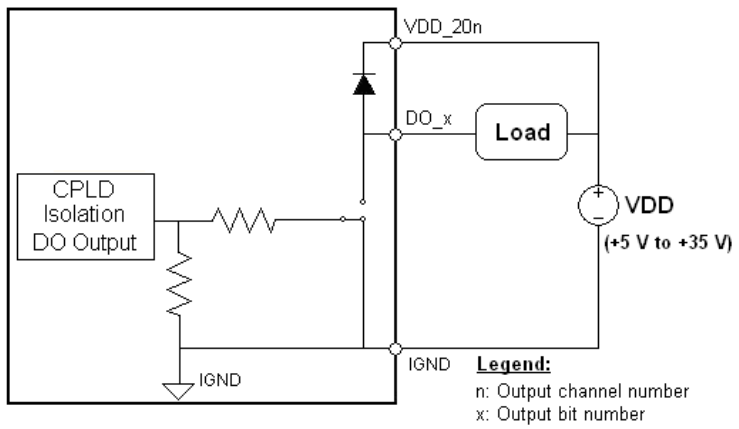


Figure3-4 Isolated digital output is switched off with load

There is a fly-wheel diode provided at the drain of the MOSFET. This is for closed loop current release and to protect the MOSFET from any high reversed voltage, which may be generated by the inductive load when the output stage is being switched from **ON** to **OFF**.

The following SCPI examples show the way to read a digital input channel and to output a digital output signal.

SCPI Example 1, Read one bit of a digital input channel

```
-> DIG:DATA:BIT? 1,(@101)          //Read bit 1 of channel 101
<- 1    //The return value will be either 1 or 0. 1 means there is a input at that particular bit.
```

SCPI Example 2, Read a digital input channel

```
-> DIG:DATA:BYTE? (@101)           //Read digital input at channel 101
<- 9    //The return value is in decimal, where 9 means bit 0 and bit 3 of channel 101 have digital inputs.
```

SCPI Example 3, Output a signal at one bit of a digital output channel

```
-> SOUR:DIG:DATA:BIT 1,6,(@201)    //Set to "1" for bit 6 of channel 201.
-> SOUR:DIG:DATA:BIT? 6,(@201)     //Query the output signal at bit 6 of channel 201.
<- 1                               //Return of "1" means there is an output signal.
```

SCPI Example 4, Output a signal at a digital output channel

```
-> SOUR:DIG:DATA:BYTE 123,(@201:204)   //Output 123 (in decimal) at channel 201 to 204.
-> SOUR:DIG:DATA:BYTE? (@201:204)      //Query the output signal at channel 201 to 204.
<- 123,123,123,123
```

Virtual Port Group Function

The U2600A Series DIO modules allow the users to randomly select any eight input bits or output bits and group them into one channel as virtual DIO port. The users must select exactly eight bits to group them to a virtual channel. However, only input bits can group with input bits and output bits group with output bits. Therefore, the input bits should not group with output bits.

NOTE The users must select exactly eight input bits and group them into virtual channel 199 or exactly eight output bits and group them into channel 299.

For input operations, the channel number is 199 and for output operations, the channel number is 299. The grouping does not need to be sequential in nature, since the bits in channel 199 or 299 will link the specified bits to its reference points.

The following shows the examples of SCPI commands on how to group the input bits in channel number 199 and output bits in channel number 299.

SCPI Example 1, Grouping the input bits

```
//Group the eight input bits in channel number 199
-> CONF:DIG:GRO 101.0,101.3,102.5,102.2,102.5,102.7,101.2,102.6, (@199)

-> DIG:DATA? (@199)                    //Query the values at the channel
```

SCPI Example 2, Grouping the output bits

```
//Group the eight output bits in channel number 299
-> CONF:DIG:GRO 202.0,202.3,202.5,202.7,203.5,203.7,204.0,204.5, (@299)

-> SOUR:DIG:DATA 0, (@299)             //Set channel number 299 to output all zeros

//Group different output bits in channel number 299
-> CONF:DIG:GRO 202.0,202.1,202.5,202.7,203.5,203.7,204.0,204.5, (@299)

-> SOUR:DIG:DATA 1, (@299)             //Set channel number 299 to output with ones
```

Interrupt Function

This feature is available for U2651A and U2652A. There are two interrupt sources for the interrupt function, which are bit 301 and bit 302 located at input channel 101. They are actually physically sharing the same bit with bit 101.0 and bit 101.1. See “Connector Pins Configuration for U2651A” on page 25 and “Connector Pins Configuration for U2652A” on page 27 for the location of bit 301 and bit 302.

To use this feature, the user has to enable the interrupt first by selecting the triggering source (i.e. bit 301 or bit 302). For example, the following SCPI command is used to set bit 301 as the triggering source.

```
SENS:DIG:INT:ENAB ON, (@301)
```

When the logic level of bit 301 changes from “0” to “1” (i.e. an interrupt has occurred), the bit 0 of *Event Register* (EV) is set to “1”. See Figure 3-5. To alert the *Status Byte Register* that an interrupt has occurred, the user has to enable the *Enable Register* (EN) at the *Interrupt Operation Register* using the following SCPI command:

```
STAT:INT:ENAB 1
```

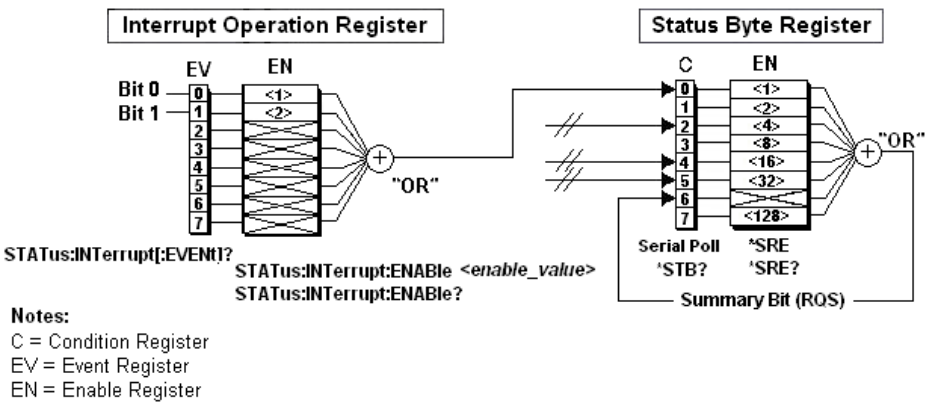


Figure3-5 Enabling the Interrupt Operation Register will allow it to send a signal, “1” to the Status Byte Register when either the logic level for bit 301 or bit 302 changes from “0” to “1”.

The *Enable Register* acts like a gate for the *Interrupt Operation Register*. If the *Event Register* is not enabled (i.e. gate is close), the interrupt signal will not be sent to the *Status Byte Register*. If the *Event Register* is enabled, the interrupt signal will be sent to bit 0 of the *Status Byte Register*. To check whether the *Enable Register* is enabled, use the following SCPI command:

```
STAT:INT:ENAB?
```

If the return value is "1" (in binary is 01), it means that the information at bit 0 of *Event Register* in *Interrupt Operation Register* will be sent to bit 0 of *Status Byte Register*. If the return value is "2" (in binary is 10), it means that the information at bit 0 of *Event Register* in *Interrupt Operation Register* will be sent to bit 0 of *Status Byte Register*. To enable both bit 0 and bit 1 of *Enable Register* to send the information in bit 0 and bit 1 of *Event Register* in *Interrupt Operation Register*, send the following SCPI command:

```
STAT:INT:ENAB 3
```

The user may send the SCPI command "*STB?" to query the status of the *Status Byte Register* and observe bit 0 of the return value to check whether an interrupt has occured provided that the user has previously select the trigger source and enable the *Enable Register* of the *Interrupt Operation Register*.

The flowchart in Figure 3-6 shows an example of the interrupt function operation.

.

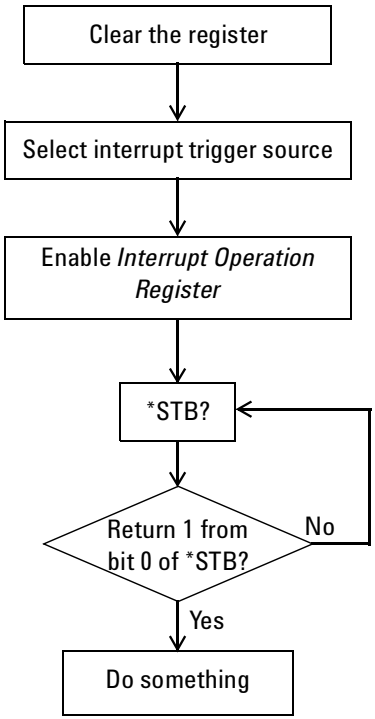


Figure3-6 Flowchart for interrupt function operation

Firstly, it is recommended to clear the register prior to enabling the interrupt function. Use the SCPI command "`*CLS`" to clear the register.

Secondly, choose the trigger source (for example bit 301) using the SCPI command "`SENS:DIG:INT:ENAB ON,(@301)`".

Thirdly, enable the *Interrupt Operation Register* so that it will alert the *Status Byte Register* whenever an interrupt has occured.

Then, check the status in *Status Byte Register* with the SCPI command "`*STB?`". If bit 0 of STB returns "`1`", it means that an interrupt has occurred. If bit 0 of STB returns "`0`",

continue to check its status. The user may do something when an interrupt has occured, for example output a signal from the DIO device.

SCPI Example 1, Enable interrupt at bit 301 and

```
-> *RST;*CLS    // clear the register to start from known state
-> SENS:DIG:INT:ENAB ON, (@301)// Enable interrupt for bit 0
-> ...          // Interrupt occurs in bit 301
-> *STB?        // Query Status Byte Register
<- +0           // Interrupt occurred but STB doesn't see it yet
-> STAT:INT:ENAB 1    // Enable the bit so STB can see it
-> *STB?                // Query STB again
<- +1           // Now STB sees that an interrupt has occurred
-> STAT:INT:EVEN?  // Find out which interrupt source
<- +1           // "1" means the interrupt source is from bit 301
-> STAT:INT:EVEN?  // Once read the event is cleared
<- +0    // 0 now. If there is another interrupt, it will be set to 1 again
```

NOTE

Refer to *U2600A Series USB Isoltated Digital Input/Output Programmer's Reference* under the topic "`[SENSE:]DIGital:INTerrupt[:ENABle]`" for more example on interrupt function.

Trigger Function

The major difference between interrupt function and trigger function is after the user selects any trigger sources, the IO operation will be frozen. In other words, the output will stay at the previous stage while the input reading values will also be frozen. Unlike the interrupt function where the IO operation is still running.

The following flowchart illustrates the way the trigger function operates.

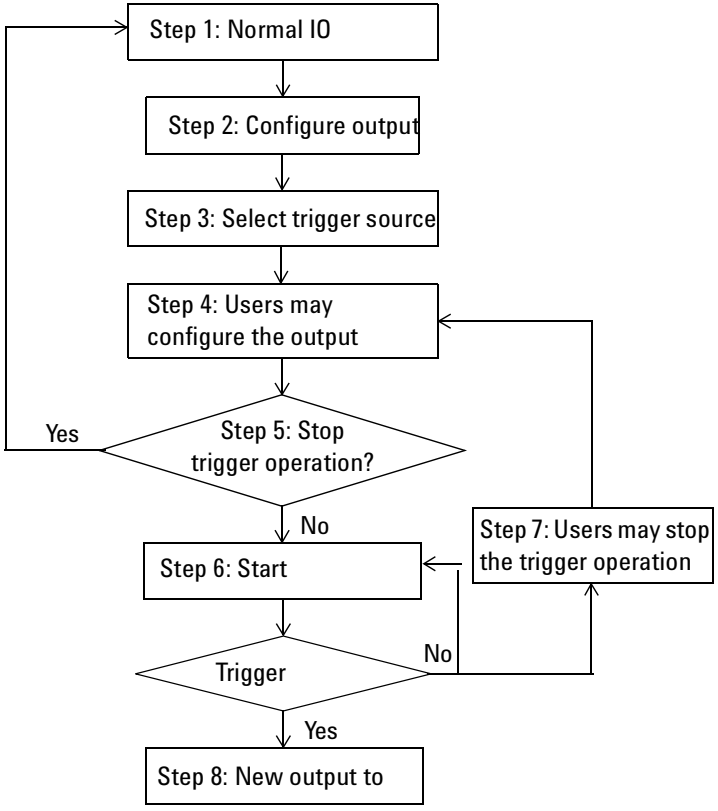


Figure3-7 Flowchart for trigger function operation

Table 3-1 Step-by-step descriptions for trigger function flowchart

Steps	Descriptions
Step 1	By default, no trigger souce is selected (`TRIG:SOUR NONE`). Hence, all digital inputs and digital outputs will operate immediately.

Step 2	Users may configure the desired output values before a trigger occurred. For example:
	`-> SOUR:DIG:DATA:BYTE 123,(@201:204)`
	
	And read the input values, for example:
	`-> SENS:DIG:DATA:BYTE? (@101:104)`
	`<- 111,111,111,111`

Step 3	Select one of the trigger source. (`TRIG:SOUR 301|302|STRG`) The star trigger "`STRG`" trigger source can only be used when the DIO module is installed in a modular instrument U2700A chassis.

Step 4	All IO operation will freeze when the user select one of the trigger source. So, if the user supply 98 to the input, sending the query command "`SENS:DIG:DATA:BYTE? (@101:104)`" will return "`111,111,111,111`" even the supply value at the DIO module has changed to 98 (for this case).
	
	At this stage, users are allow to configure the output values. For example:
	`-> SOUR:DIG:DATA:BYTE 220, (@201:204)`
	`-> SOUR:DIG:DATA:BYTE? (@201:204)`
	`<- 220,220,220,220`
	
	Even though the query command returns "`220,220,220,220`", the real output value at the hardware DIO module will remain the same as previous stage (Step 2), which is 123 in this case. The output value will remain at 123 until the DIO module receives the trigger signal.

Step 5	Users may stop trigger operation at this stage by sending the command "`TRIG:SOUR NONE`". If this command is sent without receiving any trigger signal, then the query of this command "`SOUR:DIG:DATA:BYTE? (@201:204)`" should give back the previous stage (Step 2) value, which is 123 in this example but not 220.

Step 6	Send the command "TRIG:MON ON" to start monitoring the trigger signal. Users are **NOT** allowed to change the output setting at this stage.
Step 7	Users can stop monitoring the trigger signal manually at any time. To stop monitoring, send the command "TRIG:MON OFF".
Step 8	If trigger happen, DIO module will output 220 (as configured in Step 4). The device will return to normal IO operation. So, when read the input value, it will return 98 (in this case). The command "TRIG:MON:STAT?" is used to query the current monitoring status process. For example, when this command is sent at this stage: -> TRIG:MON:STAT? <- +1 -> TRIG:MON:STAT? <- +0 The "+1" indicates that trigger has happened. But this will only be shown once. If the query command is sent for the second time, it will reset to "+0". The monitoring process will stop after trigger signal is received. -> TRIG:MON? <- 0

Example 1, Trigger did not happen

```
-> *RST; *CLS
-> SOUR:DIG:DATA:BYTE 123,(@201,203)
-> SOUR:DIG:DATA:BYTE 99,(@202,204)
-> SOUR:DIG:DATA:BYTE? (@201:204)

<- 123,99,123,99                          // Actual hardware value at 123,99,123,99

-> TRIG:SOUR 301                          // Setting trigger source will not affects the
-> SOUR:DIG:DATA:BYTE? (@201:204)         output value. Thus, output values remained
<- 123,99,123,99

-> SOUR:DIG:DATA:BYTE 44, (@201,202)      // Configure output value only. The actual
-> SOUR:DIG:DATA:BYTE 222, (@203,204)     hardware output did not change yet, still remain
                                          at 123,99,123,99
```

```
-> SOUR:DIG:DATA:BYTE? (@201:204)
<- 44,44,222,222
```
// Actual hardware value is 123,99,123,99 but SCPI show 44,44,222,222. The SCPI value will be source out, if the DAQ receives the trigger signal

```
-> TRIG:SOUR NONE
```
// User decides not to use trigger function anymore. Trigger does not happen

```
-> SOUR:DIG:DATA:BYTE? (@201:204)
<- 123,99,123,99
```
// Since trigger did not happen, the output value did not change. Thus SCPI return 123,99,123,99 to show the actual hardware status

Example 2, Trigger happen

```
-> *CLS; *RST
-> SOUR:DIG:DATA:BYTE 11,(@204)
-> SOUR:DIG:DATA:BYTE 233,(@201)
-> SOUR:DIG:DATA:BYTE 9,(@202)
-> SOUR:DIG:DATA:BYTE 205,(@203)
-> SOUR:DIG:DATA:BYTE? (@201:204)
-> 233,9,205,11
```
// Actual hardware value at 233,9,205,11

```
-> TRIG:SOUR 302
```
// Set trigger source at 302

```
-> SOUR:DIG:DATA:BYTE? (@201:204)
<- 233,9,205,11
```
// SCPI value remain

```
-> SOUR:DIG:DATA:LWOR 40154879,(@201)
-> SOUR:DIG:DATA:WORD? (@201,203)
<- 46847,612
-> SOUR:DIG:DATA:BYTE? (@201:204)
-> 255,182,100,2
```
// User may configure the output value as many times as they like using different type "SOUR" command. But the actual hardware value will not change until a trigger signal is received

```
-> SOUR:DIG:DATA:BYTE 33,(@202)
-> SOUR:DIG:DATA:BYTE 145,(@201)
-> SOUR:DIG:DATA:WORD 6523,(@203)
-> SOUR:DIG:DATA:BYTE? (@201:204)
-> 145,33,123,25
```
// The last configured SOUR value will determine the later hardware value when a trigger signal is received

```
-> TRIG:MON ON
```
// Start monitor the trigger signal

// After start monitor trigger signal, users are not allow to change SOUR command

```
-> SOUR:DIG:DATA:BYTE 23,(@201)
-> SYST:ERR?
<- +308,"Channel not able to perform requested operation; Chan 201"
```

```
-> SOUR:DIG:DATA:BYTE? (@201:204)        // However, user is still allow to make query on
<- 145,33,123,25                          SOUR command. Note that the actual hardware
                                          is still at 233,9,205,11 but SCPI value is at
                                          145,33,123,25
```

***** Trigger happen *****

```
-> TRIG:MON:STAT?                         // Check whether trigger had happened and
<- +1                                     reset to zero when user query for second time
-> TRIG:MON:STAT?
<- +0

-> TRIG:MON?                              // This command will also be reset to OFF,
<- 0                                      indicating that the trigger monitoring process has
                                          been stopped

-> SOUR:DIG:DATA:BYTE? (@201:204)         // Now the SCPI and actual hardware value are
<- 145,33,123,25                          the same, which is 145,33,123,25
```

***** From here onwards, user may choose to continue with trigger or turn off trigger *****

```
-> TRIG:SOUR NONE                         // Turn off trigger function

-> SOUR:DIG:DATA:BYTE?(@201:204)          // Now the SOUR query command shows the
<- 145,33,123,25                          actual hardware value, which is 145,33,123,25
```

Example 3, Interrupt commands during trigger are not allow

E.g. 1: After trigger source is selected, interrupt function feature is not allowed

```
-> *CLS; *RST

-> TRIG:SOUR 302                  // Set 302 as trigger source

// Interrupt command is not allow in trigger mode. If used, an error will occur.
-> DIG:INT 1,(@301)
-> SYST:ERR?
<- +308,"Channel not able to perform requested operation; Chan 301"
-> DIG:INT 1,(@302)
-> SYST:ERR?
<- +308,"Channel not able to perform requested operation; Chan 302"

-> DIG:INT? (@301:302)            // However, user can check whether the interrupt is enabled
<- 0,0
```

E.g 2: Interrupt feature is disabled if a trigger source is selected

```
-> *CLS; *RST

-> DIG:INT 1,(@302)          // Interrupt command is not allow in trigger mode. If used, an error
-> DIG:INT? (@301:302)       will occur.
<- 0,1

-> TRIG:SOUR 301             // Select 301 as trigger source
-> DIG:INT? (@301)           // Interrupt feature will be automatically disabled when user select
<- 0                         trigger source. "0" means the interrupt function is not enabled.
-> DIG:INT? (@302)
<- 0
-> DIG:INT? (@301:302)
<- 0,0

-> TRIG:SOUR NONE            // Turn off the trigger source

-> DIG:INT? (@301:302)       // This query command will still return 0,0
<- 0,0
```

E.g. 3: STRG as the trigger source when used in the instrument modular chassis (U2781A)

```
-> *CLS; *RST

-> TRIG:SOUR STRG        // Select STRG as trigger source

-> STAT:INT:ENAB 3       // No error generated when enable the "STRG" trigger source. This
-> STAT:INT ENAB?        command can still be use because it is only an enable register. Since
<- +3                    interrupt comand has been disabled, this command have no effect on
-> STAT:INT?             interrupt or trigger.
<- +0
```

Example 4, Group command during trigger

```
-> *CLS; *RST

-> CONF:DIG:GRO 101.3,104.2,101.7,102.5,103.6,102.0,103.4,102.1,(@199)
-> CONF:DIG:GRO 203.2,201.4,204.3,202.7,201.5,204.1,203.0,201.2,(@299)
-> SOUR:DIG:DATA:BYTE 234,(@299)
-> SOUR:DIG:DATA:BYTE? (@299)
<- 234

-> SOUR:DIG:DATA:BYTE? (@201:204)        // Actual hardware value at 20,128,1,2
<- 20,128,1,2

-> TRIG:SOUR 302                         // Set 302 as trigger source

-> SOUR:DIG:DATA:BYTE? (@201:204)
<- 20,128,1,2
-> SOUR:DIG:DATA:BYTE? (@299)
<- 234

-> SOUR:DIG:DATA:BYTE 31,(@299)
-> SOUR:DIG:DATA:BYTE? (@299)
<- 31

-> SOUR:DIG:DATA:BYTE? (@201:204)
<- 48,128,4,8

-> TRIG:MON ON

-> SOUR:DIG:DATA:BYTE 23,(@299)
-> SYST:ERR?
<- +308,"Channel not able to perform requested operation; Chan 299"

// However, users are still allow to re-arrange the channels in 299 or 199 since it will not alter the SCPI value,
48,128,4,8
-> CONF:DIG:GRO 201.2,202.4,203.3,204.7,201.5,202.1,203.0,204.2,(@299)
-> CONF:DIG:GRO 101.3,102.2,103.7,104.5,101.6,102.0,103.4,104.1,(@199)

-> SOUR:DIG:DATA:BYTE? (@299)            // Although this value has changed from 31 to 16
<- 16                                    due to re-configured of the channels, it will not
-> SOUR:DIG:DATA:BYTE? (@201:204)        affect the SCPI value. The value in channel
<- 48,128,4,8                            201:204 still remain unchanged. Note that before
                                         the trigger occur, the hardware value still at
                                         20,128,1,2 but SCPI value is at 48,128,4,8
```

***** TRIGGER OCCURED *****

```
-> TRIG:MON:STAT?                    // Check whether a trigger signal is detected
<- +1                                // "1" mean trigger signal is detected
-> TRIG:MON:STAT?                    // Query the second will receive "0" because
<- +0                                this command auto-reset the register to "0"
-> TRIG:MON?                         // Trigger monitoring process will be auto turned
<- 0                                 off when a trigger source is detected

-> SOUR:DIG:DATA:BYTE? (@201:204)    // After the trigger signal is detect, the SCPI and
<- 48,128,4,8                        actual hardware value are the same, which is
-> SOUR:DIG:DATA:BYTE? (@299)        48,128,4,8
<- 16
```

***** From here onwards, users may choose to continue with trigger or turn off trigger function *****

```
-> TRIG:SOUR NONE                    // Turn off trigger function
```

4 Product Characteristics and Specifications

This chapter provides the information on general product characteristics and product specifications.

Product Characteristics

REMOTE INTERFACE
- USB 2.0 High Speed
- USBTMC Class Device

POWER REQUIREMENT
- +12 VDC (Typical)
- 2 A (maximum) input rated current
- Installation Category II

POWER CONSUMPTION
- +12 VDC, 260 mA (maximum)

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
- Canada: CAN/CSA-C22.2 No.61010-1-04
- USA: ANSI/UL 61010-1: 2004

EMC COMPLIANCE
- IEC 61326-1:2002/EN 61326-1:1997+A1:1998+A2:2001+A3:2003
- CISPR 11: 1990/EN55011:1990 – Group 1 Class A
- Canada: ICES-001: 2004
- Australia/New Zealand: AS/NZS CISPR11:2004

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

IO CONNECTOR
- 100-pin SCSI-II connector

DIMENSION (WxDxH)
- 120.00 mm x 182.40 mm x 44.00 mm (with plastic casing)
- 105.00 mm x 174.54 mm x 25.00 mm (without plastic casing)

WEIGHT
- 535 g (with plastic casing)
- 370 g (without plastic casing)

WARRANTY

3 years

Product Specifications

U2600A Series DIO Specifications

Table 4-1 Product specifications for U2600A Series DIO (U2651A, U2652A, and U2653A)

Digital Input			
Model Number	**U2651A**	**U2652A**	**U2653A**
Number of isolated bits	32-bit	64-bit	N/A
Input type	Opto-isolated	Opto-isolated	N/A
Maximum input voltage range [1]	24 V, non-polarity	24 V, non-polarity	N/A
Digital logic levels [2]	High: 10 V to 24 V Low: 0 V to 2.0 V	High: 10 V to 24 V Low: 0 V to 2.0 V	N/A
Input resistance	24 kΩ at 0.75 W	24 kΩ at 0.75 W	N/A
Input current (maximum)	1.5 mA per bit	1.5 mA per bit	N/A
Isolation voltage	1250 Vrms	1250 Vrms	N/A
Interrupt sources	DI 301 and 302	DI 301 and 302	N/A

Digital Output			
Model Number	**U2651A**	**U2652A**	**U2653A**
Number of isolated bits	32-bit	N/A	64-bit
Output type	Open drain power MOSFET driver	N/A	Open drain power MOSFET drive
External supply voltage range	5 V to 35 V	N/A	5 V to 35 V
Voltage drop at MOSFET when on	V_{Drop} < 1.0 V	N/A	V_{Drop} < 1.0 V
Output sink current per bit	500 mA (100 % duty cycle) per bit, 400 mA (100% duty cycle) when full 32-bit loaded	N/A	500 mA (100 % duty cycle) per bit, 400 mA (100% duty cycle) when full 64-bit loaded
Isolation voltage	1250 Vrms	N/A	1250 Vrms

[1] Maximum input voltage range is 24 V with reference to COM pin

[2] Voltage level with reference to COM

On Board Isolated +5 V Power Supply			
Model Number	**U2651A**	**U2652A**	**U2653A**
Output voltage (Typical)	+5 V	N/A	+5 V
Output current (Typical)	150 mA	N/A	150 mA
Maximum power	0.85 W	N/A	0.85 W

General Specification			
Model Number	**U2651A**	**U2652A**	**U2653A**
User interface	Hi-speed USB 2.0		
Dimensions (W x D x H)	120.00 mm x 182.40 mm x 44.00 mm (with plastic casing)		
	105.00 mm x 174.54 mm x 25.00 mm (not including plastic cover)		
Connector type	100-pin SCSI-II connector		
Operating temperature	0 °C to +55 °C		
Storage temperature	–20 °C to +70 °C		
Relative humidity	Operating: 15 to 85% at 40°C non-condensing		
	Non-operating: 90% RH at 65°C for 24 hours		
Power consumption	+12 VDC at 235 mA typical	+12 VDC at 115 mA typical	+12 VDC at 260 mA typical

5
Dismantle Procedures

This chapter describes the step-by-step disassemble procedures and list the available replacement parts for U2600A Series DIO modules,

General Disassemble

This chapter provides the step-by-step guides on how to dismantle the module and install the replacement assembly. To assemble back the module, follow the instructions in reverse order.

NOTE The parts shown in the following figures are representative and may look different than what you have in your module.

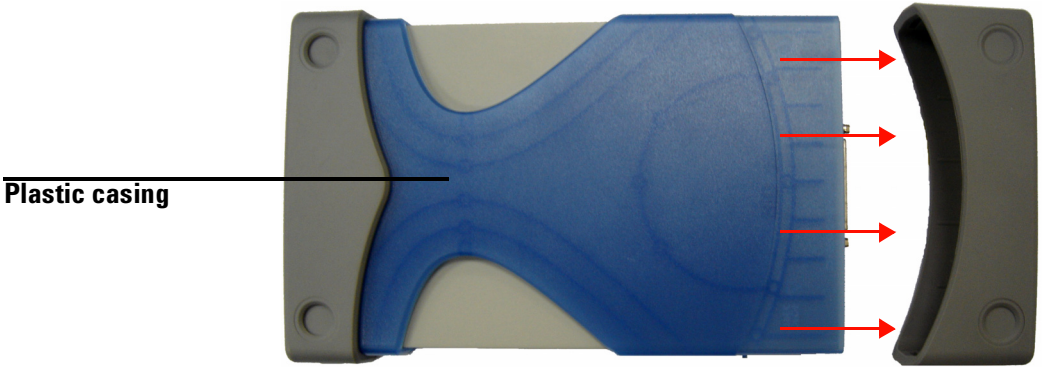
The removable assemblies include:

- Plastic casing
- Metal casing
- Rear metal casing
- Front metal casing, which is attached to the carrier board and measurement board

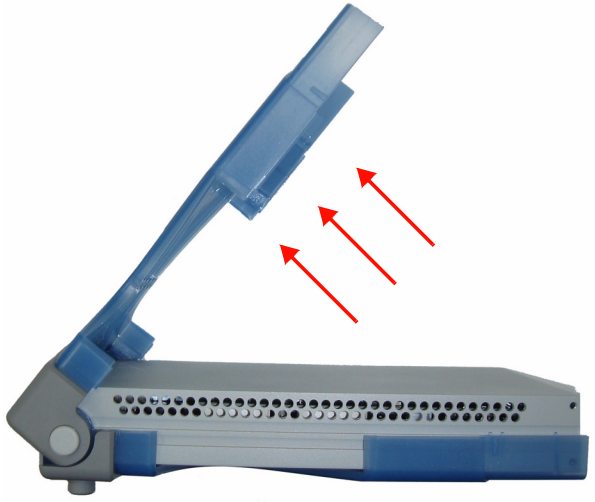
Mechanical Disassemble

Follow the instructions in this section for the instrument disassemble process.

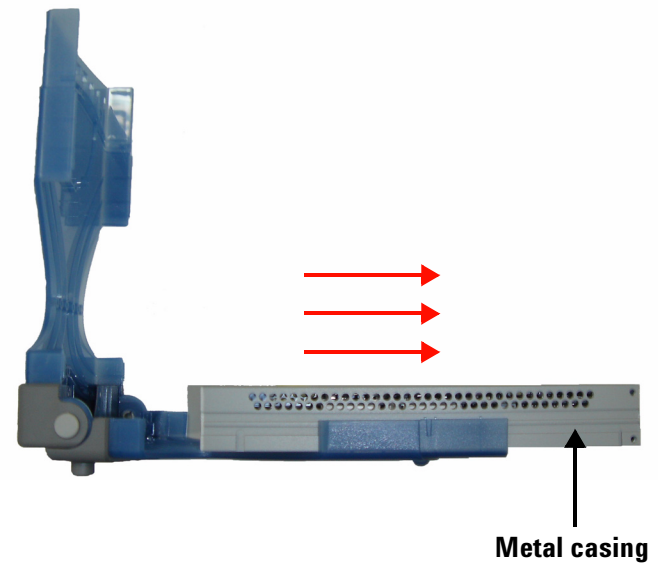
Step 1: Pull the bumper out to remove the plastic casing.



Step 2: Flip the plastic casing open.



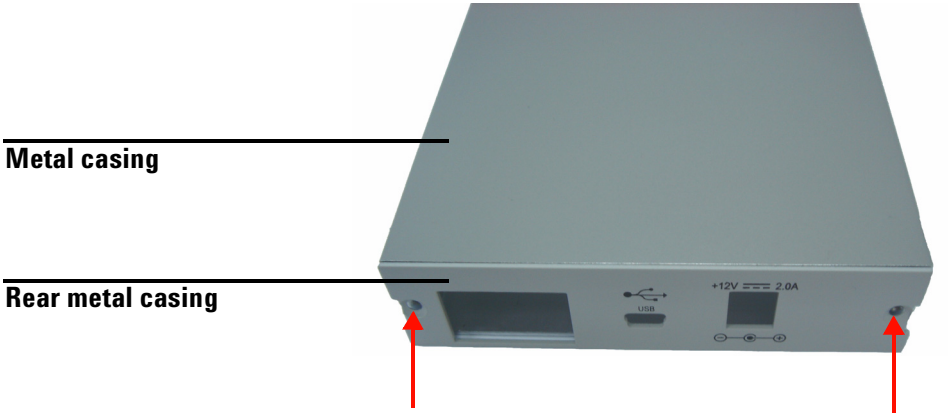
Step 3: Slide the metal casing out of the plastic casing.



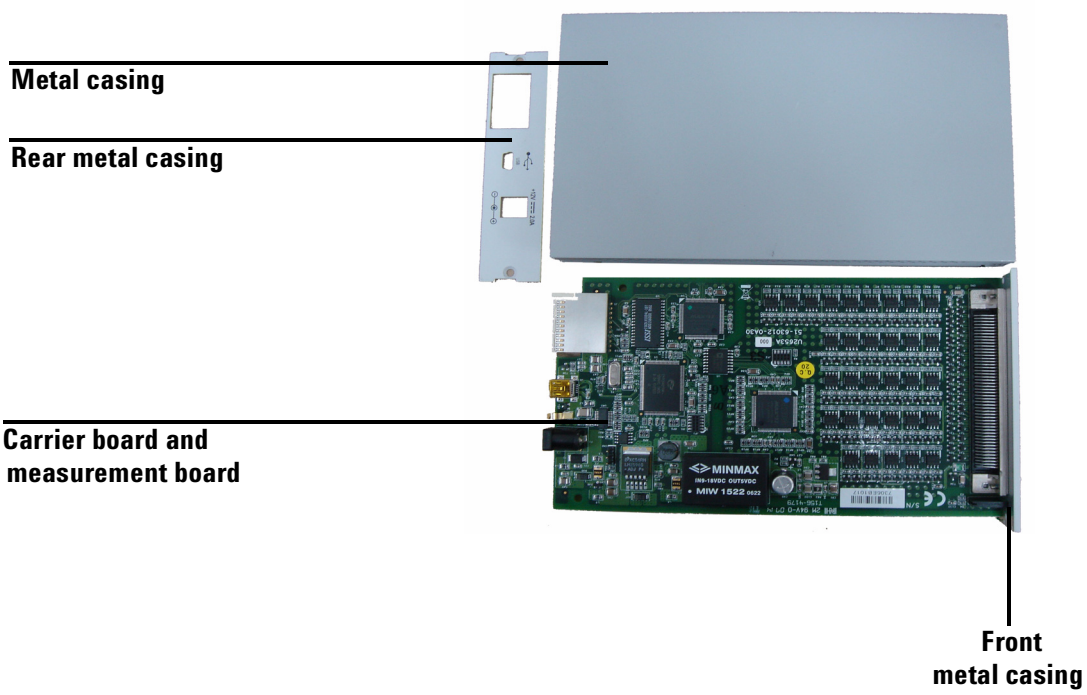
Step 4: Unscrew all the following indicated screws from metal casing.

Step 5: Gently pull the front metal piece out, which is attached to the carrier and measurement boards.

Step 6: Unscrew all the following indicated screws from the metal casing and remove the rear metal piece.



Disassembled parts:



Troubleshooting

This section provides suggestions for solving general problems that you may encounter with the instrument. It guides you on what to check in the following situations:

1. Power Indicator LED is not lit

Verify that the ac power cord is connected to the power inlet in the DAQ device.

2. Power Indicator LED is lit but the AO/ AI Indicator LED is not lit

Verify that the USB cable is connected to the PC and the USB inlet in the DAQ device.

3. Power Indicator LED is lit and AO/ AI Indicator LED is lit

Verify if the SCPI commands are correct with "`SYSTem:ERRor?`" command.

Refer to *U2600A Series USB Multifunction Programming Guide* for SCPI error messages.

NOTE If there are no response from the instrument, contact the nearest Agilent Service Center to obtain further assistance.

Self-Test Procedures

WARNING **Do not connect any cables and terminal block prior to performing self-test procedures.**

1. Go to **Start > All Programs > Agilent IO Libraries Suite > Agilent Connection Expert** to launch the Agilent Connection Expert.
2. Go to **Start > All Programs > Agilent T&M Toolkit > Agilent Interactive IO** to launch the Interactive I/O dialog box.
3. Send the SCPI command "`*TST?`" to the instrument to start perform the self-test of the instrument.
4. The command will return either "`+0`" to indicate all tests passes or "`+1`" to indicate one or more tests failed.
5. If the command returns "`+1`" , apply SCPI command "`SYSTem:ERRor?`" to enquire the error message.

NOTE Refer to *Agilent U2600A Series USB Multifunction Data Acquisition Programming Guide* for SCPI error messages.

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Contact us

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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:
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Printed in Malaysia
September 5, 2007

U2651-90011

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