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GXSW

Switching Instruments

GX6616

High Density Switching PXI Board

User's Guide

Last Updated: November 29, 2012

GEOTEST

MARVIN TEST SYSTEMS, INC.

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Chapter 1 - Introduction

Manual Scope and Organization

Manual Scope

This manual provides all the information necessary for installation, operation, and maintenance of the **GX6616** PXI Switch Matrix Board. The manual also covers the **GXSW** software package that includes the GX6616 driver. This manual assumes the reader has a general knowledge of PC based computers, Windows operating systems, and a general knowledge of modular test equipment.

Manual Organization

The GX6616 manual is organized in the following manner:

Chapter	Content
Chapter 1 – Introduction	Introduces the GX6616 manual and shows warning conventions used in the manual.
Chapter 2 – Overview	Provides the GX6616 list of features, description of the board, architecture, specifications and the virtual panel description and operation.
Chapter 3 –Installation and Connections	Provides instructions about how to install a GX6616 board and the GXSW software.
Chapter 4 – Functions Reference	Provides a list of the GXSW driver functions for the GX6616. Each function description provides syntax, parameters, and any special programming comments.

Conventions Used in this Manual

Symbol Convention	Meaning
	Static Sensitive Electronic Devices. Handle Carefully.
	Warnings that may pose a personal danger to your health. For example, shock hazard.
	Cautions where computer components may be damaged if not handled carefully.
	Tips that aid you in your work.

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Formatting Convention	**Meaning**
`Monospaced Text`	Examples of field syntax and programming samples.
Bold type	Words or characters you type as the manual instructs. For example: function or panel names.
Italic type	Specialized terms. Titles of other references and information sources. Placeholders for items you must supply, such as function parameters

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Chapter 2 - Overview

Introduction

Users of the Geotest GX6616 Switching instruments must be familiar with the GXSW User's Guide for a more thorough understanding of the following topics:

- Theory of Operation of Switching Systems
- Control GXSW Switching instruments using various programming languages
- Setup and Installation of GXSW Switching instruments

Caution - Do not attempt to insert or remove a switching instrument until you are familiar with **GXSW User's Guide Chapter 3 "Setup and Installation"**.

Features

The GX6616 is a one-slot 6U PXI high-density switch matrix instrument supporting the following features:

- 6 groups of 2x16 switch matrix
- Groups can be connected to form up to 2x96 or 12x16 switch matrix
- Six individual range groups allow multiple configurations
- Extensive built in self-test
- Occupies one PXI bus slot

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Board Description

The GX6616 is a 6U PXI board featuring 6 groups of 2x16 switch matrix with two connectors J6 and J7 and one chassis ground jumper - JP1.

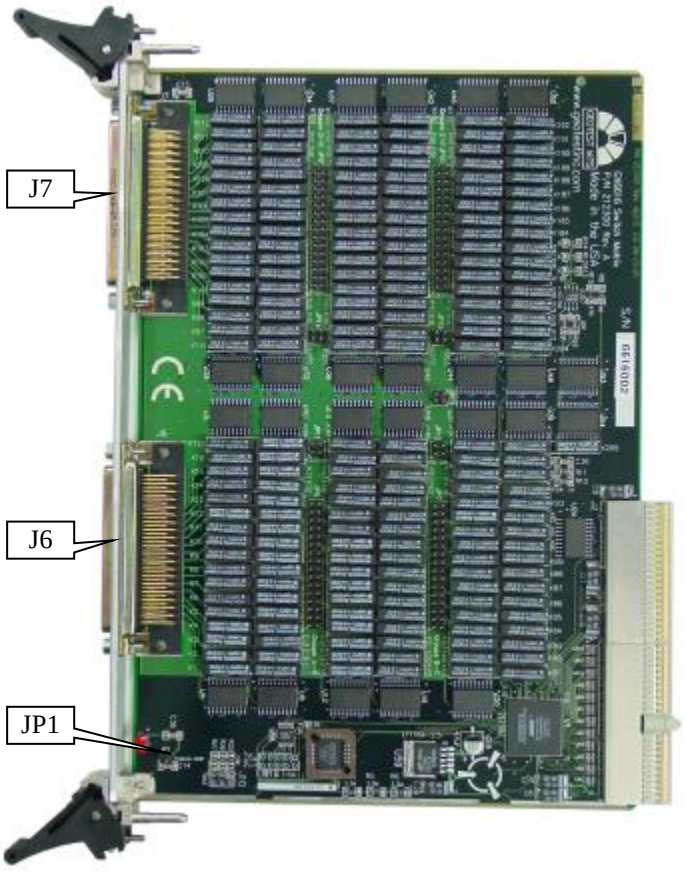


Figure 2-1: GX6616 Switch Matrix

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Architecture

The GX6616 consists of 6 switching groups, A through F, each providing switching of any two lines to any 16 other lines as shown in Figure 2-2:

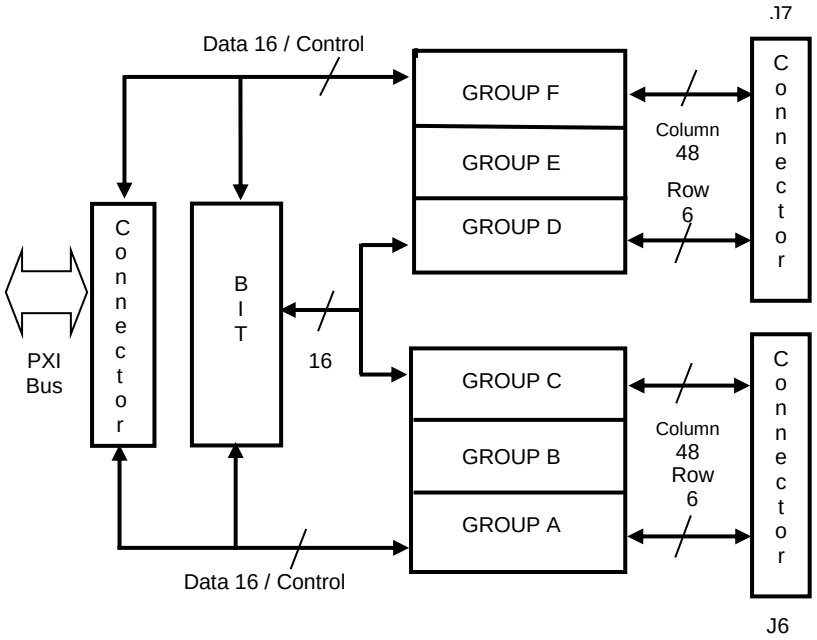


Figure 2-2: GX6616 Architecture

The built-in self test (BIT) module provides a way to verify that the board relays are working properly. An optional BIT adapter that is connected externally to J6 and J7 is required to perform the BIT.

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GX6616 Switching Groups

The GX6616 has 6 switching groups: A to F. There are two rows per group and 16 relays per row for a total of 192 relays. Each switching group can be connected to an adjacent group via jumper; either horizontally or vertically.

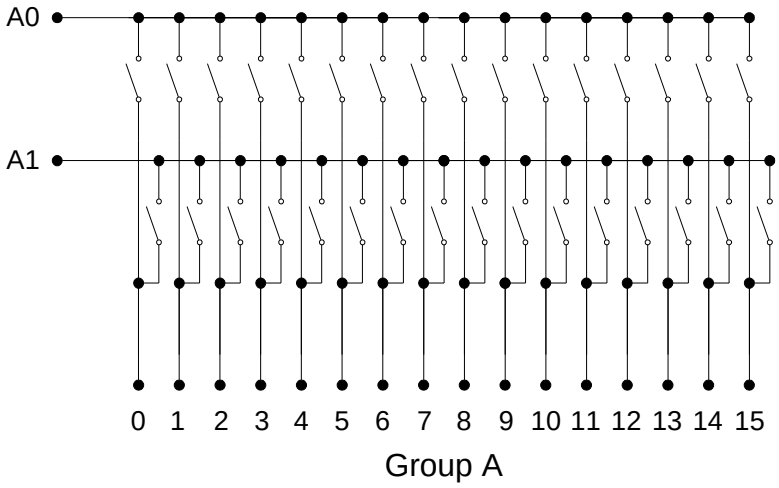


Figure 2-3: GX6616 Typical Switching Group

GX6616 Jumpers

There are nine jumper header blocks that are used to connect adjacent switching groups. Four jumpers header blocks of 16 jumpers each are used for connecting 16 columns to their adjacent group. Five jumpers header blocks of 2 jumpers each are used for connecting 2 rows to their adjacent group.

Figure 2-4 shows jumper headers for groups A to C with JP6, JP7, JP11, JP12 and JP13.

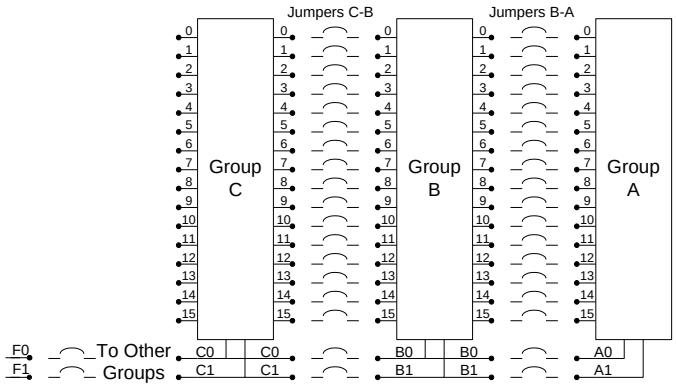


Figure 2-4: GX6616 A, B and C Groups Jumpers

Ground and Guard

All the shielding on the GX6616 board is connected to a chassis signal. JP4 can be installed to connect the chassis and Ground.

Specifications

The following table outlines the specifications of the GX6616:

Contact Specifications

Relay Contact Resistance	0.2 Ω Maximum 0.03Ω Initial
Contact Life Rating At 28 VDC @ 0.5A	$10x10^6$ Typical Rated Load
Switch able Voltage	200 VDC Maximum
Switch able Current	0.5 Max
Contact Carry Current	1.2 Max
Operate Time	500 µS
Release Time	250 µS
Frequency Response	15 MHz
Power	10 Watts

Power Requirements

3.3V Power	100mA Typical / 300mA Max
5V Power	200mA Typical, 2.0A Max

Environmental

Temperature:	0 to +40 °C Operating -10 to +70 °C Storage
Vibration	5g at 500Hz
Shock	5g for 6mS ½ Sine

Physical

Size	6U PXI
Weight	18 oz.

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Virtual Panel Description

The GX6616 includes a virtual panel program, which enables full utilization of the various configurations and controlling modes. To fully understand the front panel operation, it is best to become familiar with the functionality of the board.

To open the virtual panel application, select **GX6616 Panel** from the **Geotest**, **GXSW** menu under the **Start** menu. The GX6616 virtual panel opens as shown here:

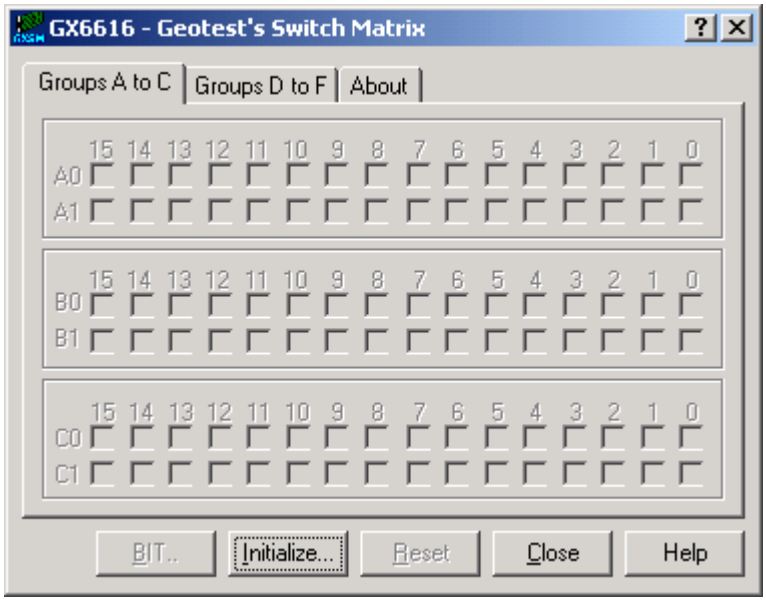


Figure 2-5: GX6616 Virtual Panel

The following controls are shown:

BIT: Performs the built-in test. Before clicking on this button make sure the BIT adapter is installed on the 6616's connector. The result of the BIT is displayed in a message box after the BIT is completed. This button is enabled only when the BIT adapter (one or two adapters) to J6 and J7.

Initialize Opens the Initialize Dialog (see Initialize Dialog paragraph) in order to initialize the board driver. The current settings of the selected counter **will not change after calling initialize**. The panel will reflect the current settings of the counter after the Initialize dialog closes.

Reset: Resets all relays to an open state and sets panel parameters to the default state.

Close: Closes (exits) the GX6315 panel.

Help: Opens the GX6315 on-line help window.

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Virtual Panel Initialize Dialog

The Initialize dialog initializes the driver for the selected counter board. The counter settings **will not change** after initialize is called. Once initialize, the panel will reflect the current settings of the counter.

The Initialize dialog supports two different device drivers that can be used to access and control the board:

1. **Use Geotest's HW** – this is the device driver installed by the setup program and is the default driver. When selected, the **Slot Number** list displays the available counter boards installed in the system and their slots. The chassis, slots, devices and their resources are also displayed by the HW resource manager, **PXI/PCI Explorer** applet that can be opened from the Windows Control Panel. The PXI/PCI Explorer can be used to configure the system chassis, controllers, slots and devices. The configuration is saved to PXISYS.INI and PXIeSYS.INI located in the Windows folder. These configuration files are also used by VISA. The following figure shows the slot number 0x105 (chassis 1 Slot 5). This is the slot number argument (*nSlot*) passed by the panel when calling the driver **Gx6616Initialize** function used to initialize driver with the specified board.

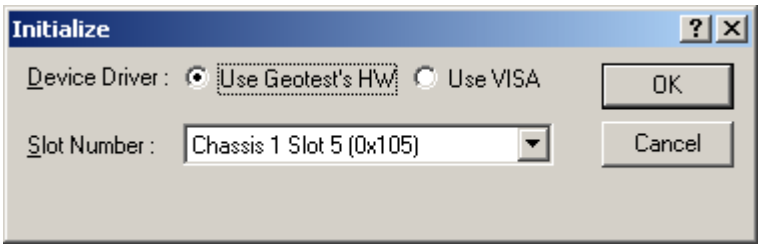


Figure 2-6: Initialize Dialog Box using Geotest's HW driver

2. **Use VISA** – this is a third party device driver usually provided by National Instrument (NI-VISA). When selected, the **Resource** list displays the available boards installed in the system and their VISA resource address. The chassis, slots, devices and their resources are also displayed by the VISA resource manager, **Measurement & Automation** (NI-MAX) and in Geotest **PXI/PCI Explorer**. The following figure shows PXI9::13::INSTR as the VISA resource (PCI bus 9 and Device 13). This is VISA resource string argument (*szVisaResource*) passed by the panel when calling the driver **Gx6616InitializeVisa** function to initialize the driver with the specified board.

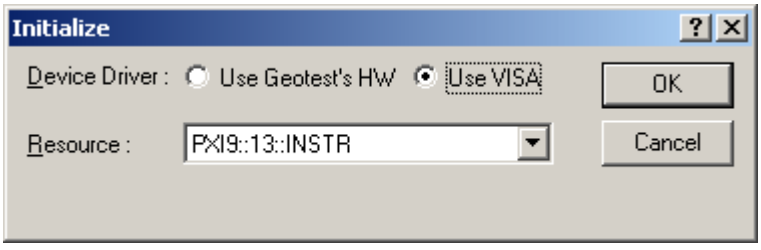


Figure 2-7: Initialize Dialog Box using VISA resources

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Virtual Panel Group Page

After the board is initialized the panel is enabled and will display the current setting of the board. The following picture shows the **Group page** settings:

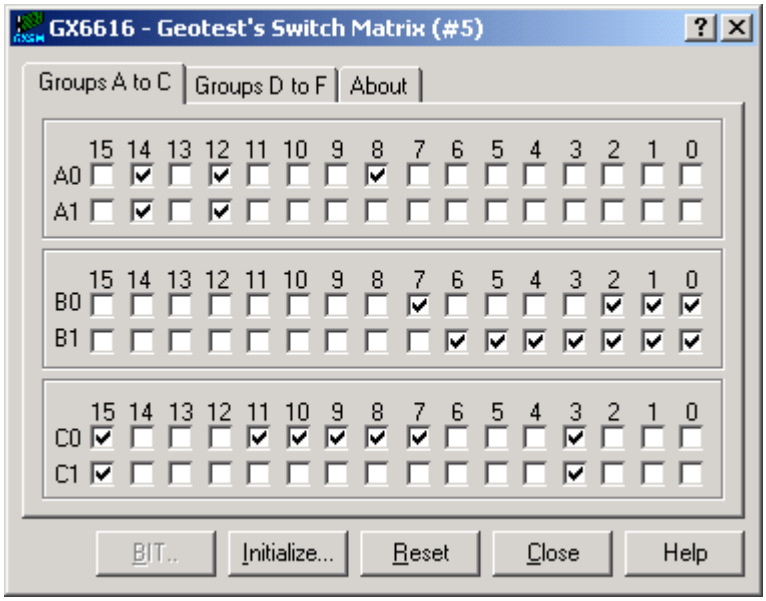


Figure 2-8: GX6616 Virtual Panel (Initialized)

The following controls are shown:

Groups A-C, D-F Tabs: The **Groups** tab changes the view of the Matrix Display Area. Choices are A to C or D to F.

Matrix Display Area: Displays the current relay setting (closed or open) of the selected Groups tab. When a box in the matrix is checked, the relay in that row/column is closed. Similarly, unchecked boxes mean relays are open.

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Virtual Panel About Page

Clicking on the **About** tab will show the **About page** as shown in Figure 2-9:

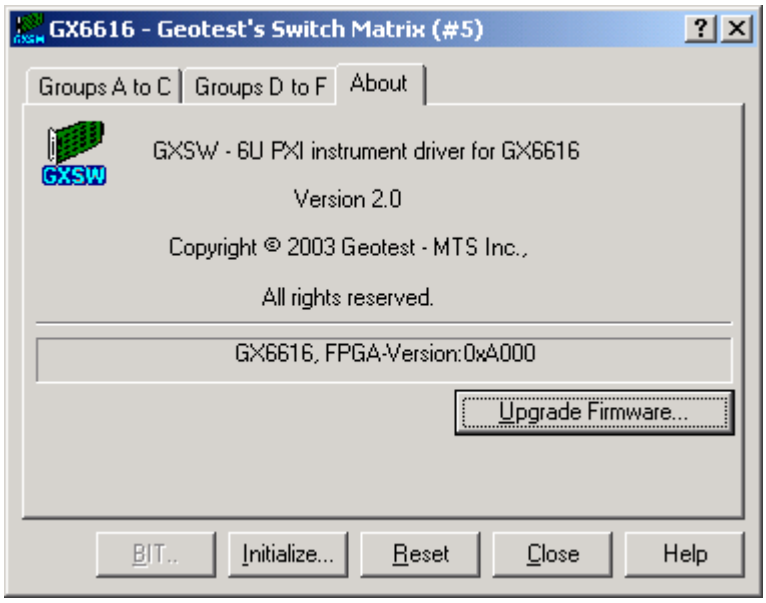


Figure 2-9:GX6616 Virtual Panel – About Page

The top part of the **About** page displays version and copyright of the GX6616 driver. The bottom part displays the board summary, including the EEPROM version, the board Revision, the FPGA version, the board serial number and the calibration time. The **About** page also contains a button **Upgrade Firmware…** used to upgrade the board FPGA. This button maybe used only when the board requires upgrade as directed by Geotest support. The upgrade requires a firmware file (.jam) that is written to the board FPGA. After the upgrade is complete you must shut down the computer to recycle power to the board.

Performing the Built In Test (BIT)

Caution - Do not run the BIT test with the Unit Under Test (UUT) attached. Damage may result to the UUT and/or to the GX6616 if it is not connected to the BIT self test adapter during the test.

The GX6616 is designed with onboard Built-In-Test capabilities (BIT). The BIT requires the use of *optional* one or two external self-test connectors. All the relays on board are tested in closed and open states. To run the BIT test perform the following:

1. Remove the UUT test cables/connectors and attach the BIT connector(s). If only one self test adapter is available, connect it to J6. After the BIT is complete repeat this procedure for J7.
2. Click on the **BIT** button in the panel to start the test. A message box is displayed to disconnect all connectors and to connect the BIT (self test) adapter.
3. The Panel will perform the BIT test. Upon completion the panel will display a message box showing the status of the test. If an error occurred, the program will display an error message describing the problem(s).

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Chapter 3 - Installation and Connections

Getting Started

This section includes general hardware installation procedures for the GX6616 board and installation instructions for the GX6616 (GXSW) software. Before proceeding, please refer to the appropriate chapter to become familiar with the board being installed.

To Find Information on…	Refer to…
Hardware Installation	This Chapter
GX6616 Driver Installation	This Chapter
GX6616 Function Reference	Chapter 4

Packing List

All GX6616 boards have the same basic packing list, which includes:

1. GX6616 Board
2. CD that includes the GXSW software

Unpacking and Inspection

After removing the board from the shipping carton:

 **Caution -** Static sensitive devices are present. Ground yourself to discharge static.

4. Remove the board from the static bag by handling only the metal portions.
5. Be sure to check the contents of the shipping carton to verify that all of the items found in it match the packing list.
6. Inspect the board for possible damage. If there is any sign of damage, return the board immediately. Please refer to the warranty information at the beginning of the manual.

System Requirements

The GX6616 instrument board is designed for use with a 3U or 6U cPCI or PXI compatible chassis. The software is compatible with any computer system running Windows 98, Windows Me, Windows 2000, Windows XP, and Windows VISTA (32-bit) operating systems. In addition, Microsoft Windows Explorer version 4.0 or above is required to view the online help.

Each board requires one unoccupied 3U PXI bus slot.

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Installation of the GXSW Software

Before installing the board it is recommended that you install the GXSW software as described in this section. To install the GXSW software, follow the instruction described below:

1. Insert the Geotest CD-ROM and locate the **GXSW.EXE** setup program. If you computer's Auto Run is configured, when inserting the CD a browser will show several options. Select the Geotest Files option, then locate the setup file. If Auto Run is not configured you can open the Windows explorer and locate the setup files (usually located under \Files\Setup folder). You can also download the file from Geotest's web site (www.geotestinc.com).
2. Run the GXSW setup and follow the instruction on the Setup screen to install the GXSW driver.

   Note: When installing under Windows NT/2000/XP/VISTA, you may be required to restart the setup after logging-in as a user with Administrator privileges. This is required in-order to upgrade your system with newer Windows components and to install kernel-mode device drivers (HW.SYS and HWDEVICE.SYS) which are required by the GXSW driver to access resources on your board.
3. The first setup screen to appear is the Welcome screen. Click **Next** to continue.
4. Enter the folder where GXSW is to be installed. Either click **Browse** to set up a new folder, or click **Next** to accept the default entry of `C:\Program Files\Geotest\GXSW`.
5. Select the type of Setup you wish and click **Next.** You can choose between **Typical**, **Run-Time** and **Custom** setups types. The **Typical** setup type installs all files. **Run-Time** setup type will install only the files required for controlling the board either from its driver or from its virtual panel. The **Custom** setup type lets you select from the available components.

The program will now start its installation. During the installation, Setup may upgrade some of the Windows shared components and files. The Setup may ask you to reboot after completion if some of the components it replaced were used by another application during the installation – do so before attempting to use the software.

You can now continue with the installation to install the board. After the board installation is complete you can test your installation by starting a panel program that lets you control the board interactively. The panel program can be started by selecting it from the Start, Programs, GXSW menu located in the Windows Taskbar.

Setup Maintenance Program

You can run the Setup again after GXSW has been installed from the original disk or from the Windows Control Panel – Add Remove Programs applet. Setup will be in the Maintenance mode when running for the second time. The Maintenance window show below allows you to modify the current GXSW installation. The following options are available in Maintenance mode:

- **Modify.** When you want to add or remove GXSW components.
- **Repair.** When you have corrupted files and need to reinstall.
- **Remove.** When you want to completely remove GXSW.

Select one of the options and click **Next** and follow the instruction on the screen until Setup is complete.

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Overview of the GXSW Software

Once the software is installed, the following tools and software components are available:

- **GXSW Panel** – Configures and controls the GX6616 various features via an interactive user interface.
- **GXSW driver** - A DLL based function library (GXSW.DLL, located in the Windows System folder) used to program and control the board.
- **Programming files and examples** – Interface files and libraries for support of various programming tools. A complete list of files and development tools supported by the driver is included in subsequent sections of this manual.
- **Documentation** – On-Line help and User's Guide for the GX6616 board, GXSW driver and panel.
- **HW driver and PXI/PCI Explorer applet** – HW driver allows the GXSW driver to access and program the supported boards. The explorer applet configures the PXI chassis, controllers and devices. This is required for accurate identification of your PXI instruments later on when installed in your system. The applet configuration is saved to PXISYS.ini and PXIeSYS.ini and is used by Geotest instruments HW driver and VISA. The applet can be used to assign chassis numbers, Legacy Slot numbers and instrument alias names. The HW driver is installed and shared with all Geotest products to support accessing the PC resources. Similar to HW driver, VISA provides a standard way for instrument manufacturers and users to write and use instruments drivers. VISA is a standard maintained by the VXI Plug & Play System Alliance and the PXI Systems Alliance organizations (http://www.vxipnp.org/, http://www.pxisa.org/). The VISA resource manager such as National Instruments **Measurement & Automation** (NI-MAX) displays and configures instruments and their address (similar to Geotest's PXI/PCI Explorer). The GXPIO driver can work with either HW or VISA to control an access the supported boards.

Installation Folders

The GX6384 driver files are installed in the default folder `C:\Program Files\Geotest\GXPIO`. You can change the default `GXPIO` folder to one of your choosing at the time of installation.

During the installation, `GXPIO` Setup creates and copies files to the following folders:

Name	Purpose / Contents
…\Geotest\GXSW	The GXSW folder. Contains panel programs, programming libraries, interface files and examples, on-line help files and other documentation.
…\Geotest\HW	HW device driver. Provide access to your board hardware resources such as memory, IO ports and PCI board configuration. See the README.TXT located in this directory for more information.
…\ATEasy\Drivers	ATEasy drivers folder. GXPIO Driver and example are copied to this directory only if ATEasy is installed to your machine.
…\Windows\System (Windows 9x/Me), or …\Windows\System32 when running Windows NT/2000/XP/VISTA	Windows System directory. Contains the GXSW DLL driver, HW driver shared files and some upgraded system components, such as the HTML help viewer, etc.

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Configuring Your PXI System using the PXI/PCI Explorer

To configure your PXI/PCI system using the **PXI/PCI Explorer** applet follow these steps:

1. **Start the PXI/PCI Explorer applet**. The applet can be start from the Windows Control Panel or from the Windows Start Menu, **Geotest**, **HW**, **PXI/PCI Explorer**.
2. **Identify Chassis and Controllers**. After the PXI/PCI Explorer is started, it will scan your system for changes and will display the current configuration. The PXI/PCI Explorer automatically detects systems that have Geotest controllers and chassis. In addition, the applet detects PXI-MXI-3/4 extenders in your system (manufactured by National Instruments). If your chassis is not shown in the explorer main window, use the Identify Chassis/Controller commands to identify your system. Chassis and Controller manufacturers should provide INI and driver files for their chassis and controllers which are used by these commands.
3. **Change chassis numbers, PXI devices Legacy Slot numbering and PXI devices Alias names.** These are optional steps and can be performed if you would like your chassis to have different numbers. Legacy slots numbers are used by older Geotest or VISA drivers. Alias names can provide a way to address a PXI device using a logical name (e.g. "DMM1"). For more information regarding slot numbers and alias names, see the **Gx6616Initialize** and **Gx6616InitializeVisa** functions.
4. **Save your work**. PXI Explorer saves the configuration to the following files located in the Windows folder: PXISYS.ini, PXIeSYS.ini and GxPxiSys.ini. Click on the **Save** button to save your changes. The PXI/Explorer will prompt you to save the changes if changes were made or detected (an asterisk sign ' *' in the caption indicated changes).

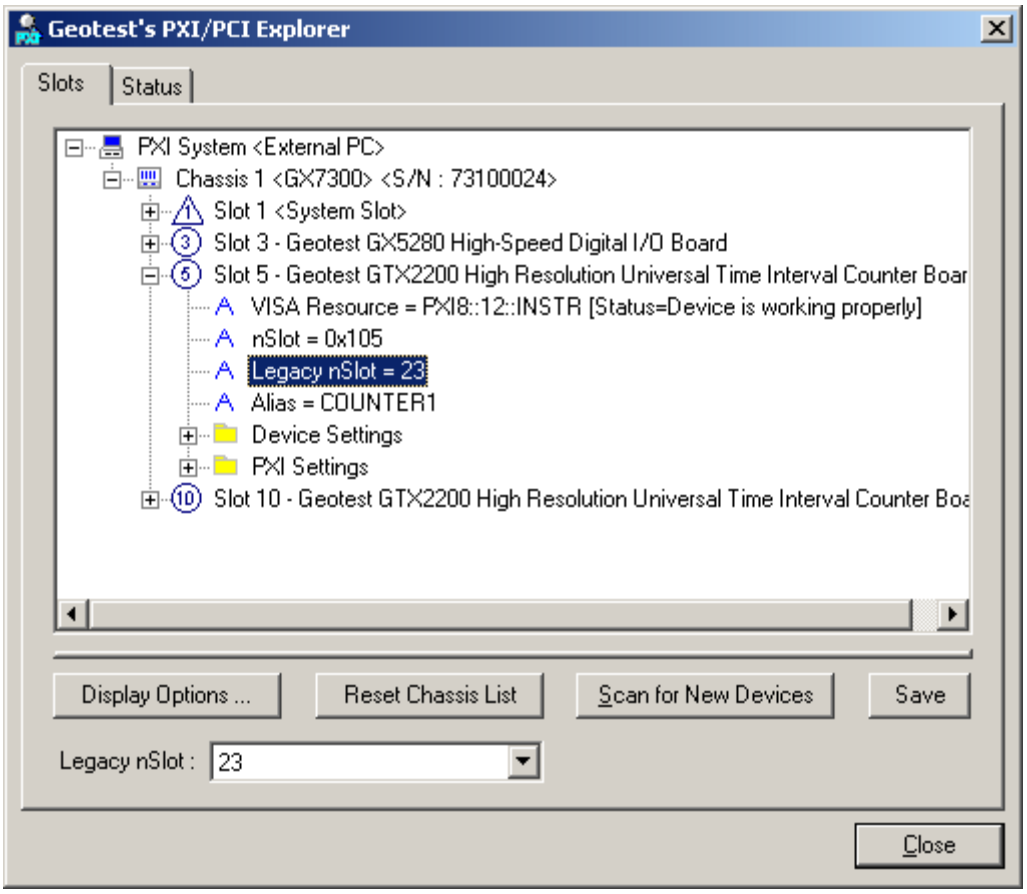


Figure 3-1: PXI/PCI Explorer

Board Installation

Before you Begin

- Install the GXSW driver as described in the prior section.
- Configure your PXI/PC system using **PXI/PCI Explorer** as described in the prior section.
- Verify that all the components listed in the packing list (see previous section in this chapter) are present.

Electric Static Discharge (ESD) Precautions

To reduce the risk of damage to the GX6616 board, the following precautions should be observed:

- Leave the board in the anti-static bags until installation requires removal. The anti-static bag protects the board from harmful static electricity.
- Save the anti-static bag in case the board is removed from the computer in the future.
- Carefully unpack and install the board. Do not drop or handle the board roughly.
- Handle the board by the edges. Avoid contact with any components on the circuit board.

Caution – Do not insert or remove any board while the computer is on. Turn off the power from the PXI chassis before installation.

Installing a Board

Install the board as follows:

1. Install first the GXSW Driver as described in the next section.
2. Turn off the PXI chassis and unplug the power cord.
3. Locate a PXI empty slot on the PXI chassis.
4. Place the module edges into the PXI chassis rails (top and bottom).
5. Carefully slide the PXI board to the rear of the chassis, make sure that the ejector handles are pushed **out** (as shown in Figure 3-2).

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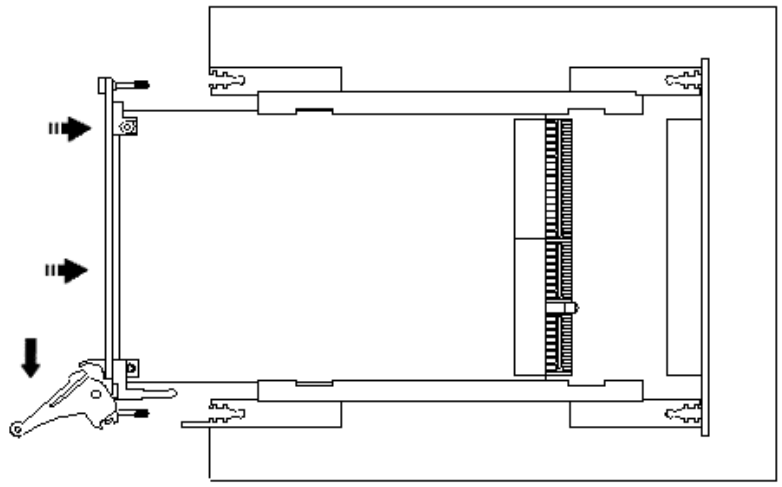


Figure 3-2: Ejector handles position during module insertion

6. After you feel resistance, push in the ejector handles as shown in Figure 3-3 to secure the module into the frame.

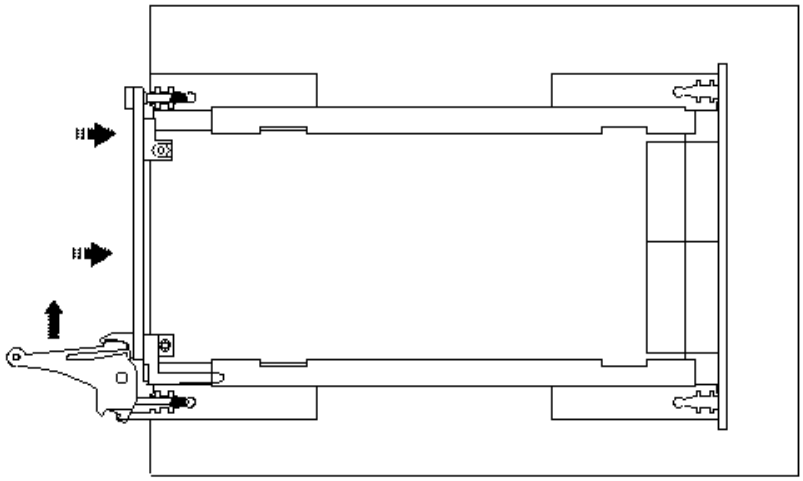


Figure 3-3: Ejector handles position after module insertion

7. Tighten the module's front panel to the chassis to secure the module in.
8. Connect any necessary cables to the board.
9. Plug the power cord in and turn on the PXI chassis.

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Plug & Play Driver Installation

Plug & Play operating systems such as Windows 9x, Me, Windows 2000, XP or VISTA (Not Windows NT) notifies the user that a new board was found using the **New Hardware Found** wizard after restarting the system with the new board.

If another Geotest board software package was already installed, Windows will suggest using the driver information file: HW.INF. The file is located in your Program Files\Geotest\HW folder. Click **Next** to confirm and follow the instructions on the screen to complete the driver installation.

If the operating system was unable to find the driver (since the GXSW driver was not installed prior to the board installation), you may install the GXSW driver as described in the prior section, then click on the **Have Disk** button and browse to select the HW.INF file located in C:\Program File\Geotest\HW.

If you are unable to locate the driver click **Cancel** to the found New Hardware wizard and exit the New Hardware Found Wizard, install the GXSW driver, reboot your computer and repeat this procedure.

The Windows Device Manager (open from the System applet from the Windows Control Panel) must display the proper board name before continuing to use the board software (no Yellow warning icon shown next to device). If the device is displayed with an error you can select it and press delete and then press F5 to rescan the system again and to start the New Hardware Found wizard.

Removing a Board

Remove the board as follows:

1. Turn off the PXI chassis and unplug the power cord.
2. Locate a PXI slot on the PXI chassis.
3. Disconnect and remove any cables/connectors connected to the board.
4. Un-tighten the module's front panel screws to the chassis.
5. Push out the ejector handles and slide the PXI board away from the chassis.
6. Optionally – uninstall the GXSW driver.

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Connectors and Jumpers

Figure 3-4 shows the GX6616 board connectors and jumpers followed by their description:

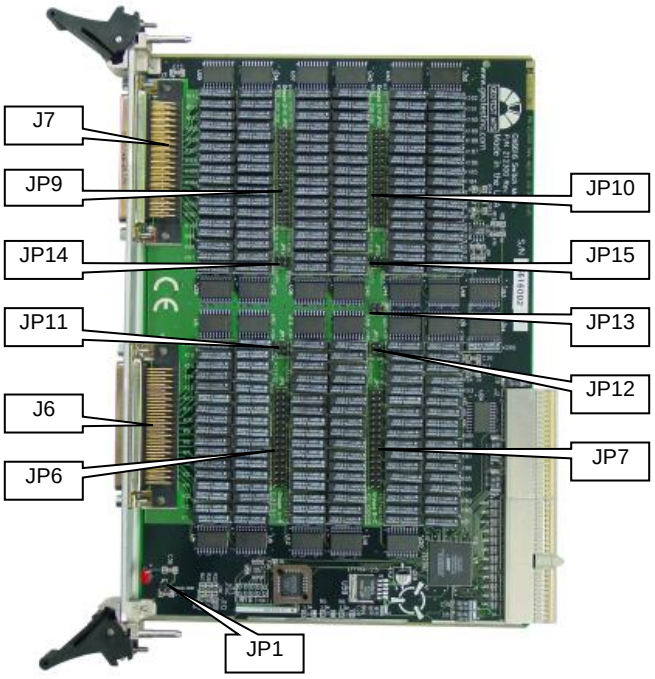


Figure 3-4: GX6616 Connectors and Jumpers

JP6, JP7, JP9 and JP10 Jumper Headers: These are four 32 pins jumper headers that are used to connect columns of adjacent switching groups. **JP6** is used for connecting columns between groups A and B, **JP7** between groups B and C, **JP9** between groups D and E and JP10 between groups E and F.

JP11-JP15 Jumper Headers: These are five 4 pins jumper headers that are used to connect rows of adjacent switching groups. **JP11** is used for connecting rows between groups A and B, **JP12** between groups B and C, **JP13** between groups C and F, **JP14** between groups D and E and **JP15** between groups E and F.

Note: Not all the jumpers in a subset need to be installed. Installing some of the jumpers will share these columns across the groups.

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Figure 3-5 shows jumper headers for groups A to C with JP6, JP7, JP11, JP12 and JP13.

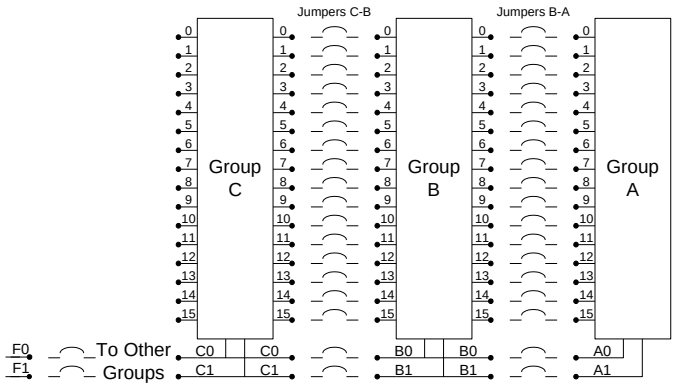


Figure 3-5: GX6616 Relay Jumper Configuration

JP1- Guard Ground: The JP4 jumper is used to connect the relay ground layer to ground.

Cable Connections

When building an adapter, refer to the Pin Connector Listing table later in this chapter.

The GX6616 has two D-type 78 pin male plug connector J6 and J7, one for each three groups. Each GX6616 comes with two mating GT78 connectors.

Connectors and Accessories

The following accessories are available from Geotest for GX6616 switching instruments.

Part / Model Number	Description
GX96001	Extra switching products user manual
GX96301	Extra user manual for GX6616
GT96002	Connector, D-Type 78 pin male with solder pins
GT96078	78 pin connector to screw terminal interface
GT96107	3’ harness, 78 pin male connector on both ends
GT97102	3’ harness, 78 pin male connector on one end, loose wires (numbered) other end
GT97103	1’ harness, 78 pin male connector on one end, loose wires (numbered) other end
GT97104	1’ harness, 78 pin male connectors on both ends

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J6 – Group A - C Relays Connector

The following table describes the J6 (78 Pin D Type) connector's pins:

Pin	Name	Pin	Name	Pin	Name	Pin	Name
1	Col A0	21	Col B0	40	Col C0	60	Not Used
2	Col A1	22	Col B1	41	Col C1	61	Not Used
3	Col A2	23	Col B2	42	Col C2	62	Not Used
4	Col A3	24	Col B3	43	Col C3	63	Not Used
5	Col A4	25	Col B4	44	Col C4	64	Not Used
6	Col A5	26	Col B5	45	Col C5	65	Not Used
7	Col A6	27	Col B6	46	Col C6	66	Not Used
8	Col A7	28	Col B7	47	Col C7	67	Not Used
9	Col A8	29	Col B8	48	Col C8	68	Not Used
10	Col A9	30	Col B9	49	Col C9	69	Not Used
11	Col A10	31	Col B10	50	Col C10	70	Not Used
12	Col A11	32	Col B11	51	Col C11	71	Not Used
13	Col A12	33	Col B12	52	Col C12	72	Not Used
14	Col A13	34	Col B13	53	Col C13	73	Not Used
15	Col A14	35	Col B14	54	Col C14	74	Not Used
16	Col A15	36	Col B15	55	Col C15	75	Not Used
17	Row A0	37	Row B0	56	Row C0	76	Not Used
18	Row A1	38	Row B1	57	Row C1	77	Not Used
19	ConPres0	39	CHASSIS	58	STPres0	78	GND
20	NC			59	NC		

Table 3-1: Group A-C Connector J6

ConPres and STPres are internally pulled high. They are used by Gx6616BIT to determine if a Self-Test Adapter is installed.

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J7 – Group D - F Relays Connector

The following table describes the J7 (78 Pin D Type) connector's pins:

Pin	Name	Pin	Name	Pin	Name	Pin	Name
1	COL D0	21	COL E0	40	COL F0	60	Not Used
2	COL D1	22	COL E1	41	COL F1	61	Not Used
3	COL D2	23	COL E2	42	COL F2	62	Not Used
4	COL D3	24	COL E3	43	COL F3	63	Not Used
5	COL D4	25	COL E4	44	COL F4	64	Not Used
6	COL D5	26	COL E5	45	COL F5	65	Not Used
7	COL D6	27	COL E6	46	COL F6	66	Not Used
8	COL D7	28	COL E7	47	COL F7	67	Not Used
9	COL D8	29	COL E8	48	COL F8	68	Not Used
10	COL D9	30	COL E9	49	COL F9	69	Not Used
11	COL D10	31	COL E10	50	COL F10	70	Not Used
12	COL D11	32	COL E11	51	COL F12	71	Not Used
13	COL D12	33	COL E12	52	COL F12	72	Not Used
14	COL D13	34	COL E13	53	COL F13	73	Not Used
15	COL D14	35	COL E14	54	COL F14	74	Not Used
16	COL D15	36	COL E15	55	COL F15	75	Not Used
17	Row D0	37	Row E0	56	Row F0	76	Not Used
18	Row D1	38	Row E1	57	Row F1	77	Not Used
19	ConPres1	39	CHASSIS	58	STPres1	78	GND
20	NC			59	Not Used		

Table 3-2: Group D-F Connector J7

ConPres and STPres are internally pulled high. They are used by Gx6616BIT to determine if a Self-Test Adapter is installed.

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Header JP6 – Group A - B

The following table describes the JP6 connection:

Pin	Function	Pin
1	COL A15 connected to COL B15	2
3	COL A14 connected to COL B14	4
5	COL A13 connected to COL B13	6
7	COL A12 connected to COL B12	8
9	COL A11 connected to COL B11	10
11	COL A10 connected to COL B10	12
13	COL A9 connected to COL B9	14
15	COL A8 connected to COL B8	16
17	COL A7 connected to COL B7	18
19	COL A6 connected to COL B6	20
21	COL A5 connected to COL B5	22
23	COL A4 connected to COL B4	24
25	COL A3 connected to COL B3	26
27	COL A2 connected to COL B2	28
29	COL A1 connected to COL B1	30
31	COL A0 connected to COL B0	32

Table 3-3: Header JP6 Connection Group A-B

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Header JP7 – Group B - C

The following table describes the JP7 connection:

Pin	Function	Pin
1	COL B15 connected to COL C15	2
3	COL B14 connected to COL C14	4
5	COL B13 connected to COL C13	6
7	COL B12 connected to COL C12	8
9	COL B11 connected to COL C11	10
11	COL B10 connected to COL C10	12
13	COL B9 connected to COL C9	14
15	COL B8 connected to COL C8	16
17	COL B7 connected to COL C7	18
19	COL B6 connected to COL C6	20
21	COL B5 connected to COL C5	22
23	COL B4 connected to COL C4	24
25	COL B3 connected to COL C3	26
27	COL B2 connected to COL C2	28
29	COL B1 connected to COL C1	30
31	COL B0 connected to COL C0	32

Table 3-4: Header JP7 Connection Group B-C

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Header JP9 – Group D - E

The following table describes the JP9 connection:

Pin	Function	Pin
1	COL D15 connected to COL E15	2
3	COL D14 connected to COL E14	4
5	COL D13 connected to COL E13	6
7	COL D12 connected to COL E12	8
9	COL D11 connected to COL E11	10
11	COL D10 connected to COL E10	12
13	COL D9 connected to COL E9	14
15	COL D8 connected to COL E8	16
17	COL D7 connected to COL E7	18
19	COL D6 connected to COL E6	20
21	COL D5 connected to COL E5	22
23	COL D4 connected to COL E4	24
25	COL D3 connected to COL E3	26
27	COL D2 connected to COL E2	28
29	COL D1 connected to COL E1	30
31	COL D0 connected to COL E0	32

Table 3-5: Header JP9 Connection Group D-E

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Header JP10 – Group E - F

The following table describes the JP10 connection:

Pin	Function	Pin
1	COL E15 connected to COL F15	2
3	COL E14 connected to COL F14	4
5	COL E13 connected to COL F13	6
7	COL E12 connected to COL F12	8
9	COL E11 connected to COL F11	10
11	COL E10 connected to COL F10	12
13	COL E9 connected to COL F9	14
15	COL E8 connected to COL F8	16
17	COL E7 connected to COL F7	18
19	COL E6 connected to COL F6	20
21	COL E5 connected to COL F5	22
23	COL E4 connected to COL F4	24
25	COL E3 connected to COL F3	26
27	COL E2 connected to COL F2	28
29	COL E1 connected to COL F1	30
31	COL E0 connected to COL F0	32

Table 3-6: Header JP10 Connection Group E-F

Header JP11 - JP15

The following table describes the JP11–JP15 connection:

Header	Pin	Connection	Pin
JP11	1	ROW A1 to ROW B1	2
	3	ROW A0 to ROW B0	4
JP12	1	ROW B1 to ROW C1	2
	3	ROW B0 to ROW C0	4
JP13	1	ROW C1 to ROW F1	2
	3	ROW C0 to ROW F0	4
JP15	1	ROW E1 to ROW F1	2
	3	ROW E0 to ROW F0	4
JP14	1	ROW D1 to ROW E1	2
	3	ROW D0 to ROW E0	4

Table 3-7: Headers JP11-JP15 Connection

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Chapter 4 - Functions Reference

Introduction

The GX6616 driver functions reference chapter is organized in alphabetical order. Each function is presented starting with the syntax of the function, a short description of the function parameters description and type followed by a Comments, an Example (written in C), and a See Also sections.

All function parameters follow the same rules:

- Strings are ASCIIZ (null or zero character terminated).
- Most function's first parameter is *nHandle* (16-bit integer). This parameter is required for operating the board and is returned by the **Gx6616Initialize** function. The *nHandle* is used to identify the board when calling a function for programming and controlling the operation of that board.
- All functions return a status with the last parameter named *pnStatus*. The *pnStatus* is zero if the function was successful, or less than a zero on error. The description of the error is available using the **GxSWGetErrorString** function or by using a predefined constant, defined in the driver interface files: GXSW.H, GXSW.BAS, GXSW.PAS or GX6616.DRV.
- Parameter name are prefixed as follows:

Prefix	Type	Example
a	Array, prefix this before the simple type.	*anArray* (Array of Short)
n	Short (signed 16-bit)	*nMode*
d	Double - 8 bytes floating point	*dReading*
dw	Double word (unsigned 32-bit)	*dwTimeout*
hwnd	Window handle (32-bit integer).	*hwndPanel*
l	Long (signed 32-bit)	*lBits*
p	Pointer. Usually used to return a value. Prefix this before the simple type.	*pnStatus*
sz	Null (zero value character) terminated string	*szMsg*
w	Unsigned short (unsigned 16-bit)	*wParam*

Table 4-1: Parameter Prefixes

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GX6616 Functions

The following list is a summary of functions available for the GX6616:

Driver Functions	Description
Gx6616BIT	Performs the board internal Build In Test (BIT).
Gx6616Close	Closes a relay specified by group, row, and column.
Gx6616GetBoardSummary	Returns the board summary.
Gx6616GetChannel	Returns the state of the relay in the specified group, row and column.
Gx6616GetRow	Returns the state of all relays of the specified group and row.
Gx6616Initialize	Initializes the GX6616 driver for the specified PXI slot.
Gx6616InitializeVisa	Initializes the driver for the specified slot using VISA. The function returns a handle that can be used with other GX6616functions to program the board.
Gx6616Open	Opens a relay specified by group, row, and column.
Gx6616Panel	Opens a virtual panel used to interactively control the GX6616 board.
Gx6616Reset	Opens all the board relays.
Gx6616SetRow	Opens or closes all 16 relays of the specified row in the specified group.
GxSWGetErrorString	Returns the error string associated with the specified error number.

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Gx6616BIT

Purpose

Performs the board internal Built In Test (BIT).

Syntax

Gx6616BIT (*nHandle, pszError, nErrorMaxLen, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6616 board.
pszError	LPSTR	Pointer to buffer to receive the error string.
nErrorMaxLen	SHORT	The buffer length.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure or incomplete (one adapter was present). See the **GxSWGetErrorString** for a complete list of possible errors.

Comments

The function performs the BIT by connecting the on-board voltage reference to the on-board comparator by closing and opening relays on the board.

The self-test adapter must be installed before calling this function.

WARNING: Do not run this function with a UUT attached. Possible damage to the Board /UUT may occur.

The returned string *pszError* contains a description of the error occurred. This can be a description of the group and column relays number where the error occurred. If no error occurred, this buffer contains an empty string.

After the BIT is performed the board is in reset state.

Example

The following example perform a BIT test:

```
CHAR    sz[128];
SHORT   nStatus

/* Notify the user to connect the Selftest Adptor … */
/* perform BIT */
Gx6616BIT(nHandle, sz, sizeof sz, &nStatus);
if (nStatus < 0)
    printf("GX6616-bit Status:%s", sz);
else
    printf("GX6616-bit Status: Passed);
```

See Also

Gx6616Initialize, GxSWGetErrorString, Gx6616Reset

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Gx6616Close

Purpose

Closes a relay specified by group, row, and column.

Syntax

Gx6616Close (*nHandle, nGroup, nRow, nColumn, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6616 board.
nGroup	SHORT	Group number 0-5. Corresponds to groups A-F.
nRow	SHORT	Row number 0 or 1.
nColumn	SHORT	Column number 0 - 15.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function closes the specified relay. The function ensures that a proper delay (one millisecond) is used from the last open command. This prevents a relay being closed before a previous switching command is complete.

Caution - The flexibility provided by the switch matrix means that any point could be connected to any other point. Extreme care should be observed when developing the control software to prevent shorts between low-impedance sources (such as power supplies). A typical method to prevent such shorts is to use a resistor in series between the power supplies and the switch matrix if these signals are for measurement purposes only. Before closing a relay, verify that no other low-impedance source is connected to the same Row/Column.

Example

The following example closes relay at group D row 1 relay 0:

```
Gx6616Close(nHandle, 3, 1, 0, &nStatus);
```

See Also

Gx6616Initialize, **Gx6616Open**, **Gx6616SetRow**, **Gx6616GetChannel**

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Gx6616GetBoardSummary

Purpose

Returns the board summary.

Syntax

Gx6616GetBoardSummary (*nHandle, szSummary, nSumMaxLen, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6616 board.
szSummary	PSTR	Buffer to contain the returned board info (null terminated) string.
nSumMaxLen	SHORT	Size of the buffer to contain the board info string.
pnStatus	PSHORT	Returned status: 0 on success, negative number on failure.

Comments

The GX6616 summary string provides the following data from in the order shown:

- Instrument Name (e.g., GX6616)
- FPGA version (e.g. 0xA003)

For example, the returned string look like the following:

```
"GX6616, FPGA-Version:0xB201"
```

See Also

GxSWGetErrorString

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Gx6616GetChannel

Purpose

Return the state of the relay in the specified group, row and column.

Syntax

Gx6616GetChannel (*nHandle, nGroup, nRow, nCoulmn, pnState, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6616 board.
nGroup	SHORT	Group number 0-5 corresponds to groups A-F.
nRow	SHORT	Row number 0 or 1.
nColumn	SHORT	Column number 0 - 15.
pnState	LPLONG	Returned state of the relay. 1 for close and 0 for open.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

Use the **Gx6616GetRow** function to retrieve the state of all relays in the specified row and group.

Example

The following example checks whether relay at group C, row 0, relay 3 is closed:

```
Gx6616GetChannel(nHandle, 2, 0, 3, &nState, &nStatus);
if (nClose==1)
    printf("C0-3 relay is closed");
else
    printf("C0-3 relay is open");
```

See Also

Gx6616Initiailize, GxSWGetErrorString, Gx6616GetRow, Gx6616SetRow, Gx6616Close, Gx6616Open

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Gx6616GetRow

Purpose

Returns the state of all relays of the specified group and row.

Syntax

Gx6616GetRow (*nHandle, nGroup, nRow, pnStates, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6616 board.
nGroup	SHORT	Group number 0-5. Corresponds to groups A-F.
nRow	SHORT	Row number 0 or 1.
pnStates	LPSHORT	Returned state of the 16 relays in the row. Each bit corresponds to a relay in the selected row where a '1' corresponds to a closed relay and '0' to an open relay. The low order bit represents column 0 and the high order bit represents column 15.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

Use the **Gx6616GetChannel** function to retrieve the state of a specific relay.

Example

The following example checks whether relay at group C, row 0, column 3 and 4 are closed:

```
Gx6616GetRow(nHandle, 2, 0, &nStates, &nStatus);
if (nStates & 0xC)
    printf("C0-3/4 relays are closed");
```

See Also

Gx6616Initiailize, GxSWGetErrorString, Gx6616GetChannel, Gx6616SetRow, Gx6616Close, Gx6616Open

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Gx6616Initialize

Purpose

Initializes the driver for the board at the specified slot number. The function returns a handle that can be used with other GX6616 functions to program the board.

Syntax

Gx6616Initialize (*nSlot, pnHandle, pnStatus*)

Parameters

Name	Type	Comments
nSlot	SHORT	GX6616 board slot number on the PCI bus.
pnHandle	LPSHORT	Returned handle for the board. The handle is set to zero on error and <> 0 on success.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The **Gx6616Initialize** function verifies whether or not the GX6616 board exists in the specified PXI slot. The function does not change any of the board settings. The function uses the HW driver to access and program the board.

The Geotest HW device driver is installed with the driver and is the default device driver. The function returns a handle that for use with other Counter functions to program the board. The function does not change any of the board settings.

The specified PXI slot number is displayed by the **PXI/PCI Explorer** applet that can be opened from the Windows **Control Panel**. You may also use the label on the chassis below the PXI slot where the board is installed. The function accepts two types of slot numbers:

- A combination of chassis number (chassis # x 256) with the chassis slot number. For example 0x105 (chassis 1 slot 5).
- Legacy nSlot as used by earlier versions of HW/VISA. The slot number contains no chassis number and can be changed using the **PXI/PCI Explorer** applet (1-255).

The returned handle *pnHandle* is used to identify the specified board with other GX6616 functions.

Example

The following example initializes two GX6616 boards at slot 1 and 2.

```
SHORT nHandle1, nHandle2, nStatus;
Gx6616Initilize (1, &nHandle1, &nStatus);
Gx6616Initilize (2, &nHandle2, &nStatus);
if (nHandle1==0 || nHandle2==0)
    {   printf("Unable to Initialize the board")
        return;
}
```

See Also

Gx6616Reset, **GxSWGetErrorString**

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Gx6616InitializeVisa

Purpose

Initializes the driver for the specified PXI slot using the default VISA provider.

Syntax

Gx6616InitializeVisa (*szVisaResource, pnHandle, pnStatus*)

Parameters

Name	Type	Comments
szVisaResource	LPCTSTR	String identifying the location of the specified board in order to establish a session.
pnHandle	PSHORT	Returned Handle (session identifier) that can be used to call any other operations of that resource
pnStatus	PSHORT	Returned status: 0 on success, 1 on failure.

Comments

The **Gx6616InitializeVisa** opens a VISA session to the specified resource. The function uses the default VISA provider configured in your system to access the board. You must ensure that the default VISA provider support PXI/PCI devices and that the board is visible in the VISA resource manager before calling this function.

The first argument *szVisaResource* is a string that is displayed by the VISA resource manager such as NI Measurement and Automation (NI_MAX). It is also displayed by Geotest PXI/PCI Explorer as shown in the prior figure. The VISA resource string can be specified in several ways as follows:

- Using chassis, slot, for example: “PXI0::CHASSIS1::SLOT5”
- Using the PCI Bus/Device combination, for example: “PXI9::13::INSTR” (bus 9, device 9).
- Using alias, for example: “COUNTER1”. Use the PXI/PCI Explorer to set the device alias.

The function returns a board handle (session identifier) that can be used to call any other operations of that resource. The session is opened with VI_TMO_IMMEDIATE and VI_NO_LOCK VISA attributes. On terminating the application the driver automatically invokes **viClose**() terminating the session.

Example

The following example initializes a GX6384 boards at PXI bus 5 and device 11.

```
SHORT nHandle, nStatus;
Gx6616InitializeVisa (“PXI5::11::INSTR”, &nHandle, &nStatus);
if (nHandle==0)
{
    printf("Unable to Initialize the board")
    return;
}
```

See Also

Gx6616Initialize, Gx6616Reset, **GxSWGetErrorString**

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Gx6616Open

Purpose

Opens a relay specified by group, row, and column.

Syntax

Gx6616Open (*nHandle, nGroup, nRow, nColumn, pnStatus*)

Parameters

Name	Type	Comments
nGroup	SHORT	Group number 0-5. Corresponds to groups A-F.
nRow	SHORT	Row number 0 or 1.
nColumn	SHORT	Column number 0 - 15.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function ensures that a proper delay (one millisecond) is used from the last switching command. This prevents a relay being opened before a previous switching command is complete.

Example

The following example opens relay at group D, row 1, column 0:

```
Gx6616Open(nHandle, 3, 1, 0, &nStatus);
```

See Also

Gx6616Initialize, Gx6616SetRow, Gx6616GetChannel

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Gx6616Panel

Purpose

Opens a virtual panel used to interactively control the GX6616 board.

Syntax

Gx6616Panel (*pnHandle, hwndParent, nMode, phwndPanel, pnStatus*)

Parameters

Name	Type	Comments
pnHandle	LPSHORT	Handle to a GX6616 board. This number may be zero if the board is to be initialized by the panel window.
hwndParent	DWORD	Sets the panel parent window handle. A value of 0 sets the desktop as the parent window.
nMode	SHORT	The mode in which the panel main window is created. 0 for modeless and 1 for modal window.
phwndPanel	LPDWORD	Returned window handle for the panel (for modeless panel only).
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function is used to create the panel window. The panel window may be open as a modal or a modeless window, depending on the *nMode* parameters.

If the mode is set to modal dialog (*nMode*=1), the panel will disable the parent window (*hwndParent*) and the function will return only after the user closed the window. In that case the *pnHandle* may return the handle created by the user using the panel Initialize dialog. This handle may be used when calling other GX6616 functions.

If a modeless dialog was created (*nMode*=0), the function returns immediately after creating the panel window, returning the window handle to the panel - *phwndPanel.* It is the responsibility of the calling program to dispatch window messages to this window, so that the window can respond to messages.

Example

The following example opens the panel in modal mode:

```
DWORD   dwPanel;
SHORT   nHandle=0, nStatus;
...
Gx6616Panel (&nHandle, 0, 1, &dwPanel, &nStatus);
```

See Also

Gx6616Initialize, **GxSWGetErrorString**

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Gx6616Reset

Purpose

Opens all the board relays.

Syntax

Gx6616Reset (*nHandle*, *pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6616 board.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function is typically called after calling the **Gx6616Initialize** function.

Example

The following example initializes the driver and then resets the board.

```
Gx6616Initilize (1, &nHandle, &nStatus);
if (nStatus < 0)
    return nStatus;    // return error
Gx6616Reset (nHandle, &nStatus);
```

See Also

Gx6616Initialize, **GxSWGetErrorString**

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Gx6616SetRow

Purpose

Opens or closes the 16 relays that belong to the specified group and row.

Syntax

Gx6616SetRow (*nHandle, nGroup, nRow, nStates, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6616 board.
ngroup	SHORT	Group number 0-5. Corresponds to groups A-F.
nRow	SHORT	Row number 0 or 1.
nStates	LONG	The state of all 16 column relays in the row. Each bit corresponds to a relay in the selected row where the low order bit represents column 0 and the high order bit represents column 15.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function perform break before make when switching the relays, opening all relays that were closed than it closes the relays that were specified to be closed. The function ensures that a proper delay (one millisecond) is used between switching a relay. This prevents a relay being closed before a previous switching open command is complete.

 **Caution -** The flexibility provided by the switch matrix means that any point could be connected to any other point. Extreme care should be observed when developing the control software to prevent shorts between low-impedance sources (such as power supplies). A typical method to prevent such shorts is to use a resistor in series between the power supplies and the switch matrix if these signals are for measurement purposes only. Before closing a relay, verify that no other low-impedance source is connected to the same Row/Column.

Example

The following example checks closes relay at group C, row 0, relay 3 and 4 and opens all other relays in the same row.

```
Gx6616SetRow(nHandle, 2, 0, 0xC, &nStatus);
```

See Also

Gx6616Initiailize, GxSWGetErrorString, GX6616GetChannel, Gx6616GetRow, Gx6616Close, Gx6616Open

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GxSWGetErrorString

Purpose

Returns the error string associated with the specified error number.

Syntax

GxSWGetErrorString (*nError* , *pszMsg*, *nErrorMaxLen*, *pnStatus*)

Parameters

Name	Type	Comments
nError	SHORT	Error number as returned by the *pnStatus* of any GXSW function. See table below for possible error numbers values. The error number should be a negative number, otherwise the function returns the "No error has occurred" string.
pszMsg	LPSTR	Buffer containing the returned error string (null terminated string).
nErrorMaxLen	SHORT	Size of the buffer *pszMsg*.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function returns the error string associated with the *nError* as returned from other driver functions.

This function returns error values, or 0 on success.

The following table displays the possible error values; not all errors apply to this board type:

Resource Errors

-1 Board does not exist in this slot

-2 Unable to open the HW device/Service

-3 Different board exist in the specified PCI slot

-4 PCI slot not configured properly. You may configure it by using the **PCIExplorer** from the Control Panel

-5 Unable to register the PCI device

-6 Unable to allocate system resource or memory for the PCI device

-7 Too many boards

-8 Unable to create panel

-9 Unable to create a Windows timer

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Parameter Errors

-20 Invalid parameter

-21 Invalid PCI slot number

-22 Invalid board handle

-23 Invalid channel number

-24 Invalid bus number

-25 Invalid mode

-26 Invalid group number

-27 Invalid string length

-28 Invalid row number

-29 Invalid column number

Board Errors/Warnings

-50 BIT error: Adapter not connected

-51 BIT error : Comparator Error

-52 BIT error : Unable to open/close a relay in Group *x*, Row *y* Column *z*

-53 BIT error : Error occurred while switching a relay in Group *x* (Row y Column *z*) in Row *a*, Column *b*

-54 The board successfully passed the BIT. Only one BIT adapter was found and tested.

Miscellaneous Errors

-99 Invalid or unknown error number

Example

The following example initializes the board at slot 3. If the initialization failed the following error string is printed:

```
CHAR    sz[256];
SHORT   nStatus, nHandle;

GX6338Initialize(3, &Handle, &Status);
if (nStatus<0)
{   GxSWGetErrorString(nStatus, sz, sizeof sz, &nStatus);
    printf(sz);        // print the error string return;
}
```

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