GXSW

Switching Instruments

GX6115

High Current Relay Board
User's Guide

Last Updated: July 6, 2020

MARVIN TEST
SOLUTIONS

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Each product shipped by Marvin Test Solutions is carefully inspected and tested prior to shipping. The shipping box provides protection during shipment, and can be used for storage of both the hardware and the software when they are not in use.

The circuit boards are extremely delicate and require care in handling and installation. Do not remove the boards from their protective plastic coverings or from the shipping box until you are ready to install the boards into your computer.

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Table of Contents

Chapter 1 - Introduction

Manual Scope and Organization

Manual Scope

This manual provides all the information necessary for installation, operation, and maintenance of the **GX6115** PXI Switch Matrix Board. The manual also covers the **GXSW** software package that includes the GX6115 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 GX6115 manual is organized in the following manner:

Chapter	Content
Chapter 1 – Introduction	Introduces the GX6115 manual and shows warning conventions used in the manual.
Chapter 2 – Overview	Provides the GX6115 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 GX6115 board and the GXSW software.
Chapter 4 – Functions Reference	Provides a list of the GXSW driver functions for the GX6115. 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.

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

Chapter 2 - Overview

Introduction

Users of the Marvin Test Solutions GX6115 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 of GXSW Switching Instruments using various languages

- Setup and Installation of GXSW Switching instruments

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

Features

The GX6115 is a one-slot 3U PXI high-density switching instrument. The switching instrument has the following features:

- 15 individual high-current SPDT relays

  7.0A contact rating per channel

- 3 additional open collector drivers for external relays or indicators

- Occupies one PXI/CompactPCI 3U bus slot.

Board Description

The GX6115 is a 3U PXI board featuring 15 high-current Single Pole Double Throw (SPDT) relays (Form C).

The GX6115 provides 3 open collector relay drivers. These drivers may be used to drive external load, such as heavier duty relays or lamps. The 15 on-board relays, combined with 3 external relays, yield a total of 18 relays that are controlled from a single GX6115.
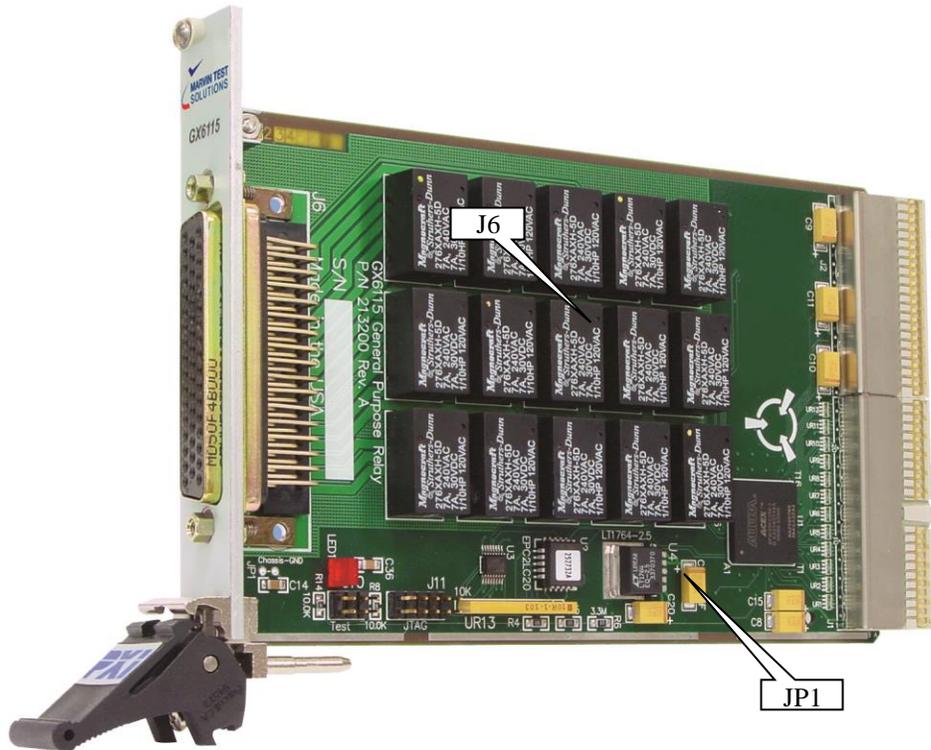
Figure 2-1: GX6115-High Current Relay Board

Architecture

The GX6115 has 15 high-current relays and three open collector relay drivers and a connector as shown in:
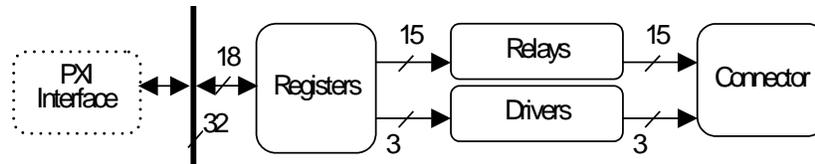
Figure 2-2: GX6115 Architecture

Relays
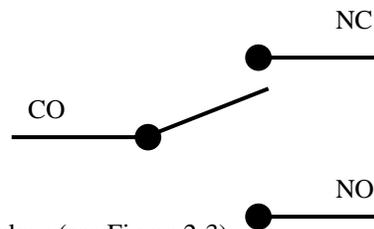
The GX6115 has 15 Form C (SPDT) relays (see Figure 2-3).

Figure 2-3: A Typical GX6115 Relay

When the relay is activated, the Change Over (CO) terminal is connected to the Normally Open (NO) terminal. When the relay is deactivated, the CO terminal is connected to the Normally Closed (NC) terminal. After the board is reset, all relays are deactivated.

A Form C, 7.0A relay is used. The relay has one part per package that is connected to normally closed contact and upon activation switches to the normally open.
Note: The single contact ensures a break before make when switching. This prevents potential momentary short circuit between NO and NC.

Relay Drivers

The GX6115 has three open collector drivers as shown in Figure 2-4 below:
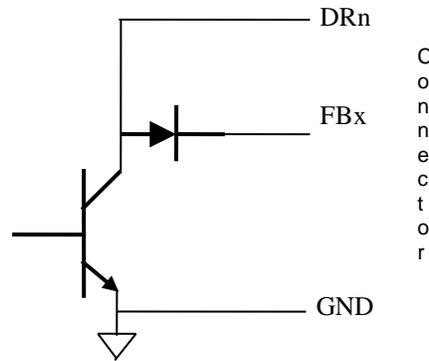
Figure 2-4: A Typical GX6115 Open Collector Driver

Each open collector driver has a diode connected to a fly-back signal, which is available at the connector. All three drivers are connected via three diodes to the same fly-back signal. The fly-back signal can be connected to the external relays supply, thus providing suppression for voltage spikes generated by the relays' coil.

Specifications

The following table outlines the specifications of the GX6115.

Contact Specifications

Relay Format	1A1B	
Channel Resistance	0.3 Ω	Maximum
	0.1Ω	Typical
Relay Contact Resistance	0.1 Ω	Maximum
	0.03Ω	Initial
Contact Life Rating	Mech. 10 Million Elect. 100,000	Rated Load
Switching Voltage	240 VAC 30 VDC	Maximum
Switching Current	7.0 A	Maximum
Contact Carry Current	7.0 A	Maximum
Operate Time	10mS @ nominal voltage	Excluding bounce
Release Time	10mS @ nominal voltage	Excluding bounce

Driver Outputs

Driver Channels	3 Open Collector outputs
Current	500 mA sink per driver

Power Requirements

3.3 V Power (mA):	160mA
5V Typical Power (A):	70mA per channel
5V Maximum Power (A):	1.75A max

Environmental

Operating Temperature:	-40 to +70°C
Storage Temperature:	-40 to+100°C
Vibration	9g at 10-55Hz
Shock ½ Sine	100G for 6mS

Physical

Size	3U PXI
Weight	250g

Virtual Panel Description

The GX6115 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 **GX6115 Panel** from the **Marvin Test Solutions**, **GXSW** menu under the **Start** menu. The GX6115 virtual panel opens as shown here:
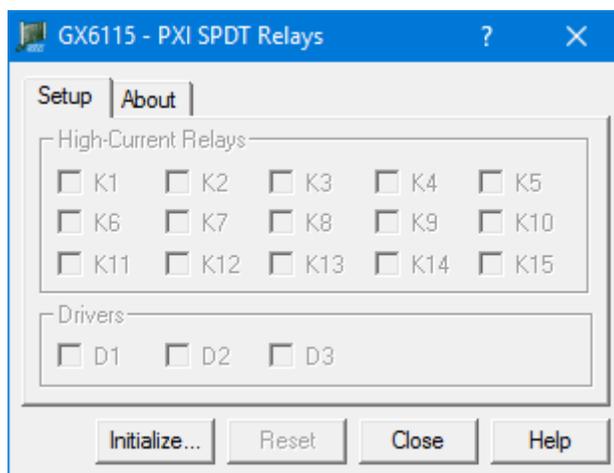
Figure 2-5: GX6115 Virtual Panel

The following controls are shown:

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 GX6115 panel.

Help: Opens the GX6115 on-line help window.

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 Marvin Test Solutions' HW – this is the device driver installed by the setup program and is the default driver. When selected, the Slot Number list displays the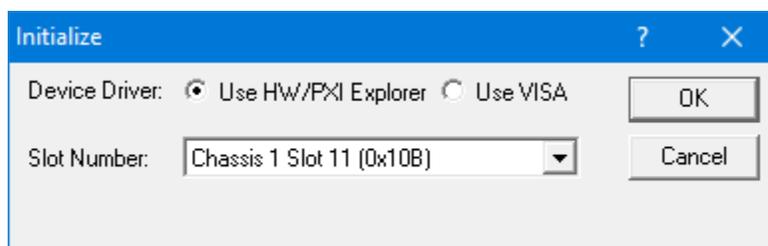 available counter boards installed in the system and their slots. The chassis, slots, devices and their resources are also displayed by the HW resource manager, PXI/PCI Explorer applet that can be opened from the Windows Control Panel. The PXI/PCI Explorer can be used to configure the system chassis, 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 0x10B (chassis 1 Slot 8). This is the slot number argument (*nSlot*) passed by the panel when calling the driver **Gx6115Initialize** function used to initialize driver with the specified board.

Figure 2-6: Initialize Dialog Box using Marvin Test Solutions' 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 Marvin Test Solutions **PXI/PCI Explorer**. The following figure shows PXI10::12::INSTR as the VISA resource (PCI bus 10 and Device 12). This is VISA resource string argument (*szVisaResource*) passed by the panel when calling the driver **Gx6115InitializeVisa** function to initialize the driver with the specified board.
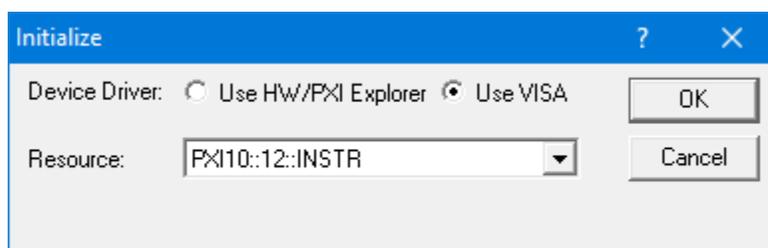
Figure 2-7: Initialize Dialog Box using VISA resources

Virtual Panel Setup Page

After the board is initialized the panel is enabled and will display the current setting of the board. The following picture shows the **Setup page** settings:
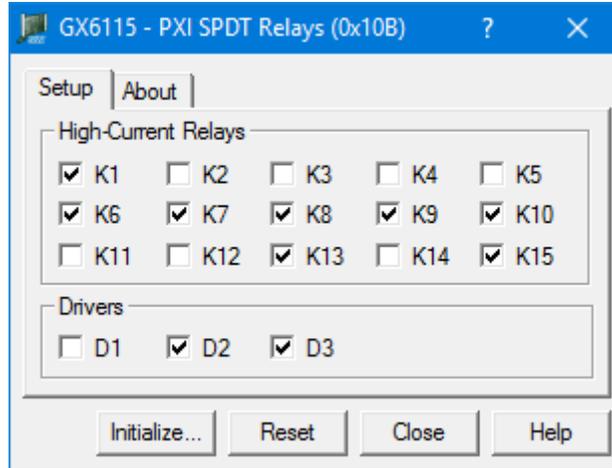
Figure 2-8: GX6115 Virtual Panel (Initialized)

The following controls are shown in the Setup page:

High Current Relays Group Box (Relays K1 – K15): Displays the current relay setting (closed or open). When a box is checked, the relay is closed. Similarly, unchecked boxes mean relays are open.

Drivers Group Box (Driver Relays D1 – D3): Displays the current drivers' settings (closed or open). When a box is checked, the relay driver is closed.

Virtual Panel About Page

Clicking on the **About** tab will show the **About page** as shown in Figure 2-9:
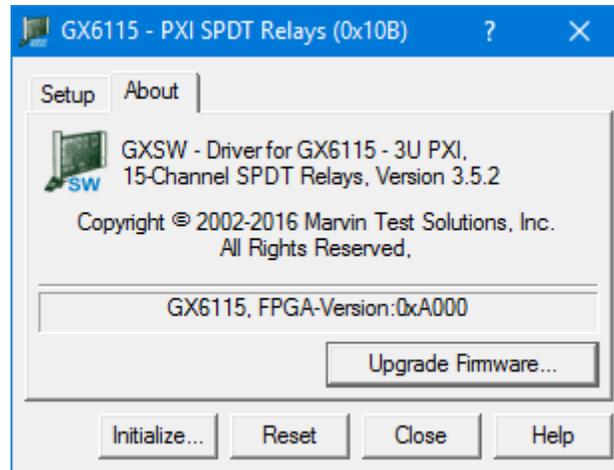
Figure 2-9:GX6115 Virtual Panel – About Page

The top part of the **About** page displays version and copyright of the GX6115 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 Marvin Test Solutions 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.

Chapter 3 - Installation and Connections

Getting Started

This section includes general hardware installation procedures for the GX6115 board and installation instructions for the GX6115 (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
GX6115 Driver Installation	This Chapter
GX6115 Function Reference	Chapter 4

Packing List

All GX6115 boards have the same basic packing list, which includes:

1. GX6115 Board
3. DVD 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.

1. Remove the board from the static bag by handling only the metal portions.
2. Be sure to check the contents of the shipping carton to verify that all of the items found in it match the packing list.
3. 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 GX6115 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 XP SP3, or newer (32/64 bit) operating systems.

Each board requires one unoccupied 3U PXI bus slot.

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 Marvin Test Solutions DVD-ROM and locate the GXSW.EXE setup program. If your computer's Auto Run is configured, when inserting the DVD a browser will show several options. Select the Marvin Test Solutions 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). It is also recommended that you download the latest file from Marvin Test Solutions' web site (www.MarvinTest.com).

2.   Run the GXSW setup and follow the instruction on the Setup screen to install the GXSW driver.

> **Note:** When installing under Windows, 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 driver) which are required by the GXSW driver to access resources on your board.

1.   The first setup screen to appear is the Welcome screen. Click **Next** to continue.

2.   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. The default entry for 32-bit machines is **C:\Program Files\Marvin Test Solutions\GXSW**, and for 64-bit Windows **C:\Program Files (x86)\Marvin Test Solutions\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.

Overview of the GXSW Software

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

- **GXSW Panel** – Configures and controls the GX6115 various features via an interactive user interface.

- **GXSW driver** - A DLL based function library (GXSW.DLL (32 or 64-bit), located in the Windows 32/64-bit System folders) used to program and control the board.

- **Programming files and examples** – Interface files and libraries for support of various programming tools such as C#, C++, VB, VB6, LabVIEW. 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 GX6115 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 Marvin Test Solutions 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 Marvin Test Solutions 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.ivifoundation.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 Marvin Test Solutions' PXI/PCI Explorer). The GXSW driver can work with either HW or VISA to control an access the supported boards.

Installation Folders

The GX6115 driver files are installed in the default folder **C:\Program Files\Marvin Test Solutions\GXSW**, or on 64-bit systems they are installed in the default folder **C:\Program Files (x86)\Marvin Test Solutions\GXSW**. You can change the default GXSW folder to one of your choosing at the time of installation.

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

Name	Purpose / Contents
…\Marvin Test Solutions\GXSW	The GXSW folder. Contains panel programs, programming libraries, interface files and examples, on-line help files and other documentation.
…\Marvin Test Solutions\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\ System32, or …\Windows\SysWOW64 when running 64-bit Windows	Windows System directory. Contains the GXSW DLL driver, HW driver shared files and some upgraded system components, such as the HTML help viewer, etc.

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, **Marvin Test Solutions**, **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 Marvin Test Solutions 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 Marvin Test Solutions 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 **Gx6115Initialize** and **Gx6115InitializeVisa** 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).
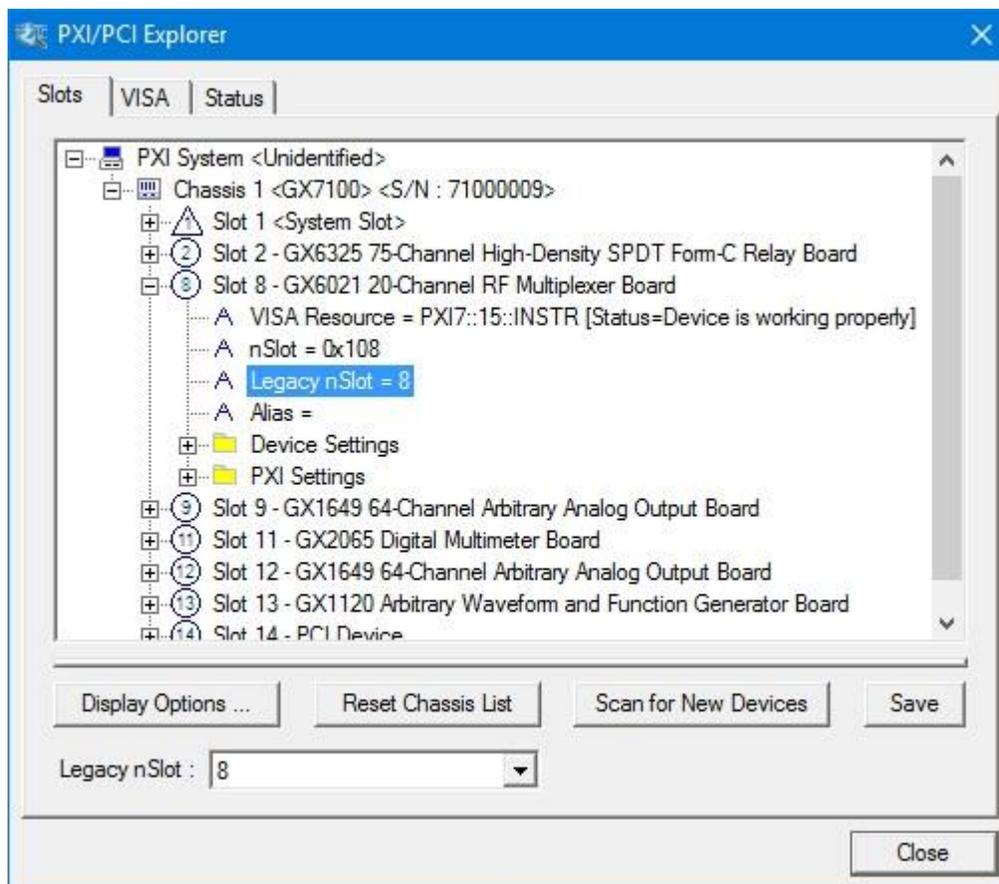

Figure 3-1: PXI/PCI Explorer

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 GX6115 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 **<u>out</u>** (as shown in Figure 3-2).
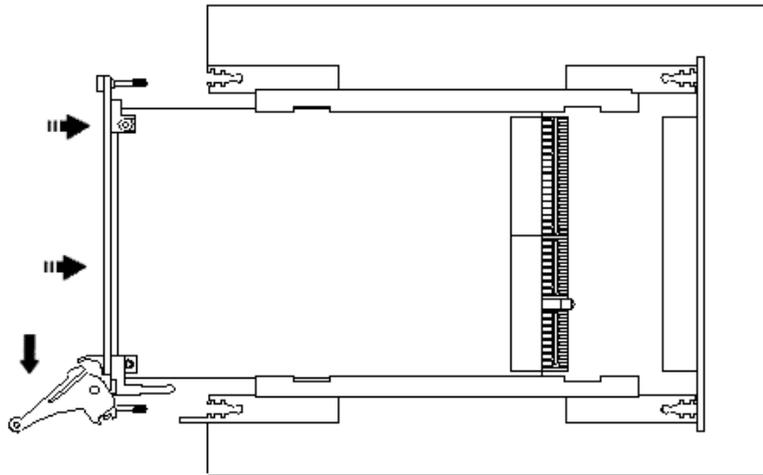
Figure 3-2: Ejector handles position during module insertion

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

Error! Objects cannot be created from editing field codes.

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.

PXI Board Software Installation

Plug & Play operating systems, such as Windows, notifies the user whenever a new hardware was found after restarting the system using the Windows **New Hardware Found wizard**. The following describes the installation of Marvin Test Solutions board:

1. Before installing any new Marvin Test Solutions board, make sure that the latest software package for your board was installed (the latest product setup can be found at https://www.marvintest.com/downloads.aspx).

2. Power down the machine, Insert the new hardware to your system and restart the machine.

3. Windows will notify the user that a new hardware was found using the Windows **New Hardware Found wizard**. If no wizard is displayed, proceed to step 7.

4. Select Browse my computer for driver software.

5. Click the Browse button and locate the driver file under C:\Program Files\Marvin Test Solutions\HW folder, or on 64-bit machines C:\Program Files (x86)\Marvin Test Solutions\HW.

6. Click **Next** to confirm and follow the instructions on the screen to complete the driver installation.

7. Verify that the board driver is installed correctly: Open the appropriate board panel application from the Windows Start menu and use the **Initialize…** button. Select the board PXI slot and press **OK**. If no error is displayed and the panel pages are enabled and displays the correct board settings, then installation is complete. If the no board PXI slot is displayed in the Initialize dialog or initialization failed, proceed to the next step.

8. If initializing the new Marvin Test Solutions board fails the driver might have been installed incorrectly by windows:

    a. Open the Windows **Device Manager**.

    b. The Windows Device Manager should display the board name and description under the **Marvin Test Solutions** entry. If the board is displayed with a yellow or red icon next to it, or the board description is generic and not described the board correctly (i.e. **PCI Data Acquisition and Signal Processing Controller** is displayed in the device list) , follow these steps:

        1) Right click on the PCI Data Acquisition and Signal Processing Controller, and select Update Driver from the context menu.

        2) Select Browse my computer for driver software.

        3) Click the Browse button and locate the driver file under C:\Program Files\Marvin Test Solutions\HW folder, or on 64-bit machines C:\Program Files (x86)\Marvin Test Solutions\HW.

        4) Click Next to confirm and follow the instructions on the screen to complete the driver installation.

        5) Repeat step 7 and verify that the board driver is installed correctly.

Removing a PXI 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.

Connectors and Jumpers

Figure 3-4 shows the available GX6115 board connectors and jumpers followed by their description:
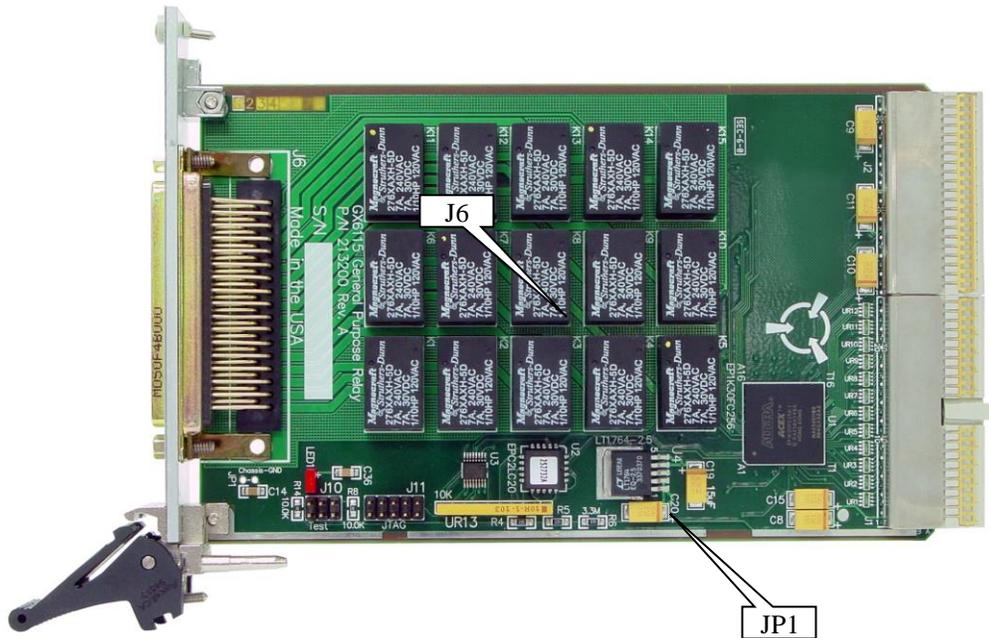
Figure 3-4: GX6115 Connectors and Jumpers

JP1 – Chassis Ground Jumper

JP1 jumper connects the chassis ground to the logic ground. When jumper is not installed (default), chassis and logic ground are separate. This does not preclude them being connected elsewhere, such as in the power supplies. When the jumper is installed, chassis and logic ground are connected on the board.

Connections

Connections to the GX6115 may be made with three D Type, 50 pin male plug connector. Each GX6115 is shipped with three mating connectors. Extra connectors are available from Marvin Test Solutions.

Table 3-1 list the connectors' pins.

Connectors and Accessories

The following accessories are available from Marvin Test Solutions for GX6115 switching instruments.

Part / Model Number	Description
GT96108	Connector, D-type 50 pin male with solder pins (for GX6115)
GT97106	1' harness, 50 pin male connector on one end, loose wires (numbered) other end
GT97107	3' harness, 50 pin male connector on one end, loose wires (numbered) other end
GT97108	1' harness, 50 pin male connectors on both ends
GT96109	3' harness, 50 pin male connectors on both ends

J6 – Relays Connector

The following table describes the J6 (50 D Type) connector's pins:

Pin	Function	Pin	Function	Pin	Function
1	NO 1	18	CO 1	34	NC 1
2	NO 2	19	CO 2	35	NC 2
3	NO 3	20	CO 3	36	NC 3
4	NO 4	21	CO 4	37	NC 4
5	NO 5	22	CO 5	38	NC 5
6	NO 6	23	CO 6	39	NC 6
7	NO 7	24	CO 7	40	NC 7
8	NO 8	25	CO 8	41	NC 8
9	NO 9	26	CO 9	42	NC 9
10	NO 10	27	CO 10	43	NC 10
11	NO 11	28	CO 11	44	NC 11
12	NO 12	29	CO 12	45	NC 12
13	NO 13	30	CO 13	46	NC 13
14	NO 14	31	CO 14	47	NC 14
15	NO 15	32	CO 15	48	NC 15
16	DR 1	33	FB A	49	DR 3
17	DR 2			50	GND

Table 3-1: J6 Connector

Legend

NO – Normally Open   CO – Change Over   NC – Normally Closed

DR – Driver   FB – Fly Back

Chapter 4 - Functions Reference

Introduction

The GX6115 driver functions reference chapter is organized in alphabetical order. Each function description contains the function name, purpose, syntax, parameters description and type followed by a Comments, an Example (written in C), and a See Also sections.

All function parameters syntax follows the same rules:

- Strings are ASCIIZ (null or zero character terminated).

- The first parameter of most functions is *nHandle* (16-bit integer). This parameter is required for operating the board and is returned by the **Gx6115Initialize** or the **Gx6115InitalizeVisa** functions. 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 GX6115.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 Name Prefixes

GX6115 Functions

The following list is a summary of functions available for the GX6115:

Driver Functions	Description
Gx6115Close	Closes any relay.
Gx6115GetBoardSummary	Returns the board summary.
Gx6115GetChannel	Returns the state of a specified channel.
Gx6115GetChannels	Returns the state of all channels.
Gx6115Initialize	Initializes the driver for the specified GX6115 board.
Gx6115InitalizeVisa	Initializes the driver for the specified slot using VISA. The function returns a handle that can be used with other GX6062 functions to program the board.
Gx6115Open	Opens any relay.
Gx6115Panel	Opens the GX6115 virtual panel.
Gx6115Reset	Opens all relays.
Gx6115SetChannels	Sets all relays to a specified state.
GxSWGetErrorString	Returns the error string specified by the error number.

Gx6115Close

Purpose

Closes a relay or relay driver for the board handle passed.

Gx6115Close (*nHandle, nRelayType, nChannel, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6115 board.
nRelayType	SHORT	Specifies the type of relay 0 or 1: 0 for the high current relay, 1 for the relay driver.
nChannel	SHORT	Specifies the relay number. Can be 1-15 for the high current relay, 1-3 for the driver relay.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The **Gx6115GetChannel** function can be used to retrieve the current channel state.

Caution - When closing a relay, verify that all other relays on the same circuit that may cause a short are disconnected (a delay may be required between switching commands). Low Impedance sources such as power supplies may cause irreversible damage to this product when shorted to other signals.

Example

The following example closes relay 1 and relay driver 2:

```
Gx6115Close(nHandle, 0, 1, &nStatus);
Gx6115Close(nHandle, 1, 2, &nStatus);
```

See Also

Gx6115Initialize, **Gx6115Open**, **Gx6115SetChannels**, **Gx6115GetChannel**

Gx6115GetBoardSummary

Purpose

Returns the board summary.

Syntax

Gx6115GetBoardSummary *(nHandle, pszSummary, nSumMaxLen, pnStatus)*

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6115 board.
pszSummary	PSTR	Buffer to contain the returned board info (null terminated) string.
nSumMaxLen	SHORT	Size of the buffer to contain the error string.
pnStatus	PSHORT	Returned status: 0 on success, negative number on failure.

Comments

The GX6115 summary string provides the following data:

- Instrument name (e.g., GX6115)

- FPGA version of main board (e.g. 0xA003)

For example, the returned string could look like the following:

```
GX6115, FPGA Version:0xA000
```

See Also

GxSWGetDriverSummary, GxSWGetErrorString

Gx6115GetChannel

Purpose

Returns whether the specified relay or relay driver at the specified board is open or closed.

Syntax

Gx6115GetChannel (*nHandle, nRelayType, nChannel, pnState, pnStatus*)

Parameters

Name	Type	Comments
Nhandle	SHORT	Handle to a GX6115 board.
nrelayType	SHORT	Specifies the type of relay 0-1: 0 for the high current relay, 1 for the driver relay.
nChannel	SHORT	Specifies the relay number. Can be 1-15 for the high current relay, 1-3 for the driver relay.
pnState	LPSHORT	Returned relay state. Closed = 1 and Open = 0.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

Use the **Gx6115GetChannels** to retrieve the status of all channels in one function call.

Example

The following example return the status of relay 1:

```
Gx6115GetChannel(nHandle, 0, 1, &nClose, &nStatus);
if (nClose==1)
    printf("Relay 1 is Close");
else
    printf("Relay 1 is Open");
```

See Also

Gx6115Initialize, **GxSWGetErrorString**, **Gx6115Close**, **Gx6115Open**, **Gx6115GetChannels**

Gx6115GetChannels

Purpose

Returns the status of all relays and relays drivers.

Syntax

Gx6115GetChannels (*nHandle, plStates, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6115 board.
plStates	LPLONG	Returned state of all relays and driver relays. See Comments.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function returns the status of all the channels (relays) in a single 32-bit long pointer *plStates*. The low order bits 0-14 are for relays 1-15 and bits 16-18 are for relay drivers 1-3 respectively. For each bit, a value of 0 indicates that the channel is open while a value of 1 indicates that the channel is closed.

Use **Gx6115GetChannel** function instead to retrieve the status of a single channel.

Example

The following example checks whether relays 1 and 3 are closed:

```
Gx6115GetChannels(nHandle, &lStates, &nStatus);
if ((lStates & 0x5) == 0x5)    // binary ..0000101
    printf("Relay 1 and 3 are closed");
```

See Also

Gx6115Initialize, **Gx6115GetErrorString**, **Gx6115GetChannel**, **Gx6115SetChannels**

Gx6115Initialize

Purpose

Initializes the driver for the board at the specified PCI slot.

Syntax

Gx6115Initialize (*nSlot, pnHandle, pnStatus*)

Parameters

Name	Type	Comments
NSlot	Short	GX6115 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 **Gx6115Initialize** function verifies whether or not the GX6115 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 Marvin Test Solutions 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 GX6115 functions.

Example

The following example initializes two GX6115 boards at slot 1 and 2.

```
SHORT   nHandle1, nHandle2, nStatus;

Gx6115Initialize(1, &nHandle1, &nStatus);
Gx6115Initialize(2, &nHandle2, &nStatus);
if (nHandle1==0 || nHandle2==0)
    printf("Unable to Initialize the board")
```

See Also

Gx6115Reset, **GxSWGetErrorString**

Gx6115InitializeVisa

Purpose

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

Syntax

Gx6115InitializeVisa (*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 **Gx6115InitializeVisa** 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 Marvin Test Solutions 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 GX6115 boards at PXI bus 5 and device 11.

```
SHORT nHandle, nStatus;
Gx6115InitializeVisa ("PXI5::11::INSTR", &nHandle, &nStatus);
if (nHandle==0)
{
    printf("Unable to Initialize the board")
    return;
}
```

See Also

Gx6115Initialize, Gx6115Reset, **GxSWGetErrorString**

Gx6115Open

Purpose

Opens a relay or relay driver at the specified board.

Syntax

Gx6115Open (*nHandle, nRelayType, nChannel, pnStatus*)

Parameters

Name	Type	Comments
NHandle	SHORT	Handle to a GX6115 board.
nRelayType	SHORT	Specifies the type of relay 0-1:
		0 for the high current relay,
		1 for the driver relay.
NChannel	SHORT	Specifies the relay number. Can be 1-15 for the high current relay, 1-3 for the driver relays.
PnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The **Gx6115GetChannel** function can be used to retrieve the current channel state.

Example

The following example opens relay 1 and relay driver 2:

```
Gx6115Open(nHandle, 0, 1, &nStatus);
Gx6115Open(nHandle, 1, 2, &nStatus);
```

See Also

Gx6115Initialize, **GxSWGetErrorString**, **Gx6115Reset**, **Gx6115Close**, **Gx6115GetChannels**

Gx6115Panel

Purpose

Opens a virtual panel used to interactively control the GX6115 board.

Syntax

Gx6115Panel (*pnHandle, hwndParent, nMode, phwndPanel, pnStatus*)

Parameters

Name	Type	Comments
pnHandle	LPSHORT	Handle to a GX6115 board. This number may be zero if the board is to be initialized by the panel window.
hwndParent	HWND	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	LPHWND	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 virtual panel. The panel window may be opened 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 window is closed by the user. In that case the *pnHandle* returns the handle created by the user using the panel Initialize dialog. This handle then may be used when calling other GX6115 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:

```
HWND    hwndPanel;
SHORT   nHandle=0, nStatus;
...
Gx6115Panel (&nHandle, 0, 1, &hwndPanel, &nStatus);
```

See Also

Gx6115Initialize, **GxSWGetErrorString**

Gx6115Reset

Purpose

Opens all relays (1-15) and relay drivers (1-3) at the specified board.

Syntax

Gx6115Reset (*nHandle, pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6115 board.
pnStatus	PSHORT	Returned status: 0 on success, negative number on failure.

Comments

The function is normally called after calling the **Gx6115Initialize** function, since the initialize function will not reset the board.

Example

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

```
Gx6115Initialize(1, &nHandle, &nStatus);
if (nStatus<0)
    return nStatus;    // return error
Gx6115Reset (nHandle, &nStatus);
```

See Also

Gx6115Initialize, **GxSWGetErrorString**, **Gx6115SetChannels**

Gx6115SetChannels

Purpose

Sets all relays to a specified state according to the specified parameter.

Syntax

Gx6115SetChannels (*nHandle*, *lStates*, *pnStatus*)

Parameters

Name	Type	Comments
nHandle	SHORT	Handle to a GX6115 board.
lStates	LONG	Each bit represents a relay state: 0 = Open 1 = Closed. See Comments.
pnStatus	LPSHORT	Returned status: 0 on success, negative number on failure.

Comments

The *lStates* parameter sets the state of all channels. The low order bits 0-14 are for relays 1-15 and bits 16-18 are for relay drivers 1-3 respectively. For each bit, a value of 0 indicates that the channel is open while a value of 1 indicates that the channel is closed.

Caution - When closing a relay, verify that all other relays on the same circuit that may cause a short are disconnected (a delay may be required between switching commands). Low Impedance sources such as power supplies may cause irreversible damage to this product when shorted to other signals.

Example

The following example sets relays 1 and 3 to a closed state:

```
SHORT nStatus;
Gx6115SetChannels(nHandle, 0x5, &nStatus);
```

See Also

Gx6115Initialize, **Gx6115GetChannel**, **GxSWGetErrorString**

GxSWGetDriverSummary

Purpose

Returns the driver name and version.

Syntax

GxSWGetDriverSummary (*pszSummary, nSummaryMaxLen, pdwVersion, pnStatus*)

Parameters

Name	Type	Comments
pszSummary	PSTR	Buffer to the returned driver summary string.
nSummaryMaxLen	SHORT	The size of the summary string buffer.
pdwVersion	PDWORD	Returned version number. The high order word specifies the major version number where the low order word specifies the minor version number.
pnStatus	PSHORT	Returned status: 0 on success, negative number on failure.

Comments

The returned string is: "GXSW Driver for GX6021, GX6062, GX6115, GX6125, GX6138, GX6188, GX6196, GX6264, GX6315, GX6325, GX6338, GX6377, GX6384, GX6616, and GX7016 (GX6192/GX6256/6864), Version 3.5.6 Copyright(c) 2000-2020, Marvin Test Solutions, Inc."

Example

The following example prints the driver version:

```
CHAR sz[512];
DWORD dwVersion;
SHORT nStatus;

GxFpgaGetDriverSummary (sz, sizeof sz, &dwVersion, &nStatus);
printf("Driver Version %d.%d", (INT)(dwVersion>>16), (INT)
    dwVersion &0xFFFF);
```

See Also

Gx6115GetBoardSummary, GxSWGetErrorString

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 of the driver functions. See table below for possible values. The 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.

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 PXI-**PCI Explorer** 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

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. If the initialization failed, the following error string is printed:

```
CHAR    sz[256];
SHORT   nStatus, nHandle;
..
Gx6115Initialize(3, &Handle, &Status);
if (nStatus<0)
{   GxSWGetErrorString(nStatus, sz, sizeof sz, &nStatus);
    printf(sz);         // prints the error string returns
}
```

Index

W