PCI Genius® Card
Quick Install Guide

PCI Genius Card
IC660ELB931

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Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use. In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Note: Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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The PCI Genius Card has been tested and found to meet or exceed the requirements of U.S. (47 CFR 15), Canadian (ICES-003), Australian (AS/NZS 3548) and European (EN55022) regulations for Class A digital devices when installed in accordance with guidelines noted in this manual.

Note: This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received including interference that may cause undesired operation.

Note: This Class A digital apparatus complies with Canadian ICES-003.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Note: Any changes or modifications to the product or installation that are not expressly approved by GE Fanuc Automation could void the user's authority to operate the equipment under FCC rules.

The following statements are required to appear for Class 1, Div 2 Hazardous Locations.

1. EQUIPMENT LABELED WITH REFERENCE TO CLASS 1, GROUPS A, B, C, AND D, DIV 2 HAZARDOUS LOCATIONS IS SUITABLE FOR USE IN CLASS 1, DIVISION 2, GROUPS A, B, C, D, OR NON-HAZARDOUS LOCATIONS ONLY.

2. WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

3. WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

4. WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES

Table of Contents

Description

PCI Genius Card

The PCI Genius card provides an intelligent interface between a PCI slot in a PC compatible computer and a single channel general purpose controller interface to the Genius serial bus. This card complies with Rev 2.2 of PCI Local Bus Specification and handles all the interface and protocol tasks associated with the Genius bus communications. The primary function of this card is to provide a means for third parties to interface the CPU, PLC, or Genius I/O Blocks on the Genius bus.

Faceplate

The PCI Genius card has a 4-pin right angle male terminal box connector with retention screws for the Genius I/O interface. Two LEDs (GENI OK and COMM OK) on the faceplate indicate the single channel Genius bus status. Openings in the faceplate accommodate the bus connector and LEDs.

Software

If you are using the PCI Genius card with Machine Edition software, Machine Edition installs custom drivers for its use. Please consult the topic "Installing the device driver for a PCI device (card)" in the Machine Edition online help for more details.

If you are not using Machine Edition, you can use a Windows driver for the PCI Genius card that is available for Windows NT4, 2000, and XP. This driver allows user-mode programs to gain access to the PCI Genius card's Shared RAM, configuration register, status register, and control register and also to determine the physical bus and slot of the card. The driver is available under special license from GE Fanuc. Contact the GE Fanuc Global Customer Care Center at 1-800-GEFANUC for more details concerning part number 44A750896-G01.

Programming Interface

Programming user applications to communicate with the drivers are not covered in this manual. Users wishing to write their own interface to the hardware should see Appendix A for hardware register details.

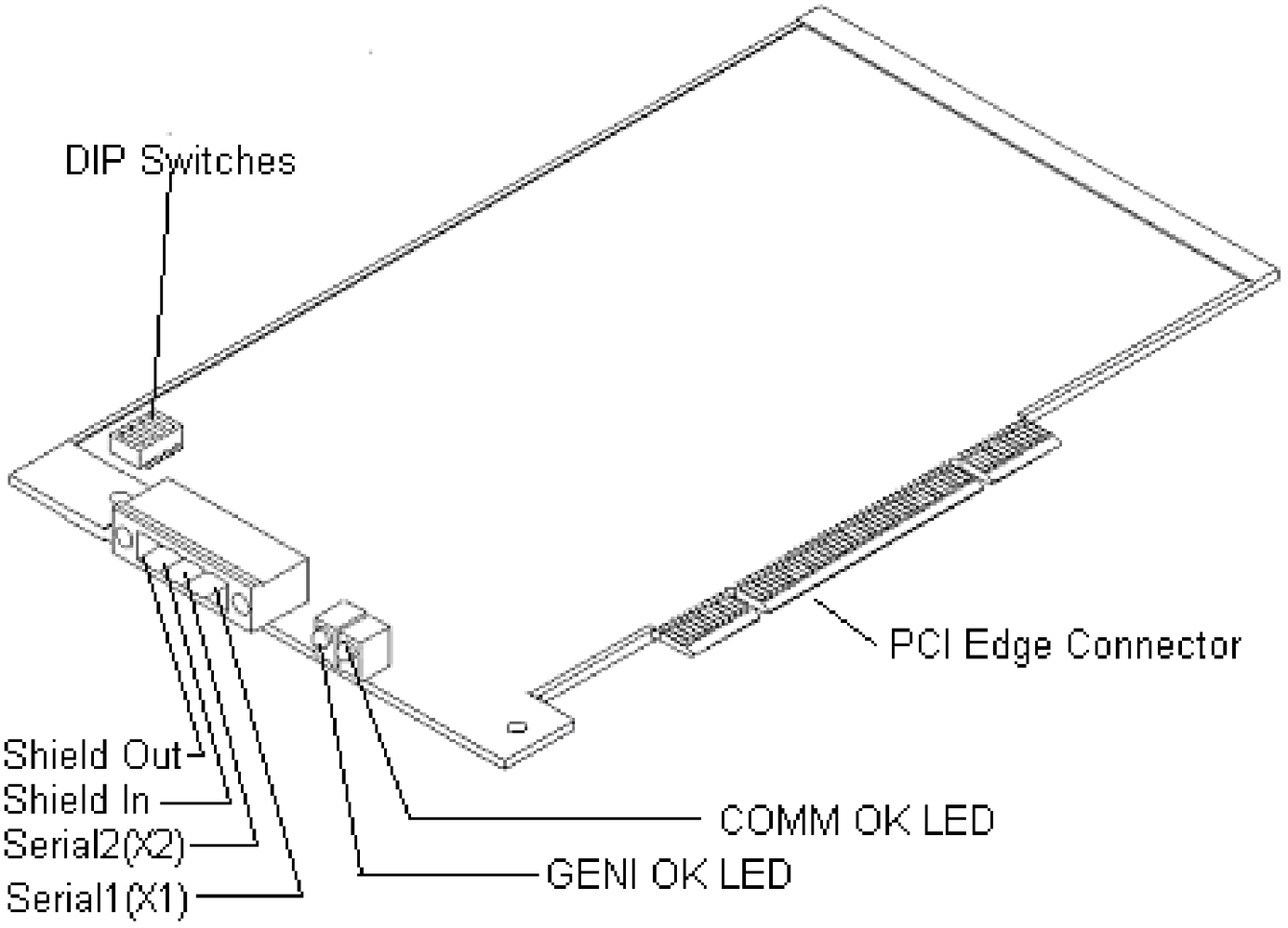
Installing the PCI Genius Card

Warning: Always use anti-static precautions when handling the PCI Genius card or working inside the host computer.

1. Power off the host computer and unplug it from its power source.
2. Install the PCI Genius card according to computer manufacturer's instructions for option cards.
3. Power up the computer and login to Windows.

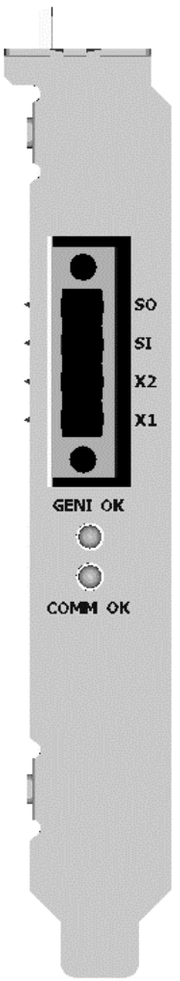
Mechanical Overview

The PCI Genius card is shown on the next page. The interface card will plug into PCI slot of a computer. The Genius bus connector is where the Genius bus cable is connected to the module. DIP switches are used to set the termination resistance for the Genius bus. LED indicators display the status of the module.


DIP Switches
PCI Edge Connector
Shield Out
Shield In
Serial2(X2)
Serial1(X1)
COMM OK LED
GENI OK LED

Indicators

The Genius Interface module has two LED indicators on the faceplate. These are used for displaying the status of the module.



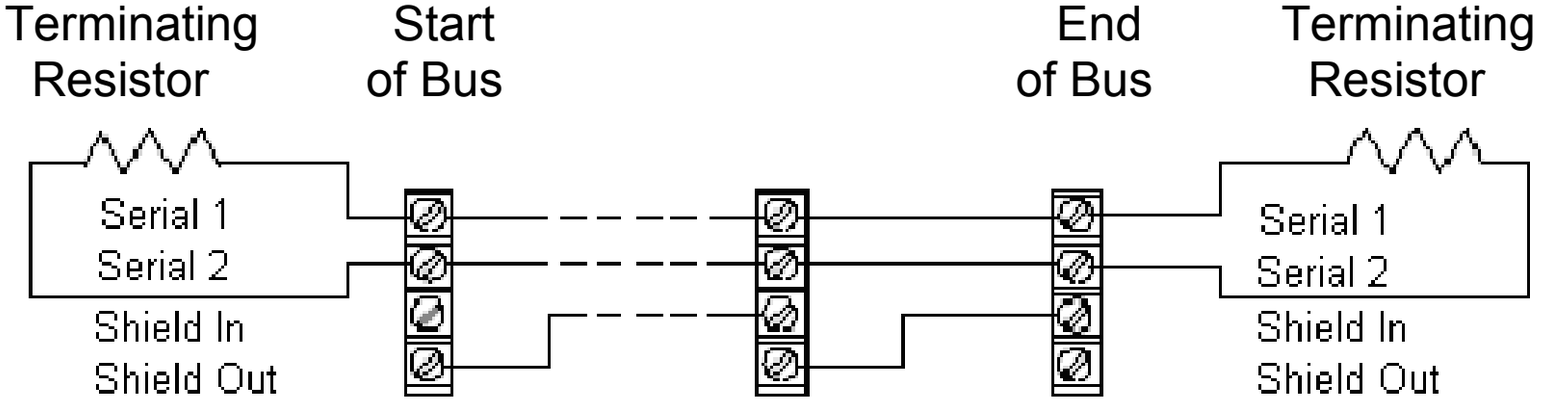
LED	*LED Status*	*Description*
Communication OK	ON	The Genius Interface can send and receive data on the serial bus.
	OFF (Flashing)	An error has been detected in communications on the serial bus.
Genius OK	ON	Power is available to the Genius Interface, and the onboard self-diagnostics passed.
	OFF	The watchdog timer has timed out, indicating a board failure.

Connecting the Bus

Devices can be connected in any physical sequence on the bus. The Genius bus connector has four terminals for the bus cable: (Serial 1 (X1), Serial 2 (X2), Shield In (SI), and Shield Out (SO)).

Connect the Serial 1 terminal of each connector to the Serial 1 terminals of the previous device and the next device. Connect the Serial 2 terminal of each connector to the Serial 2 terminals of the previous device and the next device. Shield In of each connector must be connected to Shield Out of the preceding device. For the first device on the bus, Shield In can be left unconnected. For the last device on the bus, Shield Out can be left unconnected.

Sample Bus Configuration



Caution: When making bus connections, the maximum exposed length of bare wires should be two inches. For added protection, each shield drain wire should be insulated with electrically isolated tubing to prevent the Shield In and Shield Out wires from touching each other.

Refer to *The Genius I/O System and Communications User's Manual, GEK-90486-1* for additional details on Genius bus wiring.

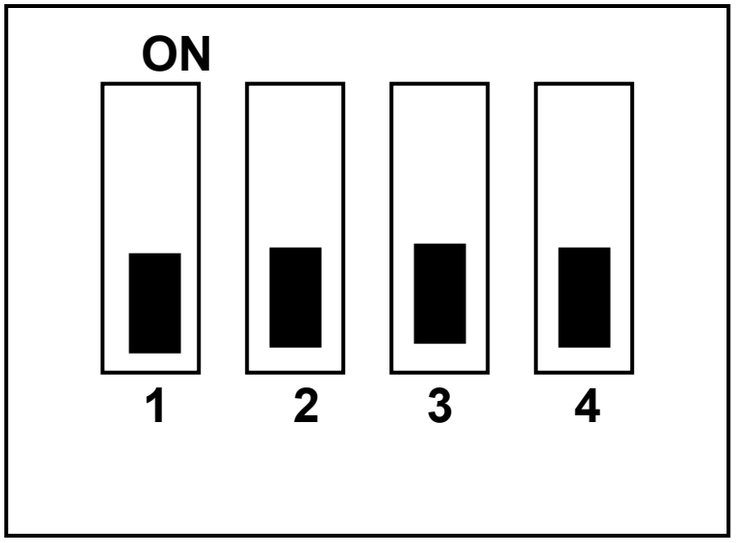
DIP Switch Setting

Bus Termination Resistor Setting

A bus must be terminated at each end by the correct impedance for the particular cable type. The impedance will be either 75, 100, 120, or 150 ohms. Install the appropriate terminating resistor across the Serial 1 and Serial 2 terminals.

The Genius Interface has on-board termination resistors that can be selected by the DIP switch setting. *The Genius I/O System and Communications User's Manual, GEK-90486-1* lists appropriate terminating resistors for each recommended bus cable type.

The DIP switch configuration should be set according to the description on the next page.



Pole1	*Pole 2*	*Pole3*	*Pole 4*	*Resistor Value*
ON	OFF	OFF	OFF	150 OHM
ON	ON	OFF	OFF	125 OHM
ON	ON	ON	OFF	100 OHM
ON	ON	ON	ON	75 OHM
OFF	OFF	OFF	OFF	*NONE

* Default setting.

Specifications

Board Specifications

Environmental:	
Operating:	
Operating temperature at board	0°C to +60°C, 32°F to + 140°F
Humidity	5% to 95% non–condensing
Vibration	IEC 68-2-6; 10 - 57Hz, 0.012" peak to peak displacement; 57 - 500Hz, 1.0g constant acceleration.
Shock	IEC 68-2-27; 15g, 11ms (sine wave).
Non–operating:	
Ambient Temperature at board	–40°C to +85°C, –40°F to +185°F
Humidity	5% to 95% non–condensing
Vibration	IEC 68-2-6; 10 - 57Hz, 0.012" peak to peak displacement; 57 - 500Hz, 1.0g constant acceleration
Shock	IEC 68-2-27; 15g, 11ms (sine wave).

Network Specification

Bus Type	Daisy-chained bus cable; single twisted pair plus shield or Twinax
Bus Termination	On board DIP switch selectable: None, 75, 100, 120, or 150 ohms.
Baud Rate	Configurable 153.6 Kbaud standard, 153.6 Kbaud extended, 76.8 Kbaud, or 38.4 Kbaud.
Max. Number of Devices	32 devices at 153.6 Kbaud standard, 153.6 Kbaud extended, or 76.8 Kbaud. 16 devices at 38.4 Kbaud.

Bus Cable Type and Maximum Cable Length:

Cable # & Make	***Terminating Resistor –10%to+20% 1/2 Watt***	***Maximum Length Cable Run, feet/meters at baud rate***			
		153.6s	***153.6e***	***76.8***	***38.4 •***
(A)9823 (B)9182 (C)4596 (M)M39240	150 ohms	2000ft 606m	3500ft 1061m	4500ft 1364m	7500ft 2283m
(B)89182	150 ohms	2000ft	3500ft	4500ft	7500ft

Cable # & Make	***Terminating Resistor –10%to+20% 1/2 Watt***	***Maximum Length Cable Run, feet/meters at baud rate***			
		153.6s	***153.6e***	***76.8***	***38.4 •***
		606m	1061m	1364m	2283m
(B)9841 (M)M3993	120 ohms	1000ft 303m	1500ft 455m	2500ft 758m	3500ft 1061m
(A)9818C (B)9207 (M)M4270	100 ohms	1500ft 1818m	2500ft 455m	3500ft 758m	6000ft 1061m
(A)9109 (B)89207 (C)4798 (M)M44270	100 ohms	1500ft 1818m	2500ft 455m	3500ft 758m	6000ft 1061m
(A)9818D (B)9815	100 ohms	1500ft 1818m	2500ft 455m	3500ft 758m	6000ft 1061m
(A)9818 (B)9855 (M)M4230	100 ohms	1200ft 364m	1700ft 516m	3000ft 909m	4500ft 1364m
(A)9110 (B)89696	100 ohms	1200ft 364m	1700ft 516m	3000ft 909m	4500ft 1364m

Cable # & Make	***Terminating Resistor –10%to+20% 1/2 Watt***	***Maximum Length Cable Run, feet/meters at baud rate***			
		153.6s	***153.6e***	***76.8***	***38.4 •***
(B)89855 (M)M64230					
(A)9814C) (B)9463 (M)M4154	75 ohms	800ft 242m	1500ft 455m	2500ft 758m	3500ft 1061m
(A)5902C (B)9302 (M)M17002	75 ohms	800ft 242m	1500ft 455m	2500ft 758m	3500ft 1061m

Notes: A = Alpha, B = Belden, C = Consolidated, M = Manhattan
• = Limited to 16 taps at 38.4 Kbaud

Refer to *The Genius I/O System and Communications User's Manual, GEK-90486-1* for details on selection and installation of the bus cable.

Product Certification

Description	*Agency Standard or Marking*	*Comments*
North American Safety for Industrial Control Equipment	UL 508/C-UL	Certification by Underwriter's Laboratories to UL standard and equivalent CSA standard
North American Safety for Hazardous Locations Class I, Div. 2, Groups A, B, C, D	UL 1604C-UL	Certification by Underwriter's Laboratories to UL standard and equivalent CSA standard
Electromagnetic Compatibility Directive European EMC for Industrial Control Equipment	CE	Certification by Competent Body in accordance with European Directives. Refer to Declaration of Conformity.

Diagnostics

Troubleshooting involves thinking logically of the function of each part of the system, and understanding how these functions interrelate. When problems occur, the total system must be considered. All the devices on the bus must be connected and operating properly.

A malfunction causing improper operation of Genius Interface board can usually be isolated by checking the board LEDs on the module. These indicate the status of the board itself and its communications with the Genius bus. During proper operation, both the LEDs will be on.

Diagnostic Steps

The module should be plugged in, powered up and the proper software application should be running:

Indication	*Troubleshooting Steps*
Genius OK is off COMM OK is on	Make sure the correct parameters are entered using the configuration software. Ensure that the Genius interface Module is completely inserted in the host backplane connector, and that all connector pins are properly aligned. If these steps do not correct the problem, replace the Genius Interface Module.

Indication	***Troubleshooting Steps***
Genius OK is on COMM OK is off	Ensure correct cable type and length *(see Genius I/O System and communications User's Manual, GEK-90486-1).* Ensure correct terminating resistors are installed at both ends of the bus length *(see Genius I/O System and communications User's Manual, GEK-90486-1).* Ensure the serial bus is wired in a daisy-chain fashion. Make sure cabling is not in proximity to high voltage runs. Make sure cable is not broken.
Both LEDs are off	Make sure the Genius interface Module is plugged in, seated properly, and receiving power.
	Make sure the proper software application is loaded and running. (Try reloading the application)
Both LEDS are flashing together	Two devices on the same bus have probably been configured with the same Device Number (serial bus address). Check the bus addresses, and if necessary correct them.

Indication	***Troubleshooting Steps***
Repeated bus errors occur	Ensure that cable shielding is properly installed and Grounded *(see Genius I/O System and communications User's Manual, GEK-90486-1).* Unplug the bus communications cable from the Interface Module, verify the serial bus addresses (SBAs) of all network nodes with a hand-held monitor (HHM), and use the HHM to read the configuration and verify device numbers and I/O reference numbers.
Bus errors--can't get the Interface Module up and running	Serial 1 and Serial 2 are crossed. Correct the bus wiring (see "Sample Bus Configuration" on page 14.)
Intermittent or total lack of communications	Mixed baud rates. Power up blocks one at a time and confirm the baud rate for each. Any changes to baud rate in a block will not take effect until block power is cycled.

Appendix A

Many users of the ISA bus Genius cards have developed private software that interfaces with the Genius network. This appendix provides hardware details to help those users transition to the PCI card.

History

In working with the GENIUS PCI card, it is helpful to understand some of the history of the GENIUS PC interfaces. The core of the GENIUS PC interface products is a shared memory module called a GENI or µGENI, which is described in the *Genius I/O µGENI Board User's Manual,* GFK-0845. This module has a 16Kbyte memory mapped interface that allows a host processor to communicate on the GENIUS network. The other input and output signals to a µGENI module are the four GENIUS bus lines, two LED signals, and eight initialization signals that specify the card's SBA, network baud rate, and output enabled status.

Previous ISA PC GENIUS cards either implemented the µGENI circuitry as a single circuit board or had a carrier ISA circuit board that allowed one or two µGENI daughter modules to attach to the carrier ISA circuit board. The eight initialization signal values and the address information as to where the µGENI mapped into the ISA space were programmed into non-volatile memory on the carrier board. This configuration information resided at one range of I/O registers and control of the reset

and watchdog lines going into the µGENI hardware were controlled at a second set of I/O registers.

The GENIUS PCI card continues this tradition. The µGENI module has been integrated onto the single circuit board and the setup signals and control of the reset and watchdog functions have been mapped to I/O registers. There is no non-volatile memory on the PCI card, so the card does not retain its SBA address, bus baud rate, or output enable state in non-volatile storage.

PCI Configuration

The Device and Vendor IDs of the PCI Genius card are 0x0100 and 0x1FC3. The card reports five resource descriptors:

- An interrupt descriptor
- A memory and I/O region of length 128 bytes for access to the internal PCI hardware
- A four byte I/O area for the Functional Registers
- A 16K byte memory area for the Shared RAM

Users programming their own drivers should only need to access the Functional Registers and Shared RAM in most cases.

Functional Registers

The PCI Genius card has three I/O mapped registers. The PCI stack maps these registers into I/O space The Windows driver controls access to these registers.

Register	*Size*	*Description*	*Access Type*
0	1 Byte	Configuration Register	Read /Write
1	1 Byte	Status Register	Read only
2	1 Byte	Control Register	Read /Write

Configuration Register

The Configuration register must be programmed prior to releasing the PCI Genius card from reset. The bits of this register are read by the µGENI firmware during its initialization. The bits of this register are described below:

Bit	*Name*	*Function*
7	Output Enable	0=enabled 1=disabled (Default)
6—5	Baud Rate	Serial Bus Baud Rate 00=153.6 Kbaud Extended (8 bit skip time) 01=38.4 Kbaud (8 bit skip time) 10=76.8 Kbaud (8 bit skip time) 11=153.6 Kbaud Standard (4 bit skip time) (Default)
4—0	Address	Serial Bus Address, see “Serial Bus Addresses” on page 29.

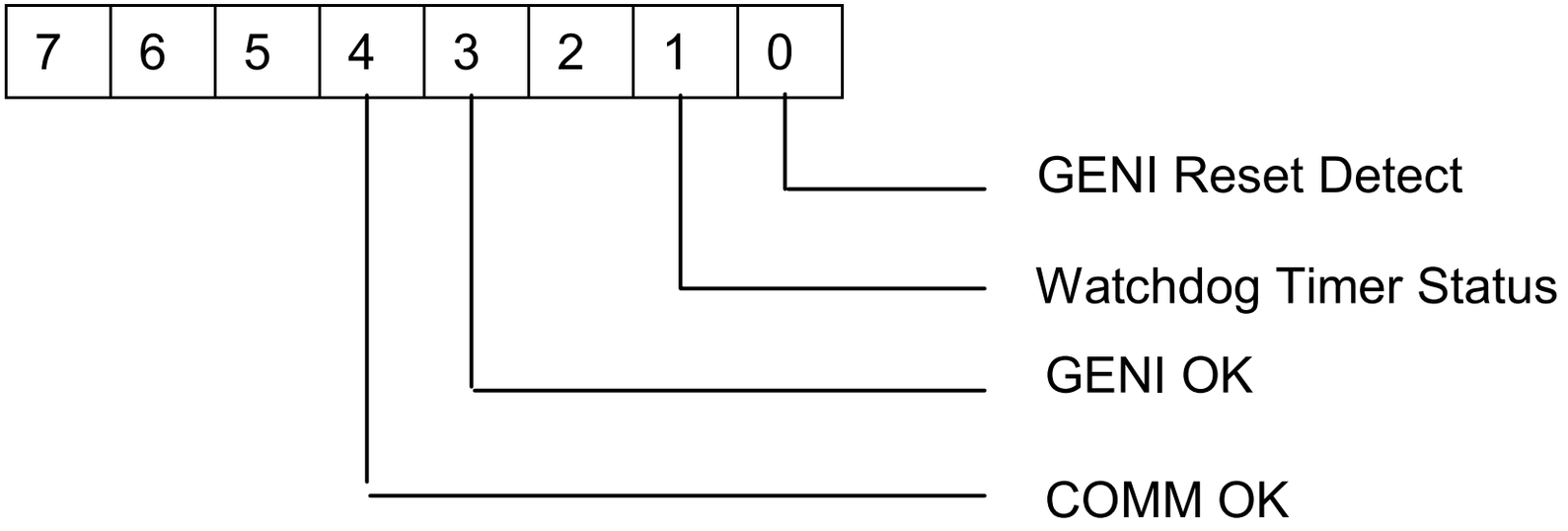
Serial Bus Addresses

	Bit4	***Bit3***	***Bit2***	***Bit1***	***Bit0***	***SBA***
Default	0	0	0	0	0	0
	0	0	0	0	1	1
	0	0	0	1	0	2
	0	0	0	1	1	3
	0	0	1	0	0	4
	0	0	1	0	1	5
	0	0	1	1	0	6
	0	0	1	1	1	7
	0	1	0	0	0	8
	0	1	0	0	1	9
	0	1	0	1	0	10
	0	1	0	1	1	11
	0	1	1	0	0	12
	0	1	1	0	1	13
	0	1	1	1	0	14
	0	1	1	1	1	15
	1	0	0	0	0	16

Bit4	*Bit3*	*Bit2*	*Bit1*	*Bit0*	*SBA*
1	0	0	0	1	17
1	0	0	1	0	18
1	0	0	1	1	19
1	0	1	0	0	20
1	0	1	0	1	21
1	0	1	1	0	22
1	0	1	1	1	23
1	1	0	0	0	24
1	1	0	0	1	25
1	1	0	1	0	26
1	1	0	1	1	27
1	1	1	0	0	28
1	1	1	0	1	29
1	1	1	1	0	30
1	1	1	1	1	31

Status Register

The individual bits in the Status register have the following functions:



Bit 0 –GENI RESET Detect

This bit is set to 0 whenever PCI Genius board goes into reset. During normal operation this bit will be 1.

Bit 1 – Watchdog Timer Status

This bit is 1 if the watchdog timer is being pulsed every 500ms. The watchdog timer is pulsed by the accesses into the Shared Memory area. If the timer expires, this bit goes to 0. The Shared RAM area should be accesses to set this value before enabling the watchdog timer.

Bit 3 –GENI OK

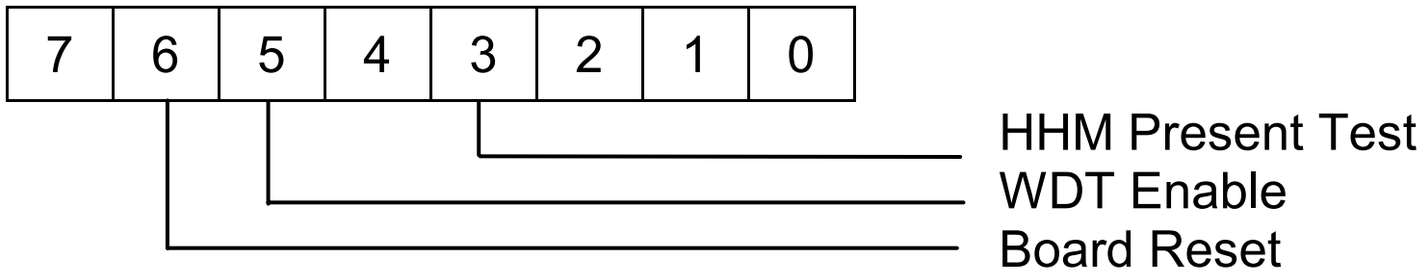
The state of this bit follows the condition of the GENI OK LED on the board. If the LED is lit, the GENI OK bit is 0. This bit also indicates the MIT watchdog timer (an onboard firmware watchdog timer) has timed out, indicating a failure in the onboard firmware. The board can be reset by pulsing bit 6 of the control register to low and then high again.

Bit 4 – COMM (Communications) OK

Like the GENI OK bit, this bit follows the output of one of the LED's on the board. This bit is 0 if the COMM OK LED on the board is lit.

Control Register

The individual bits in the Control register are used for the following functions:



Bit 3 – HHM Test

An HHM present can be indicated even when one is not plugged in by raising this bit to 1. After power up and under normal conditions, this bit should be 0. It is not used on the PCI Genius card.

Bit 5 – WDT Enable

When this bit is 0 it enables the hardware watchdog timer. The host can set this bit to '1' to disable the watchdog timer. During power on this bit will be default zero (watchdog timer enabled).

Bit 6 –Board RESET

When this bit is 0 it resets the PCI Genius board. Under normal running conditions, it should be 1. During power on, this bit will default to 0. Before setting this bit to 1, the host can update the configuration register

and the control register; this bit can be set to 1 to bring the board out of reset.

Watchdog Timer

The watchdog timer provides watchdog time out period of 0.99 seconds. Once the watchdog circuit is enabled, it will monitor access to the Shared RAM area of the card. If the host does not access the card within the 0.99 seconds +/- 25% the watchdog expires. It is recommended that host application should communicate with the Genius card at least once every 0.5 second. The host should access the Shared RAM area at least one before enabling the watchdog to reset the timeout before enabling the watchdog reset feature.

Shared RAM Memory Map

The 16Kbyte Shared RAM area is allocated by the PCI stack. User applications must use a Windows driver to access this area or map it to the process address space.

Host Address	***Content***	***Size in bytes***
Base + 0x0000	Request Queue	2176
Base + 0x0880	Request Queue Head Pointer	1
Base + 0x0881	Request Queue Tail Pointer	1
Base + 0x0882	Setup Table	16
Base + 0x0892	Status Table	16
Base + 0x08A2	Interrupt Status Table	16
Base + 0x08B2	Interrupt Disable Table	16
Base + 0x08C2	Command Block	16
Base + 0x08D2	Transmit Datagram Buffer	240
Base + 0x09C2	Read Datagram Buffer	134
Base + 0x0A48	I/O Table lockout Request	1
Base + 0x0A49	I/O Table lockout state	1
Base + 0x0A4A	Host Clear	1
Base + 0x0A4B	Reserved	64

Host Address	*Content*	*Size in bytes*
Base + 0x0A8B	Auxiliary Request Queue	48
Base + 0x0ABB	Heartbeat Enable	2
Base + 0x0ABD	Heartbeat Timeout Multiplier	1
Base + 0x0ABF	Reserved	4930
Base + 0x1E00	Device Configuration Table	256
Base + 0x1F00	Directed Control Input Table	128
Base + 0x1F80	Broadcast Control Output Table	128
Base + 0x2000-0x3FFF	Device I/O Table	8192

For more details on how to operate the Shared RAM Interface refer to the *Genius I/O µGENI Board User's Manual,* GFK-0845.