

**User Manual**

GFK-1535D

Jan 2023

# **PACSystems™ VersaMax**

**GENIUS® NETWORK INTERFACE UNIT**

**USER MANUAL**



**EMERSON™**

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## Warnings, Caution 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.

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### **CAUTION**

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

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

These instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met during installation, operation, and maintenance. The information is supplied for informational purposes only, and Emerson makes no warranty as to the accuracy of the information included herein. Changes, modifications, and/or improvements to equipment and specifications are made periodically and these changes may or may not be reflected herein. It is understood that Emerson may make changes, modifications, or improvements to the equipment referenced herein or to the document itself at any time. This document is intended for trained personnel familiar with the Emerson products referenced herein.

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# Section 1: Introduction

This manual explains how to install and use a VersaMax™ Genius® Network Interface Unit module.

**NIU installation procedures** are described in Section 2: Installation.

**NIU operation** is described in Section 3: Operation. This section explains how the NIU interacts with the modules in its station, how it stores data, and how it exchanges data with the system host.

**Configuration** is described in Section 4: Configuration.

The **datagrams** that can be sent to an NIU are described in Section 5: Datagrams.

Genius Bus, CPU, and GMR **Redundancy** options are explained in Section 6: Redundancy.

**Bus operation** is detailed in Appendix A: Operation of the Genius Bus.

I/O module scan time **performance data** is listed in Appendix B: Performance Data.

## 1.1 Revision History

Revision	Date	Description
D	Jan 2023	Enhanced descriptions of old and new Rotary switches.

## 1.2 Related Manuals

<i>VersaMax Modules, Power Supplies, and Carriers User's Manual</i>	GFK-1504
<i>Remote I/O Manager User's Guide</i>	GFK-1847
<i>VersaMax Ethernet Network Interface Unit User's Manual</i>	GFK-1860
<i>VersaMax DeviceNet Communications Modules User's Manual</i>	GFK-1533
<i>VersaMax Profibus Communications Modules User's Manual</i>	GFK-1534
<i>VersaMax PLC User's Manual</i>	GFK-1503
<i>Genius System and Communications Manual</i>	GEK-90486-1

## 1.3 The VersaMax™ Family of Products

The VersaMax family of products provides universally distributed I/O that spans PLC and PC-based architectures. Designed for industrial and commercial automation, VersaMax I/O provides a common, flexible I/O structure for local and remote-control applications. The VersaMax PLC combines big-PLC power with a full range of I/O and option modules. VersaMax I/O Stations with Network Interface Modules make it possible to add the flexibility of VersaMax I/O to other types of networks. VersaMax meets UL, CUL, CE, Class1 Zone 2, and Class I Division 2 requirements.

As a scalable automation solution, VersaMax I/O combines compactness and modularity for greater ease of use. The 70-mm depth and small footprint of VersaMax I/O enable easy, convenient mounting as well as space-saving benefits. Modules can accommodate up to 32 points of I/O each.

The compact, modular VersaMax products feature DIN-rail mounting with up to eight I/O and option modules per “rack” and up to 8 racks per VersaMax PLC or VersaMax I/O Station system. Expansion racks can be located up to 750 meters from the main VersaMax PLC or VersaMax I/O Station rack. Expansion racks can include any VersaMax I/O, option, or communications module.

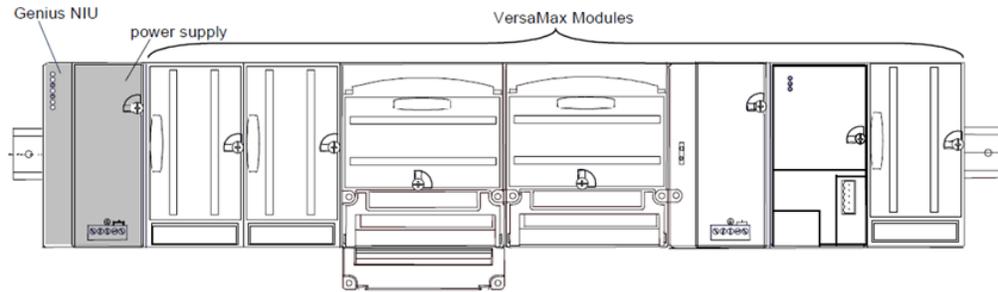
VersaMax provides automatic addressing that can eliminate traditional configuration and the need for hand-held devices. Multiple field wiring termination options provide support for two, three, and four-wire devices.

For faster equipment repair and shorter Mean-Time-To-Repair, the hot insertion feature enables the addition and replacement of I/O modules while a machine or process is running and without affecting field wiring.

## 1.4 The VersaMax Genius I/O Station

A VersaMax Genius I/O Station consists of a group of VersaMax modules with a VersaMax Genius NIU and attached power supply in the first position.

**Figure 1: Example of a VersaMax Genius I/O Station**

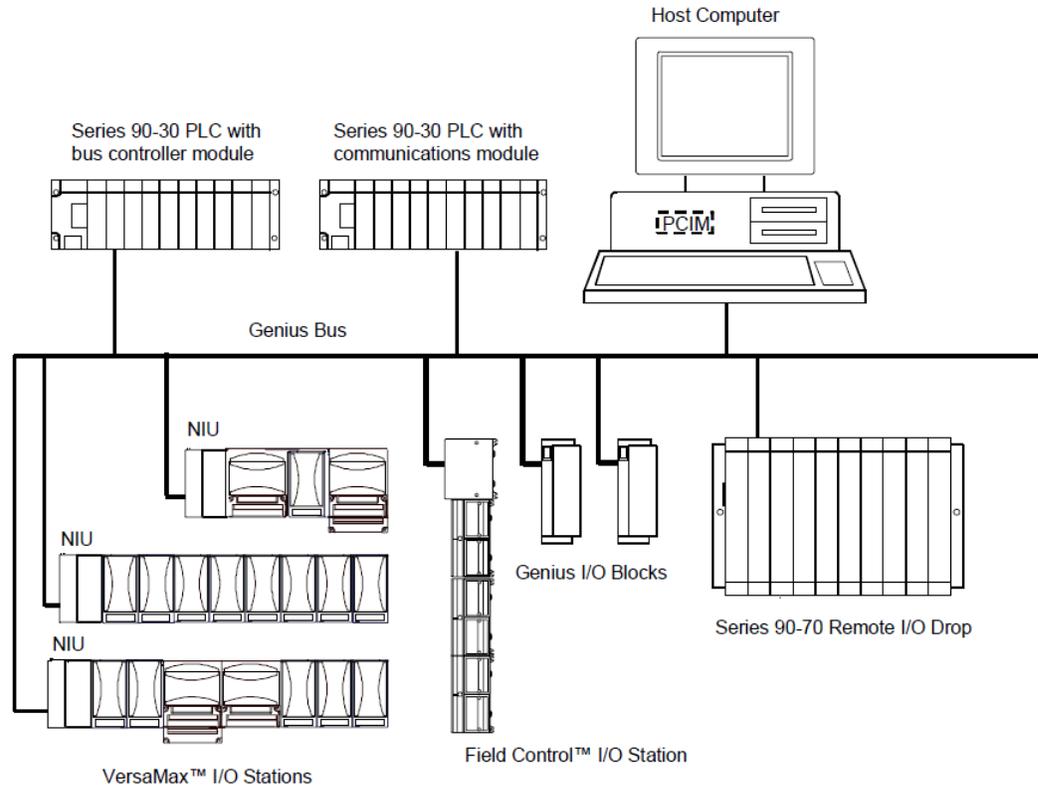


An I/O Station provides up to 64 analog channels and up to 1024 discrete points for 256 total bytes of I/O. The Genius NIU operates as a device on a Genius bus, automatically exchanging I/O, diagnostic, and control data with a PLC or host computer.

## 1.4.1 VersaMax I/O in a Genius System

A VersaMax Genius I/O station can be used on the same bus as PLCs with Genius Bus Controllers, Genius I/O blocks, Field Control I/O stations, and Remote I/O drop.

**Figure 2: Example of a VersaMAX I/O Station in a Genius System**

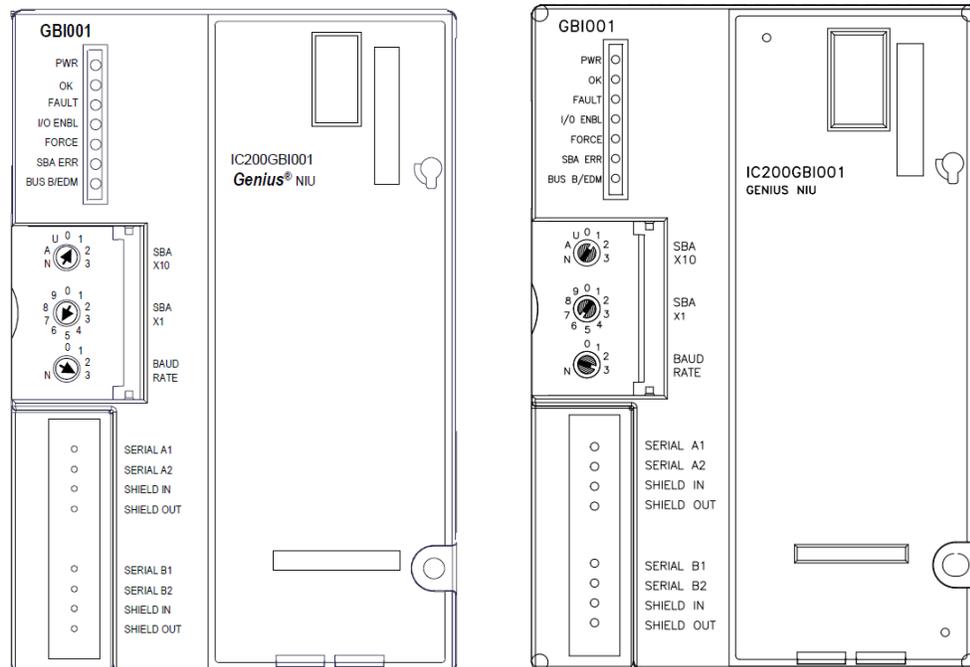


VersaMax I/O stations can be used in redundant bus and redundant CPU applications. The Genius NIU provides a built-in bus-switching capability. See Section 6: Redundancy for more information about using the NIU in a redundancy system.

## 1.5 The Genius NIU

The VersaMax Genius Network Interface Unit (IC200GBI001) interfaces a VersaMax I/O Station to a Genius I/O bus. The system host can be any PLC or computer capable of controlling the Genius bus.

**Figure 3: Genius NIU (Old Rotary on Left/New Rotary on Right)**



The Network Interface Unit installs on a 35mm x 7.5mm conductive DIN rail. A VersaMax power supply module mounts directly on the righthand side of the NIU. LEDs on the lefthand side indicate the presence of power and show the operating mode and status of the NIU. Three rotary dials beneath a clear protective door are used to configure the NIU's address on the Genius bus and to set its communications baud rate. Removable connectors are used to install single or redundant bus cables. These connectors make it possible to disconnect a bus cable from the NIU without breaking the continuity of the bus, so other devices on the same bus can continue operating.

## 1.6 Genius NIU Specifications

Feature	Specification
Number of Modules	8 per rack, 64 per NIU/station
Network inputs per bus scan	128 bytes
Network outputs per bus scan	128 bytes
Discrete Input Memory	1024 points
Discrete Output Memory	1024 points
Analog Input Memory	128 bytes
Analog Output Memory	128 bytes
Power Consumption	+5V@250mA, +3.3V@10mA
Serial Bus Address	0 to 31
Network data rate	153.6 Kbaud extended, 153.6 Kbaud standard, 76.8 Kbaud, or 38.4 Kbaud.

### 1.6.1 Genius NIU Compatibility

Network Interface Unit IC200GBI001 is compatible with any type of PLC or computer capable of controlling the Genius bus. Examples:

- PACSystems RX7i controller
- PACSystems RX3i controller
- Series 90™-70 PLC
- Series 90™-30 PLC

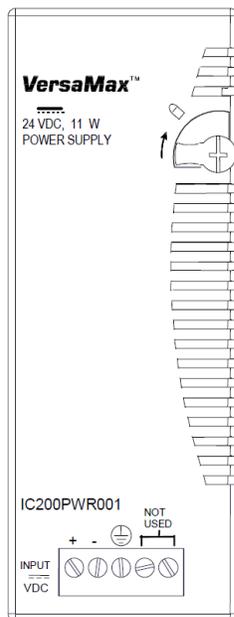
For some products, minimum versions are required for use with a Genius NIU:

- On a Genius bus controlled by an IC697 PLC or PACSystems RX7i:
  - IC697 CPU firmware, release 3.0 or later.
  - Genius Bus Controller release 5.4 or later. Upgrading the 90-70
  - Genius Bus Controller firmware to version 6.0 (or higher) is strongly recommended.
- For a Series 90™-30 PLC
  - CPU firmware: any version.
  - Bus Controller: any version.

## 1.7 Power Supplies

An AC or DC Power Supply module installs directly on the NIU. The Power Supply provides +5 V and +3.3 V power to the modules in the station. Additional power supplies can be installed on special booster carriers if needed for systems where the number of modules creates the need for a booster. No booster supply is needed to power conventional I/O modules.

**Figure 4: VersaMax Power Supply**



### Available Power Supplies and Carriers

The following VersaMax power supplies and carriers are available:

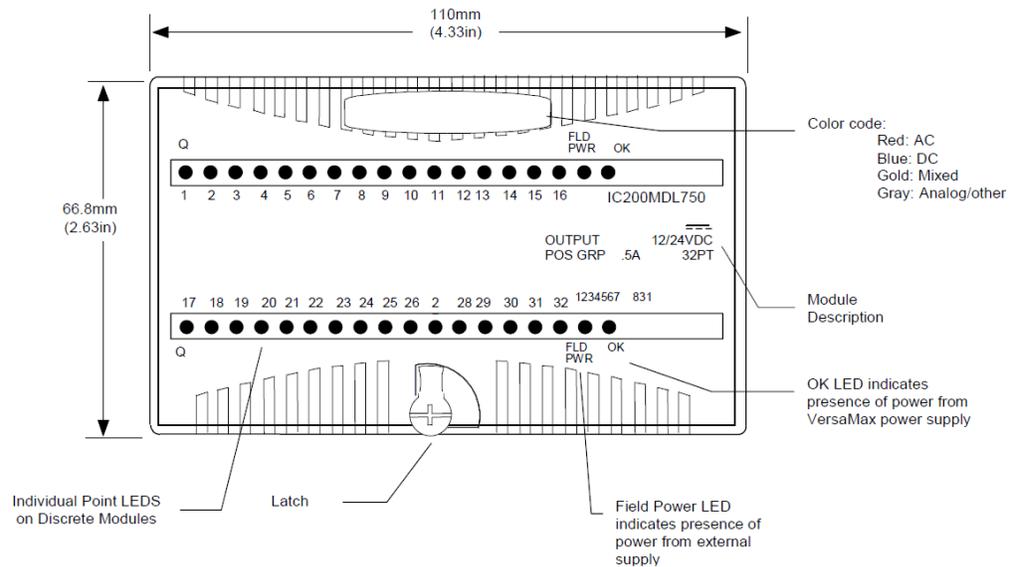
Part Description	Part Number
24VDC Power Supply	IC200PWR001
24VDC Expanded 3.3V Power Supply	IC200PWR002
120/240VAC Power Supply	IC200PWR101
120/240VAC Expanded 3.3V Power Supply	IC200PWR102
12VDC Power Supply	IC200PWR201
12VDC Expanded 3.3V Power Supply	IC200PWR202
Power Supply Booster Carrier	IC200PWB001

Power supplies are described in the VersaMax Modules, Power Supplies, and Carriers User's Manual (GFK-1504).

## 1.8 VersaMax Modules

VersaMax IO and option modules are approximately 110mm (4.3in) by 66.8mm (2.63in) in size. Modules can be mounted either horizontally or vertically on several types of available I/O Carriers. Modules are 50mm (1.956 in) in depth, not including the height of the carrier or the mating connectors.

**Figure 5: VersaMax Module**



VersaMax I/O modules are described in the VersaMax Modules, Power Supplies, and Carriers User's Manual (GFK-1504).

**Note:** The I/O Station cannot include the following communication modules: IC200BEM002 (Profibus-DP) and IC200BEM103 (DeviceNet Master/Slave).

### Available I/O Modules

The following types of VersaMax I/O Modules are available:

<b>Discrete Input Modules</b>	
<b>Module</b>	<b>Part Number</b>
Input 120VAC 8 Point Grouped Module	IC200MDL140
Input 240VAC 8 Point Grouped Module	IC200MDL141
Input 120VAC 8 Point Isolated Module	IC200MDL143
Input 240VAC 4 Point Isolated Module	IC200MDL144
Input 120VAC (2 Groups of 8) 16-Point Module	IC200MDL240
Input 240VAC (2 Groups of 8) 16-Point Module	IC200MDL241
Input 120VAC 16 Point Isolated Module	IC200MDL243
Input 240VAC 8 Point Isolated Module	IC200MDL244
Input 125VDC Positive/Negative Logic Grouped 8-Point Module	IC200MDL631
Input 125VDC Positive/Negative Logic Grouped 16-Point Module	IC200MDL632
Input 48VDC Positive/Negative Logic Grouped 16-Point Module	IC200MDL635
Input 48VDC Positive/Negative Logic Grouped 32-Point Module	IC200MDL636
Input 24VDC Positive/Negative Logic (2 Groups of 8) 16 Point Module	IC200MDL640
Input 5/12VDC (TTL) Positive/Negative Logic 16 Point Module	IC200MDL643
Input 5/12VDC (TTL) Positive/Negative Logic Grouped 32-Point Module	IC200MDL644
Input 24VDC Positive/Negative Logic (4 Groups of 8) 32 Point Module	IC200MDL650
<b>Discrete Output Modules</b>	
Output 120VAC 0.5A per Point Isolated 8 Point Module	IC200MDL329
Output 120VAC 0.5A per Point Isolated 16 Point Module	IC200MDL330
Output 120VAC 2.0A per Point Isolated 8 Point Module	IC200MDL331
Output 24VDC Positive Logic 2.0A per Point (1 Group of 8) w/ESCP 8 Point	IC200MDL730
Output 12/24VDC Positive Logic 0.5A per Point (1 Group of 16) 16 Point	IC200MDL740
Output 24VDC Positive Logic 0.5A per Point (1 Group of 16) w/ESCP 16	IC200MDL741
Output 24VDC Positive Logic 0.5A per Point (2 Groups of 16) w/ESCP 32	IC200MDL742
Output 5/12/24VDC Negative Logic 0.5A per Point (1 Group of 16) 16 Point	IC200MDL743
Output 5/12/24VDC Negative Logic 0.5A per Point (2 Groups of 16) 32	IC200MDL744
Output 12/24VDC Positive Logic 0.5A per Point (2 Groups of 16) 32 Point	IC200MDL750
Output Relay 2.0A per Point Isolated Form A 8 Point Module	IC200MDL930
Output Relay 2.0A per Point Isolated Form A 16 Point Module	IC200MDL940
<b>Discrete Mixed I/O Modules</b>	
Mixed 24VDC Positive Logic Input Grouped 20 Point/Output Relay 2.0A per Point Grouped 12 Point Module	IC200MDD840
Mixed 24VDC Positive Logic Input 20 Point/Output 12 Point / (4) High-Speed Counter, PWM, or Pulse Train Configurable Points	IC200MDD841
Mixed 16 Point Grouped Input 24VDC Pos/Neg Logic/16 Pt Grouped Output 24VDC Pos. Logic 0.5A w/ESCP	IC200MDD842
Mixed 24VDC Positive Logic Input Grouped 10 Point / Output Relay 2.0A per Point 6 Point Module	IC200MDD843
Mixed 24 VDC Pos/Neg Logic Input Grouped 16 Point / Output 12/24VDC Pos. Logic 0.5A 16-Point Module	IC200MDD844

<b>Discrete Mixed I/O Modules</b>	
<b>Module</b>	<b>Part Number</b>
Mixed 16 Point Grouped Input 24VDC Pos/Neg Logic/8 Pt Relay Output 2.0A per Pt Isolated Form A	IC200MDD845
Mixed 120VAC Input 8 Point/Output Relay 2.0A per Point 8 Point Module	IC200MDD846
Mixed 240VAC Input 8 Point/Output Relay 2.0A per Point 8 Point Module	IC200MDD847
Mixed 120VAC Input 8 Point/Output 120VAC 0.5A per Point Isolated 8 Point Module	IC200MDD848
Mixed 120VAC In Isolated 8 Point/Output Relay 2.0A Isolated 8 Point Module	IC200MDD849
Mixed 240VAC In Isolated 4 Point/Output Relay 2.0A Isolated 8 Point Module	IC200MDD850
Mixed, Output 12/24VDC Pos. Grouped 16 Pts/Input 5/12VDC Pos/Neg Grp16 Pts	IC200MDD851
<b>Analog Input Modules</b>	
Analog Input Module, 12 Bit Voltage/Current 4 Channels	IC200ALG230
Analog Input Module, 16 Bit Voltage/Current, 1500VAC Isolation, 8 Channels	IC200ALG240
Analog Input Module, 12 Bit Voltage/Current 8 Channels	IC200ALG260
Analog Input Module, 15-Bit Voltage Differential 8 Channels	IC200ALG261
Analog Input Module, 15-Bit Current Differential 8 Channels	IC200ALG262
Analog Input Module, 15 Bit Voltage 15 Channels	IC200ALG263
Analog Input Module, 15 Bit Current 15 Channels	IC200ALG264
Analog Input Module, 15 Bit Voltage 15 Channels, Enhanced Overvoltage	IC200ALG265
Analog Input Module, 15 Bit Current 15 Channels, Enhanced Overvoltage	IC200ALG266
Analog Input Module, 16 Bit RTD, 4 Channels	IC200ALG620
Analog Input Module, 16 Bit Thermocouple, 7 Channels	IC200ALG630
<b>Analog Output Modules</b>	
Analog Output Module, 12 Bit Current, 4 Channels	IC200ALG320
Analog Output Module, 12 Bit Voltage 4 Channels. 0 to +10VDC Range	IC200ALG321
Analog Output Module, 12 Bit Voltage 4 Channels. -10 to +10VDC Range	IC200ALG322
Analog Output Module, 13-Bit Voltage 8 Channels	IC200ALG325
Analog Output Module, 13-Bit Current 8 Channels	IC200ALG326
Analog Output Module, 13-Bit Voltage 12 Channels	IC200ALG327
Analog Output Module, 13 Bit Current 12 Channels	IC200ALG328
Analog Output Module, 13-Bit Voltage 8 Channels	IC200ALG325
Analog Output Module, 16 Bit Voltage/Current, 1500VAC Isolation, 4	IC200ALG331
<b>Analog Mixed I/O Modules</b>	
Analog Mixed Module, Input Current 4 Channels, Output Current 2	IC200ALG430
Analog Mixed Module, 0 to +10VDC Input 4 Channels, Output 0 to +10VDC 2 Channels	IC200ALG431
Analog Mixed Module, 12 Bit -10 to +10VDC, Input 4 Channels/Output -10 to +10VDC 2 Channels	IC200ALG432

## 1.9 Carriers

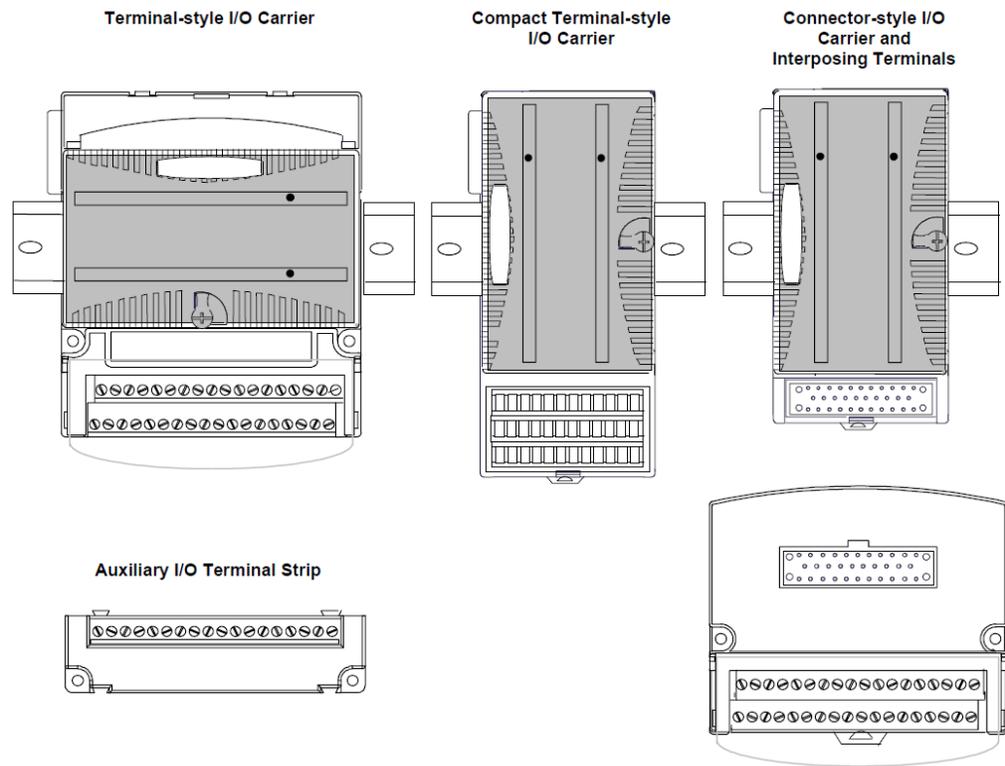
Carriers provide mounting, backplane communications, and field wiring connections for all types of VersaMax modules. I/O modules can be installed on carriers or removed without disturbing field wiring.

There are three basic I/O Carrier types:

- Terminal-style I/O carriers. Modules mount parallel to the DIN rail.
- Compact Terminal-style I/O Carriers. Modules mount perpendicular to the DIN rail.
- Connector-style I/O Carriers. Modules mount perpendicular to the DIN rail. These carriers are normally used with Interposing I/O Terminals as illustrated below. Other terminal types are also available.

See the VersaMax Modules, Power Supplies, and Carriers User's Manual (GFK-1504) for information about VersaMax I/O Carriers and Terminal Strips.

**Figure 6: VersaMax Carrier Styles**



### Available I/O Carriers and Terminal Strips

The following types of I/O Carriers, terminals, and cables are available:

<b>Terminal-Style I/O Carriers</b>	
<b>Part Description</b>	<b>Part Number</b>
Barrier-Style Terminal I/O Carrier	IC200CHS001
Box-Style Terminal I/O Carrier	IC200CHS002
Spring-Style Terminal I/O Carrier	IC200CHS005
<b>Compact Terminal-Style I/O Carriers</b>	
Compact Box-Style I/O Carrier	IC200CHS022
Compact Spring-Style I/O Carrier	IC200CHS025
<b>Connector-Style I/O Carrier</b>	
Connector-Style I/O Carrier	IC200CHS003
<b>Interposing Terminals for use with Connector-Style Carrier</b>	
Barrier-Style Interposing I/O Terminals	IC200CHS011
Box-Style Interposing I/O Terminals	IC200CHS012
Thermocouple-Style Interposing I/O Terminals	IC200CHS014
Spring-Style Interposing I/O Terminals	IC200CHS015
Disconnect-Style Interposing I/O Terminals, Main Base	IC200CHS101
Disconnect-Style Interposing I/O Terminals, Expansion Base	IC200CHS102
Relay-Style Interposing I/O Terminals, Main Base	IC200CHS111
Relay-Style Interposing I/O Terminals, Expansion Base	IC200CHS112
Fuse-Style Interposing I/O Terminals, Main Base	IC200CHS121
Fuse-Style Interposing I/O Terminals, Expansion Base	IC200CHS122
<b>Cables for use with Connector-Style I/O Carriers</b>	
2 connectors, 0.5m, no shield	IC200CBL105
2 connectors, 1.0m, no shield	IC200CBL110
2 connectors, 2.0m, no shield	IC200CBL120
1 connector, 3.0m, no shield	IC200CBL230
<b>Auxiliary I/O Terminal Strips for use with Terminal-style I/O Carriers and Interposing Terminals</b>	
Barrier-Style Auxiliary I/O Terminal Strip	IC200TBM001
Box-Style Auxiliary I/O Terminal Strip	IC200TBM002
Spring-Style Auxiliary I/O Terminal Strip	IC200TBM005
<b>Other Carriers</b>	
Communications Carrier	IC200CHS006
Power Supply Booster Carrier	IC200PWB001

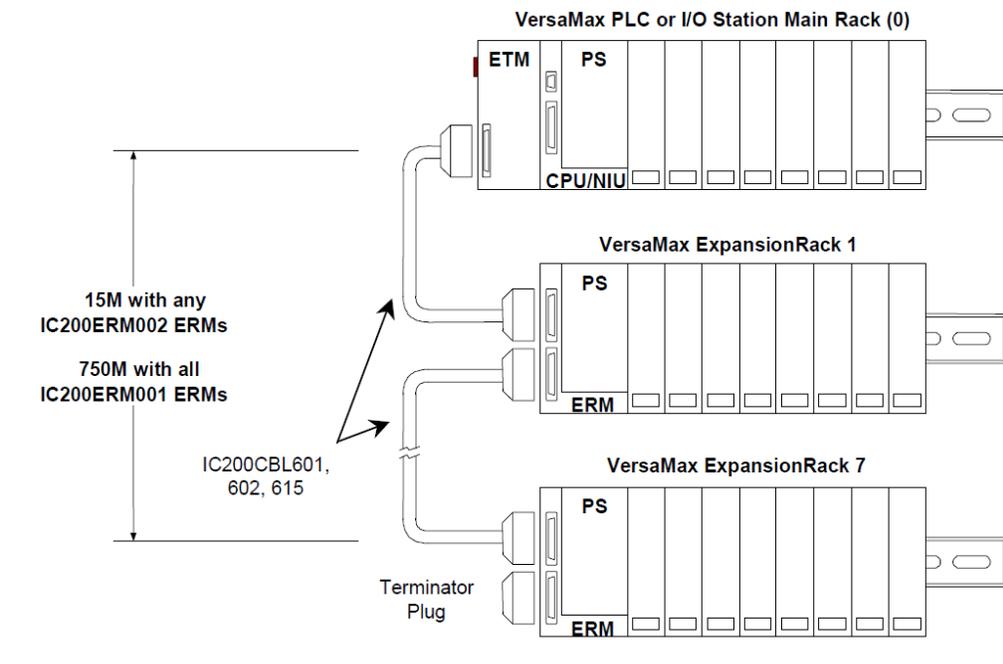
## 1.10 Expansion Modules

Expansion modules can be used to extend the I/O Station and add more modules.

To use an expansion rack with a Genius NIU that is controlled by a Series 90-30 PLC, the 90-30 CPU must be model CPU366, 367, or 374 (any version) or 350, 352, 360, 363, 364, or 374, Release 10.0 or later. There are two basic types of VersaMax I/O expansion systems, Multi-Rack, and Two-Rack Local:

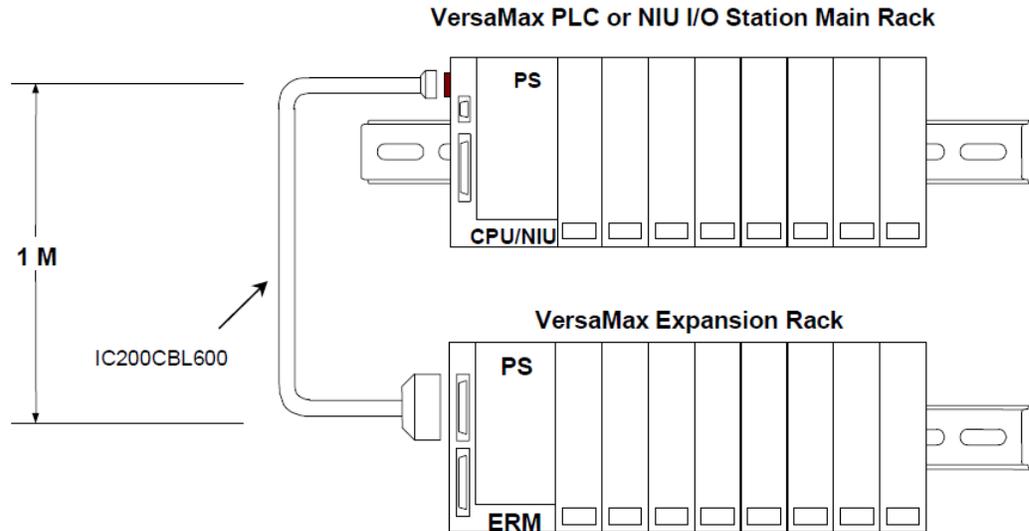
- **Multi-Rack:** A VersaMax PLC or NIU I/O Station with an Expansion Transmitter Module (IC200ETM001) and one to seven expansion “racks”, each with an Expansion Receiver Module (IC200ERM001 or IC200ERM002). If all the Expansion Receivers are the Isolated type (IC200ERM001), the maximum overall cable length is 750 meters. If the expansion bus includes any non-isolated Expansion Receivers (IC200ERM002), the maximum overall cable length is 15 meters.

**Figure 7: Example of Multi-Rack VersaMax Expansion Modules**



- **Two-Rack Local:** A PLC or NIU I/O Station connected directly to one expansion rack with a non-isolated Expansion Receiver Module (IC200ERM002). Maximum cable length is 1 meter.

**Figure 8: Example of Two-Rack Local VersaMax Expansion Modules**



**Available Expansion Modules**

The following Expansion Modules and related products are available:

<b>Expansion Modules</b>	
<b>Description</b>	<b>Part Number</b>
Expansion Transmitter Module	IC200ETM001
Expansion Receiver Module, Isolated	IC200ERM001
Expansion Receiver Module, Non-isolated	IC200ERM002
<b>Cables</b>	
Expansion Cable, 1 meter	IC200CBL601
Expansion Cable, 2 meters	IC200CBL602
Expansion Cable, 15 meters	IC200CBL615
Firmware Update Cable	IC200CBL002
Terminator Plug (included with ETM)	IC200ACC201
Connector Kit	IC200ACC302

See the VersaMax Modules, Power Supplies, and Carriers User’s Manual (GFK-1504) for information about VersaMax Expansion modules.

### VersaMax Modules for Expansion Racks

All types of VersaMax I/O and communications modules can be used in expansion racks. Some VersaMax analog modules require specific module revisions as listed below:

Module	Module Revision
IC200ALG320	B or later
IC200ALG321	B or later
IC200ALG322	B or later
IC200ALG430	C or later
IC200ALG431	C or later
IC200ALG432	B or later

## 1.11 VersaMax General Product Specifications

Environmental		
Specification	Standard	Range/Description
Vibration	IEC68-2-6	1G @57-150Hz, 0.012in p--p @10-57Hz
Shock	IEC68-2-27	15G, 11ms
Operating Temp.		0 deg C to +60 deg C ambient -40 deg C to +60 deg C ambient for I/O carriers, interposing I/O terminals, and auxiliary I/O terminals
Storage Temp		-40 deg C to +85 deg C
Humidity		5% to 95%, non-condensing
Enclosure Protection	IEC529	Steel cabinet per IP54: protection from dust & splashing water
EMC Emission		
Radiated, Conducted	CISPR 11/EN 55011	Industrial Scientific & Medical Equipment (Group 1, Class A)
	CISPR 22/EN 55022	Information Technology Equipment (Class A)
	FCC 47 CFR 15	Referred to as FCC part 15, Radio Devices (Class A)

<b>EMC Immunity</b>		
Electrostatic Discharge	EN 61000-4-2	8KV Air, 4KV Contact
RF Susceptibility	EN 61000-4-3	10V /m, 80Mhz to 1000Mhz, 80% AM
	ENV 50140/ENV 50204	10Vrms/m, 900MHz +/-5MHZ 100%AM with 200Hz square wave
<b>EMC Immunity</b>		
<b>Specification</b>	<b>Standard</b>	<b>Range/Description</b>
Fast Transient Burst	EN 61000-4-4	2KV: power supplies, 1KV: I/O, communication
Surge Withstand	ANSI/IEEE C37.90a	Damped Oscillatory Wave: 2.5KV power supplies, I/O [12V-240V]; 1KV communication
	IEC255-4	Damped Oscillatory Wave: Class II, power supplies, I/O [12V-240V]
	EN 61000-4-5	2 kV cm(P/S); 1 kV cm (I/O and communication modules)
Conducted RF	EN 61000-4-6	10Vr , 0.15 to 80Mhz, 80%AM
<b>Isolation</b>		
Dielectric Withstand	UL508, UL840, IEC664	1.5KV for modules rated from 51V to 250V
<b>Power Supply</b>		
Input Dips, Variations	EN 61000-4-11	During Operation: Dips to 30% and 100%, Variation for AC +/-10%, Variation for DC +/-20%

## Section 2: Installation

This section gives instructions for installing the Network Interface Unit and the Genius® bus.

- Module clearance
- Thermal considerations
- Mounting instructions
- Panel-mounting
- Installing an Expansion Transmitter Module
- Installing an Expansion Receiver Module
- Installing Power Supply Modules
- Installing Additional Modules
- Setting the SBA and baud rate
- Special switch settings on the NIU
- Selecting a cable type
- Making bus connections
- Observing the LEDs
- CE Mark installation requirements

Additional installation instructions are located in the VersaMax Modules, Power Supplies, and Carriers Manual, GFK-1504.

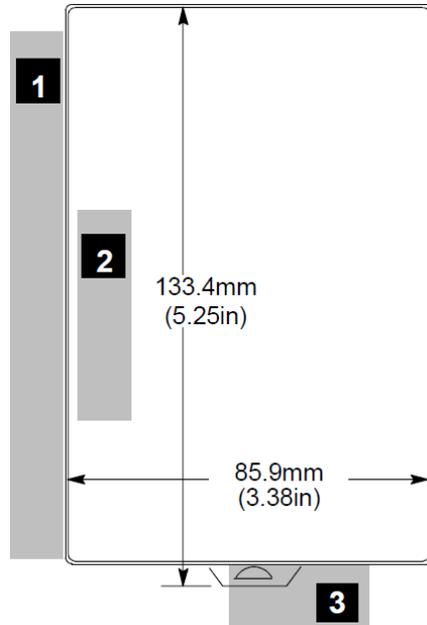
### **WARNING**

- Explosion hazard - substitution of components may impair suitability for Class I, Division 2;
  - Explosion hazard - when in hazardous locations, turn off the power before replacing or wiring modules; and
  - Explosion hazard - do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
-

## 2.1 Module Clearance

Maintain a clearance of 2 inches (5.1cm) above and below the equipment and 1 inch (2.54cm) to the left. Additional clearance requirements are shown below.

**Figure 9: Module Clearance**



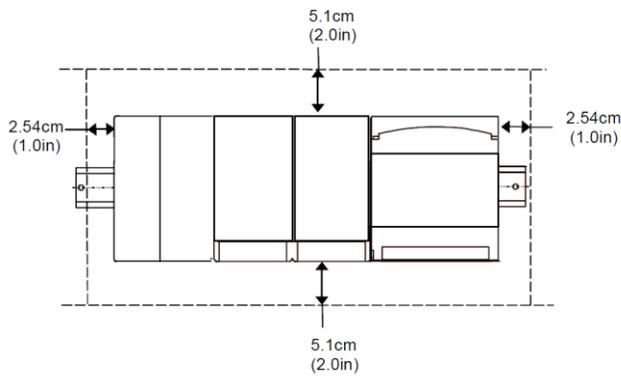
1. Allow sufficient finger clearance for opening the NIU door.
2. Allow adequate clearance for communications cables.
3. Allow adequate space for power wiring.

## 2.2 Thermal Considerations

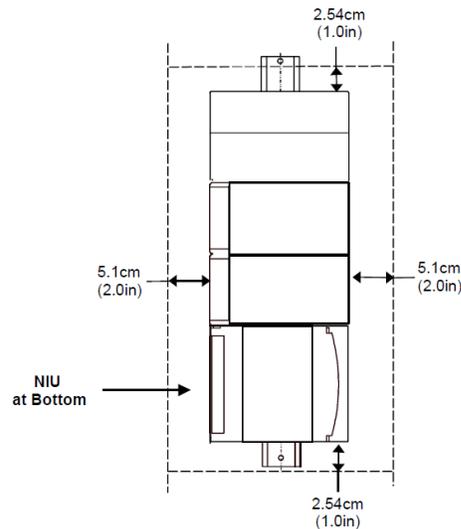
The thermal performance specified for VersaMax I/O modules requires a clearance of 2 inches (5.1cm) above and below the modules and 1 inch (2.54cm) on each side of the modules as shown below, regardless of the orientation of the DIN rail.

When using a vertical DIN rail, the NIU module must be installed at the bottom.

**Figure 10: VersaMax Thermal Clearances**



**Figure 11: VersaMax NIU Thermal Clearances**



## 2.3 Mounting Instructions

Each rack in a VersaMax I/O Station must be installed on a single section of 7.5mm X 35mm DIN rail. "Rack" is the term used for an NIU or Expansion Receiver, plus up to 8 physically connected I/O carriers. The first rack in a system is called Rack 0. If there are multiple expansion racks, Rack 0 also includes an Expansion Transmitter module installed in the leftmost position, before the NIU.

The DIN rail used in a VersaMax installation must be electrically grounded to provide EMC protection. The rail must have a conductive (unpainted) corrosion-resistant finish. DIN rails compliant with DIN EN50032 are preferred.

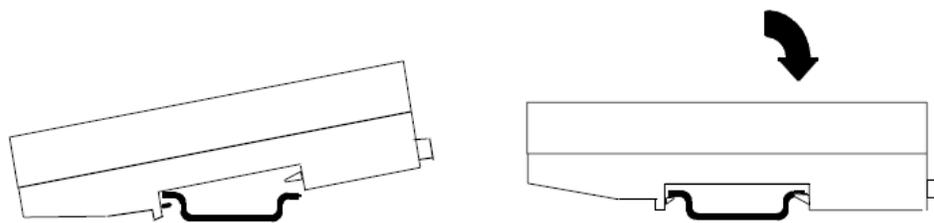
For vibration resistance, the DIN rail should be installed on a panel using screws spaced approximately 5.24cm (6 inches) apart. DIN-rail clamps (available as part number IC200ACC313) can also be installed at both ends of the station to lock the modules in position.

For applications requiring maximum resistance to mechanical vibration and shock, the NIU and DIN-rail-mounted carriers should also be mounted on the panel, as described on the next page.

The base snaps easily onto the DIN rail. No tools are required for mounting or grounding the rail.

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**Figure 12: Mounting a VersaMax Module**



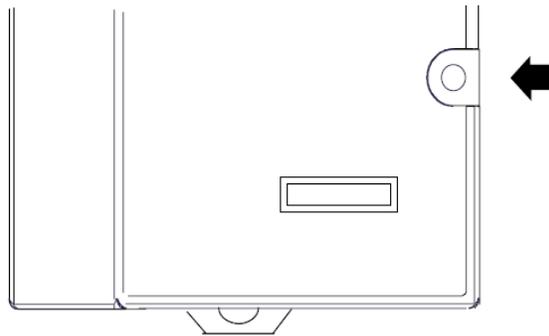
## 2.3.1 Removing the NIU from the DIN Rail

1. Turn off the power to the power supply.
2. If the NIU is attached to the panel with a screw remove the power supply module. Remove the panel-mount screw.
3. Slide the NIU along the DIN rail away from the other modules until the connector disengages.
4. With a small flathead screwdriver, pull the DIN rail latch tab outward while tilting the other end of the module down to disengage it from the DIN rail.

## 2.4 Panel-Mounting

For maximum resistance to mechanical vibration and shock, the DIN-rail-mounted module must also be installed on a panel. Using the module as a template, mark the location of the module's panel-mount hole on the panel. Drill the hole in the panel. Install the module using an M3.5 (#6) screw in the panel-mount hole.

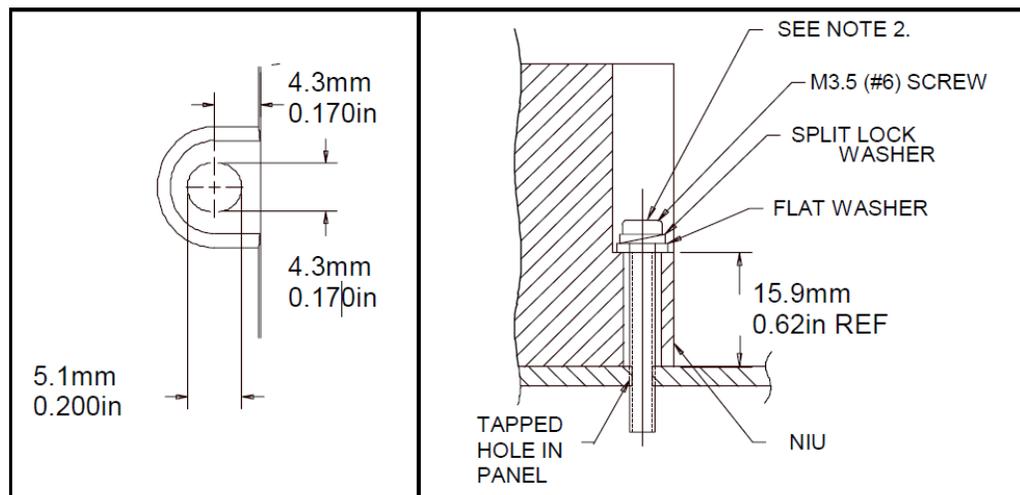
**Figure 13: VersaMax Panel-Mounting**



**Note:**

- Tolerances on all dimensions are  $\pm 0.13\text{mm}$  (0.005in) non-cumulative. 1-1.4Nm (10-12 in/lbs) of torque should be applied to M3.5 (#6-32) steel screw threaded into material containing internal threads and having a minimum thickness of 2.4mm (0.093in).

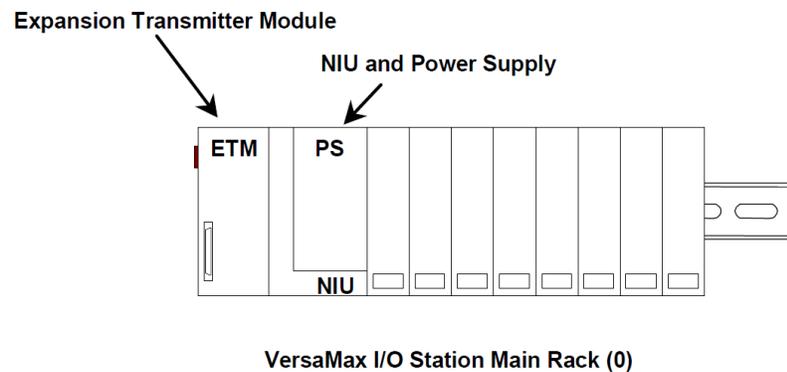
**Figure 14: Panel-Mounting Specifications**



## 2.5 Installing an Expansion Transmitter Module

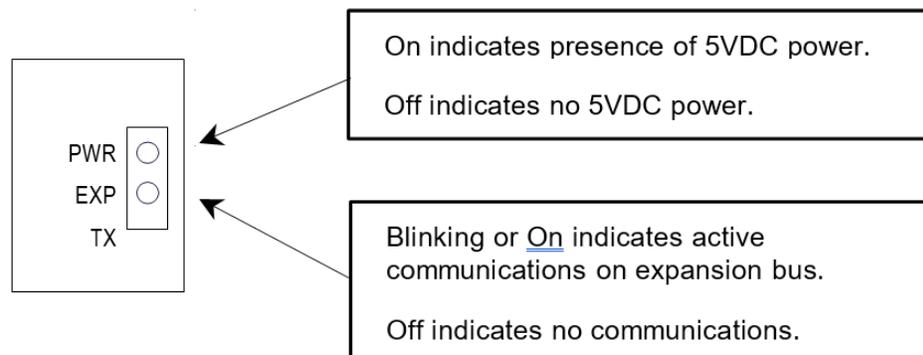
If the I/O Station will have more than one expansion rack or one expansion rack that uses an Isolated Expansion Receiver Module (IC200ERM001) as its interface to the expansion bus, an Expansion Transmitter Module must be installed to the left of the NIU. The Expansion Transmitter Module must be installed on the same section of the DIN rail as the rest of the modules in the main “rack” (rack 0).

**Figure 15: Expansion Transmitter Module Installation**



1. Make sure the rack power is off.
2. Attach the Expansion Transmitter to the DIN rail to the left of the NIU position.
3. Install the NIU as instructed. Connect the modules and press them together until the connectors are mated.
4. After completing any additional system installation steps, apply power and observe the module LEDs

**Figure 16: Power Indicators**



## 2.5.1 Removing an Expansion Transmitter Module

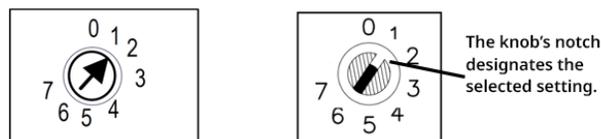
1. Make sure the rack power is off.
2. Slide module on DIN rail away from the NIU in the main rack.
3. Using a small screwdriver, pull down on the tab on the bottom of the module and lift the module off the DIN rail.

## 2.6 Installing an Expansion Receiver Module

An Expansion Receiver Module (IC200ERM001 or 002) must be installed in the leftmost slot of each VersaMax expansion “rack”.

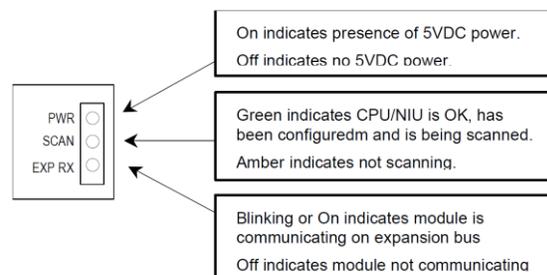
1. Insert the label inside the access door at the upper left corner of the module.
2. Attach the module to the DIN rail at the left end of the expansion rack.
3. Select the expansion rack ID (1 to 7) using the rotary switch under the access door at the upper left corner of the module. Duplicate Rack IDs are not permitted. In a single-ended expansion system, the receiver Rack ID must be set to 1.

**Figure 17: Old Rotary (Left) and New Rotary (Right) Switches**



4. Install the Power Supply module on top of the Expansion Receiver.
5. Attach the cables. If the system includes an Expansion Transmitter Module, attach the terminator plug to the EXP2 port on the last Expansion Receiver Module.
6. After completing any additional system installation steps, apply power and observe the module LEDs.

**Figure 18: Power Indicators**



## 2.6.1 Removing an Expansion Receiver Module

1. Make sure the rack power is off.
2. Un-install the Power Supply module from the Expansion Receiver Module.
3. Slide the Expansion Receiver Module on the DIN rail away from the other modules.
4. Using a small screwdriver, pull down on the tab on the bottom of the module and lift the module off the DIN rail.

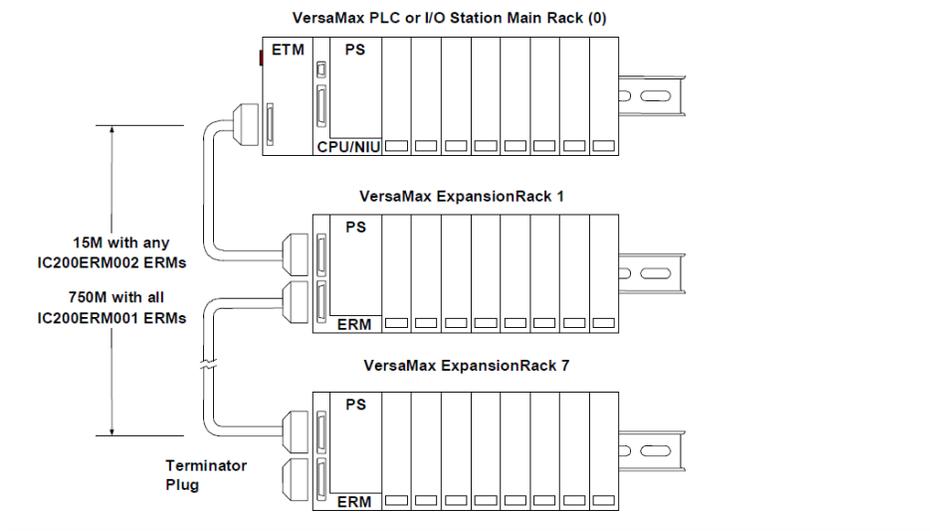
## 2.6.2 Expansion Rack Power Sources

Power for module operation comes from the Power Supply installed on the Expansion Receiver Module. If the expansion rack includes any Power Supply Booster Carrier and additional rack Power Supply, it must be tied to the same source as the Power Supply on the Expansion Receiver Module.

## 2.6.3 Connecting the Expansion Cable: RS-485 Differential

For a multiple-rack expansion system, connect the cable from the expansion port on the Expansion Transmitter to the Expansion Receivers as shown below. If all the Expansion Receivers are the Isolated type (IC200ERM001), the maximum overall cable length is 750 meters. If the expansion bus includes non-isolated Expansion Receivers (IC200ERM002), the maximum overall cable length is 15 meters.

**Figure 19: Connecting Expansion Cable(s)**

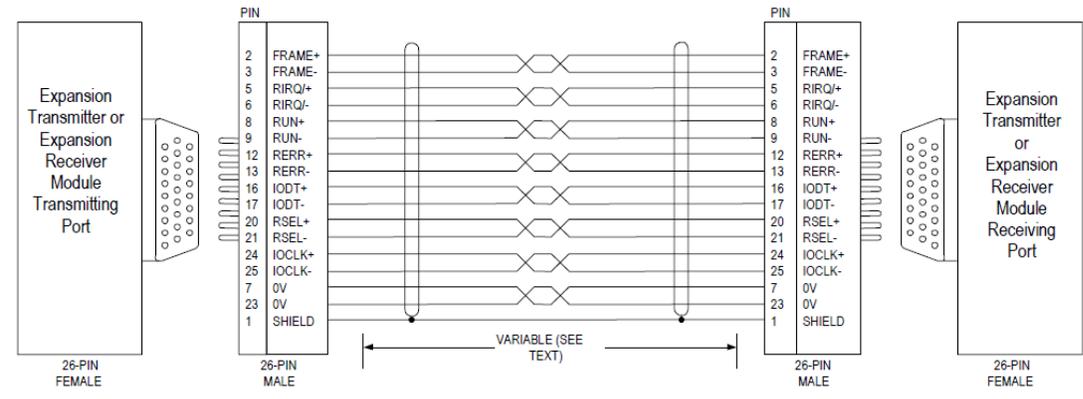


Install the Terminator Plug (supplied with the Expansion Transmitter module) into the lower port on the last Expansion Receiver. Spare Terminator Plugs can be purchased separately as part number IC200ACC201 (Qty 2).

**Note:** Do not disconnect an expansion cable while the system is operating. It will cause momentary disruptions in bus communications.

## RS-485 Differential Inter-Rack Connection (IC200CBL601, 602, 615)

**Figure 20: IC200CBL601, 602, 615 Differential Inter-Rack Connection**



### Building a Custom Expansion Cable

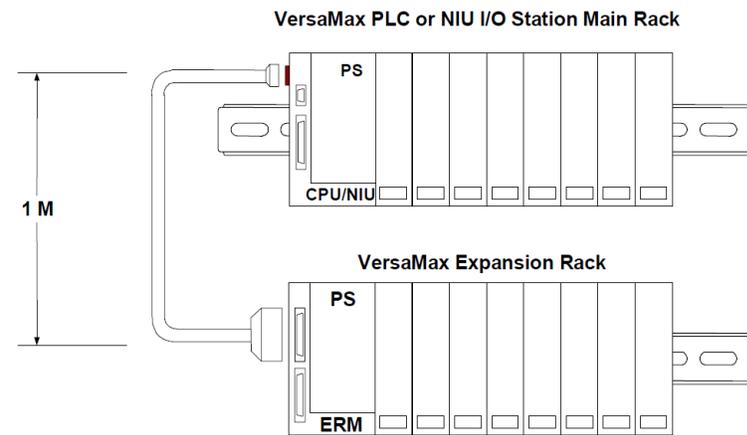
Custom expansion cables can be built using Connector Kit IC200ACC202, Crimper AMP 90800-1, and Belden 8138, Manhattan/CDT M2483, Alpha 3498C, or equivalent AWG #28 (0.089mm<sup>2</sup>) cable.

## 2.6.4 Connecting the Expansion Cable: Single-ended

For a system with one non-isolated expansion rack (IC200ERM002) and NO Expansion Transmitter, connect the expansion cable from the serial port on the VersaMax NIU to the Expansion Receiver as shown below. The maximum cable length is one meter. Cables cannot be fabricated for this type of installation; cable IC200CBL600 must be ordered separately.

**Note:** Do not disconnect an expansion cable while the system is operating. It will cause momentary disruptions in bus communications.

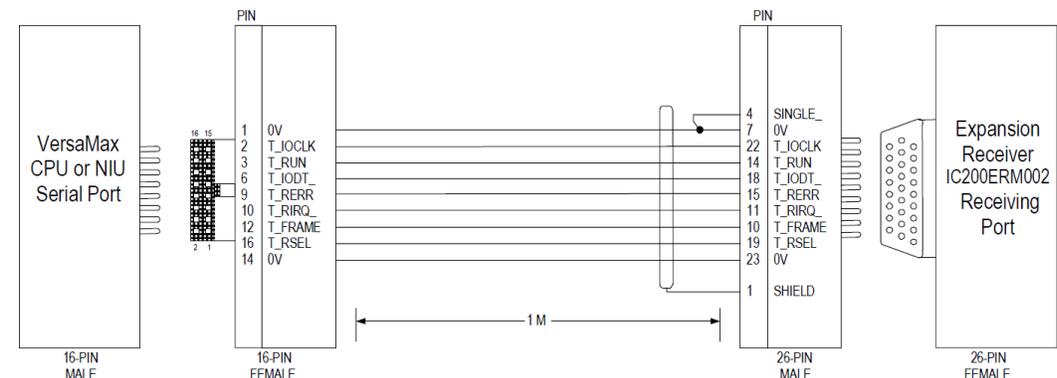
**Figure 21: Single-Ended Expansion Cable**



No Terminator Plug is needed in a single-ended installation; however, it will not impede system operation if installed.

### Single-Ended Inter-Rack Connection (IC200CBL600)

**Figure 22: IC200CBL600 Single-Ended Connection**



## Power Sources for Single-Ended Expansion Rack Systems

When operating the system in single-ended mode, the power supplies for the main rack and expansion rack must be fed from the same main power source. The main rack and expansion racks cannot be switched ON and OFF separately; either both must be ON or both must be OFF for proper operation.

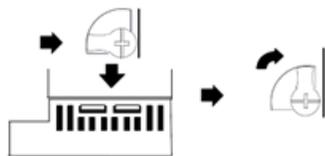
Power for module operation comes from the Power Supply installed on the Expansion Receiver Module. If the expansion rack includes any Power Supply Booster Carrier and additional rack Power Supply, it must be tied to the same source as the Power Supply on the Expansion Receiver Module.

## 2.7 Installing Power Supply Modules

Power supply modules install directly onto the NIU module, Expansion Receiver Modules, and supplementary power supply carriers. The power supply provides +5 V and +3.3 V to downstream modules through the mating connector. The number of modules that can be supported depends on the power requirements of the modules. Additional booster power supplies can be used as needed to meet the power needs of all modules. The configuration software provides power calculations with a valid hardware configuration. If a rack includes more than one power supply, additional power supplies must be installed so that they can be turned at the same time as the main power supply.

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**Figure 23: Power Supply Installation**



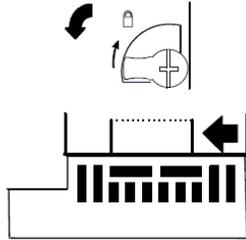
1. The latch on the power supply must be in the unlocked position.
2. Align the connectors and the latch post and press the power supply module down firmly, until the two tabs on the bottom of the power supply click into place. Be sure the tabs are fully inserted in the holes in the bottom edge of the NIU, ERM, or carrier.
3. Turn the latch to the locked position to secure the power supply.



### Removing the Power Supply

Exercise care when working around operating equipment. Devices may become very hot and could cause injury.

**Figure 24: Power Supply Removal**



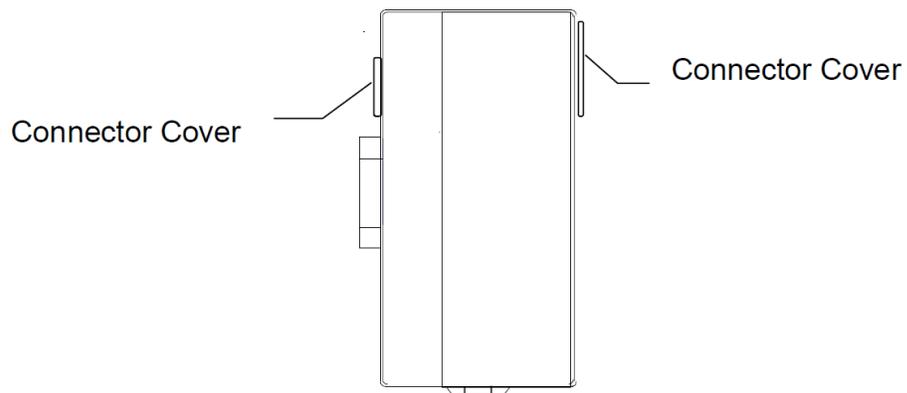
1. Remove power.
2. Turn the latch to the unlocked position as illustrated.
3. Press the flexible panel on the lower edge of the power supply to disengage the tabs on the power supply from the holes in the carrier.
4. Pull the power supply straight off.

## 2.8 Installing Additional Modules

Before joining carriers to the NIU, remove the connector cover on the righthand side of the NIU. Do not discard this cover; you will need to install it on the last carrier. It protects the connector pins from damage and ESD during handling and use.

Do not remove the connector cover on the left-hand side.

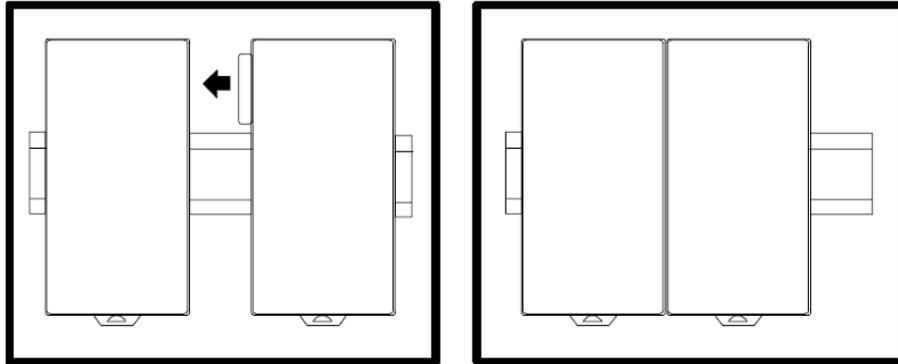
**Figure 25: Module Connection Covers**



Install additional modules by mounting modules on their carriers and sliding them along the DIN rail to fully engage the connectors in the sides of the carriers.

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**Figure 26: Connecting Additional Modules**



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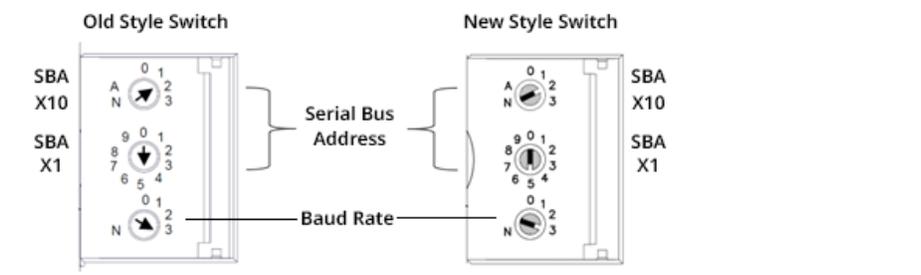
Hot insertion of modules in an I/O Station is permitted. However, if an I/O Station is part of a Genius Modular Redundancy system, hot insertion/removal of I/O modules is not recommended.

If the Enhanced Diagnostics feature of the Genius NIU is configured as Enabled, hot insertion/removal of I/O modules is prohibited.

## 2.9 Setting the SBA and Baud Rate

1. Open the clear protective door by pulling upward at the indentation in the side of the NIU.
2. Use a 2.44 mm (3/32 in) flat screwdriver to adjust the rotary switches. (Refer to Section 2.10, *Special Switch Settings on the NIU* if the NIU is being configured using datagrams or for information about upgrading the NIU firmware).

**Figure 27: Setting SBA and Baud Rate**



3. Select the serial bus address with the two upper rotary switches, SBA X10 (for the tens digit) and SBA X1 (for the ones digit). Each device on a bus must have a unique serial bus address in the range of 0 - 31.
4. Select the baud rate to match that used by the other devices on the bus by setting the bottom rotary switch: (3) 153.6 Kbaud extended, (2) 153.6 Kbaud standard, (1) 76.8 Kbaud, or (0) 38.4 Kbaud.
5. Cycle power to the NIU after changing the switch settings.

## 2.9.1 Selecting a Baud Rate

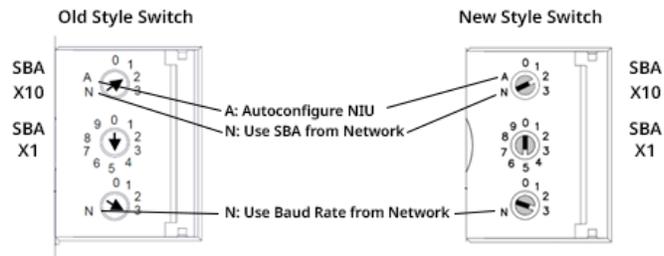
- All devices on a bus must use the same baud rate.
- If the cable length is between 4500 and 7500 feet, you must select 38.4 Kbaud. This data rate only supports a maximum of 16 devices on the bus.
- If the cable length is between 3500 and 4500 feet, select 76.8 Kbaud.
- If cable length is between 2000 and 3500 feet, select 153.6 Kbaud extended.
- If the cable length is less than 2000 feet, either 153.6 Kbaud standard or 153.6 Kbaud extended can be used. 153.6 Kbaud extended is recommended, especially if the system will include a dual bus. In noisy environments, 153.6 Kbaud extended provides improved noise immunity with little effect on bus scan time.
- The selection of an appropriate baud rate for the system may also be determined by the type of cable used. For more information, see [Selecting a Cable Type](#).

## 2.10 Special Switch Settings on the NIU

The lettered positions of the rotary switches can optionally be used to:

- Use a serial bus address that has been sent from the network.
- Use a baud rate that has been sent from the network.
- Re-enable autoconfiguration.

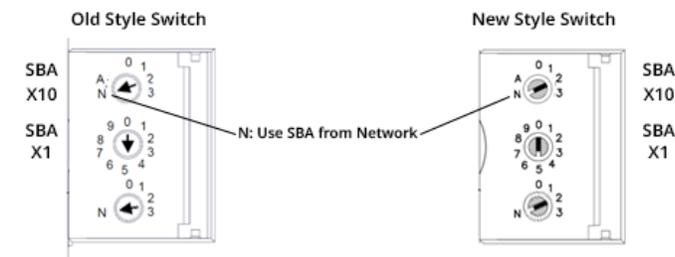
**Figure 28: NIU Special Switch Settings**



### 2.10.1 Using a Network Serial Bus Address

To use a Serial Bus Address previously received via a Set SBA datagram from the network instead of the switch settings, set the upper switch (SBAx10) to the N (network) position and cycle power to the NIU

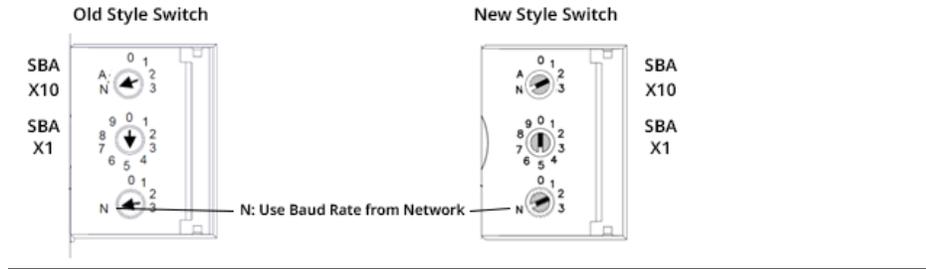
**Figure 29: Network Serial Bus**



## 2.10.2 Using the Network Baud Rate

To use a baud rate previously received via Set Baud Rate datagram from the network, set the lower switch (Baud Rate) to the N (Network) position and cycle power to the NIU.

**Figure 30: Network Baud Rate**

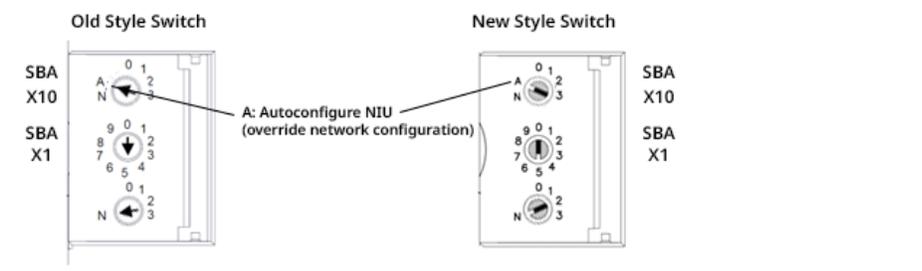


## 2.10.3 Overriding a Network Configuration

The NIU can also be configured via a message from the network. A network configuration can be set up to deliberately disable the auto-configuration function. If autoconfiguration has previously been disabled by a network configuration, you can restore the autoconfiguration function by following the steps below.

1. Set the upper SBA select switch (SBAX10) on the NIU to the A position.

**Figure 31: Overriding a Network Configuration**



2. Cycle power.
3. Reset the upper SBA switch to select the tens digit of the SBA.
4. Cycle power again.

Changing the SBA to a normal SBA does not disable autoconfiguration again. Once autoconfiguration has been enabled, it cannot be disabled manually. A configuration message sent to the NIU over the network or from the configuration tool disables autoconfiguration.

## 2.10.4 Re-enabling Network Configuration

To re-enable a network configuration that has been overridden as described above:

1. Set the SBA select switches on the NIU to a valid address between 0 and 31.
2. Cycle power.

## 2.11 Selecting a Cable Type

Proper cable selection is critical to the successful operation of the system.  
Each bus in the system can be any cable type listed in the table below.

Cable # & Make	NEC (USA) Type	Outer Diameter	Terminating Resistor* -10%to+20% 1/2 Watt	Number of Conductors/ AWG	Dielectric Voltage Rating	Ambient Temp Rating	Maximum Length Cable Run, feet/meters at the baud rate			
							153.6s	153.6e	76.8	38.4 •
(A)9823 (C)4596 (M)M3924	none CL2 CM	.350in 8.89mm	150 ohms	2 / #22	30v	60°C	2000ft 606m	3500ft 1061m	4500ft 1364m	7500ft 2283m
(B)89182	CL2P	.322in 8.18mm	150 ohms	2 / #22	150v	200°C	2000ft 606m	3500ft 1061m	4500ft 1364m	7500ft 2283m
(B)9841 (M)M3993	CM CL2	.270in 6.86mm	120 ohms	2 / #24	30v	80°C	1000ft 303m	1500ft 455m	2500ft 758m	3500ft 1061m
(A)9818C (B)9207 (M)M4270	CL2 CM CM	.330in 8.38mm	100 ohms	2 / #20	300v	80°C	1500ft 455m	2500ft 758m	3500ft 1061m	6000ft 1818m
(A)9109 (B)89207 (C)4798 (M)M4427 0	CL2P CM * CMP	.282in 7.16mm	100 ohms	2 / #20	150v	200°C	1500ft 455m	2500ft 758m	3500ft 1061m	6000ft 1818m
(A)9818D (B)9815	none *	.330in 8.38mm	100 ohms	2 / #20			1500ft 455m	2500ft 758m	3500ft 1061m	6000ft 1818m
(O)911264 **	none	.260in 6.60 mm	100 ohms	2 / #22 flexing	250V	80°C	1500ft 455m	2000ft 606m	3000ft 909m	4500ft 1364m
(E)532185 BBDN	CM	approx .50in (12.7mm)	100 ohms	4 pairs #24 (solid)	>150V	80°C	1500ft 455m	2000ft 606m	3000ft 909m	4500ft 1364m
(A)9818 (B)9855 (M)M4230	* CM CM	.315in 8.00mm	100 ohms	4 (two pairs) #22	150v	60°C	1200ft 364m	1700ft 516m	3000ft 909m	4500ft 1364m
(A)9110 (B)89696 (B)89855	none CMP CMP	.274in 6.96mm	100 ohms	4 (two pairs) #22	150v	200°C	1200ft 364m	1700ft 516m	3000ft 909m	4500ft 1364m

Cable # & Make	NEC (USA) Type	Outer Diameter	Terminating Resistor* -10%to+20% 1/2 Watt	Number of Conductors/ AWG	Dielectric Voltage Rating	Ambient Temp Rating	Maximum Length Cable Run, feet/meters at the baud rate			
							153.6s	153.6e	76.8	38.4 •
(A)9814C	none	.243in	75 ohms	2 / #20	150v	60°C	800ft	1500ft	2500ft	3500ft
(B)9463 (M)M4154	CM CL2	6.17mm					242m	455m	758m	1061m
(A)5902C	none	.244in	75 ohms	4 (two pairs)	300v	80°C	200ft	500ft	1200ft	2500ft
(B)9302 (M)M1700 2	CM CM	6.20mm		#22			60m	152m	333m	758m

A = Alpha, B = Belden, C = Consolidated, E = Essex, M = Manhattan, O = Olflex  
 • = Limited to 16 taps at 38.4 Kbaud  
 \* = not known  
 \*\*= Suitable for applications requiring high flexibility, continuous flex, or vibration

NEC classes are based on data obtained from manufacturers and are subject to change. CANADIAN CEC codes are similar. Other countries may vary.

The serial bus can be treated as a Class 2 circuit when appropriate wiring practices are followed. Maximum available bus lengths may be affected when installation requires the high voltage CM (Communications) rating. CM types can replace CL2, but not vice versa.

Do not mix cables of different impedance, regardless of cable run length. Do not mix cable types in long and/or noisy installations. Other, small-size twisted pair shielded wire of unspecified impedance can be used for short runs of 50 feet or less, using 75-ohm terminations. The selection of wire type may be limited by local and national codes and industry standards. Consult the cable manufacturer to determine the cable's suitability for a particular type of installation.

Conservative wiring practices and national and local codes require physical separation between control circuits and power distribution or motor power. Refer to sections 430 and 725 of the National Electric Code.

## 2.11.1 Using Other Cable Types

The cable types listed in the preceding table are recommended. If the cable types listed above are not available, the cable selected must meet the following guidelines.

1. High-quality construction. Most important is the uniformity of cross-section along the length of the cable. A poor-quality cable may cause signal distortion, and increase the possibility of damage during installation.
2. Precision-twisted shielded wire of EIA RS422 standard type, having a uniform number of twists per unit of length. This type of cable may also be listed as a twin axial cable, data cable, or computer cable.
3. Relatively high characteristic impedance; 100 to 150 ohms is best; 75 ohms is the minimum recommended.
4. The low capacitance between wires is typically less than 20pF/foot (60pF/meter). This may be accomplished by inner dielectrics of foamed type, usually, polypropylene or polyethylene, having a low dielectric constant. Alternatively, the conductors may be spaced relatively far apart. Lower impedance types have smaller cross-sections and provide easier wiring for shorter total transmission distances.
5. Shield coverage of 95% or more. Solid foil with an overlapped folded seam and drain wire is best. Braided copper is less desirable; spiral wound foil is least desirable.
6. An outer jacket that provides appropriate protection, such as water, oil, or chemical resistance. While PVC materials can be used in many installations, Teflon, polyethylene, or polypropylene are usually more durable.
7. Electrical characteristics: cable manufacturers' information about pulse rise time and NRZ data rate is useful for comparing cable types. The Genius bit consists of three AC pulses; the equivalent NRZ bit rate is about three times as great.

For assistance in selecting a specific cable type, please consult your local Emerson application engineer.

## 2.11.2 Bus Length

The maximum bus length for shielded, twisted-pair cable is 7500 feet. Some cable types are restricted to shorter bus lengths. In turn, the bus length determines which baud rate may be selected. Refer to Section 2.9.1, *Selecting a Baud Rate*.

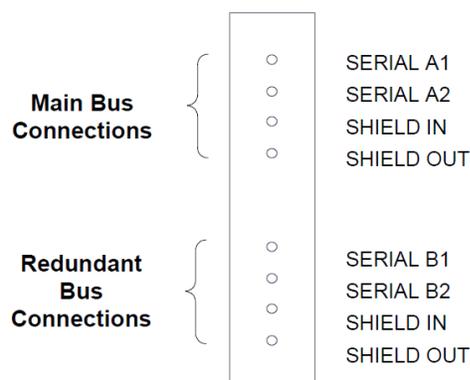
## 2.12 Making Bus Connections

The NIU has two bus connectors. The upper connector is for the main bus cable; it is always used. The lower connector is for an optional redundant bus cable. The NIU has a built-in bus-switching capability. In a dual-bus installation, do not attach a separate bus-switching device to the NIU. (The NIU can be located on a bus stub downstream of a bus-switching device, however).

The maximum exposed length of unshielded wires should be 5cm (2in). For protection, each shield drain wire should be insulated with spaghetti tubing to keep the Shield In and Shield Out wires from touching each other or the signal wires.

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**Figure 32: Bus Connections**



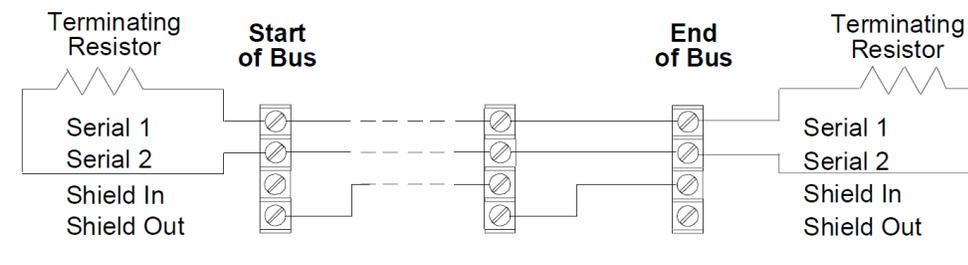
- 
1. Connect Serial 1 to the Serial 1 terminals of the previous and next devices.
  2. Connect Serial 2 to the Serial 2 terminals of the previous and next devices.
  3. Connect Shield In to Shield Out of the preceding device. Connect Shield Out to Shield In of the next device. If the NIU is the first device on a bus, Shield In can be left unconnected. If it is the last device on a bus, Shield Out can be left unconnected.

- When inserting two wires into the same terminal, the wire size must be 0.86mm<sup>2</sup> (18 AWG) or smaller. Both wires should be the same size and type. Do not mix stranded with solid wire in the same position.

## 2.12.1 Terminating a Bus

If the bus terminates at the NIU, connect a 75, 100, 120, or 150-ohm terminating resistor across Serial 1 and Serial 2. The use of a ferrule is recommended to crimp each resistor lead to the corresponding serial line. If ferrules are not used, twist each resistor lead with the corresponding serial line and solder them together before inserting the wires into the terminal.

**Figure 33: Terminating a Bus**



## 2.12.2 Lightning Transient Suppression

Running the bus cable outdoors or between buildings may subject it to lightning transients beyond the 1,500-volt transient rating of the system. Installing cable underground reduces the probability of a direct lightning strike. However, buried cables can pick up hundreds of amperes of current when lightning contacts the ground nearby.

Therefore, it is important to protect the installation by including surge protectors on underground data lines. The cable shields should be grounded directly. Surge suppressors and spark gaps should be used to limit the voltage that might appear on the signal lines. It is recommended to install two (only) silicon surge suppressors or spark gaps to control transients of 1 to 25 Kilovolts from 100 to 1000 amps or more. These devices should be installed close to the entrance of the bus to the outdoors.

In extreme situations, such as isolated power systems, additional protection against lightning damage should be provided. Such

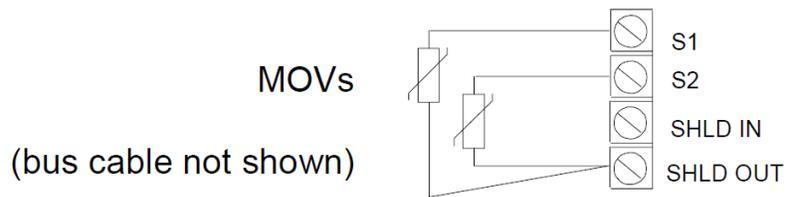
suppressors should be installed from incoming power leads to the ground.

### Adding Suppression at the Communications Line

For an individual NIU, suppression can be supplied by connecting two small metal oxide varistors (MOVs) from Serial 1 and Serial 2 to the Shield Out terminal:

---

**Figure 34: Adding Suppression at the Communications Line**



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Suitable MOVs include Harris part number V220MA2A, Panasonic ERZ-CO5FK221U, and Siemens 505K140. If necessary, higher energy-rated devices can also be used.

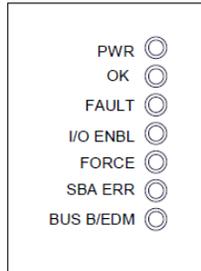
The use of a ferrule is recommended to crimp each MOV lead to the corresponding serial line. If ferrules are not used, twist each MOV lead with the corresponding serial line and solder them together before inserting the wires into the terminal block.

It is important to be sure that the MOV leads do not cause any shorts between the serial data and shield connectors.

## 2.13 Observing the LEDs

The LEDs indicate the presence of power and show the operating mode and status of the NIU.

**Figure 35: LED Panel**



LED	Description
PWR	Indicates that the NIU is receiving power.
OK	Indicates powerup diagnostics executed successfully.
FAULT	Is ON if there are one or more faults.
I/O ENBL	This bicolor LED is green if the I/O scan is enabled and output messages are being received from the bus. Otherwise, this LED is amber.
FORCE	Is ON if one of more I/O points is forced* or bus switching is forced.
SBA ERR	Is ON if a duplicate device SBA or no valid SBA is selected.
BUS B/EDM	Is ON if: <ul style="list-style-type: none"> <li>• the NIU has selected Genius bus B</li> <li>or</li> <li>• the NIU's Enhanced Diagnostics Mode is active</li> </ul>
* Forcing I/O references of the host controller only affects the input data received and/or the output data sent to the NIU. To force I/O points at the Genius NIU level, send one or more Genius datagrams to the NIU.	

## 2.14 CE Mark Installation Requirements

The following requirements for surge, electrostatic discharge (ESD), and fast transient burst (FTB) protection must be met for applications that require CE Mark listing:

- The VersaMax I/O Station is considered to be open equipment and should therefore be installed in an enclosure (IP54).
- This equipment is intended for use in typical industrial environments that utilize anti-static materials such as concrete or wood flooring. If the equipment is used in an environment that contains static material, such as carpets, personnel should discharge themselves by touching a safely grounded surface before accessing the equipment.
- If the AC mains are used to provide power for I/O, these lines should be suppressed before distribution to the I/O so that immunity levels for the I/O are not exceeded. Suppression for the AC I/O power can be made using line-rated MOVs that are connected line-to-line, as well as line-to-ground. A good high-frequency ground connection must be made to the line-to-ground MOVs.
- AC or DC power sources less than 50V are assumed to be derived locally from the AC mains. The length of the wires between these power sources and the PLC should be less than a maximum of approximately 10 meters.
- Installation must be indoors with primary facility surge protection on the incoming AC power lines.
- In the presence of noise, serial communications could be interrupted.

## Section 3: Operation

This section explains how the Genius NIU interacts with the modules in its station, how it stores data, and how it exchanges data on the Genius bus.

- NIU data memories
- Scanning inputs and outputs in the I/O Station
- Data transfer between the Genius NIU and the Genius bus
- Genius bus scan time
- Operation of the Genius NIU in Enhanced Diagnostics Mode

### Genius Hand-held Monitor Use

The Network Interface Unit does not have a Hand-held Monitor connection. A Genius Hand-held Monitor cannot be used to configure, monitor I/O, force I/O, or unforce I/O of a Genius NIU.

If there is a Hand-held Monitor elsewhere on the bus, it will display the presence of the NIU on the bus as an “unsupported device”.

## 3.1 NIU Data Memories

All of the data for the I/O station utilizes the NIU's four I/O data memories. The NIU has 128 bytes of memory available for each of the four types of data (discrete inputs and outputs, data types I and Q, and analog inputs and outputs, data types AI and AQ). During NIU configuration, data for individual modules are assigned to specific areas of this memory.

NIU Memory Type	Typically Used For	Amount Available in NIU
I	Discrete inputs, and status data from intelligent modules (each byte contains 8 input points)	128 bytes
Q	Discrete outputs, and fault clearing for intelligent modules (each byte contains 8 output points)	128 bytes
AI	Analog inputs (requires 2 bytes per channel)	128 bytes
AQ	Analog outputs (requires 2 bytes per channel)	128 bytes

Data always starts at the beginning of each table.

Each table starts at 1 internally. The combination of analog channels and discrete points must not exceed 128 bytes for inputs and 128 bytes for outputs.

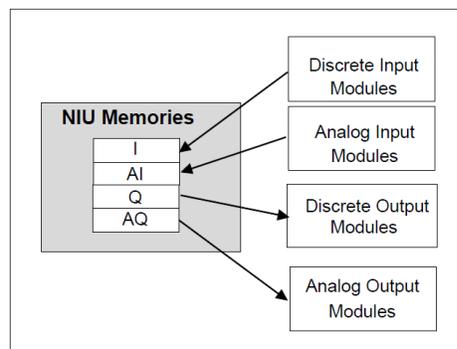
## 3.2 Scanning Inputs and Outputs in the I/O Station

The NIU performs a regular I/O scan of all inputs and outputs.

During each I/O scan, the NIU reads inputs from all discrete and analog input modules and places the data into its I and AI memories.

The NIU also sends outputs from its Q and AQ memories to all discrete and analog output modules.

**Figure 36: NIU Memories**



### Data Handling for Modules with More than One Data Type

Some modules have multiple types of I/O data. The NIU reads all input data from these modules and sends all their output data during every I/O scan.

## 3.3 Data Transfer Between the NIU and the Genius Bus

For each Genius bus scan, an NIU exchanges the following data with the bus:

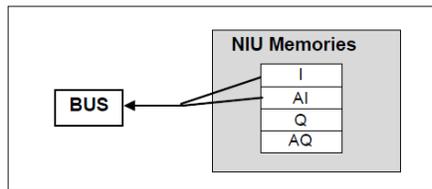
- It sends an input message with up to 128 bytes of discrete and/or analog inputs.
- It receives an output message with up to 128 bytes of discrete and/or analog outputs.

The exact length of these messages is determined by the network I/O map configured for the NIU.

### 3.3.1 Communications on the Genius Bus

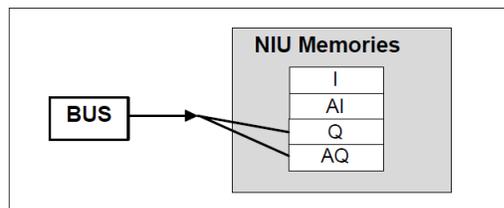
After completing its first input scan, the NIU starts broadcasting its input data onto the Genius bus. After the NIU completes a successful login on the bus, it starts accepting output data from the bus. The NIU communicates on the bus repetitively and asynchronously relative to the I/O scan. When the NIU receives the bus communications token, it sends the most recent data from its %I and %AI memories.

**Figure 37: NIU Memories Output to Bus**



The NIU receives new outputs from the bus when the PLC or computer bus controller has the communications token. The NIU places these outputs in its %Q and %AQ output tables.

**Figure 38: Bus Output to NIU Memories**

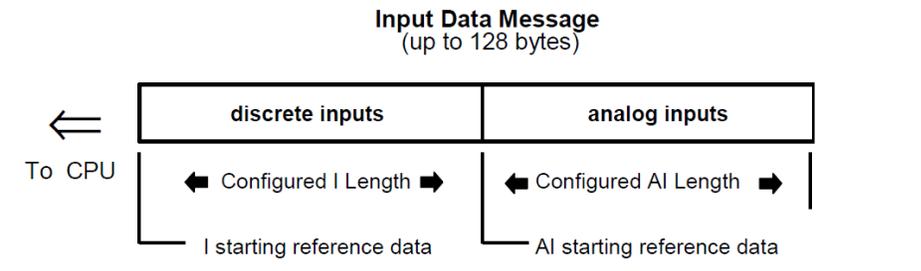


These outputs are then passed to the devices in the station on the NIU's next internal I/O scan.

## 3.3.2 Input Data Format

When the NIU takes its turn on the bus, it sends one input data message containing the latest values for all configured discrete inputs followed by all configured analog inputs. Because they are broadcast, they can be obtained by any bus controller on the bus.

**Figure 39: Input Data Format**



The data lengths are equal to the lengths of %I and %AI data configured in the NIU. Either length may be zero.

Discrete inputs appear in the input message in the same sequence as their assigned input references. Each discrete input module occupies one byte per eight circuits.

Analog inputs are also in the same sequence as their input references. Each analog input module occupies two bytes (one word) for each analog channel.

### Input Defaults

If an input module is removed or fails to operate correctly, its configured default state is substituted for actual input data. A diagnostic message is provided to indicate the loss of the module. Forced input data is not affected.

## I/O Data Handling by the PLC or Computer

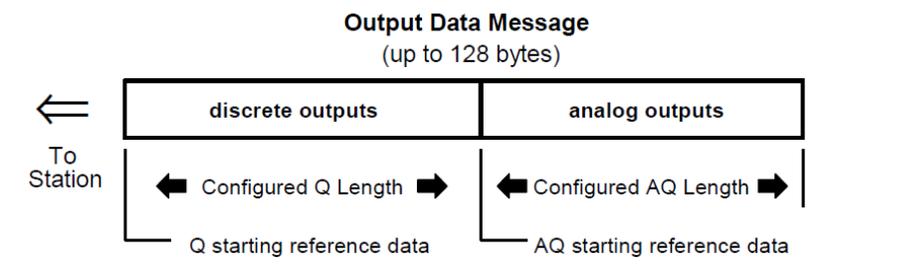
How a PLC or computer handles input data from the NIU depends on its type:

- A Series 90 PLC places the data in the %I and %AI references selected in the PLC's configuration for the corresponding serial bus address.
- A Series Six or Series Five PLC places the data into the I/O table or register memory. A beginning address in Series Six or Series Five I/O Table memory can be entered during station configuration.
- A host computer with a PCIM places the data into the input table segment that corresponds to the serial bus address (Device Number) of the NIU.

### 3.3.3 Output Data Format

Each time the PLC or computer that controls the NIU has the bus communications token, it sends fresh output data on the bus. Outputs for the NIU are sent in one output data message, with all configured discrete outputs followed by all configured analog outputs.

**Figure 40: Output Data Format**



The data lengths are equal to the configured lengths of %Q and %AQ data selected for the NIU (regardless of the host type or the amount of output data needed for the modules physically present in the station). Either length may be zero.

When generating the output data message, a Series 90 bus controller automatically places the %Q data ahead of the %AQ data. Other types of controllers must send an output message consisting of the correct number of bytes of discrete output data followed by the correct number of bytes of analog output data. The output data format shown above is required by the NIU. As soon as new output data is received, the NIU checks to be sure the data is error-free and of the correct length. After verifying the accuracy of the data, the NIU puts the data in its %Q and

%AQ tables. Each discrete output module receives one byte of data for every eight points. Each analog output module receives two bytes (one word) for each analog channel

## Output Defaults

During its first I/O scan after power-up, the GNIU sets each of its outputs to its configured default value (unless that output had been previously forced). Outputs that had been previously forced remain set to their forced values.

When the first error-free outputs message from a bus controller arrives, the NIU sets its I/O Enabled LED to green and updates each output module with the new output values (unless the output is currently forced).

When no redundancy features are configured for the GNIU, if the NIU loses contact with its host for three successive Genius bus scans, the NIU sets its I/O Enabled LED to amber and sets each of its outputs to its configured default value (unless the output is currently forced).

When redundancy features are configured (such as "Hot Standby", "Duplex", "GMR", "BSM Controller", or "BSM present"), the NIU operates as described in Section 6: Redundancy.

## 3.4 Genius Bus Scan Time

The Genius bus scan time depends on the number of devices on the bus as well as the amount of I/O traffic on the bus. The bus scan time may vary from 3- 400ms, but 20-30ms is typical. It cannot be less than 3ms.

The Genius bus scan time contribution for the NIU depends on its I/O data usage. The table below shows the scan time contribution, at each baud rate, for stations with a total of 16, 32, 64, 128, and 256 bytes, when the NIU receives outputs from only one bus controller at a time.

To find the exact scan time contribution for the NIU, follow the procedure on the next page.

Total Amount of Input and Output Data	Contribution time in ms at each baud rate			
	153.6 Kb std	153.6 Kb ext	76.8 Kb	38.4 Kb
16 bytes	2.09	2.16	3.83	7.16
32 bytes	3.24	3.31	6.12	11.74
64 bytes	5.52	5.60	10.69	20.89
128 bytes	10.10	10.17	19.85	39.20
256 bytes (fully loaded)	19.25	19.32	38.15	75.80

**Procedure for Estimating the GNIU’s Contribution to Genius Bus Scan Time**

1. Find the total number of input bytes and output bytes. (Each analog channel is 2 bytes. Every eight discrete points are one byte).

number of input bytes = \_\_\_\_\_

number of output bytes = \_\_\_\_\_

total bytes = \_\_\_\_\_

2. With this total, calculate a scan time contribution using the formula below that corresponds to the Genius bus baud rate.

The formula for 153.6 Kbaud Standard:

$0.943\text{ms} + (0.0715 \times \text{total bytes}) = \text{_____ ms}$

The formula for 153.6 Kbaud Extended:

$1.015\text{ms} + (0.0715 \times \text{total bytes}) = \text{_____ ms}$

Formula for 76.8 Kbaud:

$1.538\text{ms} + (0.143 \times \text{total bytes}) = \text{_____ ms}$

Formula for 38.4 Kbaud:

$2.583\text{ms} + (0.286 \times \text{total bytes}) = \text{_____ ms}$

**Timing Responsiveness**

If output in the station is tied to an input in the same station, the output changes state (or value, in the case of an analog output module) within a few milliseconds of the new output being sent from the bus controller to the NIU. (To guarantee that an output changes state, that state must be present for at least one NIU sweep time or one Genius bus scan time, whichever is greater.

The input which is tied to the output responds as soon as any load effects have settled out and input filtering is completed. This may occur as soon as the NIU's next I/O scan.

If the host is a PLC, the input must be present for at least one PLC sweep time plus one Genius bus scan time plus one NIU sweep time to guarantee its detection by the PLC. If the input changes state only briefly and then changes again before the input data is sent on the bus, the interim state may be overwritten in the NIU's internal memory by some new input state or value before it can be sent.

As mentioned on the next page, if the NIU's Enhanced Diagnostics parameter is set to enabled, the NIU is expected to respond less rapidly.

### 3.4.1 Fault Transfer Times

The time required to transfer the Genius datagram message that contains a fault depends on the Genius Baud Rate. The table below lists the Genius transfer time for the longest datagram required. Please note that the GNIU must send a series of datagrams to report a single fault. The data in this table should only be used for estimating Fault Reporting Latency as described in GFK-1277.

Baud Rate	Genius NIU Fault Transfer Time (Z) in ms
153.6 K std	5.2195
153.6 K ext	5.2195
76.8 K	10.439
38.4 K	20.878

## 3.5 Operation of the Genius NIU in Enhanced Diagnostics Mode

Genius NIUs that are version -GJ or later have a configurable Enhanced Diagnostics Mode feature. PAC Machine Edition version 5.6 SIM 8 or later is required to configure the new mode. When used in the safety-relevant portion of a GMR system, the GNIU's Enhanced Diagnostics Mode must be enabled.

When Enhanced Diagnostics Mode is enabled, the operation of the Genius NIU changes as described below.

- The Genius NIU turns on its BUS B/EDM LED. The color of this LED is amber.
- The Genius NIU continuously executes extensive diagnostic tests in the background. These diagnostics cause the GNIU to be more sensitive to disturbances on the Genius bus. When a Genius bus disturbance or spontaneous hardware failure causes a diagnostic test to declare an error, the GNIU stops communicating on the Genius bus and attempts to reset itself. The loss of communications causes the host PLC(s) to log a Loss of Device fault and default the affected inputs (according to the host's configuration). GMR PLCs will disregard the channels associated with that GNIU. If the GNIU can revive itself, it tries to resume normal operation several seconds later. If this is successful, the host PLC(s) will log an Addition of Device fault. For the case of a GMR PLC, an operator must issue a GMR I/O Reset command (%M12258) to recover the use of those input channels.
- The GNIU's sweep time is larger. See "GNIU Sweep Times for Enhanced Diagnostics Mode" later in this section.
- The GNIU reports a Loss of Device fault for failed modules immediately after detecting an error, instead of freezing the inputs and delaying the fault for 1.25 seconds.
- The following datagrams are not permitted: Write Configuration, Force I/O, Unforce I/O, Switch BSM, Force BSM, and Unforce BSM.

- Modules in the I/O Station can NOT be hot-removed or hot-inserted. If a module needs to be replaced, power must first be removed from the Genius NIU. This will cause the system to temporarily lose all of the analog channels (up to 60) in that station, not just the channels associated with the module that is being replaced. If a redundant VersaMax Input Station is available, the procedures may optionally allow the overall system to continue to operate with a degraded level of input channel redundancy for a short time while the faulted input station is being repaired.

### CAUTION

Attempting to hot insert or hot remove a VersaMax module can interfere with backplane transfers between the GNIU and other modules in the I/O Station. You also run the risk of causing one of the GNIU's diagnostics to declare an error. Such errors will either cause one or more otherwise healthy modules in the station to be marked as faulted and may also cause the entire input station to go offline.

You must avoid situations where all three of the following are true at the same time:

- The GNIU's Enhanced Diagnostics Mode is set to Enabled
- The GNIU is online with a Genius Bus Controller
- Serial communications (programmer operations: Download Remote I/O Configuration, Verify Equality, Clear Configuration; or Winloader) are taking place

If a hardware configuration with Enhanced Diagnostics Mode set to Enabled either is currently installed or will be installed in the GNIU, disconnect the GNIU from the Genius bus before attempting any serial communications.

After completing serial communications, disconnect the serial cable from the GNIU's expansion port. The GNIU can then be reattached to the Genius bus.

An alternative to disconnecting the GNIU from the Genius bus is to stop, power off, or disconnect all of the Genius Bus Controllers on the corresponding Genius bus.

Once you have stored the correct hardware configuration to the Genius NIU, you must disconnect the serial cable from the GNIU's expansion port.

---

## 3.5.1 Input Message Times for Enhanced Diagnostics Mode

The time required to transfer the Genius message that contains the input data depends on the Genius Baud Rate and the number of inputs configured in the station. The table below lists the input message times for configurations where Enhanced Diagnostics Mode is set to Enabled.

Baud Rate	Genius NIU Input Message Time (ms)			
	Number of ALG265/266 Modules Installed			
	1	2	3	4
153.6 K std	2.288	4.576	6.864	9.152
153.6 K ext	2.288	4.576	6.864	9.152
76.8 K	4.576	9.152	13.728	18.304
38.4 K	9.152	18.304	27.456	36.608

## 3.5.2 GNIU Sweep Times for Enhanced Diagnostics Mode

The Genius NIU's sweep time refers to the amount of time it takes for the GNIU to execute one iteration of its background loop where it scans I/O and executes a small portion of its background diagnostics. When Enhanced Diagnostics Mode is enabled, the GNIU's sweep time depends on the Genius bus scan time and the number of analog input modules configured in the station. The table below lists the maximum GNIU's sweep times in mS for each configuration and several different Genius bus scan times.

Number of Analog Modules IC200ALG265 and IC200ALG266 Configured in the Station								
Number of additional I/O Bytes Transferred on the Genius Bus	1		2		3		4	
	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time
Genius Baud rate = 153.6K std (Times for 153.6K ext are similar)								
0	5	24.8	7	40	10	62	12	90
8	6	19.2	8	30	11	47	13	69
16	7	16.4	9	29	12	39.6	14	50
32	8	14.4	10	23.6	13	31.2	15	40
40	9	14.4	11	18.8	14	30.8	16	39
48	9	13.2	12	18.8	14	24.4	16	39
56	10	13.2	13	18.8	14	24.4	16	30
64	10	13.2	13	18.8	15	24.4	17	30
72	10	13.2	14	18.8	15	24.4	18	30
80	11	13.2	14	18.8	16	24.4	19	30
88	12	10.8	14	18.8	17	24.4	19	30
96	12	10.8	15	13.8	17	24.4	20	29
104	13	10.8	16	13.6	18	24.4	20	29
112	13	10.8	16	13.6	18	16.8	21	28.8
120	14	10.8	16	13.6	19	16.8	21	19.6
128	14	10.8	17	13.6	20	16.8	22	19.6
...								

Number of Analog Modules IC200ALG265 and IC200ALG266 Configured in the Station								
Number of additional I/O Bytes Transferred on the Genius Bus	1		2		3		4	
	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time
256	25	10.2	27	13.6	29	16.4	32	19.2
Genius Baud rate = 76.8K								
0	13	11.2	17	14	22	16.8	28	20
8	14	10.8	18	13.6	23	16.8	29	19.6
16	15	10.8	19	13.6	24	16.8	31	19.6
32	17	10.8	22	13.6	27	16.8	33	19.6
40	18	10.8	23	13.6	28	16.8	34	19.6
48	19	10.8	24	13.6	29	16.8	35	19.6
56	21	10.8	25	13.6	31	16.8	36	19.6
64	22	10.8	26	13.6	32	16.8	37	19.6
72	23	10.8	27	13.6	33	16.9	38	19.6
80	24	10.8	28	13.6	34	16.9	39	19.6
88	25	10.8	29	13.6	35	16.8	40	19.6
96	26	10.8	30	13.6	36	16.8	41	19.6
104	27	10.8	32	13.6	37	16.8	42	19.6
112	28	10.8	33	13.6	39	16.8	43	19.6
120	30	10.8	35	13.6	40	16.8	44	19.6
128	31	10.8	36	13.6	41	16.8	45	19.6
...								
256	51	10.8	56	13.6	61	16.8	65	20.5
Baud rate = 38.4K								
0	25	10.6	34	11.2	44	12.8	52	13.2
8	27	10.6	36	11.2	46	12.6	55	13.2
16	30	10.6	39	11.2	48	12.6	58	13.2
32	34	10.6	44	11.2	53	12.6	63	13.2
40	36	10.4	46	11.2	56	12.6	65	13.2
48	39	10.4	48	11.2	58	12.6	67	13.1
56	41	10.4	50	11.2	60	12.6	69	13.2
64	44	10.4	53	11.2	62	12.6	71	13.2
72	46	10.4	56	11.2	65	12.6	73	13.2

Number of Analog Modules IC200ALG265 and IC200ALG266 Configured in the Station								
Number of additional I/O Bytes Transferred on the Genius Bus	1		2		3		4	
	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time	Genius Bus Scan Time	Max GNIU Sweep Time
80	47	10.4	58	11.2	68	12.6	76	13.2
88	51	10.4	60	11.2	70	12.6	78	13.1
96	53	10.4	63	11.2	72	12.6	80	13.2
104	55	10.4	65	11.2	74	12.6	83	13.2
112	58	10.4	68	11.2	76	12.6	86	13.2
120	61	10.4	70	11.2	78	12.6	88	13.2
128	63	10.4	72	11.2	80	12.6	90	13.2
...								
256	102	10.4	112	11.2	121	12.4	130	13.2

## Section 4: Configuration

This section explains how a Genius NIU and the modules in an I/O Station are configured. Configuration determines certain characteristics of module operation and also determines how the I/O data exchanged with the Genius network is divided among the modules in the station.

This section describes:

- Station Racks and Slots
- Using autoconfiguration or programmer configuration

The configuration for a Genius NIU and I/O Station can either be downloaded from the programming software or established by an autoconfiguration.

- Programmer configuration of the Genius NIU and I/O Station

Software configuration provides greater flexibility than autoconfiguration in setting up an I/O Station.

- Autoconfiguration of the Genius NIU and I/O Station

Autoconfiguration establishes a default configuration for the NIU and I/O Station and does not require the use of a programmer. I/O modules that have software-configurable features always use their default settings when autoconfigured.

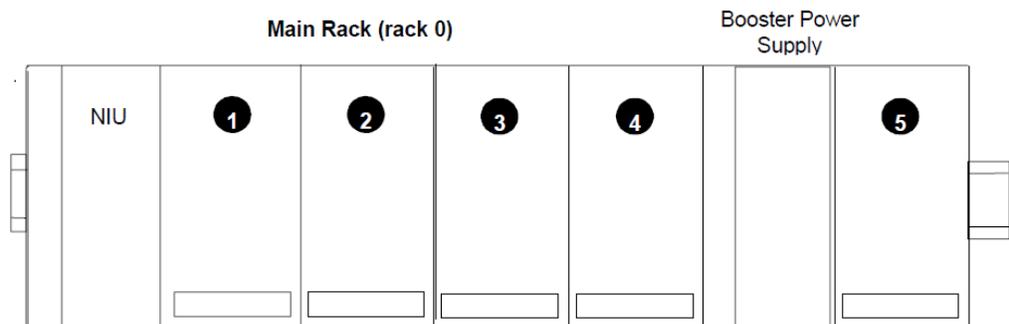
## 4.1 Station Racks and Slots

Even though a VersaMax I/O Station does not have a backplane with a fixed number of slots, both the programming software and the autoconfiguration process use the conventional labels of racks and slots to uniquely identify modules in the station. Each rack consists of an NIU or an Expansion Receiver module plus up to 8 additional I/O modules mounted on a common DIN rail. Each I/O module occupies one slot. The slot immediately to the right of the NIU or Expansion Receiver module is called slot 1. Booster power supplies do not count as occupying slots.

The rack that contains the NIU is called the main rack and is labeled rack 0. An example main rack is pictured below. Optionally, additional racks may be attached to the main rack via Expansion Receiver modules. These racks are called expansion racks and are labeled racks 1 to 7.

---

**Figure 41: Example Station Racks/Slots**



## 4.2 Autoconfiguration or Programmer Configuration

The configuration for a Genius NIU and I/O Station can either be downloaded from the programming software or established by autoconfiguration.

### 4.2.1 Autoconfiguration

Autoconfiguration is done by the NIU itself. It provides a default configuration for the NIU and I/O Station and does not require the use of a programmer. During autoconfiguration, the NIU determines which modules are installed and automatically creates a configuration for the I/O Station. I/O modules that have software-configurable features can only use their default settings when the I/O Station is autoconfigured.

### 4.2.2 Programmer Configuration

Using the programming software makes it possible to reassign the module's I/O reference addresses, and configure many I/O module features. The programming software runs on a computer that connects to the NIU via the NIU expansion port.

The programming software can be used to:

- Create a customized configuration
- Download a configuration to the NIU
- Upload an existing configuration from the NIU
- Compare the configuration in the NIU with a configuration file stored in the programmer.
- Clear the configuration that is currently being used by the NIU and force the NIU to autoconfigure.

The NIU retains its configuration across power cycles. Downloading a configuration disables autoconfiguration, which means that the NIU will not overwrite the downloaded configuration during subsequent power-ups.

However, clearing the NIU's configuration from the programmer does cause a new autoconfiguration to be generated. In that case, autoconfiguration is enabled for the next power-up unless a configuration is subsequently downloaded using a programmer.

## 4.3 Programmer Configuration of the Genius NIU and I/O Station

Programmer configuration provides greater configuration flexibility than autoconfiguration. Programmer configuration can be done using PAC Machine Edition as described in this section. It can also be done using the Remote I/O Manager configuration software as described in the Remote I/O Manager Software User's Guide (GFK-1847). That software is available with a programmer cable as catalog number IC641CFG110, or without a programmer cable as catalog number IC641CFG100. Configuration can also be done using the VersaPro programming/configuration software, version 1.5, or later.

### 4.3.1 Notes on Programmer Configurations for the I/O Station

- Unlike an autoconfiguration, empty slots are permitted in a downloadable NIU configuration.
- Unlike an autoconfiguration, the I/O reference addresses assigned to the modules within the station can be adjusted. The I/O reference addresses are not required to be consecutive.
- The programming software runs on a personal computer. To download, upload, verify, and clear NIU configurations, cable IC200CBL002 is required to connect the PC's serial port to the I/O station's expansion port.

### 4.3.2 Basic Steps for Programmer Configuration

Basic configuration steps are listed below.

Please note that when the NIU's Enhanced Diagnostics Mode is enabled or the station is used in a Genius Modular Redundancy system, specific configuration restrictions apply, as described later in this section. Restrictions for using VersaMax Stations in GMR systems are explained in the GMR Manual, GFK- 1277 revision E or later.

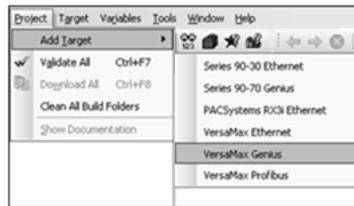
- Open or Create a Machine Edition project
- Create a new VersaMax Genius target.

- Configure the type of expansion racks that are used(non-expanded, single-ended expanded, or multi-rack expanded). This automatically adds the appropriate types of expansion transmitter modules to the main rack. An icon for the expansion transmitter does not appear under the main rack.
- Add the expansion racks (if used).
- Configure the power supplies.
- Configure the Genius NIU's operating parameters.
- For each location of the station:
  - Add a carrier for the module.
  - Add the module to the carrier.
  - Configure the module's operating parameters.
- Save the configuration file.
- Download the configuration to the NIU.

### 4.3.3 Create a New VersaMax Genius Target

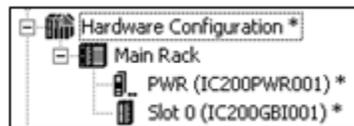
To configure a VersaMax Genius I/O Station using PAC Machine Edition, create a new VersaMax Genius target:

**Figure 42: Creating a VersaMax Genius Target**



In the Navigator, a Main Rack appears with a default Power Supply and Genius NIU in Slot 0:

**Figure 43: New Main Rack**

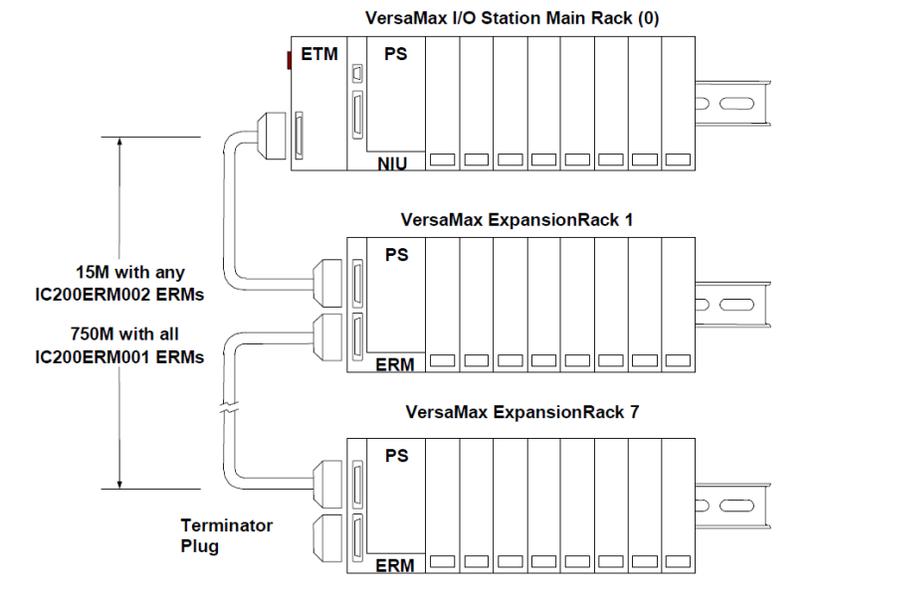


## 4.3.4 Configure the Type of Expansion Racks

There are two ways to connect expansion racks to the NIU.

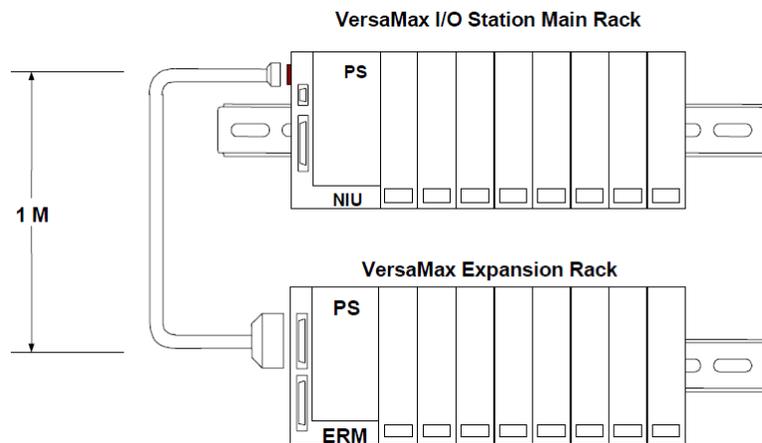
**Multiple Expansion Racks:** When an I/O Station will contain more than one expansion rack, you must attach an Expansion Transmitter Module (IC200BTM001) to the NIU as shown in the figure below. With this arrangement, up to seven expansion racks may be used. Each expansion rack must have an Expansion Receiver Module (IC200ERM001 or IC200ERM002) placed in slot 0 as shown in the figure below. For this case, each expansion rack may be configured as any unique number between 1 and 7.

**Figure 44: Multiple Expansion Racks**



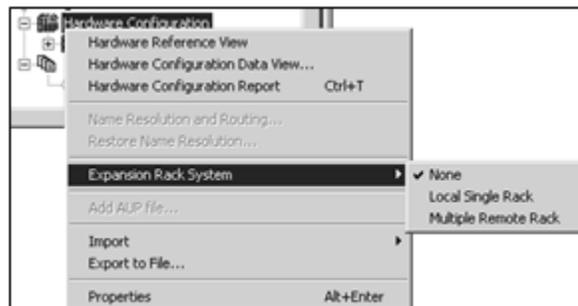
**Single Expansion Rack:** When an I/O Station will contain just one expansion rack, you are not required to attach an Expansion Transmitter Module (IC200BTM001) to the NIU. Instead, you may attach the expansion cable directly to the NIU and place a non-isolated Expansion Receiver Module (IC200ERM002) in slot 0 of the expansion rack as shown in the figure below. For this case, the expansion rack must be configured as rack 1, and the length of the expansion cable is limited to 1 meter.

**Figure 45: Single Expansion Rack**



To configure the type of Expansion Racks that will be used by the I/O station, right-click on the target's Hardware Configuration node in the Navigator window and select Expansion Rack System. If the station does not use any expansion racks, select None. If the station uses a Single Expansion Rack as described above, select Local Single Rack. If the station uses multiple expansion racks, select Multiple Remote Rack.

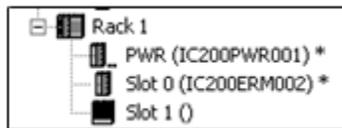
**Figure 46: Configuring Expansion Racks**



## 4.3.5 Adding Expansion Racks

When you add an expansion rack, the rack icon appears in the Navigator window. Initially, there is no Power Supply or Expansion module for the rack. Right-click on the expansion rack node and select the type of Expansion Receiver module for the rack: None, Non-Isolated Receiver, or Isolated Receiver. Only those expansion receiver modules that are valid for the current Expansion Rack system can be selected.

**Figure 47: Expansion Receiver Modules**



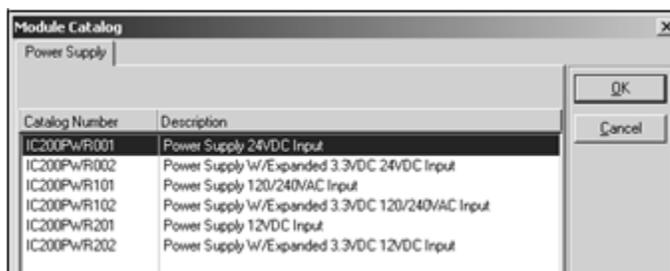
To replace one type of receiver with another, do not use the replace module command. Instead, right-click on the expansion rack node and select the new receiver type as described above.

## 4.3.6 Configure the Power Supplies

If the default Power Supply IC200PWR001 is not correct, right-click on the Power Supply icon immediately under the Rack 0 node and select Replace Module.

Select the correct VersaMax Power Supply from the Module Catalog:

**Figure 48: Selecting VersaMax Power Supply from Module Catalog**



Repeat this process for the power supply slot of each expansion rack.

## 4.3.7 Configure the Genius NIU

NIU configuration establishes the basic operating characteristics of the Network Interface Unit.

Double-click or right-click on the Rack 0 Slot 0 icon in the Navigator window to configure the Genius NIU.

**Note:** If you are using an NIU configuration that was created with a previous version of the programming software, right-click on the NIU and select Replace Module to force the programmer to present NIU configuration options that were added after that version of the programming software was released (e.g. Enhanced Diagnostics Mode and the GMR CPU Redundancy mode).

### Settings Tab

**Note:** When the I/O station has one or more Isolated Expansion Receiver Modules, the Settings tab has a parameter for selecting the expansion bus transmission speed. This parameter is not shown in the example below.

**Figure 49: Settings Tab**

Parameters	Values
Enhanced Diagnostic:	Enabled
Data Rate (bps):	19200
Parity:	Odd
Stop Bits:	1

**Enhanced Diagnostics Mode:** A VersaMax Genius NIU version -GJ or later can be configured to operate in Enhanced Diagnostics Mode PAC Machine Edition version 5.6 SIM 6 or later is required to configure the GNU for Enhanced Diagnostics mode. To use the Enhanced Diagnostics Mode feature of the Genius NIU in any GMR system, version 4.05 of the GMR System Software is required. Do not enable Enhanced Diagnostics mode on a Genius NIU in a GMR system that is using GMR System Software version 4.04 or earlier.

Operation of the Genius NIU in Enhanced Diagnostics mode is described in Section 3: Operation.

If the station is used in the safety-relevant portion of a GMR system, the NIU's Enhanced Diagnostics Mode parameter must be set to enabled.

When the NIU's Enhanced Diagnostics Mode parameter is set to enable:

1. Besides the NIU and the power supply, the only other modules permitted in the station are analog input modules IC200ALG265 and IC200ALG266. There may be any combination of up to four of these modules in the station.
2. All of the analog modules must be located in the main rack. Expansion racks are not permitted.
3. Empty IO carriers are not permitted.
4. The NIU's Report Faults parameter must be set to Enabled.
5. The NIU's CPU Redundancy parameter must be set to GMR.
6. The NIU's "BSM Present" and "BSM Controller" parameters must be set to No.
7. The Report Faults parameter on every analog module must be set to Enabled.
8. The analog module in slot 1 must be assigned to %AI0001.

The analog module in slot 2 (if present) must be assigned to %AI0017. The analog module in slot 3 (if present) must be assigned to %AI0033. The analog module in slot 4 (if present) must be assigned to %AI0049.

For each ALG module except the last one, one analog input channel assigned to the station is not used. These extra/unused channels still count towards the number of %AI channels the VersaMax station will send to the Genius Bus Controller(s). The table below describes the four possible configurations.

Number of ALG modules	Extra/Unused %AI reference(s)	Station's total %AI size
1	None	15 channels (words)
2	%AI00016	31 channels (words)
3	%AI00016, %AI00032	47 channels (words)
4	%AI00016, %AI00032, %AI00048	63 channels (words)

**Data Rate (bps):** Data transmission rate (in bits per second) for PC to NIU serial communications via the NIU’s expansion port. The default is 19200. Choices are 4800, 9600, 19200. When a programmer is first connected to a fresh GNIU, the NIU uses the default communications settings: 19,200 baud, odd parity, one start bit, one stop bit, and eight data bits. If these parameters are changed by downloading a different configuration, the revised settings for the serial port are not installed until the programmer is removed. Once these new settings take effect, the NIU will continue to use them even if its power is cycled.

**Parity:** Determines whether parity is added to words for PC to NIU serial communications via the NIU’s expansion port. The default is Odd. Choices are Odd, Even, None.

**Stop Bits:** Number of stop bits used in transmission for PC to NIU serial communications via the NIU’s expansion port. (Most serial devices use one stop bit; slower devices use two.). The default is 1. Choices are 1, 2.

**Expansion Bus Speed:** If the I/O station has one or more Isolated Expansion Receiver Modules (IC200ERM001), the default bus speed is 250kHz (“Extended Distance”). If the bus is less than 250 meters, this parameter can be changed to “Normal” (1MHz). If no Isolated Receiver Module is present, the bus speed defaults to Normal (3Mhz). The default is Extended Distance. Choices are Extended, Normal.

**Network Tab:** On the Network tab, configure the parameters of Genius communications, and the Redundancy operation of the Genius NIU.

**Figure 50: Network Tab**

Settings: Network   Memory   Power Consumption			
Parameters	Values		
Serial Bus Address:	255		
Baud Rate:	153.6 Kbps Standard		
Report Faults:	Enabled		
BSM Present:	No		
BSM Controller:	No		
Output Time Default:	2.5sec		
CPU Redundancy:	None		
Duplex Default:	Off		
BSM Forced	Unforced		
BSM State:	Bus A		
Series 6 Reference:	65535		
Config Protect:	Disabled		

**Serial Bus Address:** There are 32 available addresses (from 0 to 31) on a Genius bus. Typically, one SBA, SBA 0, is reserved for the Genius Hand-held Monitor. Another SBA is needed for each Bus Controller on that bus (typically SBA 31, 30, and 29). Duplicate bus addresses disrupt communications and are not permitted.

**Baud Rate:** Genius bus communications can occur at any of four baud rates: 153.6 Kbaud standards, 153.6 Kbaud extended, 76.8 Kbaud, or 38.4 Kbaud. The default is 153.6 K baud standard. The Genius I/O System User's Manual gives guidelines for baud rate selection. Each device's communications baud rate must be the same as that used by all other devices on the bus.

**Report Faults:** Selects whether or not the NIU will perform any fault reporting. If you want to set up partial fault reporting for the station, set this Report Faults parameter to YES, and set the Report Faults parameter for selective individual modules in the station to No.

**BSM Present:** If the NIU will be used as a bus-switching device itself, or located on a bus stub downstream of another device that acts as a bus-switching device, BSM Present should be set to YES. For all other applications, set it to NO. Please refer to Section 6: Redundancy for more information about configuring the Redundancy features.

**BSM Controller:** If the NIU will be used as the bus-switching device itself, set BSM Controller to YES. For all other applications, set it to NO. Please refer to Section 6: Redundancy for more information about configuring the Redundancy features.

**Output Time Default:** The parameter only applies when BSM Present is set to YES. If the total bus scan time is expected to exceed 100mS, set the Output Default Time to 10 seconds. The Output Default Time is normally 2.5 seconds. If the Bus Interface Unit stops receiving outputs from the Bus Controller, it will wait for this specified period before defaulting outputs in the station. Please refer to Section 6: Redundancy for more information about configuring the Redundancy features.

**CPU Redundancy:** If the NIU will have two or more bus controllers (on the same Genius bus), the NIU must be configured for a CPU Redundancy mode other than None. Please refer to Section 6: Redundancy, for more information about configuring the Redundancy features.

**Hot Standby:** When configured for Hot Standby mode, the NIU recognizes the Genius Bus Controllers at Serial Bus Address 31 and 30. In this mode, the NIU's outputs are usually controlled by SBA 31. However, if no outputs are received from SBA 31 for a period of three Genius bus scans, the NIU's outputs are immediately controlled by SBA 30. If outputs are not available from either controller, the NIU's outputs go to their configured default or hold their last state. In Hot Standby mode, the controller at SBA 31 always has priority control of the NIU's outputs. In

other words, whenever the controller at SBA 31 is online, it controls the NIU's outputs.

**Duplex:** When configured for Duplex mode, the NIU recognizes the Genius Bus Controllers at Serial Bus Address 31 and 30. When in this mode, the NIU compares the output values received from SBA 31 and SBA 30. For each output point, if the output values are the same, the NIU sets the output point to that state. If the output values are not the same, the NIU will set the output to its configured Duplex Default State, which must be configured for each output in the station as ON or OFF. If output values from either SBA 30 or SBA 31 are not available, the NIU's outputs are controlled by the remaining bus controller. If output values from both SBA 30 and SBA 31 are not available, the NIU's outputs either default to their configured default states (not their Duplex Default States) or hold their last state, as configured. When the NIU is configured for Duplex mode, no analog output modules are permitted in the station. **GMR:** When configured for GMR mode, the NIU recognizes the Genius Bus Controllers at Serial Bus Addresses 31, 30, and 29. Whenever a bus controller with any of these SBAs is available, the NIU will assert (turn green) its I/O enabled LED and report its faults to it. When the NIU is configured for GMR mode, the only types of modules permitted in the station are analog input modules. Output modules and discrete input modules are not permitted. To use GMR mode, firmware version 3.00 or higher of the Genius NIU is required, and the GMR System Software must be version 4.05 or later. Do not select GMR mode for a Genius NIU in a GMR system that is using GMR System Software version 4.04 or earlier.

**Duplex Default:** In Duplex Redundancy mode, the NIU may receive different values for one or more output points from the two bus controllers. If that happens, the NIU selects the Duplex Default State for each of those points. If neither bus controller is available, the NIU's outputs go to their configured Hold Last State or Output Default State. Please refer to Section 6: Redundancy for more information about configuring the Redundancy features.

**BSM Forced:** Currently, the Bus Switch Module's operating state cannot be changed by the programmer.

**BSM State:** Currently, the Bus Switch Module's operating state cannot be changed by the programmer.

**Series 6 Reference:** If the network controller is not a Series Six PLC or Series Five PLC, no entry is necessary here.

**Config Protect:** Currently, the NIU's config protection setting cannot be changed by the programmer.

## 4.3.8 Configuring I/O References

As I/O modules are added to the configuration, the programming software keeps a running total of input/output memory. If the modules added consume more than the maximum memory available, the programming software displays the reference address of the module that caused the error, and an error message.

You can change the I/O references assigned to a module when configuring that module. The Memory tab for the NIU displays the sizes of the NIU's memory tables. The maximum amount of data that an I/O station can exchange on the Genius bus is 128 bytes of inputs and 128 bytes of outputs. The Memory tab displays the number of input bytes and the number of output bytes that remain available when considering the I/O modules already configured and these two 128-byte limits.

**Figure 51: NIU Memory Tab**

Settings   Network   Memory   Power Consumption	
Parameters	Values
%I Discrete Input:	1024
%Q Discrete Output:	1024
%AI Analog Input:	64
%AQ Analog Output:	64
Maximum Input Size (bytes):	128
Available Inputs (bytes):	98
Maximum Output Size (bytes):	128
Available Outputs (bytes):	128

The programming software provides a Hardware Reference View that shows what portion of each I/O table is used for each I/O module. To view this information, right-click on the Hardware Configuration node of the NIU target and select "Hardware Reference view".

**Figure 52: Hardware Reference View**

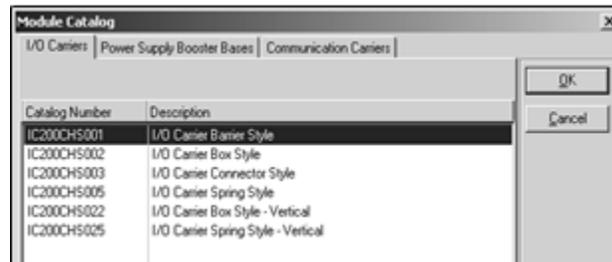
_MAIN [logic] Hardware Reference View [VM_Out]					
%AI	%AQ	%I	%Q		
Overlap	Start	End	Location	Mem Type	Catalog #
	0001	0012	(0.1)	Produced	IC200ALG327
	0013	0024	(0.2)	Produced	IC200ALG327
	0025	0036	(0.3)	Produced	IC200ALG328
	0037	0048	(0.4)	Produced	IC200ALG328

## 4.3.9 Configuring Carriers and Modules

For each module in the station, first, configure a carrier base. To do this, right-click on the slot or module icon in the Navigator. Select Add Carrier Base to add a carrier after the current location or Insert Carrier Base to insert a carrier before the current location.

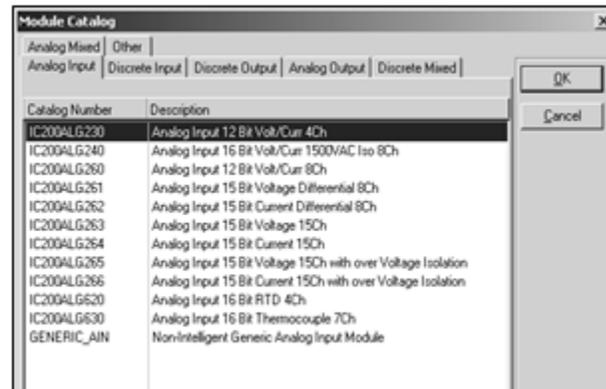
Select the carrier from the Module Catalog.

**Figure 53: Module Catalog**



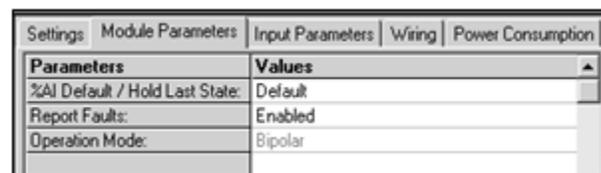
Next, add the module. To do this, right-click on the corresponding carrier base icon and select Add Module. Select the module from the Module Catalog. For example:

**Figure 54: Adding a Module Example**



Third, configure the module's parameters. For example.

**Figure 55: Example Module Parameters**

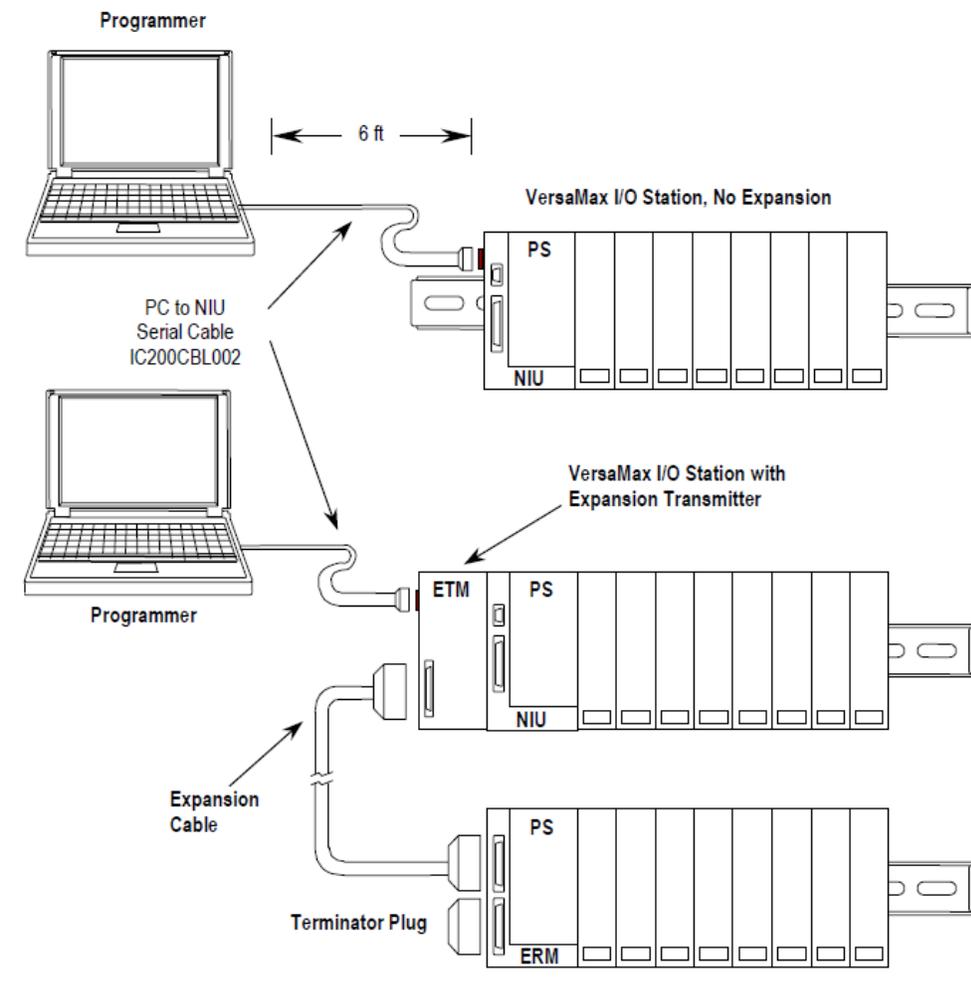


Configuration parameters of I/O modules are described in the VersaMax Modules, Power Supplies, and Carriers User's Manual (GFK-1504) or the module datasheets.

### 4.3.10 Programmer Configuration: Download, Upload, Verify, Clear

The programming software runs on a personal computer. To download, upload, verify, and clear NIU configurations, cable IC200CBL002 is required to connect the PC's serial port to the I/O station's expansion port. This port is located on the left side of the NIU. If an Expansion Transmitter Module is present, this port is located on the left side of the ETM. Both are pictured below.

**Figure 56: Example PC to NIU Connections**



The programming software has a set of serial communications parameters. These parameters must match the ones that the Genius NIU is using (see the description for Data Rate in Section 4.3.7).

### **Special Communications Rule for Enhanced Diagnostics Mode**

Do not download, upload, verify, or clear an NIU's configuration when both of the following are true at the same time:

- The NIU's Enhanced Diagnostics Mode is set to Enabled
- The NIU is online with a Genius Bus Controller

If the NIU's configuration has Enhanced Diagnostics Mode set to Enabled (either in the currently installed configuration or in the configuration you are about to download), disconnect the NIU from the Genius bus before initiating any of these commands. An alternative to disconnecting the NIU from the Genius bus is to power off or disconnect all of the Genius Bus Controllers on that bus.

After completing the command, disconnect the serial cable from the NIU's expansion port. The NIU can then be reattached to the Genius bus and/or the Genius bus controllers can be returned to normal operation.

### **Downloading a Configuration to the Genius NIU**

After completing a configuration in the programmer, the configuration must be downloaded to the Genius NIU. From the Target menu, select Download Remote I/O Configuration.

When a configuration is being downloaded, the NIU automatically drops off the Genius bus. Shortly after the download completes, the NIU attempts to come back on the bus with its revised configuration.

Downloading a configuration disables autoconfiguration. This means that the NIU will not overwrite a downloaded configuration with an autoconfiguration during subsequent startups. If a download operation is aborted or interrupted by loss of communications or loss of power, autoconfiguration may occur.

If there are any mismatched, missing, or extra modules, the download operation continues. Modules that are mismatched or extra when compared to the downloaded configuration will not be scanned. The NIU will generate fault messages for each of these conditions.

### Uploading a Configuration from the NIU to the Programmer

If desired, you may use the upload command to retrieve the configuration from the Genius NIU. From the Target menu, select Upload Remote I/O Configuration. Note: If the configuration present in the NIU was generated by an autoconfiguration, the modules' catalog numbers specified in that configuration can differ from the modules that are physically present. This happens because modules that have the same type and amount of I/O use the same hardware identification, and therefore the NIU cannot distinguish between them. If you upload a configuration like this and intend to download that configuration to any NIU, be sure to correct the configuration for those slots (select Replace Module) before you download that configuration to an NIU. The following groups of modules use the same hardware identification:

- IC200ALG263 and 265;
- IC200ALG264 and 266;
- IC200ALG321 and 322;
- IC200ALG431 and 432;
- IC200MDD842, and 844;
- IC200MDD846, 847, and 849;
- IC200MDL140, 141, and 143;
- IC200MDL240, 241, and 243;
- IC200MDL329 and 331;
- IC200MDL635, 640, and 643;
- IC200MDL636, 644, and 650;
- IC200MDL740, 741, and 743;
- IC200MDL742, 744, and 750.

### Comparing Configurations in the Programmer and NIU

You may use the Verify Equality function to compare a configuration file in the programmer with the configuration in the Genius NIU. From the Target menu, select Offline Commands - Verify Equality.

### Deleting a Software Configuration from the NIU

You may use the -Clear configuration function to remove a configuration from the NIU. From the Target menu, select Target - Offline Commands - Clear. Clearing a configuration causes a new autoconfiguration to be generated. In this case, Autoconfiguration remains enabled for the next power-up unless a configuration is subsequently downloaded using a programmer.

## 4.4 Autoconfiguration of the Genius NIU and I/O Station

Autoconfiguration is done by the NIU itself. It provides a default configuration for the NIU and I/O Station and does not require the use of a programmer. I/O modules that have software-configurable features always use their default settings when autoconfigured.

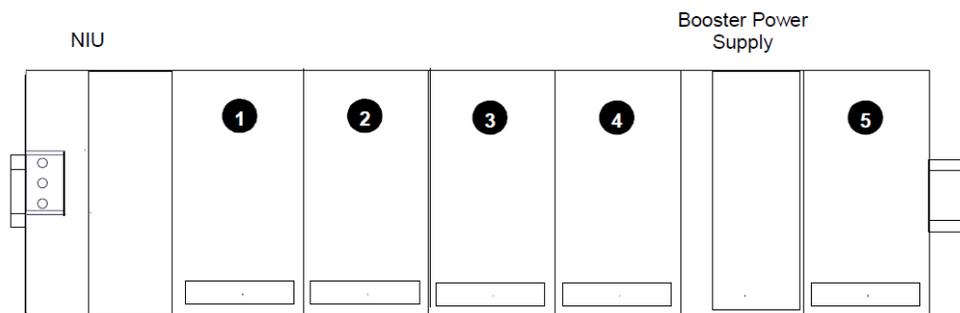
During autoconfiguration, the NIU determines which modules are installed and automatically creates a default configuration for the I/O station.

Once this autoconfiguration is complete as described below, the NIU retains this configuration until it is either cleared or a configuration is downloaded using the programmer.

### 4.4.1 Autoconfiguration Sequence

Each module is considered to occupy a "slot". The position immediately to the right of the NIU is called slot #1. Booster power supplies do not count as occupying slots.

**Figure 57: Example Autoconfiguration Sequence**



Autoconfiguration starts at slot 1 of rack 0 (the main rack) and continues in the same order the modules occupy in the I/O Station.

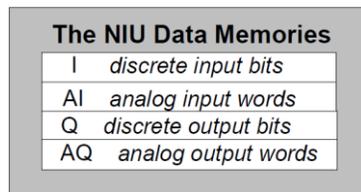
Autoconfiguration stops at the first empty slot or faulted module. For example, if there are modules in slots 1, 2, 3, 5, and 6 but slot 4 is empty, the modules in slots 5 and 6 are not autoconfigured.

For the autoconfiguration process to work as expected, any booster power supplies in the I/O Station must be powered up at the same time or before the main power supply.

## 4.4.2 Autoconfiguration Assigns Reference Addresses

The NIU stores I/O data internally as discrete input bits, discrete output bits, analog input words, and analog output words.

**Figure 58: NIU Data Memory Definitions**



The NIU Data Memories	
I	<i>discrete input bits</i>
AI	<i>analog input words</i>
Q	<i>discrete output bits</i>
AQ	<i>analog output words</i>

During autoconfiguration, the NIU automatically assigns reference addresses to the modules. Reference addresses are assigned in ascending order. For modules that have multiple data types (for example, mixed I/O modules), each data type is assigned reference addresses individually.

When autoconfigured, modules that have software-configurable features use their default configuration settings. The default configuration settings are described in the VersaMax Modules, Power Supplies, and Carriers Manual (GFK-1504).

## 4.4.3 Adding I/O modules to an Autoconfigured I/O Station

If additional I/O modules are added to an existing I/O Station, they do not become part of the autoconfiguration until the NIU is power-cycled. See the section titled How Autoconfiguration Handles Equipment Changes below.

## 4.4.4 Clearing an Autoconfiguration

To clear an existing autoconfiguration, power down the NIU, disconnect the NIU from the first I/O module, disconnect the expansion rack cable if present, and power up the NIU. This clears the NIU's configuration and enables autoconfiguration for the next power-up.

**Note:** This does not clear a configuration that was downloaded using a programmer. A configuration that was downloaded using the programmer can be cleared by using the programmer's clear command, as described previously in this section.

## 4.4.5 Hot Inserting, I/O Modules

You may hot remove and hot insert I/O modules in an autoconfigured I/O Station, as long as the module being inserted has the same I/O type and size as the module that was removed. If the module being inserted is not the same I/O type and size, refer to Section 4.4.7, *How Autoconfiguration Handles Equipment Changes*.

## 4.4.6 Autoconfiguring an I/O Station with Expansion Racks

- The Expansion Receiver modules must have their rack ID selection dials set correctly. Any available rack number can be used for a new expansion rack but they must all be unique (duplicate rack numbers are not permitted). It is best to assign expansion rack numbers from lowest (1) to highest (7) as they are installed.
- If a new expansion rack is added in the future, it should be assigned a rack number that is higher than the racks that are already installed. If a new expansion rack with a lower rack number is added and the station is then auto-configured, the racks numbered higher than the new rack number have their I/O reference addresses shifted in the reference tables. Any existing program logic using those references would need to be adjusted to use the new references.
- When autoconfiguring an I/O Station with expansion racks, either all racks must be powered from the same source or the expansion racks must be powered up before the main rack.
- To add another expansion rack to the I/O Station, the I/O Station must be powered down. After adding the expansion rack, power up the I/O Station. It will then autoconfigure.
- To force autoconfiguration for expansion racks, first power down the NIU. Remove the transmitter module from the NIU or remove the expansion cable at the transmitter. Power up the NIU and let it autoconfigure. Power the NIU down again, reattach the transmitter or cable, and power up the NIU again.

## 4.4.7 How Autoconfiguration Handles Equipment Changes

At power-up, previously-autoconfigured modules are not removed from the NIU's configuration unless no modules are connected to the NIU.

**Module Present But Non-Working During Autoconfiguration:** If a module is physically present but not working during autoconfiguration, the module is not configured.

**Empty Slot During Autoconfiguration:** Autoconfiguration stops at the first empty slot. Modules located after the empty slot are not autoconfigured.

**Previously Configured Modules Not Present During Autoconfiguration:** Previously- configured modules are not removed from the configuration during autoconfiguration unless no modules are attached to the NIU. For example, if modules are configured in slots 1, 2, and 3 then power is removed and the module in slot 1 is removed, when power has reapplied the modules in slots 2 and 3 operate normally. The original module in slot 1 is not removed from the configuration. The NIU generates a loss of module fault for slot 1.

**Different Module Present During Autoconfiguration:** If a slot was previously- configured for one module type but has a different module installed during autoconfiguration, the NIU generates a configuration mismatch fault. The slot remains configured for the original module type.

**Unconfigured Module Installed After Autoconfiguration:** If a module that was not previously configured is installed-after powerup, the NIU generates an extra module diagnostic and the module is not added to the configuration.

**Previously-configured Module Installed After Autoconfiguration:** If a previously autoconfigured module that was missing at powerup is installed after powerup, the NIU generates an addition of module fault and the module is added back into the I/O scan.

**All Modules Removed After Autoconfiguration:** If no modules are attached to the NIU at powerup, the NIU clears its configuration and enables autoconfiguration for the next power-up. Use this method when modifying the set of modules installed in the I/O station.

## Section 5: Datagrams

This section lists datagrams that can be sent to or from a Genius Network Interface Unit and shows the datagrams for VersaMax modules that are different from the formats used by other modules.

It also shows the format of configuration data for the Network Interface Unit and the modules in the station.

- Read Map
- Read Map Reply
- Report Fault Datagram Format
- Configuration Data
- Set Network Interface Unit Operating Mode

Unless otherwise noted, all multi-byte fields are stored with the least significant byte in the lowest memory location followed by the most significant byte. For double-word data, the least significant word is stored in the lowest memory location.

### **For Additional Information, Also See:**

The **User's Manual** for the PLC or computer should explain the specific programming required to send datagrams.

The **Genius I/O System and Communications Manual** (GEK-90486-1), describes Genius datagrams and data formats.

## 5.1 Datagram Types

The table below shows the primary datagrams that may be acted upon by the NIU.

<b>Datagram Type</b>	<b>Subfunction Code (hexadecimal)</b>	<b>Network Interface Unit Action</b>
Read Identification	00	send Read ID Reply
Read Configuration	02	send Read Configuration Reply
Write Configuration	04	process (possibly send configuration
Assign Monitor	05	process
Begin Packet Sequence	06	start sequence
End Packet Sequence	07	end/check sequence
Read Diagnostics	08	send Read Diagnostics Reply
Clear All Faults	13	process
Set Baud Rate	14	process (send Set Baud Rate Reply)
Set Serial Bus Address (SBA)	16	process
Set Status Table Address	17	process
Force I/O	18	process
Unforce I/O	19	process
Force BSM *	1A	process (send config. change)
Unforce BSM *	1B	process (send config. Change when the last
Switch BSM *	1C	process
Configuration Protect	23	process
Configuration Unprotect	24	process
Read Map	2A	send Read Map Reply
Set Operating Mode	39	process
Read Operating Mode	44	send Read Operating Mode Reply

\* These datagrams cannot be used when the Genius NIU is configured for Enhanced Diagnostics mode.

## 5.2 Read Map

Subfunction Code: 2A hex

This datagram is used to read the reference addresses and lengths that have been configured for the NIU's network I/O map.

Data Field Format: none

## 5.3 Read Map Reply

Subfunction Code: 2B hex

An NIU sends this reply datagram after receiving a Read Map datagram. It contains the previously configured NIU network map addresses. The network map defines the NIU memory locations of the data that is exchanged on the Genius bus. It provides no information about the I/O assignments of individual I/O modules in the station. However, the checksums indicate whether the overall configuration has been changed.

Byte No.	Byte Description
0	Not used
1	Starting reference for discrete input ( I ) data (LSB)
2	Starting reference for discrete input ( I ) data (MSB)
3	Length of discrete input ( I ) data (in bytes)
4, 5	Starting reference of analog input ( AI ) data
6	Length of analog input ( AI ) data (in bytes)
7, 8	Starting reference of discrete output ( Q ) data
9	Length of discrete output ( Q ) data (in bytes)
10,11	Starting reference of analog output ( AQ ) data
12	Length of analog output ( AQ ) data (in bytes)
13	8-bit Additive Checksum Unused (always 0)
14, 15	16-bit CRC Critical Checksum (lsb in 14, msb in 15) READ ONLY
16	8-bit Additive Checksum. Unused (always 0)
17, 18	16-bit CRC Non-Critical Checksum (lsb in 17, msb in 18) READ ONLY

Starting references for I, AI, Q, and AQ memory are returned. For each memory type, a data length is also supplied. If a length is zero, the associated starting reference can be ignored; it is not meaningful.

## 5.4 Report Fault Datagram Format

The format of Report Fault datagrams sent by an NIU is shown below. PACSystems RX7i controllers, Series 90-70 PLCs, and VersaMax PLCs interpret this information automatically; no datagram programming is required. If the host is a Series Six or Series Five PLC, this information is ignored. If the host is a computer, this information can be retrieved from the unsolicited datagram queue and interpreted as needed for the application.

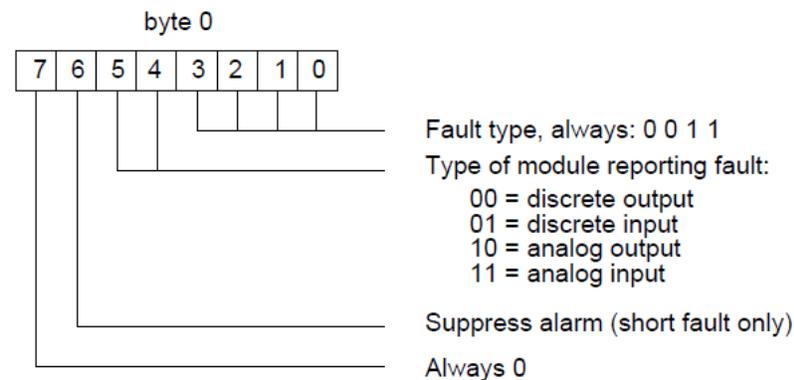
**Note:** The NIU can store up to 32 untransmitted datagrams. If an event occurs that causes more than 16 faults when the NIU is unable to transmit fault messages over the network, some report fault datagram messages can be lost. When communications are restored, the order in which the remaining messages are sent may differ from the order in which the faults occurred.

Subfunction Code: 0F hex

Byte #	Description
0	Fault Byte 1
1	Fault Byte 2
2	Fault byte 3
3	Fault byte 4
4	Fault byte 5
5	Fault byte 6
6	Fault byte 7

### Fault Byte 1

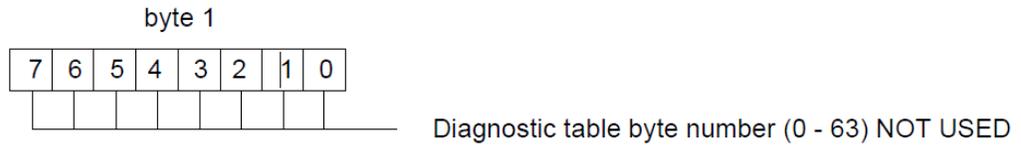
**Figure 59: Fault Byte 1**



### Fault Byte 2

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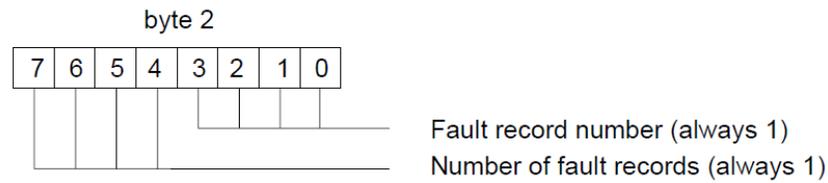
**Figure 60: Fault Byte 2**



### Fault Byte 3

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**Figure 61: Fault Byte 3**

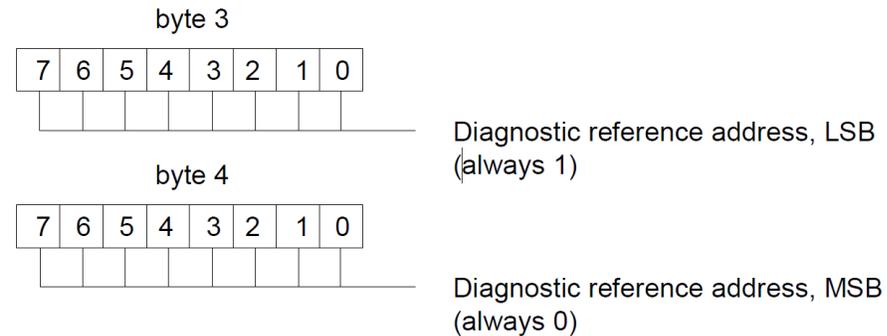


### Fault Bytes 4 and 5

Fault bytes 4 and 5 (bytes 3 and 4 of the datagram) identify the reference offset (within the NIU itself) assigned to the faulted module. This is an internal reference.

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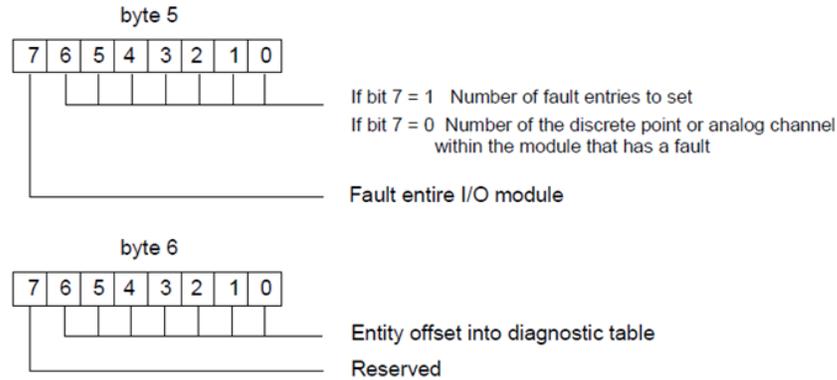
**Figure 62: Fault Bytes 4 and 5**



### Fault Bytes 6 and 7

Fault bytes 6 and 7 (datagram bytes 5 and 6) are automatically interpreted by PACSystems RX7i controllers, Series 90-70 PLCs, and. They are not relevant to other types of hosts.

**Figure 63: Fault Bytes 6 and 7**



## 5.5 Configuration Data

Datagrams can be used to read and write configuration data for an I/O Station. However, most systems will use programmer configuration or autoconfiguration.

For a Network Interface Unit, the configuration data specifies the rack and slot number of a specific module in the station. The length specified must exactly match the length of the configuration data for the module (Network Interface Unit or another module in the I/O station); partial configuration data cannot be read or written. For programming instructions, you should refer to the documentation set for the PLC.

Configuration files for conventional I/O modules can be read or written one module per message. However, the configuration files of intelligent modules may exceed the 128-byte maximum length of a Genius message. Therefore, any Write Configuration to an intelligent module must be contained within a Begin/End Packet Sequence.

Multiple byte fields in datagrams are transmitted in little-endian format. In this format, the least significant byte of a word is stored in the lowest memory location or transmitted first in time. The most significant byte follows.

## 5.5.1 Read Configuration Data

Subfunction Code: 02 hex

The Read Configuration Datagram is used to read configuration data from the NIU.

### Read Configuration Data Format

Byte #	Description
0	Rack Number (0,..., 7)
1, 2	Length (must match the length for the specific device whose configuration will be written. Maximum=128)
3	Slot (0,..., 9) Note that in datagrams, the slot numbering is different that the number described elsewhere in the manual. In datagrams only: Power Supplies and Carriers are "slot" 0 Network Interface Unit or Expansion Receiver Module is "slot" 1 Modules are "slots" 2-9
4, 5	Offset into slot configuration data, used to read module configuration data that is greater than 64 words in length

## 5.5.2 Read Configuration Reply Data

Subfunction Code: 03 hex

This datagram is a reply to the Read Configuration datagram. Bytes 0-5 are like the Read Configuration datagram above. Bytes 6-133 contain the module data and are like the Write Configuration datagram.

### Read Configuration Reply Data Format

Byte #	Description
0	Rack Number (0,..., 7)
1, 2	Length (must match the length for the specific device whose configuration will be written. Maximum=128)
3	Slot (0,..., 9) Note that in datagrams, the slot numbering is different that the number described elsewhere in the manual. In datagrams only: Power Supplies and Carriers are "slot" 0 Network Interface Unit or Expansion Receiver Module is "slot" 1) Modules are "slots" 2-9
4, 5	Offset into slot configuration data
6 - 31	"Rack/slot" record for the slot
32 to end	Context-dependent data (optional)

## 5.5.3 Write Configuration Data

Subfunction Code: 04 hex

The Write Configuration datagram is used to send configuration data for the NIU or a module in the I/O Station.

**When the NIU is configured for Enhanced Diagnostics Mode or GMR Mode, the NIU will not accept any Write Configuration datagrams. If you attempt to enable Enhanced Diagnostics Mode or GMR mode via a write configuration datagram, the NIU will not accept the datagram.**

The context-dependent slot configuration data is the same as the Read Configuration Reply. For each rack in the I/O Station, slot 0 configuration data includes the power supply, I/O carriers, and any booster power supplies present. Because configuration datagrams consider power supplies and carriers to be slot 0, this numbering scheme is different than the actual slot numbering described elsewhere in the manual. In rack 0, slot 1 configuration is the NIU. In expansion racks 1-7, slot 1 is used for the Expansion Receiver Module. Up to eight I/O modules per "rack" can be configured as slots 2 through 9.

Do not send partial configuration data; it will be rejected by the NIU. If the data is more than 128 bytes in length, multiple packets may be used. Use the Begin and End Packet sequence messages to ensure that a sequence of Write Configuration messages is treated as a single entity. Each packet should be in slot order. Multiple packets for a slot must also be in order. Multiple packets must be 128 bytes in length except the last which may be shorter.

**Note:** Multiple-byte fields in datagrams are transmitted with the least significant byte of a word in the lowest memory location or transmitted first in time. The most significant byte follows.

### Example:

Stage	Description
Begin Packet Sequence	(subfunction code 06 hex)
Write Configuration 1	(subfunction code 04 hex)
Write Configuration 2	(subfunction code 04 hex)
Write Configuration N	(subfunction code 04 hex)
End Packet Sequence	(subfunction code 07 hex). The total number of BYTES in all Write Configuration packets. The End Packet Sequence has 2 bytes. Byte 0 is the least significant byte of the data length; byte 1 is the most significant.

### Write Configuration Data Format

Byte #	Description
0	Rack Number (0,..., 7)
1	Length of this message (must match the length for the specific device whose configuration will be written.)
2	Slot (0,..., 9. Network Interface Unit is 1)
3	Packet number (0, 1, 2, ...)
4, 5	Slot length (bytes)
6 - 31	"Rack/slot" record for the slot
32 to end	Context-dependent data (optional)

## 5.5.4 Configuration Data Formats

### Power Supply and Carriers Configuration Data Format (Rack 0-7, slot 0)

(Byte in Message)	(Byte in Record)	Byte Description
6, 7	0, 1	not used (00,00)
8	2	major type (01)
9	3	power supply type: 0 = none 5 = IC200PWR001 10 = IC200PWR002 15 = IC200PWR101 20 = IC200PWR1021 40 = IC200PWB001 (carrier)
10,..., 13	4,..., 7	ASCII string Set to zeros during auto-configuration, the programmer may fill this field with an arbitrary identification string.
14	8	2
15	9	Additive checksum for entire station configuration
16, 17	10, 11	CRC checksum for the entire station configuration
18	12	number of racks present (1)
19	13	number of slots (maximum 10)
20, 21	14, 15	Feature list (00 00). A bitmapped word is reserved for forward compatibility with future releases. In the initial product release, this value is zero.
22,..., 29	16,..., 23	not used
30, 31	24, 25	Length of additional data (52)
32, 33	0, 1	not used (00,00)
34	2	61h (97)
35	3	9
36,..., 39	4,..., 7	reserved (must be 00, 00, 00, 00)

(Byte in Message)	(Byte in Record)	Byte Description
40	8	first I/O module slot carrier type: 0 = none 5 = IC200CHS001 10 = IC200CHS002 15 = IC200CHS005 20 = IC200CHS010 25 = IC200CHS011 30 = IC200CHS015 35 = IC200CHS003
41	9	second I/O module slot carrier type
42	10	third I/O module slot carrier type
43	11	fourth I/O module slot carrier type
44	12	fifth I/O module slot carrier type
45	13	sixth I/O module slot carrier type
46	14	seventh I/O module slot carrier type
47	15	eighth I/O module slot carrier type
48, ..., 55	16, ..., 23	not used
56, 57	24, 25	Length of additional data (00, 00)
58, 59	0, 1	Must be 00, 00
60	2	61h (97)
61	3	0Ah (10)
62, ..., 65	4, ..., 7	Reserved (must be 00, 00)
66	8	first booster PS Carrier type: 0 = none 5 = IC200PWR001 10 = IC200PWR002 15 = IC200PWR101 20 = IC200PWR102 40 = IC200PWB001 (carrier)
67	9	first booster PS, Power Supply type (see above)
68	10	second booster PS Carrier type
69	11	second booster PS, Power Supply type
70	12	third booster PS Carrier type
71	13	third booster PS, Power Supply type
72	14	fourth booster PS Carrier type
73	15	fourth booster PS, Power Supply type
74	16	fifth booster PS Carrier type
75	17	fifth booster PS, Power Supply type (see above)
76	18	sixth booster PS Carrier type
77	19	sixth booster PS, Power Supply type
78	20	seventh booster PS Carrier type
79	21	seventh booster PS, Power Supply type
80, ..., 81	22, ..., 23	Reserved (must be 00, 00)

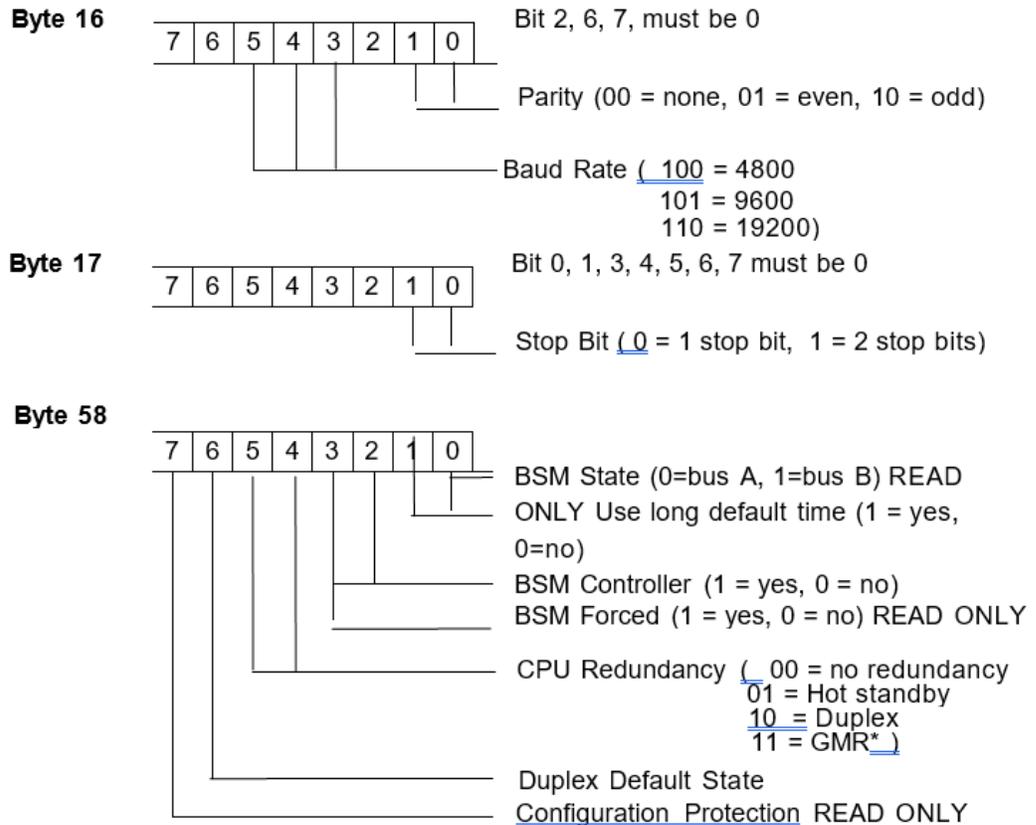
(Byte in Message)	(Byte in Record)	Byte Description
82, 83	24, 25	Additional Length (00, 00)

The “bytes in message offsets” are shown for configuration data included in a Read Configuration Data Reply datagram. For inclusion in a Write Configuration Data datagram, each offset is increased by one.

#### Network Interface Unit Configuration Data Format (Rack 0, slot 1)

(Byte in Message)	(Byte in Record)	Byte Description
6, 7	0, 1	not used (00,00)
8	2	major type (03=NIU)
9	3	minor type (01h = Enhanced diagnostic disabled 81h = Enhanced diagnostic enabled*) * Enhanced Diagnostics mode cannot be enabled via a Write Configuration datagram.
10, ..., 13	4, ..., 7	reserved (must be 00, 00, 00, 00)
14	8	autoconfiguration enable (enabled=1)
15	9	not used, must be 0
16	10	Serial port configuration data lower byte (see below)
17	11	Serial port configuration data higher byte (see below)
18, ..., 29	9, ..., 23	not used, must be 00
30, 31	24, 25	Length of additional data (52)
32, 33	0, 1	not used (00,00)
34	2	major type (05=Expansion Module)
35	3	Expansion Transmitter Present (00=no, 01=yes)
36, ..., 39	4, ..., 7	reserved (must be 00, 00, 00, 00)
40, ..., 55	8, ... 23	not used (00,00)
56, 57	24, 25	Length of additional data (00, 00)
58	0	Redundancy and BSM (see below)
59	1	Report faults (enable=0, disable=128)
60	2	Serial Bus Address (SBA) 0-31. 255 = factory default. Note: the factory default settings for SBA and baud rate must be changed to valid values before commanding the NIU to use configuration values for SBA or baud rate.
61	3	Baud Rate(read-only): 0 = 153.6Kb ext 1 = 153.6 Kb std 2 = 76.8 Kb 3 = 38.4 Kb, 15=factory default (see above).
62	4	Default time: 0 =3 bus scans, 25 = 2.5 seconds, 100 = 10.0 seconds
63, 64	5, 6	Status Table Address (used only by Series Six PLC host)
65, ..., 68	7, ..., 10	47h, 4eh, 49h, 55h (“GNIU”)
69, ..., 81	11, ..., 23	not used (00)
82, 83	24, 25	Additional Length (00, 00)

**Figure 64: Bytes 16, 17, and 58**



\* GMR mode cannot be enabled via a Write Configuration datagram.

**Expansion Receiver Module Format (Rack 1-7, slot 1)**

(Byte in Message)	(Byte in Record)	Byte Description
6, 7	0, 1	not used (must be 0)
8	2	major type (05=Expansion Module)
9	3	Type of Expansion Receiver (02=Isolated, 03=Non-isolated)
10,..., 13	4,..., 7	not used (must be 0)
14,..., 29	8,..., 23	not used (must be 0)
30, 31	24, 25	Length of additional data (0)

### I/O Module Configuration Data Format

Configuration data for I/O modules follow the same format for all non-intelligent I/O modules, analog or discrete, input, output, or mixed. The configuration datagram contains a VersaMax configuration message header, a rack/slot header, fixed I/O configuration fields, variable-length configuration fields, and module-specific data. The total length of fixed and variable I/O configuration fields and module-specific data must be a multiple of 26 bytes. Pad bytes set to a value of 0 are appended to the end of the module-specific data to meet this requirement. Fixed and variable-length configuration fields appear according to the mapping shown in the table below.

#### I/O Module Format (Rack 0-7, slot 2-9)

(Byte in Message)	(Byte in Record)	Byte Description
Rack/slot header		
6, 7	0, 1	secondary board ID (MSB in 0, LSB in 1)
8, 9	2, 3	primary board ID (MSB in 2, LSB in 3)
10, ..., 13	4, ..., 7	ASCII string. Set to zeros during auto-configuration, the programmer may fill this field with an arbitrary identification string.
14, ..., 15	8, ..., 9	Length of additional data (excluding pad bytes)
16, ..., 29	10, ..., 23	not used (must be 0)
30, 31	24, 25	Length of additional data (excluding pad bytes)
Fixed I/O configuration fields		
32, 33	0, 1	Secondary board ID (same as above.)
34, 35	2, 3	Primary board ID(same as above)
36, 37	4, 5	Offset from the start of fixed I/O configuration fields to module-specific data. The length of module-specific data is given at offset 18 below.
38, 39	6, 7	The number of discrete input reference description fields listed in the input segments list below. (may be 00)
40, 41	8, 9	Number of discrete output reference description fields listed in the output segments list below. (may be 00)
42, 43	10, 11	Number of analog input reference description fields listed in the input segments list below. (may be 00)
44, 45	12, 13	Number of analog output reference description fields listed in the output segments list below. (may be 00)

(Byte in Message)	(Byte in Record)	Byte Description
46, 47	14, 15	Module setup, a bitmapped word bit 0 indicates whether defaults are defined in the configuration structure. If this bit is '1', then input segments mode, output segments mode, default input values, and default output values fields are included below. Bit 1 enables fault reporting for the module. bits 2-15 are reserved and must be set to zero.
48, 49	16, 17	Reserved (must be 00)
50, 51	18, 19	Length in bytes of module-specific data
52, 53	20, 21	Reserved (must be 00)
54, 55	22, 23	Reserved (must be 00)
Optional I/O configuration fields		
56,... N		Input segments list, an eight-byte reference description field for each discrete or analog input segment, see below.
		Output segments list, an eight-byte reference description field for each discrete or analog output segment.
		Input segments mode, a bitmapped word with a bit representing each reference description in the input segments list. If the bit is '1', then inputs hold the last state. If the bit is '0', then the input's default values are in the default input values field below.
		Output segments mode, a bitmapped word with a bit representing each reference description in the output segments list. If the bit is '1', then outputs hold the last state. If the bit is '0', then the outputs default to values in the default output values field below.
		Default input values (one byte for each byte of inputs defined for the module)
		Default output values (one byte for each byte of outputs defined for the module)
Module-specific data		
		Context-dependent data fields Pad bytes (must be 00) round the bytes in the record up to the next larger multiple of 26.

**Reference Description Field**

(Byte in Message)	(Byte in field)	Byte Description
varies	0	The sequence number is an arbitrary value that controls the order in which segments are reported.
	1	Reference type: discrete input reference, %I = 16 discrete output reference, %Q = 18 analog input reference, %AI = 10 analog output reference, %AQ = 12
	2,3	Byte offset within reference memory. For analog references, this must be an even number. During auto-configuration, the GNIU sets this field to the next available reference address.
	4,5	The byte length of memory used by this segment. For an analog module, this is the number of channels multiplied by two. For a discrete module, this is the number of points divided by eight, rounded up.
	6,7	Offset from the start of fixed I/O configuration fields to the beginning of default values associated with this segment.

The NIU fills out the configuration data fields based on the content of the primary and secondary board ID fields. The NIU reads these fields from the I/O module. Bit fields in the module board ID indicate whether the module is discrete or analog, the number of input points or channels, the number of output points or channels, and whether diagnostic bits are returned by the module. The NIU calculates values of the fixed and variable-length configuration fields from these parameters.

The primary and secondary board ID fields in Write Configuration Data and Read Configuration Data datagrams are transmitted with the most significant byte in the lowest memory location or transmitted first in time. The least significant byte follows. All other word-length data fields appear in the opposite order.

**NON-INTELLIGENT I/O Board\_id REGISTER**

**Figure 65: Non-intelligent I/O Bytes 0 and 1**

byte 0								byte 1							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
1		0		0		Module type		Addtl data		diag bits		output points or channels		input points or channels	

Bytes	Byte Description
Module Type 8, 9	00 = Discrete DC module 01 = Discrete AC module 10= Analog voltage module 10 = Analog current module
Additional data 6,7	Analog Module: <ul style="list-style-type: none"> <li>0 = Voltage</li> <li>1= Current</li> </ul> Discrete Module is always 0
Diagnostic bits 4, 5	The number of diagnostic bits per point or channel
Output points or channels 2, 3	Discrete modules: number of pairs of output points for the module. Analog modules: number of analog output channels for the module.
Input points or channels 0, 1	Discrete modules: number of pairs of input points for the module. Analog modules: number of analog input channels for the module

Module-specific data is unique to the type of module. For analog and discrete I/O modules, two bytes of module-specific data are returned. The content of these bytes is defined in the following tables.

**DISCRETE MODULE-DEPENDENT DATA**

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	IN	FS	

Byte	Definition	Byte Description
IN	Interrupts Enabled	TRUE indicates the module is configured to interrupt the head end.
FS	Filter Selection	0 = 0 ms 1 = 1 ms 2 = 7ms

### ANALOG MODULE-DEPENDENT DATA

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	BP

Byte	Definition	Byte Description
BP	BiPolar	0 = Unipolar 1 = Bipolar

#### Example: Configuration message for IC200MDD844

The following example shows the Read Configuration Data Reply datagram for a mixed discrete I/O module, the IC200MDD844. This module contains a 16-point output board as its primary board and a 16-point input board as its secondary slot.

(Byte in Message)	(Byte in Record)	Content	Byte Description
VersaMax configuration message header			
0	0	0	Rack (e.g., Rack 0, the rack containing the GNIU)
1, 2	1, 2	82	Message length (e.g., 82 bytes total length)
3	3	3	Slot (e.g., 3, the second I/O slot)
4,5	4,5	0, 0	Offset into configuration data (e.g., zero because the configuration fits in one message)
Rack/slot header			
6, 7	0, 1	0x80, 0x08	secondary board ID (e.g., the ID is 0x8008. The LSB is in byte 0, and the MSB is in byte 1.)
8, 9	2, 3	0x80, 0x80	primary board ID (e.g., the ID is 0x8080. The LSB is in byte 2, and the MSB is in byte 3.)
10, ..., 13	4, ..., 7	0x44, 0x38, 0x34, 0x34	ASCII string. Set to zeros during auto-configuration, the programmer may fill this field with an arbitrary identification string. (e.g., this is the ASCII label "D844")
14, 15	8, 9	50, 0	Length of additional data, excluding pad bytes
16, ..., 29	10, ..., 23	0	not used (must be 0)
30, 31	24, 25	52, 0	Total Length of additional data (e.g., 52 bytes)
Fixed I/O configuration fields			
32, 33	0, 1	0x80, 0x08	secondary board ID (same as above.) (e.g., discrete DC type, no diagnostic bits, no outputs, eight pairs of inputs)
34, 35	2, 3	0x80, 0x80	primary board ID (same as above) (e.g., discrete DC type, no diagnostic bits, eight pairs of outputs, no inputs; there are two boards in this module.)

(Byte in Message)	(Byte in Record)	Content	Byte Description
36, 37	4, 5	48, 0	offset from the start of fixed I/O configuration fields to module-specific data. The length of module-specific data is given at offset 18 below.
38, 39	6, 7	1, 0	Number of discrete input reference description fields listed in the input segments list below. (may be 00)
40, 41	8, 9	1, 0	Number of discrete output reference description fields listed in the output segments list below. (may be 00)
42, 43	10, 11	0, 0	Number of analog input reference description fields listed in the input segments list below. (may be 00)
44, 45	12, 13	0, 0	Number of analog output reference description fields listed in the output segments list below.(may be 00)
46, 47	14, 15	3, 0	Module setup, a bitmapped word bit 0 indicates whether defaults are defined in the configuration structure. If this bit is '1', then input segments mode, output segments mode, default input values, and default output values fields are included below. bit 1 enables fault reporting for the module. bits 2-15 are reserved, and must be set to zero. (e.g., defaults are defined, and fault reporting is enabled by this setting.)
48, 49	16, 17	0, 0	Reserved (must be 00)
50, 51	18, 19	2, 0	Length in bytes of module-specific data (e.g., two bytes)
52, 53	20, 21	0, 0	Reserved (must be 00)
54, 55	22, 23	0, 0	Reserved (must be 00)
0	0	0	Rack (e.g., Rack 0, the rack containing the GNIU)
1, 2	1, 2	82	Message length (e.g., 82 bytes total length)
3	3	3	Slot (e.g., 3, the second I/O slot)
4,5	4,5	0, 0	Offset into configuration data (e.g., zero because the configuration fits in one message)
Rack/slot header			
6, 7	0, 1	0x80, 0x08	secondary board ID
8, 9	2, 3	0x80, 0x80	primary board ID
10, ..., 13	4, ..., 7	0x44, 0x38, 0x34, 0x34	ASCII string. Set to zeros during auto-configuration, the programmer may fill this field with an arbitrary identification string. (e.g., this is the ASCII label "D844")
14, ..., 29	8, ..., 23	0	not used (must be 0)
30, 31	24, 25	50, 0	Length of additional data (e.g., 50 bytes)

(Byte in Message)	(Byte in Record)	Content	Byte Description
Fixed I/O configuration fields			
32, 33	0, 1	0x80, 0x08	secondary board ID (same as above.) (e.g., discrete DC type, no diagnostic bits, no outputs, eight pairs of inputs)
34, 35	2, 3	0x80, 0x80	primary board ID (same as above) (e.g., discrete DC type, no diagnostic bits, eight pairs of outputs, no inputs; there are two boards in this module.)
36, 37	4, 5	48, 0	offset from the start of fixed I/O configuration fields to module-specific data. The length of module-specific data is given at offset 18 below.
38, 39	6, 7	1, 0	Number of discrete input reference description fields listed in the input segments list below. (may be 00)
40, 41	8, 9	1, 0	Number of discrete output reference description fields listed in the output segments list below. (may be 00)
42, 43	10, 11	0, 0	Number of analog input reference description fields listed in the input segments list below. (may be 00)
44, 45	12, 13	0, 0	Number of analog output reference description fields listed in the output segments list below.(may be 00)
46, 47	14, 15	3, 0	Module setup, a bitmapped word bit 0 indicates whether defaults are defined in the configuration structure. If this bit is '1', then input segments mode, output segments mode, default input values, and default output values fields are included below. bit 1 enables fault reporting for the module. bits 2-15 are reserved and must be set to zero. (e.g., defaults are defined and fault reporting is enabled by this setting.)
48, 49	16, 17	0, 0	Reserved (must be 00)
50, 51	18, 19	2, 0	Length in bytes of module-specific data (e.g., two bytes)
52, 53	20, 21	0, 0	Reserved (must be 00)
54, 55	22, 23	0, 0	Reserved (must be 00)
Optional I/O configuration fields			
			Input segments list, an eight-byte reference description field for each discrete or analog input segment. (e.g., one discrete input segment)
56	24	1	Sequence number (e.g., 1)
57	25	16	Reference type (e.g., discrete input, %I)
58, 59	26, 27	17, 0	Offset in reference memory; this value filled in by the programmer indicates these are bits %I17 through %I32)
60, 61	28, 29	2, 0	Byte length (e.g., two bytes for a 16-bit input segment)

(Byte in Message)	(Byte in Record)	Content	Byte Description
62, 63	30, 31	44, 0	Offset to defaults (e.g., see offset 44 below)
			Output segments list, an eight-byte reference description field for each discrete or analog output segment. (e.g., one discrete input segment)
64	32	2	Sequence number (e.g., 2)
65	33	18	Reference type (e.g., discrete output, %Q)
66, 67	34, 35	8, 0	Offset in reference memory; this value filled in by the programmer indicates these are bits %Q8 through %Q24)
68, 69	36, 37	2, 0	Byte length (e.g., two bytes for a 16-bit output segment)
70, 71	38, 39	46, 0	Offset to defaults (e.g., see offset 46 below)

72	40	0, 0	Input segments mode, a bitmapped word with a bit representing each reference description in the input segments list. If the bit is '1', then inputs hold the last state. If the bit is '0', then the input's default values are in the default input values field below. (e.g., only bit 0 is meaningful; use of default values is indicated)
74	42	0, 0	Output segments mode, a bitmapped word with a bit representing each reference description in the output segments list. If the bit is '1', then outputs hold the last state. If the bit is '0', then the outputs default to values in the default output values field below. (e.g., only bit 0 is meaningful; use of default values is indicated)
			Default input values
76	44	0	defaults for input points 0-7 (e.g., all zeros)
77	45	0	defaults for input points 8-15 (e.g., all zeros)
			Default output values
78	46	0xFF	defaults for output points 0-7 (e.g., all ones)
79	47	0xFF	defaults for output points 8-15 (e.g., all ones)
Module-specific data			
			Context-dependent data fields
80	48	2	bit map for discrete module parameters (e.g., select input filter = 7 milliseconds, Interrupts Disabled)
81	49	0	reserved bits
82, 83	50, 51	0, 0	Pad bytes extend the length of this record to 52 bytes (=2x26)

### Example: Configuration Message for IC200ALG265

The configuration data format of the 15-channel analog voltage module is shown below. By specifying an offset, as listed in the left column, and a length in bytes, any portion of the configuration data can be read or written.

Offset (Byte #)	Byte description
0,1	Secondary board ID (must be 0xFFFF)
2, 3	Primary board ID (must be 0x0F90)
4,...,7	Module ID string –“A265” (41h, 32h, 36h, 35h)
8, 9	Modules configuration length (must be 66)
10,..., 23	Reserved. (must be 00h)
24, 25	Length of additional data (must be 78)
26, 27	Secondary board ID (must be 0xFFFF)
28, 29	Primary board ID (must be 0x0F90)
30,31	Module-dependent offset (must be 64)
32, 33	Number of discrete input segments (must be 0000h)
34, 35	Number of discrete output segments (must be 0000h)
36, 37	Number of analog input segments (must be 0001h)
38, 39	Number of analog output segments (must be 0000h)
40	Module setup, a bitmapped word, bit 0 indicates whether defaults are defined in the configuration structure. If this bit is '1', then input segments mode, output segments mode, default input values, and default output values fields are included below. bit 1 enables fault reporting for the module. bits 2-15 are reserved and must be set to zero.
41	Reserved. Must be 00h
42, 43	Extra hardware offset (must be 0000h)
44, 45	Module-dependent length (must be 0002h)
46,..., 49	Reserved. (must be 00h)
50	Reference ID
51	Reference memory type (must be 10 for %AI)
52, 53	Starting offset for the module's analog input table(Offset in bytes)
54, 55	Length in bytes (must be 30)
56, 57	Default offset (must be 34)
58, 59	Default/Hold last state (0000h = Default, 0001h = Hold last state)
60, 61	Default input for analog channel #1
62, 63	Default input for analog channel #2
64, 65	Default input for analog channel #3
66, 67	Default input for analog channel #4
68, 69	Default input for analog channel #5
70, 71	Default input for analog channel #6
72, 73	Default input for analog channel #7

Offset (Byte #)	Byte description
74, 75	Default input for analog channel #8
76, 77	Default input for analog channel #9
78, 79	Default input for analog channel #10
80, 81	Default input for analog channel #11
82, 83	Default input for analog channel #12
84, 85	Default input for analog channel #13
86, 87	Default input for analog channel #14
88, 89	Default input for analog channel #15
90, 91	Must be 8001h

### Example Configuration Message for IC200ALG266

The configuration data format of the 15-channel analog voltage module is shown below. By specifying an offset, as listed in the left column, and a length in bytes, any portion of the configuration data can be read or written.

Offset (Byte #)	Byte description
0,1	Secondary board ID (must be 0xFFFF)
2, 3	Primary board ID (must be 0x0F94)
4,...,7	Module ID string –“A266” (41h, 32h, 36h, 36h)
8, 9	Modules configuration length (must be 66)
10,..., 23	Reserved. (must be 00h)
24, 25	Length of additional data (must be 78)
26, 27	Secondary board ID (must be 0xFFFF)
28, 29	Primary board ID (must be 0x0F94)
30,31	Module-dependent offset (must be 64)
32, 33	Number of discrete input segments (must be 0000h)
34, 35	Number of discrete output segments (must be 0000h)
36, 37	Number of analog input segments (must be 0001h)
38, 39	Number of analog output segments (must be 0000h)
40	Module setup, a bitmapped word. bit 0 indicates whether defaults are defined in the configuration structure. If this bit is '1', then input segments mode, output segments mode, default input values, and default output values fields are included below. bit 1 enables fault reporting for the module. bits 2-15 are reserved and must be set to zero.
41	Must be 00h
42, 43	Extra hardware offset (must be 0000h)
44, 45	Module-dependent length (must be 0002h)

Offset (Byte #)	Byte description
46,..., 49	Must be 00h
50	Reference ID
51	Reference memory type (must be 10 for %AI)
52, 53	Starting offset for the module's analog input table(Offset in bytes)
54, 55	Length in bytes (must be 30)
56, 57	Default offset (must be 34)
58, 59	Default/Hold last state (0000h = Default, 0001h = Hold last state)
60, 61	Default input for analog channel #1
62, 63	Default input for analog channel #2
64, 65	Default input for analog channel #3
66, 67	Default input for analog channel #4
68, 69	Default input for analog channel #5
70, 71	Default input for analog channel #6
72, 73	Default input for analog channel #7
74, 75	Default input for analog channel #8
76, 77	Default input for analog channel #9
78, 79	Default input for analog channel #10
80, 81	Default input for analog channel #11
82, 83	Default input for analog channel #12
84, 85	Default input for analog channel #13
86, 87	Default input for analog channel #14
88, 89	Default input for analog channel #15
90, 91	Mode : 8002h = 0 - 20mA,            8003h = 4 - 20mA

## 5.6 Set NIU Operating Mode

Subfunction Code: 39 hex

This datagram can be used to set the operating mode of the NIU.

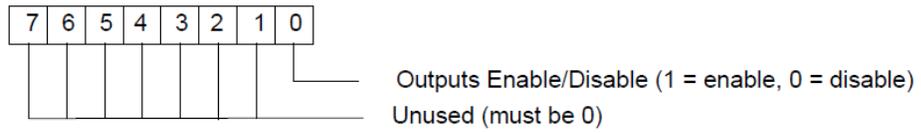
Byte No.	Byte Description
0	Mode
1	Mode

This message has two copies of the mode parameter. These copies must be equal for the command to be accepted by the NIU.

If you disable outputs, the NIU stops updating outputs for modules in the I/O Station, and outputs hold their last state.

---

**Figure 66: NIU Operating Mode Bytes**





## 6.1.1 Hot Standby CPU Redundancy

When configured for Hot Standby mode, the NIU recognizes the Genius Bus Controllers at Serial Bus Addresses 31 and 30. In this mode, the NIU's outputs are usually controlled by SBA 31. However, if no outputs are received from SBA 31 for a period of three Genius bus scans, the NIU's outputs are immediately controlled by SBA 30. If outputs are not available from either controller, the NIU's outputs go to their configured default or hold their last state. In Hot Standby mode, the controller at SBA 31 always has priority control of the NIU's outputs. In other words, whenever the controller at SBA 31 is online, it controls the NIU's outputs.

## 6.1.2 Duplex CPU Redundancy

When configured for Duplex mode, the NIU recognizes the Genius Bus Controllers at Serial Bus Addresses 31 and 30. When in this mode, the NIU compares the output values received from SBA 31 and SBA 30. For each output point, if the output values are the same, the NIU sets the output point to that state. If the output values are not the same, the NIU will set the output to its configured Duplex Default State, which must be configured for each output in the station as ON or OFF. If output values from either SBA 30 or SBA 31 are not available, the NIU's outputs are controlled by the remaining bus controller. If output values from both SBA 30 and SBA 31 are not available, the NIU's outputs either default to their configured default states (not their Duplex Default States) or hold their last state, as configured. When the NIU is configured for Duplex mode, no analog output modules are permitted in the station.

## 6.2 Using the NIU in a Genius Bus Redundancy System

In Genius bus redundancy, there are two bus cables each connected to a host PLC or computer. I/O devices such as the NIU may be connected to either one bus of the pair, or both. A device that is connected to both buses communicates on only one bus at a time. Before the alternate bus can be used for communications, a bus switchover must occur, and the device must “log in” with the Bus Controller(s) on the alternate bus.

The NIU contains a built-in bus-switching relay that is used to switch buses in a dual bus system. Other types of devices with this capability are Field Control BIUs, Bus Switching Modules, and Series 90-70 Remote I/O Scanner modules. These are the only types of devices that can be directly connected to both redundant bus cables.

An NIU cannot be used as the BSM Controller for a bus stub. Other devices cannot be located on a stub downstream of an NIU.

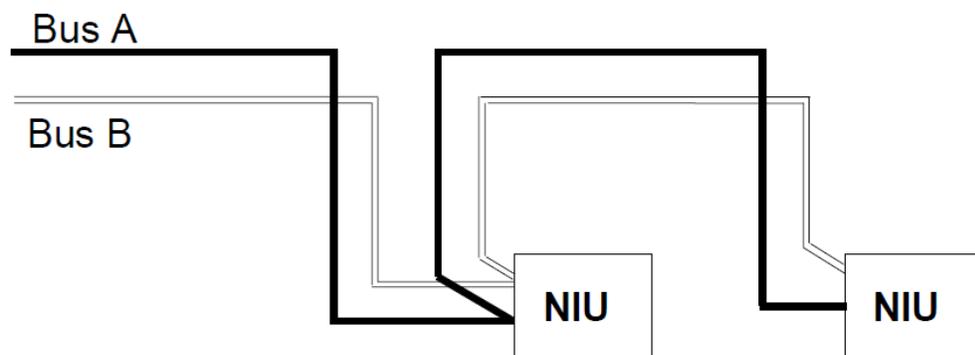
## 6.2.1 Redundant Bus Configurations

Many different redundant bus configurations are possible. Three basic ways of using an NIU with a redundant bus are described below.

- **An NIU can be installed directly on both cables of the dual bus pair.** The NIU is configured to operate as a bus-switching device in addition to performing its normal functions. Here, two NIUs are installed on a dual bus. Each NIU would be set up as a bus-switching device.

---

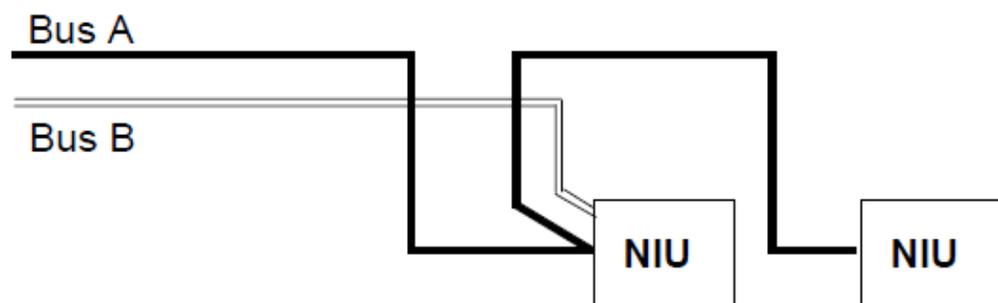
**Figure 68: Example NIU Installed Directly Installed on Both Cables**



- **An NIU can be located on one bus of a redundant bus pair if bus redundancy is not needed for the modules in that station.** In this example, the NIU on the left is connected to both Bus A and Bus B and is configured as a bus-switching device. The NIU on the right, which serves non-critical I/O modules, is connected to Bus A only and is not configured as a bus-switching device.

---

**Figure 69: Example of an NIU located on One Bus of a Redundant Pair**

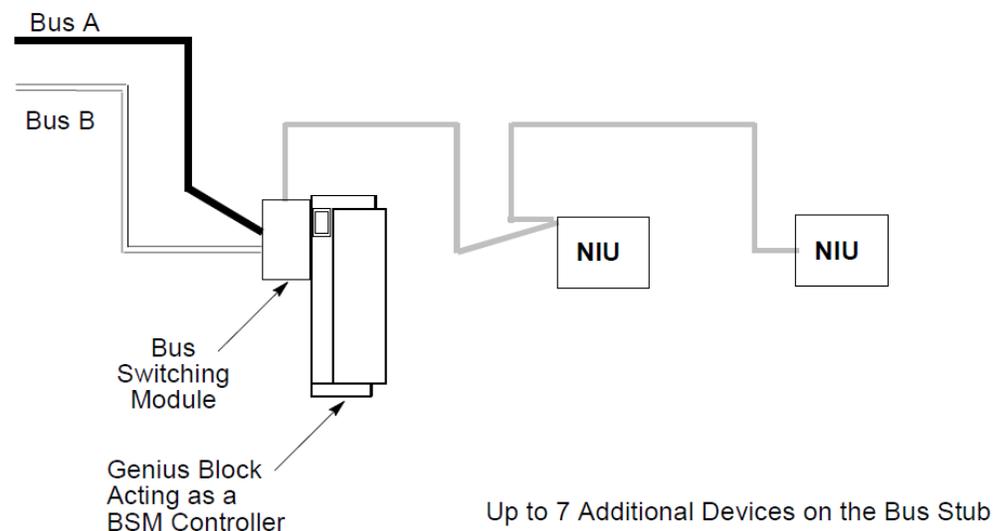


- **An NIU can be located on a bus stub.** A Network Interface Unit can also be located on a bus stub, which is a short length of unterminated cable downstream of another type of bus switching device, such as a Genius I/O block/Bus Switching Module combination. Because the bus stub cable itself is not redundant, this type of installation does not provide as much protection as connecting directly to a dual bus pair. The bus switching device to which the bus stub is connected can be another Genius block with a Bus Switching Module attached, as shown below.

In this example, there are two I/O stations installed on a bus stub. Each is configured as “BSM Present” but not configured as a “BSM Controller”

---

**Figure 70: Example of an NIU on a Bus Stub**



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Up to seven devices can be installed on a bus stub. Each device on a bus stub counts toward the total of 32 devices on the Genius bus.

Restrictions on the number and length of bus stubs that may be used on a dual bus are explained in the Genius I/O System and Communications User's Manual.

# Appendix A: Operation of the Genius Bus

This section describes the characteristics of the bus that links Genius devices. This information supplements Chapter 2 of the Genius I/O System and Communications Manual (GEK-90486-1) "The Communications Bus".

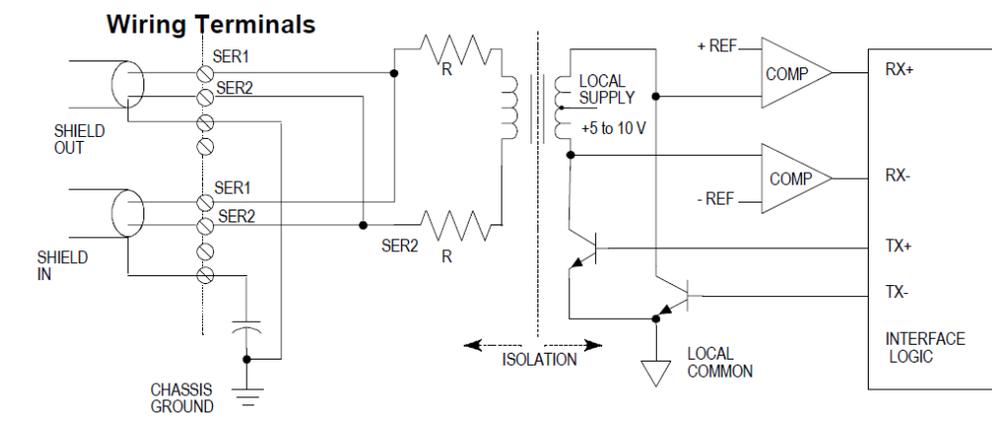
This section includes the following information:

- Electrical interface
- Serial bus waveforms
- Maximum bus length
- Serial data format
- Genius transceiver electrical specifications
- Bus errors

## A-1 Electrical Interface

All stations must receive to track the present token value and take their appropriate turn on the bus, regardless of whether the data is to be used locally. The transmit sequence is the same as the serial bus address (SBA) set into each location during configuration. A simplified interface circuit is shown below:

**Figure 71: Example of a Simplified Interface Circuit**



Signal coupling to the bus is via a high frequency, high isolation pulse transformer. The pulse waveforms are bipolar to reduce DC baseline offsets in the waveform.

The daisy-chained bus is shown on the left above. The SER 1 and SER 2 lines are tapped at the intermediate locations along the bus. These connections must be consistent since the signal is polarized. The shield of the cable is broken into segments at each location. Each shield segment is DC grounded at one end (SHIELD OUT) and terminated with a small capacitor at the other (SHIELD IN). The segmenting breaks up long ground loop paths. The capacitor termination reduces common mode noise from the high-frequency pickup while preventing large ground loop currents in the shield at low frequencies.

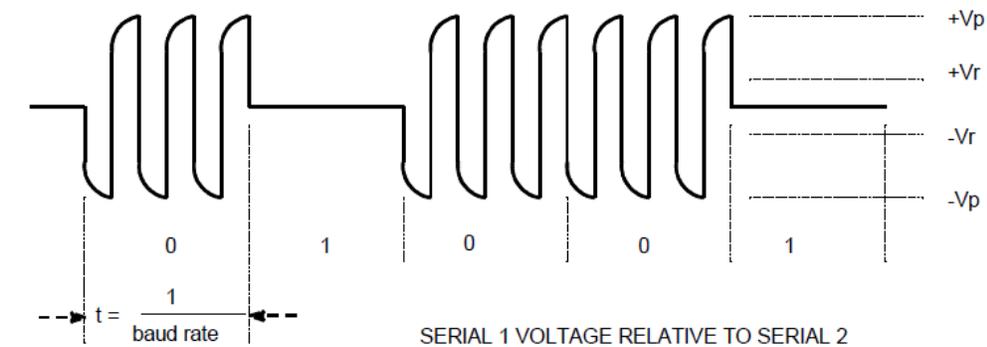
The alternately switching transistors produce a negative pulse followed by a positive pulse across SERIAL 1 relative to SERIAL 2. The bit waveform is a series of these pulses. The transformer provides isolation (2500 volts test) between the bus and the local logic, permitting these to be at different voltages. The internal resistors in each line provide a current limit and some termination during transmission.

The balanced (differential) signals on the twisted pair provide high noise immunity due to the magnetic (H field) cancellation effect of the twisting, as well as electric (E field) reduction by the shielding. Most remaining noise pickup is common mode: the transformer provides a high common mode noise rejection by looking only at the differential signal across the SER 1-2 lines. The two input comparators detect the positive polarity input pulses separately from the negative; these are sent to a custom interface logic chip which digitally filters these for timing and sequence, then reconstructs the NRZ digital data. Voltages between the two thresholds are ignored. This filtering and the high input threshold of the comparators are highly effective in rejecting both random impulse noise and low-level line reflections. Finally, a CRC-6 checksum check is performed before the data is sent to the local processor (not shown).

## A-2 Serial Bus Waveforms

The actual waveforms seen on the cable depend on the cable impedance and the distance from the station presently transmitting. A data "0" is a series of three AC pulses, while a "1" is no pulse.

**Figure 72: Example Serial Bus Waveform**



Use caution when connecting instrumentation to the bus. A differential probe or a summation of two probes relative to the ground is required. Inadvertent grounding of one side of the bus can cause loss of data or data errors.

The pulse frequency is three times the baud frequency, for example, 460.8 KHz at 153.6 Kb.

The peak transmitted voltage  $V_p$  and the receiver thresholds  $V_r$  are per the electrical specification in this section. The peak voltages measured will decline with distance along the cable from the transmitting station, so different stations will have varying amplitudes. The wave shape will also become more rounded with distance.

The minimum amplitude pulses seen during a "0" should exceed the receiver threshold  $V_r$  of 900 millivolts by 50% (about 1.4 volts) for best reliability. An occasional pulse at or below the threshold may still not cause the bit to be missed, due to a voting algorithm in the logic, however.

Likewise, no pulses greater than  $V_r$  should exist during logic "1" intervals. Occasional extra pulses during this interval are also rejected by the logic.

Line reflections will show up as notch distortion during the pulse or low-level pulses during "1" intervals, and their appearance is synchronized to

the baud frequency. These cause no problem if they do not cause a violation of the amplitude criteria of the previous paragraphs.

The Serial 1 and Serial 2 lines should always have a termination resistor equal to the characteristic impedance of the cable connected at each end.

## A-3 Maximum Bus Length

Three effects limit the maximum length of bus available at any baud rate:

- Voltage attenuation
- Waveform distortion (frequency dispersion)
- Propagation delays

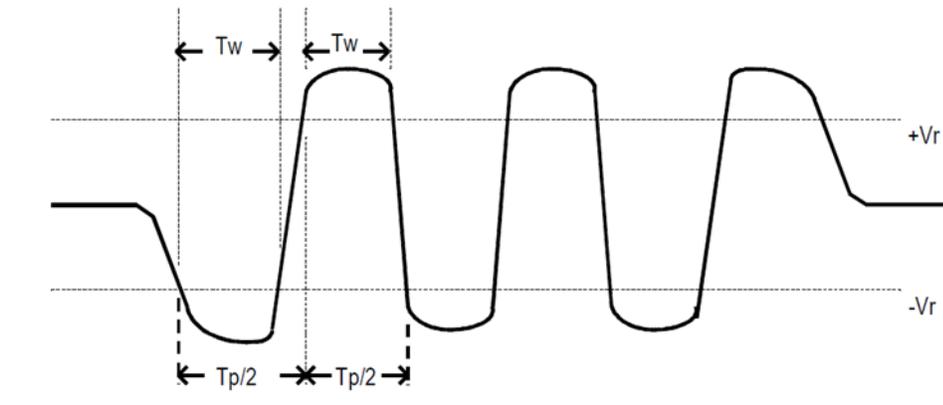
### A-3.1 Attenuation

The transmitter output levels and receiver thresholds determine the maximum attenuation that can be tolerated. This is the principal determinant when using recommended cables.

### A-3.2 Distortion

Waveform distortion is due to the limited bandwidth of wire media, which causes the various frequency components of a pulse waveform to travel at different speeds and arrive separately in time (called dispersion). As a result, the received pulse appears rounded and distorted. The signal at the end from the transmitter may look rounded and skewed as shown below. Distortion is most apparent near the beginning and end of a pulse train where it may appear as a change in phase or a frequency shift. Critical timing for a logic 0 transmission is shown below in a more detailed version of the waveform:

**Figure 73: Example Distortion Waveform**



Note the first and last half-cycle look wider. The most critical to operation is the first full cycle of the first start bit of the transmission. Detection of this pulse establishes the time synchronization of the receiver to the incoming waveform. Missing this first pulse does not cause the data to be missed, but may compromise the noise immunity concerning extra or missing pulses. The frequency of the AC pulse is

3X the baud rate as noted earlier. This means the normal period  $T_p(\text{normal})$  is:

- 2.17 microseconds at 153.6 Kb
- 4.34 microseconds at 76.8 Kb
- 8.68 microseconds at 38.4 Kb.

The half-cycle pulse width, when measured between the positive and negative receiver thresholds, denoted as  $T_p/2$  in the figure, will vary along the waveform due to dispersion, and resembles a frequency shift.. The digital input filter essentially is a band pass filter that looks at the half cycle timing  $T_p/2$ , and the duration above the thresholds,  $T_w$ . The limits are:

$T_p/2 = 0.6 T_p(\text{normal})$  maximum

$T_w = 0.188 T_p(\text{normal})$  minimum

These measurements can be taken when evaluating the maximum length of an unspecified cable. Dispersion is much less of a problem with fiber optic links since the media is a much wider bandwidth and therefore has less distortion.

### A-3.3 Propagation Delay

The propagation delay is caused by the travel time of the signal down the cable. Typical signal velocity in data-grade cables is around 65- 78% of the speed of light. This requires about 3 microseconds to travel a 2000-foot-long bus. This is about half a bit of time at 153.6 Kb. This skew could affect the bus access sequence since only one bit of quiet bus (skip) time is usually allocated between the transmission of adjacent addresses. The signal must reach all devices on the bus within a period of one bit. Propagation delay causes the ultimate limitation in bus length, even with ideal media. Propagation speed through fiber optic is not significantly different than wire, and delays through the interfaces must be accounted for.

## A-4 Serial Data Format

The Genius protocol produces maximum throughput of data by using a minimum overhead of control and synchronizing characters.

Each character is 11 bits long, comprising a start bit (always 0), next a control bit, followed by 8 bits of data, sent to LSB first. The last bit is a stop bit, always 1. Successive characters are sent with no time space between them. The control bit indicates the type of character being sent. A 1 indicates a control character, and a 0 is a data character.

A minimum transmission has a Start character, one or more data characters, and a Stop character. The Start character data contains the address and whether the transmission is directed to a specific address or broadcast to all. The End character contains the CRC-6 checksum. Complex transmissions may have additional start and end of block characters to break up the message into blocks of data. For example, a Bus Controller can send device-specific messages (blocks of data) to all devices on the bus during one transmission cycle.

### A-4.1 Bus Access

All devices receive the current SBA and the stop character even though the data is not used. After receiving the stop control character, each device starts a timer. The time delay is equal to a skip time, times the difference between the device SBA and the last SBA received. The device will transmit after the time delay if no other start bits are detected first. Thus, each device takes a turn in order of SBA. Unused SBAs result in longer times between messages. All devices must detect messages within

this skip time delay. A bus "collision" (two sources transmitting simultaneously) results if this sequence is missed. The skip time is equal to a one-bit period, except at the 153.6e rate, where it is two-bit periods long. The longer interval accommodates greater propagation delays caused by longer bus cables or fiber optic or other repeaters. The worst case is when adjacent SBAs are physically located at opposite ends of a long bus. For example, assume SBA 4 and 6 are at one end of a 2000-foot bus and SBA5 at the other, operating at 153.6s Kb. When SBA 4 end character is detected, SBA6 immediately starts timing 2 skip times (52  $\mu$ Sec) to start its transmission. SBA5 receives the end character 3  $\mu$ Sec later and starts timing 1 skip time (26  $\mu$ Sec). Thus SBA 5 will start transmitting 29  $\mu$ Sec after SBA 4 quit. This allows 23 $\mu$ Sec for the signal to get back to SBA6 to cancel its transmission turn. The 3 $\mu$ Sec transmission delay leaves only 20  $\mu$ Sec to do this and avoid a collision between SBA5 and 6.

Bus collisions result in missing data or detected CRC errors. Problems resulting from bus collisions can be fixed by skipping an SBA, re-sequencing SBAs in order along the bus, going from 153.6s baud to 153.6e, or a lower baud rate.

## A-5 Genius Transceiver Electrical Specification

Property	Min	Max
Normal peak voltage Vp into 78 ohms terminated cable (1)	3.5 volts	5.5 volts
Normal peak voltage Vp into 150 ohms terminated cable (1)	6.0 volts	9.5 volts
Rated bus impedance (2)	78 ohms	
Maximum output voltage (SER 1 and 2 open) (3)		Peak: 35 volts RMS: 15 volts
Maximum output current (SER 1 and 2 shorted together)		Peak: 180 milliamp RMS: 50 milliamp
Transmitter source resistance	80 ohms	140 ohms
Transmitter source inductance (transformer leakage inductance)		10 microhenries
Receiver input threshold; +Vr, -Vr (4)	0.7 volt	1.1 volt
Receive mode input impedance	10 K ohm	
Receive mode load inductance (transformer shunt inductance)	6 millihenries	12 millihenries
Receiver common mode rejection (DC to 1 MHZ)	60 dB	
Shield capacitor termination	0.1 microfarad	
Isolation, serial bus to circuit, continuous	240 volts AC	
Vp may vary among various module types. The rated load is half cable impedance when termination is included. Peak open circuit voltage contains underdamped ringing due to lack of termination. Input voltages between +Vr and -Vr thresholds are ignored.		

## A-6 Bus Errors

Most capacitively- and magnetically coupled noise shows up as common mode voltage on the bus. The bus provides a 60-dB common mode rejection ratio. A noise spike above 1000 volts would be required to corrupt the data. The bus receivers filter out corrupted data and perform a 6-bit cyclic redundancy check to reject bad data. Corrupted signals due to a noise show up as missed data rather than incorrect data. The bus continues operating to the maximum extent possible when bus errors are detected; random bus errors do not shut down communications. Bad data is rejected by the receiving device and excessive errors are reported to the controller.

## Appendix B: Performance Data

This section lists approximate scan times in microseconds for modules in a VersaMax Genius NIU I/O Station. Each module was configured with its default settings and user power was applied when applicable. This information is provided as a guideline for determining I/O scanning times. Actual timing may vary.

**Note:** If the GNIU has Enhanced Diagnostics Mode set to Enabled, refer to Section 3.5.2, *GNIU Sweep Times for Enhanced Diagnostics Mode.*

Module Catalog Number	Description	Main Rack	Expansion Rack	
			Non-isolated	Extended or Isolated
IC200ALG230	Analog Input Module, 12 Bit Voltage/Current 4 Channels	448	x	x
IC200ALG240	Analog Input Module, 16 Bit Voltage/Current 1500VAC Isolation, 8 Channels	968	1480	5857
IC200ALG260	Analog Input Module, 12 Bit Voltage/Current Isol. 8 Ch.	737	x	x
IC200ALG320	Analog Output Module, 12 Bit Current, 4 Channels	1258	x	x
IC200ALG321	Analog Output Module, 12 Bit Voltage 4 Channels, 0 to +10VDC Range	1258	x	x
IC200ALG322	Analog Output Module, 12 Bit Voltage 4 Channels, -10 to +10VDC Range	1258	x	x
IC200ALG331	Analog Output Module, 16 Bit Voltage/Current, 1500VAC Isolation, 4 Channels	1652	2156	6644
IC200ALG430	Analog Mixed 12 Bit Input Current 4 Channels / Output Current 2 Channels	1308	x	x
IC200ALG431	Analog Mixed 12 Bit 0 to +10VDC Input 4 Channels / Output 0 to +10V 2 Channels	1308	x	x
IC200ALG432	Analog Mixed 12 Bit -10 to +10VDC Input 4 Channels / Output -10 to +10V 2 Channels	1308	x	x
IC200ALG620	Analog Input, 16 Bit RTD, 4 Channels	843	1299	5257
IC200ALG630	Analog Input, 16 Bit Thermocouple, 7 Channels	897	1398	5731
IC200MDD840	Mixed 24VDC Positive Logic Input Grouped 20 Point/ Output Relay 2.0A per Point Grouped 12 Point Module	821	1009	2836
IC200MDD841	Mixed 24VDC Positive Logic Input 20 Point/ Output 12 Point / 4 High-Speed Counter, PWM, or Pulse Train Points	6593	7905	20744

Module Catalog Number	Description	Main Rack	Expansion Rack	
			Non-isolated	Extended or Isolated
IC200MDD842	Mixed 16 Point Grouped Input 24VDC Pos/Neg Logic / 16 Pt Grouped Output 24VDC Pos. Logic 0.5A w/ESCP	777	873	1848
IC200MDD843	Mixed 24VDC Positive Logic Input Grouped 10 Point / Output Relay 2.0A per Point 6 Point Module	659	763	1687
IC200MDD844	Mixed 24 VDC Pos/Neg Logic Input Grouped 16 Point / Output 12/24VDC Pos. Logic 0.5A 16-Point Module	780	867	1842
IC200MDD845	Mixed 16 Point Grouped Input 24VDC Pos/Neg Logic / 8 Pt Relay Output 2.0A per Pt Isolated Form A	660	759	1689
IC200MDD846	Mixed 120VAC Input 8 Point / Output Relay 2.0A per Point 8 Point Module	675	777	1676
IC200MDD847	Mixed 240VAC Input 8 Point / Output Relay 2.0A per Point 8 Point Module	675	777	1676
IC200MDD848	Mixed 120VAC Input 8 Point / Output 120VAC 0.5A per Point Isolated 8 Point Module	675	777	1676
IC200MDD849	Mixed 120VAC In Isolated 8 Point / Output Relay 2.0A Isolated 8 Point Module	675	777	1676
IC200MDL140	Input 120VAC 8 Point Grouped Module	269	322	766
IC200MDL141	Input 240VAC 8 Point Grouped Module	269	322	766
IC200MDL240	Input 120VAC (2 Groups of 8) 16-Point Module	286	390	1256
IC200MDL241	Input 240VAC (2 Groups of 8) 16-Point Module	286	390	1256
IC200MDL329	Output 120VAC 0.5A per Point Isolated 8 Point Module	400	450	901
IC200MDL330	Output 120VAC 0.5A per Point Isolated 16 Point Module	516	563	1038
IC200MDL331	Output 120VAC 2.0A per Point Isolated 8 Point Module	400	450	901
IC200MDL640	Input 24VDC Positive Logic (2 Groups of 8) 16 Point Module	286	390	1256
IC200MDL650	Input 24VDC Positive Logic (4 Groups of 8) 32 Point Module	271	363	1225

Module Catalog Number	Description	Main Rack	Expansion Rack	
			Non-isolated	Extended or Isolated
IC200MDL730	Output 24VDC Positive Logic 2.0A per Point (1 Group of 8) with ESCP 8 Point Module	469	568	1461
IC200MDL740	Output 24VDC Positive Logic 0.5A per Point (1 Group of 16) 16-Point Module	516	563	1038
IC200MDL741	Output 24VDC Positive Logic 2.0A per Point (1 Group of 16) with ESCP 16 Point Module	518	563	1042
IC200MDL742	Output 24VDC Positive Logic 0.5A per Point (2 Groups of 16) with ESCP 32 Point Module	786	881	1870
IC200MDL750	Output 24VDC Positive Logic 0.5A per Point (2 Groups of 16) 32-Point Module	786	881	1870
IC200MDL930	Output Relay 2.0A per Point Isolated Form A 8 Point Module	400	450	901
IC200MDL940	Output Relay 2.0A per Point Isolated Form A 16 Point Module	516	563	1038

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