GE
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PACSystems* RX3i Genius Dual Bus Application Guide

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Chapter 1 Introduction

This document provides application-level information on the functionality, configuration and application of the logic components that support the operation of Dual Genius I/O Busses. The application solution:

- Operates upon Dual-Redundant Hot-Standby RX3i PLC platforms
- Interfaces to existing Genius I/O devices by way of PROFINET Controllers and Genius Communications Gateway modules.
- Is scalable and configurable allowing it to service up to 16 Genius I/O bus pairs
- Allows a mixture of Genius I/O Redundancy and PROFINET System Redundancy
- Furnished as Proficy Machine Edition Toolchest items that can be added to an existing PLC project.

1.1 Revisions in this Manual

Rev	Date	Description
B	Jun-2018	• Revised the illustration for system architecture (Figure 2). • Revised the interface characteristics for the function block AUTO_SW. • Describes revision 1.06 of the app. • Added Chapter 6, *Updating from a Previous Release.*
A	Feb-2018	• Addition of Figure 21 and related section. • Minor corrections & clarifications.
	Dec-2017	• Initial publication: describes revision 1.05 of the app.

1.2 PACSystems Documentation

PACSystems Manuals

PACSystems RX7i, RX3i and RSTi-EP CPU Reference Manual	GFK-2222
PACSystems RX7i, RX3i and RSTi-EP CPU Programmer's Reference Manual	GFK-2950
PACSystems RX7i, RX3i and RSTi-EP TCP/IP Ethernet Communications User Manual	GFK-2224
PACSystems TCP/IP Ethernet Communications Station Manager User Manual	GFK-2225
C Programmer's Toolkit for PACSystems	GFK-2259
PACSystems Memory Xchange Modules User's Manual	GFK-2300
PACSystems Hot Standby CPU Redundancy User Manual	GFK-2308
PACSystems Battery and Energy Pack Manual	GFK-2741
Proficy Machine Edition Logic Developer Getting Started	GFK-1918
Proficy Process Systems Getting Started Guide	GFK-2487
PACSystems RXi, RX3i, RX7i and RSTi-EP Controller Secure Deployment Guide	GFK-2830
PACSystems RX3i & RSTi-EP PROFINET I/O Controller Manual	GFK-2571

RX3i Manuals

PACSystems RX3i System Manual	GFK-2314
PACSystems RX3i PROFIBUS Modules User's Manual	GFK-2301
PACSystems RX3i Max-On Hot Standby Redundancy User's Manual	GFK-2409
PACSystems RX3i Ethernet Network Interface Unit User's Manual	GFK-2439
PACSystems RX3i PROFINET Scanner Manual	GFK-2737
PACSystems RX3i CEP PROFINET Scanner User Manual	GFK-2883
PACSystems RX3i Serial Communications Modules User's Manual	GFK-2460
PACSystems RX3i Genius Communications Gateway User Manual	GFK-2892

RX7i Manuals

PACSystems RX7i Installation Manual	GFK-2223
PACSystems RX7i User's Guide to Integration of VME Modules	GFK-2235
Series 90-70 Genius Bus Controller User's Manual	GFK-2017

Series 90 Manuals

Series 90-30 Genius Bus Controller User's Manual	GFK-1034

Distributed I/O Systems Manuals

Genius I/O System User's Manual	GEK-90486-1
Genius I/O Analog and Discrete Blocks User's Manual	GEK-90486-2
Genius Hand-Held Monitor User's Guide	GFK-0121

In addition to these manuals, datasheets and product update documents describe individual modules and product revisions. The most recent PACSystems documentation is available on the GE Automation & Controls support website www.geautomation.com.

1.3 Abbreviations

Abbreviation	Meaning
BSM	Genius Bus Switching Module
CPE	RX3i CPU with embedded Ethernet
GCG	Genius Communication Gateway (GCG001)
HHM	Genius Hand-Held Monitor
MRP	Ethernet Media Redundancy Protocol
PME	Proficy Machine Edition (programming & configuration software tool)
PNC	PROFINET Controller
PNSR	PROFINET System Redundancy
SBA	Genius Serial Bus Address

Chapter 2 Overview

Genius Dual Busses are typically deployed in applications such as that diagrammed in Figure 1, where high availability, in particular ability to withstand faults in the I/O network and in the PLC CPU system, is required.

In the RX3i environment, Genius devices must be interfaced via the Genius Communications Module (GCG001), which then communicates over PROFINET with the host PLC.

GCG001 supports a number of different Genius head-ends, allowing other types of I/O rack to be attached to the Genius bus.

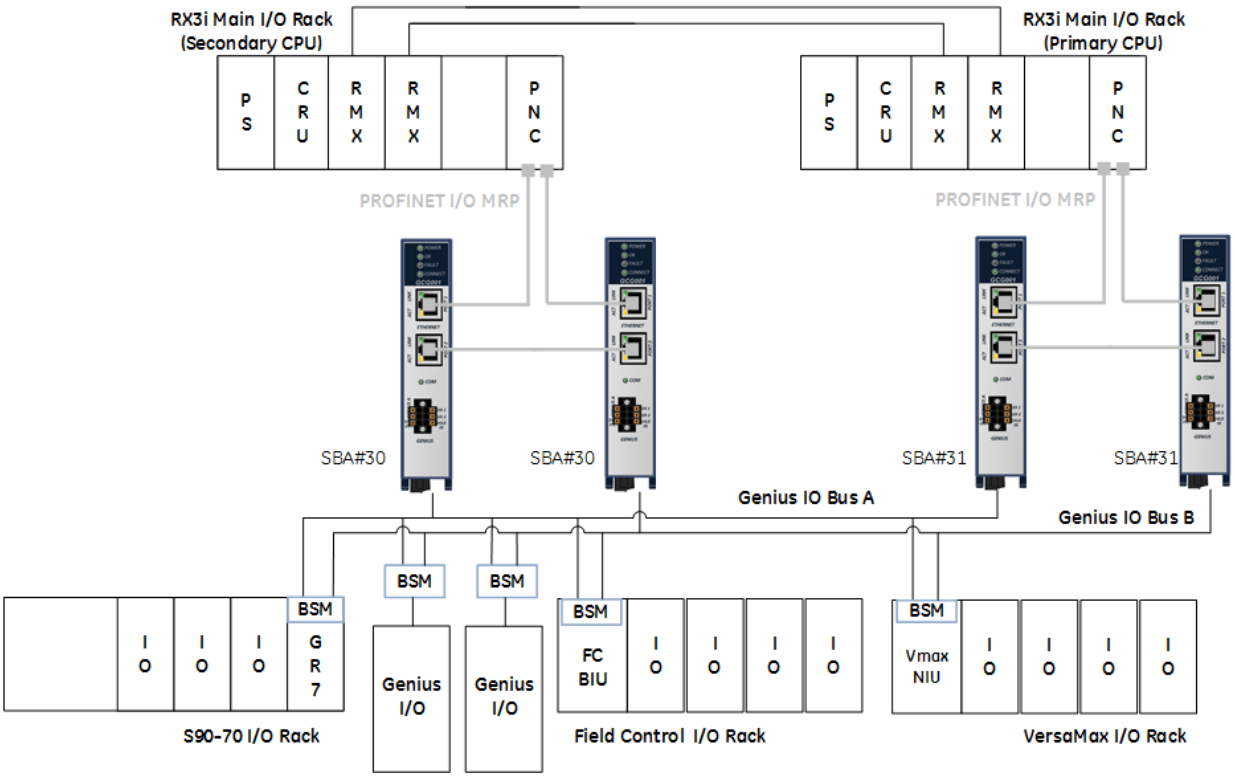

Figure 1: Genius Dual Bus Combined with RX3i Hot Standby Redundancy

For details, refer to the *PACSystems RX3i Genius Communications Gateway User Manual*, GFK-2892C or later.

Chapter 3 Application System Architecture

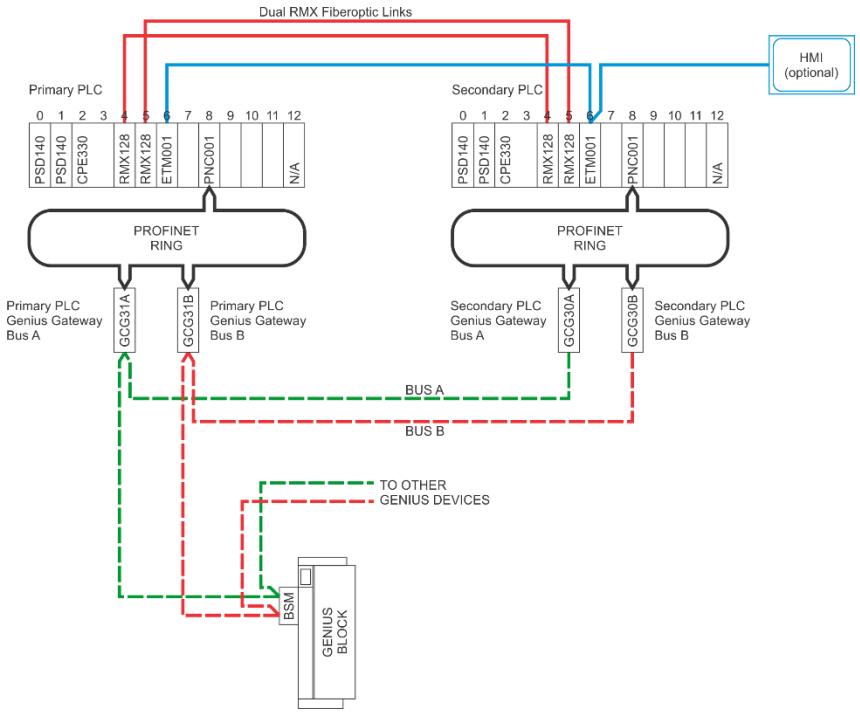

Figure 2: RX3i Genius Dual Bus Interfaced to RX3i via Genius Gateway Modules (GCG001)

A typical system consists of at least two RX3i racks, with the following components in each rack:

- One or more power supplies
- One PLC CPU module (IC695CPE330 or equivalent)
- Two RMX reflective memory exchange modules (for CPU synchronization)[1]
- Fiber optic cables for the RMX modules
- One or more PROFINET Controller modules

Additionally, the system will require the following items to interface with each dual Genius I/O network:

- Four Genius Communications Gateway modules (two associated with the Primary PLC interface and two with the Secondary PLC interface).
- Cat5 or 6 Ethernet Cables to interconnect the Gateways with the PROFINET Controllers
- Optional - interposing Ethernet switches that may be installed to provide additional MRP ring functionality
- Optional – Connectors that provide Hand Held Monitor attachment points for each of the Genius busses. (GE catalog number 44A736310-001-R001. Refer to *Genius Hand-Held Monitor User's Guide,* GFK-0121, page 2-9 for further information).

[1] If a CPE400 is used, the RMX links are replaced with LAN3 links.

3.1 PROFINET Network Arrangement

A ring topology using MRP is the preferred arrangement. With this topology, a system may use a combination of PROFINET System Redundancy (PNSR) devices and non-PNSR devices (specifically Genius Communication Gateway modules).

Also, systems may incorporate managed network switches that support MRP. The approach is particularly useful for large systems that are upgraded incrementally. In this case, Genius dual busses (each consisting of four GCG modules – Primary A & B, Secondary A & B) may be grouped into one of multiple subrings.

3.2 System and Dual Bus References

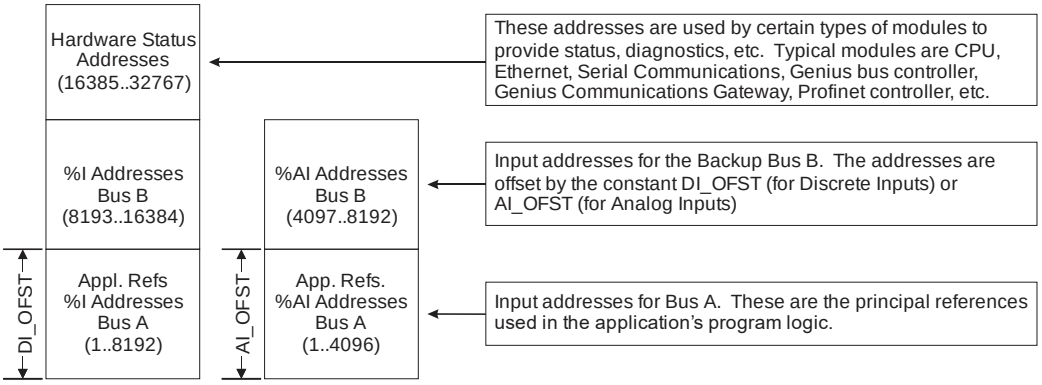

Figure 3: System and Dual Bus References

Each Genius device that has been configured to have discrete inputs must have one block of references assigned to ***Bus A*** and a separate unique block of references assigned to ***Bus B***. The application logic is always solved using the references that are assigned to ***Bus A***. There is fixed offset that specifies the location of ***Bus B*** references relative to ***Bus A***.

The references for analog inputs are configured in a similar fashion.

The offset for discrete inputs (*DI_OFST*) and the offset for analog inputs (*AI_OFST*), as shown above, are recommended values. However, they may be configured independently for each dual bus pair.

3.3 Dual Bus Mapping Description

The dual-bus application evaluates the attachment state for each Genius device on both of the busses.

- If the device is attached to ***Bus A***, then the corresponding inputs appearing in the ***A*** references are valid and no further action is needed.
- If the Genius device is attached to ***Bus B***, then the inputs appearing in the ***B*** reference area are remapped (i.e., MOVed) into the ***A*** reference area.
- If the Genius device is not attached to either ***Bus A*** or ***Bus B***, then the inputs will "*Hold Last State*". There are two choices for the time period that the inputs are frozen.
    - Normally, the inputs are frozen for up to a specified time. When that period expires, the values in the block of references are reset to OFF or 0. The preset time period may be configured independently for each pair of dual busses.
    - Or, the alternate choice is to hold last state continuously until the device re-attaches to one of the busses.
- A fault message will be posted in the PLC Fault Table if a device changes its online/offline state for the dual bus.

Controller Date/Time: 06-29-2017 15:52:19
Last Cleared: 06-29-2017 13:54:14

Fault Table Viewer

Status
Online

Controller Fault Table (Displaying 2 of 2 faults, 0 Overflowed)

Loc	Fault Description	Date/Time
0.2	Application Msg (201): S08;D004;SBA02 - AOD	06-29-2017 15:52:03
0.2	Application Msg (200): S08;D004;SBA02 - LOD	06-29-2017 15:52:01

Figure 4: Fault Table Display

The message provides the slot number (*S08* in the example) in which the PROFINET Controller is installed, the device number (*D004*) for the Bus A GCG, the serial bus address (*SBA02*) for the Genius device, and either Loss of Device (*LOD*) or Addition of device (*AOD*).

3.4 Development Environment

The software components require Proficy Machine Edition, version 9.5 or later.

3.5 Simplified Description of Project Upgrade Steps

- Convert the existing Series 90 project into an RX3i project.
- Import Software Components for Dual Bus into the *Proficy Machine Edition Toolchest*.
- Edit the Primary/Secondary Hardware Configurations.
- Drag the Dual Bus application components from the *Toolchest* into the project's PLC Program Blocks.
- Add/Edit the Dual Bus Application Blocks:
    - Add an instance of the ladder block ***BUSSES*** in ***_Main.***
    - Enter ***GBusses*** for the name.
    - Edit ***INIT_GB00*** in ***BUSSES*** to match the configuration of the Genius devices on the first dual bus pair.
    - If there are more dual busses then:
        - Copy, then paste the block named ***INIT_GBnn*** in ***BUSSES.***
        - Rename ***INIT_GBnn*** by changing ***nn*** to the next bus number.
        - Edit the block contents to accommodate the configuration settings for the PNC, GCG, and Genius device reference addresses.
        - Add a new instance of the function block ***DBUS*** in ***BUSSES.***
        - Name the instance using ***DBnn*** by changing ***nn*** to the next bus number.
        - Repeat for the remaining busses, if any.

Chapter 4 Toolchest Components

In order to use the dual bus application components, they must first be added to the *Proficy Machine Edition Toolchest*.

Click on the *View* Tab in PME. Then make certain that the *Toolchest* item is checked.

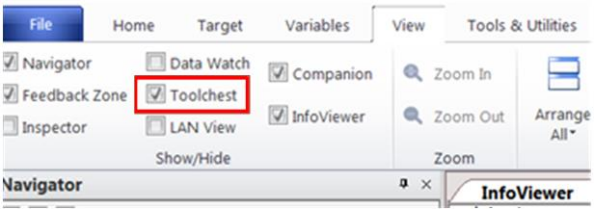

Figure 5: PME Toolchest Checkbox

The *Toolchest* will be displayed (normally docked on the right side of PME). Right click on the *Toolchest* to display a popup menu that will allow you to import a *Toolchest Drawer*. Double click on the menu item *Import Drawer*.

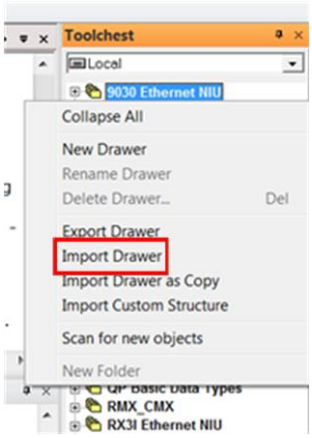

Figure 6: Import Toolchest Drawer Menu Item

A dialog box, similar to the one below, will be displayed. Navigate to the location containing the application Toolchest components and then Import the *Toolchest* drawer for dual bus support by selecting *DualBus.ZDRW (or a designated upgrade filename)*. Click on the *Open* button.

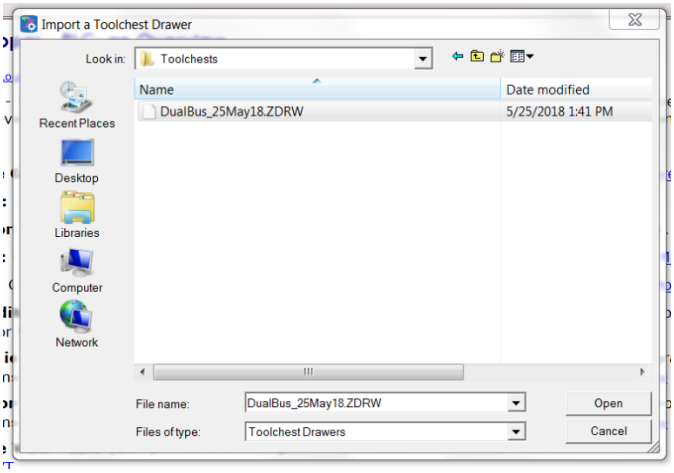

Figure 7: Select Toolchest Drawer File to Import

The *Toolchest* now contains the *DualBus* drawer. Using the dropdown text box, click on *DualBus*. Expand the drawer so that the individual folder items are visible as shown below:

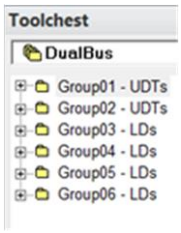

Figure 8; Folders in DualBus Drawer

4.1 Add Toolchest items to your project

While depressing the Ctrl key, drag the following items from the *Toolchest's DualBus* folders into the PLC target. Please make certain that the items are added in the proper order:

4.1.1 Place into User Defined Types

Group01 – UDTs

- *GCG*
- *G_Device*

Group02 – UDTs

- *G_Bus*

4.1.2 Place into Program Blocks

When function blocks are dragged from the Toolchest into the Program Blocks collection, Proficy Machine Edition may prompt for an entry into which a variable name must be provided.

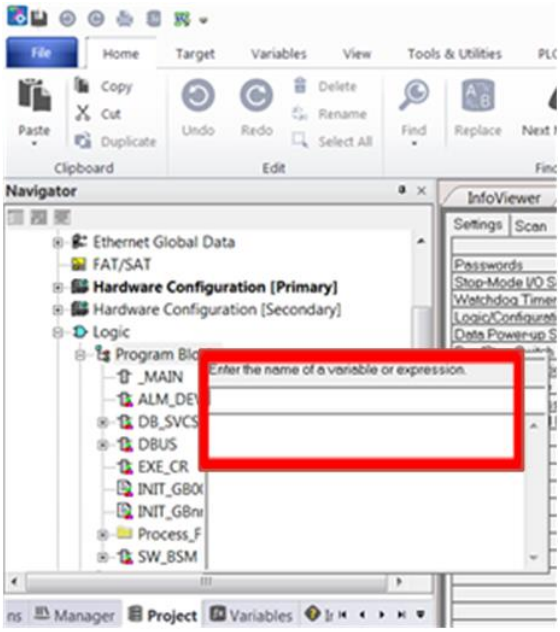

Figure 9: PME Form: Enter Variable Name

The blocks and corresponding entries are as follows:

Group03 – LDs

Block	Variable Name Entry
INIT_GBnn	<no name required>
INIT_GB00	*IGB00*
ALM_DEV	*DEV*
EXE_CR	*CR01*

Group04 – LDs

Block	Variable Name Entry
DB_SVCS	*DBS*
SW_BSM	*SW01*
AUTO_SW	*Aut_Sw*

Group05 – LDs

Block	Variable Name Entry
DBUS	*DB00*

Group06 – LDs

Block	Variable Name Entry
BUSSES	*GBusses*

4.2 Adding Dual Bus Logic

In the ladder block named ***_Main***, insert a new row at the beginning of the program.

While holding down the *Ctrl-key*, drag the program block named ***BUSSES*** and place it into the first rung. This will create a new instance of the block. It will require a name: enter ***GBusses*** for the name.

Zoom into the ladder block named ***BUSSES***. Note that the program block already contains multiple rungs of logic. Program blocks in these rungs perform the following:

INIT_GB00	This structured text block defines the parameters for a dual bus (the instance is named *IGB00* for "**I**nitialize **G**enius **B**us **00**"). The block must be edited to match the specific design characteristics of the system.
DBUS	This ladder block maps the discrete and analog inputs for the dual bus (the instance is named *DB00*). It does not require additional editing.
AUTO_SW	This ladder block provides a simple automatic role switching method (the instance is named *Aut_Sw*). It does not require additional editing, but you may wish to modify or enhance the PLC failover operation.

The logic at this point is sufficient to service one pair of dual busses. If there are more dual busses, then additional rungs will be required.

4.2.1 Dual Bus Parameters

Select the function block in the rung that immediately follows the comment rung containing the text "*Initialize the Genius Bus definition blocks*". Double-click on the function block to zoom into, and explore the logic that is contained in the block. This block will require editing in order to enter parameters that define the operation and devices on the corresponding dual bus.

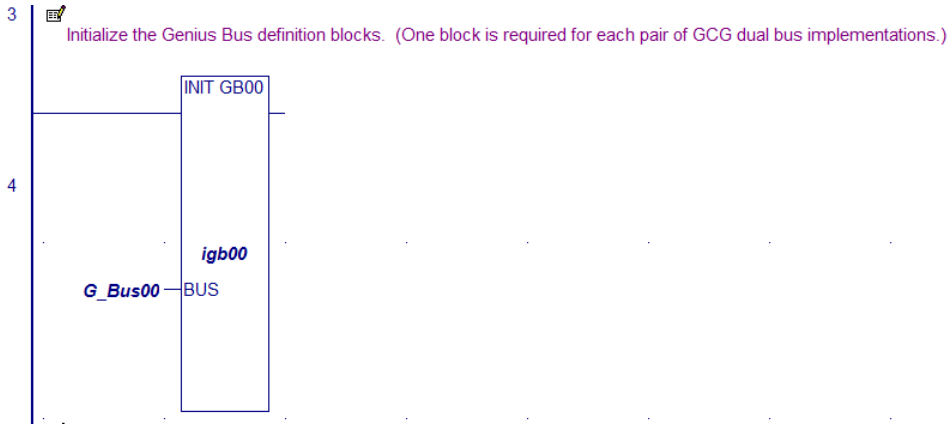

Figure 10: Edit Genius Bus Definition Block(s)

Note the variable on the left side of the function block. This a "user-defined type" that contains the detailed information specific to the dual bus. When the function block executes, the user-supplied entries present in the structured text are assigned to the members of the bus variable.

NOTE: A new variable must be declared for each additional dual bus.

4.2.2 Dual Bus Mapper

Each dual bus will require a separate instance of the DBUS function block. In this case the block refers to the first dual bus. The name DB00 relates to the first bus.

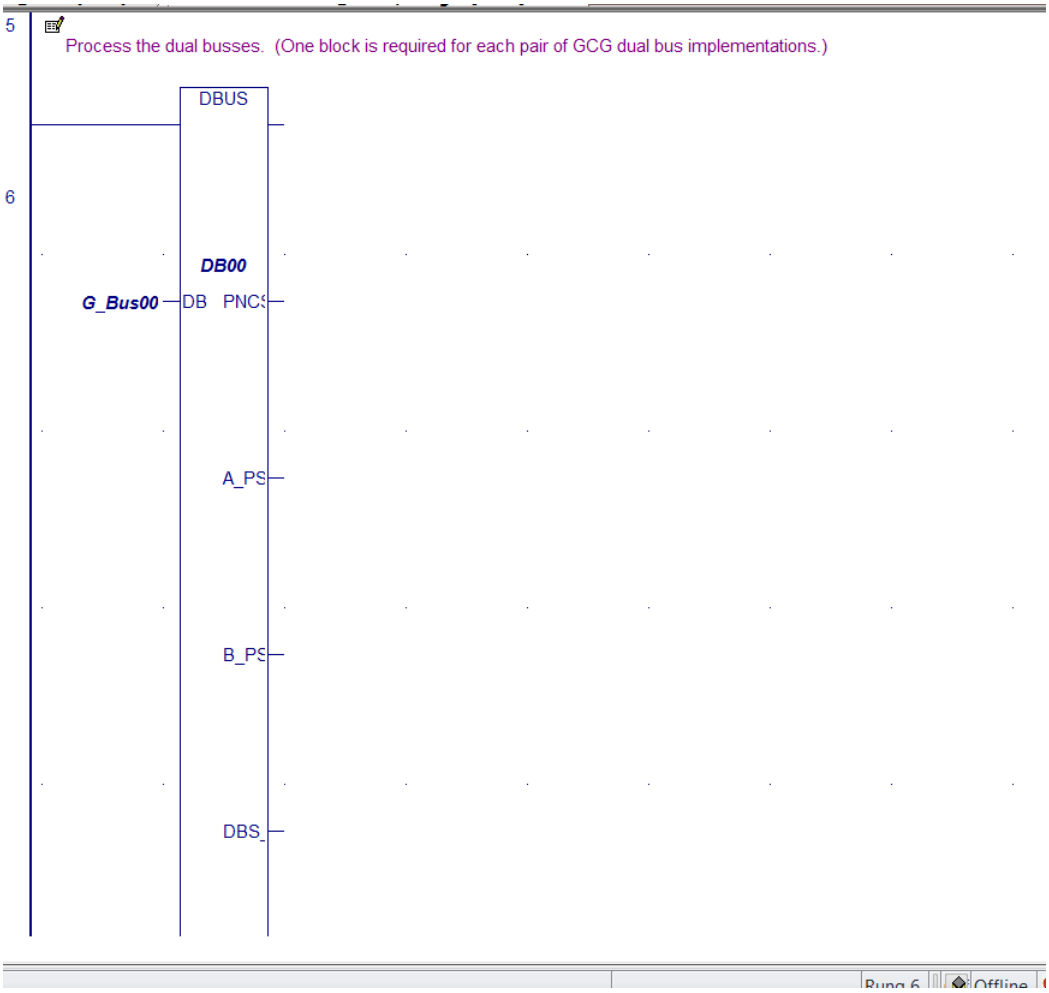

Figure 11: Edit Block for Mapping Each Dual Bus

Note the bus variable on the left side of the function block. This passes the configuration parameters (that were set by ***INIT_GB00,*** or ***INIT_GBnn***) into the dual bus mapping logic.

4.2.3 Adding a Dual Bus Configuration Block

Each dual bus requires the addition of a unique configuration block. To add a block, follow the steps below:

1. In the ***Navigator*** pane, right-click on ***INIT_GBnn***. (This block is the general template, since all of its entries have been initialized to zeroes).
2. A pop-up menu will be displayed. Click on *Copy*.

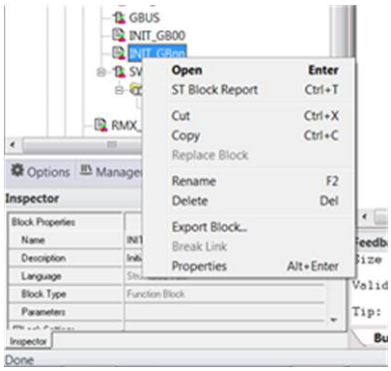

Figure 12: Copy INIT_GBnn Block

3. Right-click on Program Blocks in the Navigator pane. The following pop-up menu will be displayed:

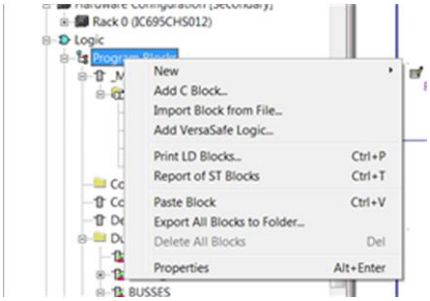

Figure 13: Paste INIT_GBnn Block

4. Click on *Paste Block*.
5. Because the block already exists, Proficy Machined Edition will prompt for further action. Click on the *Duplicate* button.
6. A new copy of the function block will be added to the Program blocks in the Navigator pane. Rename the block by editing the Name in the Inspector pane. The name should reflect the bus number that will be edited in the configuration entries.

Figure 14: Rename and Edit INIT_GBnn Block

14. Editing the Configuration Block

Click and zoom into ***INIT_GBnn***, so that the "soft" configuration parameters associated with the dual bus may be updated. (Note: in this case ***nn*** represents any of the dual busses that have been included in the project).

The various parameters are described in the following paragraphs.

Dual Bus Number

```
'Dual Bus PARMS
BUS.NUM := 0;          'Bus Number (0..15; any other value indicates an "inactive bus")
```

Figure 15: Genus Bus Number Assignment

BUS.NUM The bus number provides a bus identity to various software components. Each dual bus must have a unique value that is in the range of 0 to 15.

PNC Configuration

```
BUS.PNC_SLOT := 8;   'PROFINET Controller Slot. Used for CommReqs
BUS.PNC_ADD := 16465;    'PROFINET Controller Status Bit Address
```

Figure 16: PNC Assignments

BUS.PNC_SLOT[2] The PNC slot number is used to identify the slot location in which the PROFINET controller is installed. (Up to four PROFINET controllers may be installed in each CPU rack).

BUS.PNC_ADD The PNC address is the input reference that the PROFINET controller utilizes to return its status and diagnostic information. It is recommended that the reference should be placed in the upper segment of the discrete input references (%I16465 and above).

[2] If using an embedded PROFINET Controller in a CPE400, use slot 0 here. If using an embedded PROFINET Controller in a CPE330, use the slot number location of the CPU itself.

Genius Communication Gateway Modules

```
'Bus A GCG PARMS
BUS.GCG_A.PRI_NUM := 4;   'GCG Device Number. Used for CommReqs
BUS.GCG_A.SEC_NUM := 14;  'GCG Device Number. Used for CommReqs
BUS.GCG_A.PSDA := 16497;     'PROFINET Status Data Address.  Provides GCG operational status.
BUS.GCG_A.GSDA := 16529;     'Genius Status Data Address. Indicates if Genius device is configured and
                          'is active on the bus.
                          '(Equivalent to Device Status bits in legacy GBC documents.)
```

Figure 17: GCG Assignments – Bus A

BUS.GCG_A.PRI_NUM The PROFINET Device Number for the Primary PLC Gateway module attached to ***Bus A***.

BUS.GCG_A.SEC_NUM The PROFINET Device Number for the Secondary PLC Gateway module attached to ***Bus A.***

BUS.GCG_A.PSDA The PROFINET Status/Diagnostic bits for the Gateway module attached to ***Bus A***.

BUS.GCG_A.GSDA The Genius Device Status bits for the Gateway module attached to ***Bus A***.

```
'Bus B GCG PARMS
BUS.GCG_B.PRI_NUM := 5;
BUS.GCG_B.SEC_NUM := 15;
BUS.GCG_B.PSDA := 16561;
BUS.GCG_B.GSDA := 16593;
```

Figure 18: GCG Assignments – Bus B

BUS.GCG_B.PRI_NUM The PROFINET Device Number for the Primary PLC Gateway module attached to ***Bus B***.

BUS.GCG_B.SEC_NUM The PROFINET Device Number for the Secondary PLC Gateway module attached to ***Bus B***.

BUS.GCG_B.PSDA The PROFINET Status/Diagnostic bits for the Gateway module attached to ***Bus B***.

BUS.GCG_B.GSDA The Genius Device Status bits for the Gateway module attached to ***Bus B***.

Dual Bus Parameters

```
BUS.DEF_TO := 2500;      'Default Timer Preset - Input references on dual busses are turned OFF
                         'in the event that there is no input data from the Genius device on either
                         'Bus A or Bus B.  (As indicated by the device status bits.)  While the timer
                         'is running, inputs are in hold-last-state.

BUS.DEF_HLS := 0;        'Default Output Values -  0 = all OFF;  1 = All Hold Last State

BUS.DI_OFST := 8192;     'Reference offset for Discrete Inputs on Bus B.  (Applies to all inputs on Bus.)
BUS.AI_OFST := 2048;     'Reference offset for Analog Inputs on Bus B.  (Applies to all inputs on Bus.)
```

Figure 19: Dual Bus Parameters

BUS.DEF_TO The Default Timer Preset establishes the time interval (in milliseconds) during which inputs are frozen while a device is missing from ***Bus A*** AND from ***Bus B***.

BUS.DEF_HLS This parameter (a Boolean) determines the behavior of a missing device:

- If the parameter is set to 0, the inputs for that device will default to OFF or 0 after the Default Timer expires.
- If the parameter is set to 1, the inputs for that device will be frozen in their last state until the device is reattached to either ***Bus A*** or ***Bus B***.

BUS.DI_OFST This applies to discrete inputs. It is the reference offset between a discrete input configured on ***Bus A*** and the alternate address on ***Bus B***. For instance, a device configured at %I0001 on ***Bus A*** must be configured at %I (1+*DI_OFST*) on ***Bus B***. The offset must be in multiples of 8 (i.e., on a byte boundary).

BUS.AI_OFST This applies to analog inputs. It is the reference offset between an analog input configured on ***Bus A*** and the alternate address on ***Bus B***. For instance, a device configured at %AI0001 on ***Bus A*** must be configured at %AI (1+*AI_OFST*) on ***Bus B***.

```
' SBA 00 - Standard Assignment for HHM... normally not used for I/O device
'-------------------------------------------------------------------------------------------------
BUS.Devices[00].DI_Add := 0; BUS.Devices[00].DI_Len := 0; BUS.Devices[00].DQ_Add := 0; BUS.Devices[00].DQ_Len := 0;
BUS.Devices[00].AI_Add := 0; BUS.Devices[00].AI_Len := 0; BUS.Devices[00].AQ_Add := 0; BUS.Devices[00].AQ_Len := 0;

' SBA 01
'-------------------------------------------------------------------------------------------------
BUS.Devices[01].DI_Add := 193; BUS.Devices[01].DI_Len := 32; BUS.Devices[01].DQ_Add := 193; BUS.Devices[01].DQ_Len := 32;
BUS.Devices[01].AI_Add := 0; BUS.Devices[01].AI_Len := 0; BUS.Devices[01].AQ_Add := 0; BUS.Devices[01].AQ_Len := 0;
```

Figure 20: References by SBA of Genius Devices on Bus

BUS.Devices[nn].DI_Add This parameter applies to devices that contain discrete inputs. It is the starting reference assignment for the device installed at Serial Bus Address ***nn***.

BUS.Devices[nn].DI_Len This parameter applies to devices that contain discrete inputs. It is the number of inputs (i.e., length) associated with the device installed at Serial Bus Address ***nn***.

BUS.Devices[nn].DQ_Add This parameter applies to devices that contain discrete outputs. It is the starting reference assignment for the device installed at Serial Bus Address ***nn***.

BUS.Devices[nn].DQ_Len This parameter applies to devices that contain discrete outputs. It is the number of outputs (i.e., length) associated with the device installed at Serial Bus Address ***nn***.

BUS.Devices[nn].AI_Add This parameter applies to devices that contain analog inputs. It is the starting reference assignment for the device installed at Serial Bus Address ***nn***.

BUS.Devices[nn].AI_Len This parameter applies to devices that contain analog inputs. It is the number of inputs (i.e., length) associated with the device installed at Serial Bus Address ***nn***.

BUS.Devices[nn].AQ_Add This parameter applies to devices that contain analog outputs. It is the starting reference assignment for the device installed at Serial Bus Address ***nn***.

BUS.Devices[nn].AQ_Len This parameter applies to devices that contain analog outputs. It is the number of outputs (i.e., length) associated with the device installed at Serial Bus Address ***nn***.

NOTE: Devices that contain outputs must be configured so that the dual mapping routine can post loss-of-device or addition-of-device messages. Also, the device status (i.e., the presence on either ***Bus A*** or ***Bus B***) is shared between the Primary and Secondary PLCs for the purpose of Automatic Role Switching (if enabled).

Chapter 5 PLC Hardware Configuration

5.1 Overview

In general, the hardware configuration for the Primary and Secondary PLCs are very similar. The dual-bus elements will be configured in a nearly identical manner.

5.2 PLC Reference Memory Tab Settings

In the *Hardware Configuration* (Primary) double-click on the RX3i CPU module to display the configuration settings. Click on the *Memory* tab and adjust the upper memory limits. The minimum settings are shown below:

5.2.1 Memory Settings

%AI Analog Input	16384
%AQ Analog Output	8192
%R Register Memory	32640
%W Bulk Memory	65536
Symbolic Discrete	65536
Symbolic Non-Discrete	65536
I/O Discrete	65536
I/O Non-Discrete	65536

5.2.2 Point Fault Setting

In the *Hardware Configuration* (Primary) double-click on the RX3i CPU module to display the configuration settings. Click on the *Memory* tab and set the *Point Fault References* property to *Enabled* are shown below:

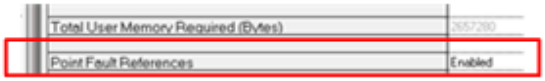

Figure 21: Enable Point Fault References

5.3 Transfer List Entries

5.3.1 Input Transfer Points

%I	configured for length=0
%Q	(as needed)
%M	(as needed)
%G	(as needed)
%AI	configured for length=0
%AQ	(as needed)
%R	(as needed)
%W	(as needed)

Optionally, there is one symbolic variable that may be included in the synchronized data transfer list. It is located in the program logic block named ***AUTO_SW***. The variable ***ACTV_CSB*** must be included in the *Input Transfer List* if you wish to perform automatic role switches based upon the loss of devices on a GCG.

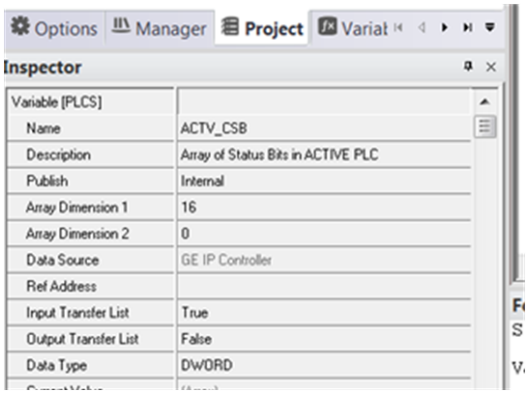

Figure 22: Include ACTV_CSB in Input Transfer List

5.3.2 Output Transfer Points

%I configured for length=0

%Q typically configured to the highest reference used for physical outputs, as a minimum

%M (as needed)

%G (as needed)

%AI configured for length=0

%AQ typically configured to the highest reference used for physical outputs, as a minimum

%R (as needed)

%W (as needed)

5.4 Configure the Built-in Ethernet Port of the CPU

The RX3i CPU includes two built-in Ethernet ports that share an 80-bit diagnostic/status reference. The recommended starting reference is %I16385.

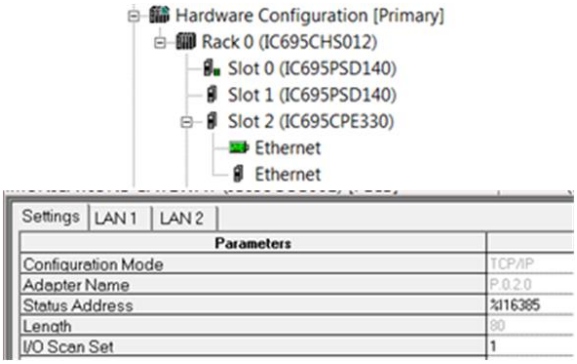

Figure 23: Assign Ethernet Status Address

Note that there are additional port settings for LAN1 and LAN2. These will require configuration entries as well.

5.5 Configure the PROFINET Controller Module

The PROFINET Controller Module has a 32-bit diagnostic/status reference. The recommended starting reference is %I16465 (the next available reference following the Ethernet port status reference).

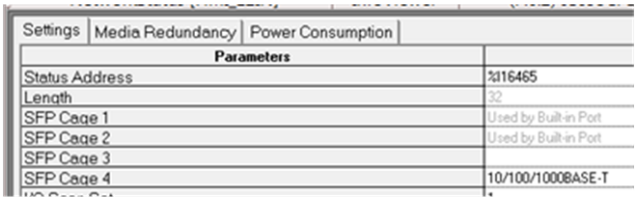

Figure 24: Assign PROFINET Status Address

NOTE 1: For each slot in which a PROFINET Controller is installed, the Primary module and the Secondary module will always have identical Status Addresses. (However, the PROFINET Controllers from one slot to another will have separate, unique addresses).

NOTE 2: For the purposes of early project development/debug, it may be simpler to disable the port criticality parameters. However, these should be enabled before the project is installed in an operating environment.

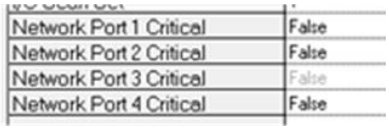

Figure 25: Disable Port Criticality (for Debug only)

5.6 Configure the Genius Communication Gateway Modules

5.6.1 Settings Tab

Genius Status Data The GCG provides 32 bits that indicate status information on devices associated with the GCG's Genius Bus. The bits indicate the attachment state for a device. Bit 0 corresponds to a device at Serial Bus Address 0. Bit 31 corresponds to a device at Serial Bus Address 31. ON=Attached; OFF=Missing. Refer to the *PACSystems RX3i Genius Communications Gateway User Manual*, GFK-2892, Section 5.1.2.

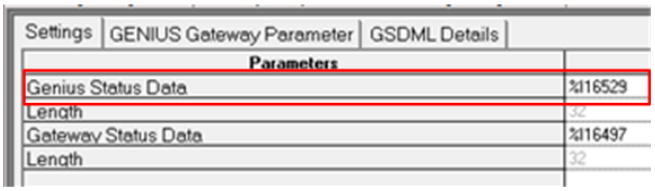

Figure 26: GCG Genius Status Data Reference Assignments

Gateway Status Data The GCG provides 32 bits of status information for the network (MRP, Port Availability), Genius Device Fault state, and GCG Module OK. Refer to the *PACSystems RX3i Genius Communications Gateway User Manual*, GFK-2892, Section 5.1.1.

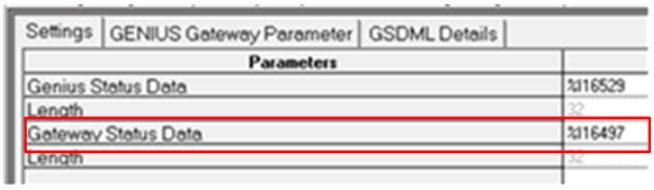

Figure 27: GCG Gateway Status Data Reference Assignments

NOTE: The reference addresses in the Primary group and the Secondary group must be configured identically. For example, in Figure 26, the *Genius Status Data* reference for Primary PLC, Dual Bus 0, Genius Bus A is %I16529. The Secondary PLC, Dual Bus 0, Genius Bus A is also configured for %I16529. Similarly for the *Gateway Status Data* (Figure 27).

5.6.2 GENIUS Gateway Parameter Tab

Baudrate This setting must be configured to match the current Genius bus baud rate characteristic.

Output at Startup This parameter must be set to *enabled*.

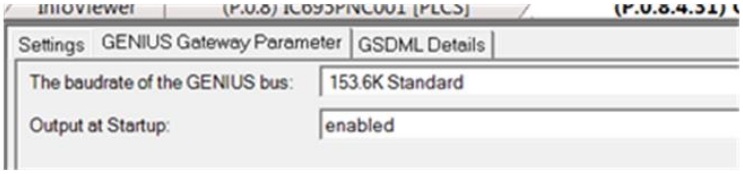

Figure 28: GCG Baud Rate & Output at Startup Settings

5.6.3 Genius Devices

Refer to the *PACSystems RX3i Genius Communications Gateway User Manual*, GFK-2892C or later, for instructions on configuring I/O devices that are attached to the GCG.

5.7 Dual Bus Function Block

The main purpose of the Dual Bus (***DBUS***) function block is to remap the discrete and analog inputs from the backup bus to the main bus by monitoring the status bits of the Genius devices that are installed on the dual bus pair.

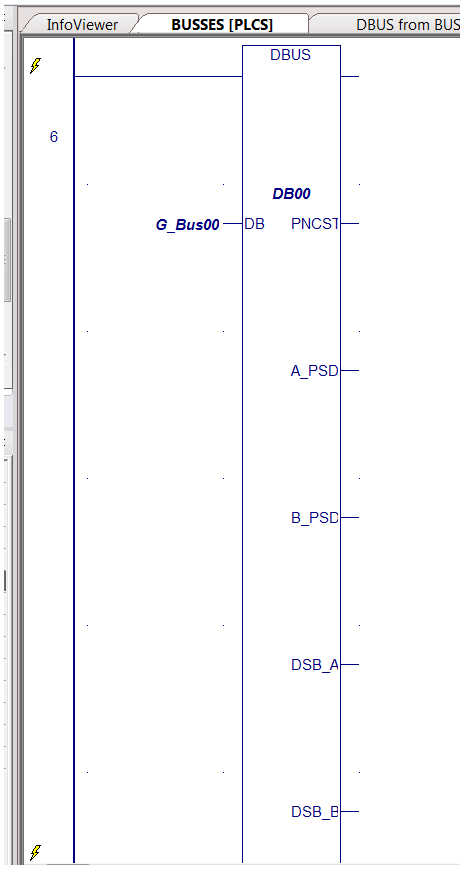

Figure 29: Dual Bus Function Block

These are the block's external connections:

5.7.1 Input

DB This receives the Genius bus parameters (via a variable of "*user defined type*" *G_Bus*). Note that the parameters are configured using the function blocks derived from either ***INIT_GB00*** or ***INIT_GBnn***.

5.7.2 Output

PNCST Provides a copy of the status information for the associated PROFINET Controller module.

A_PSD Provides a copy of the Genius Communication Gateway's PROFINET Status Data from ***Bus A***.

B_PSD Provides a copy of the Genius Communication Gateway's PROFINET Status Data from ***Bus B***.

DSB_A Provides a copy of the Genius Communication Gateway's Genius Status Data for all Configured Genius devices on ***Bus A***. (This is similar to the Device Status Bits provided by a Genius Bus Controller.)

DSB_B Provides a copy of the Genius Communication Gateway's Genius Status Data for all Configured Genius devices on ***Bus B***.

CSB: Provides device connection status for all configured Genius devices on the dual bus pair. (Each bit is latched ON by the rising edge of either of the corresponding Bus A or Bus B Genius Status bits. The bit is unlatched if both Bus A and Bus B Status Bits are OFF for a period greater than the default timeout period.)

5.7.3 Other DBUS Functionality

Alarms Posted in PLC Fault Table

LOD An internal function that posts *Loss-of-Device* if the device is not attached to either ***Bus A*** or ***Bus B***, and the default timer has expired. The time-stamped message appears in the PLC Fault Table.

AOD If the device has been offline, this internal function posts *Addition-of-Device* if the Genius device successfully logs onto either ***Bus A*** or ***Bus B***. The time-stamped message appears in the PLC Fault Table.

Real-time View of Genius Devices on Dual Busses

Device Status Bits Zoom into the block to observe the current connection status for all configured Genius devices on the dual bus pair. Four rungs display the device status on ***Bus A*** and ***Bus B***. The index inside the brackets correspond to the Genius Serial Bus Address. Figure 30 demonstrates the logic for monitoring SBA 0 through 7, so it needs to be expanded to cover the entire bus.

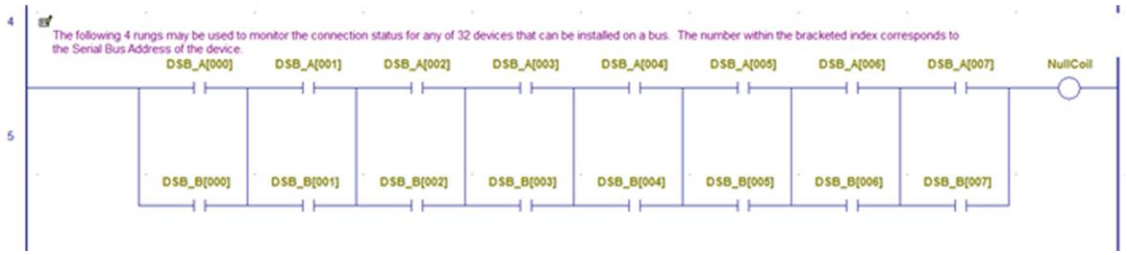

Figure 30: Monitor SBA Connection Status

Switch Devices on Busses

SW_BSM Zoom into the block to display the Switch BSM (***SW_BSM***) function block. This function block allows the user to switch a specified Genius device to either ***Bus A*** or to ***Bus B***.

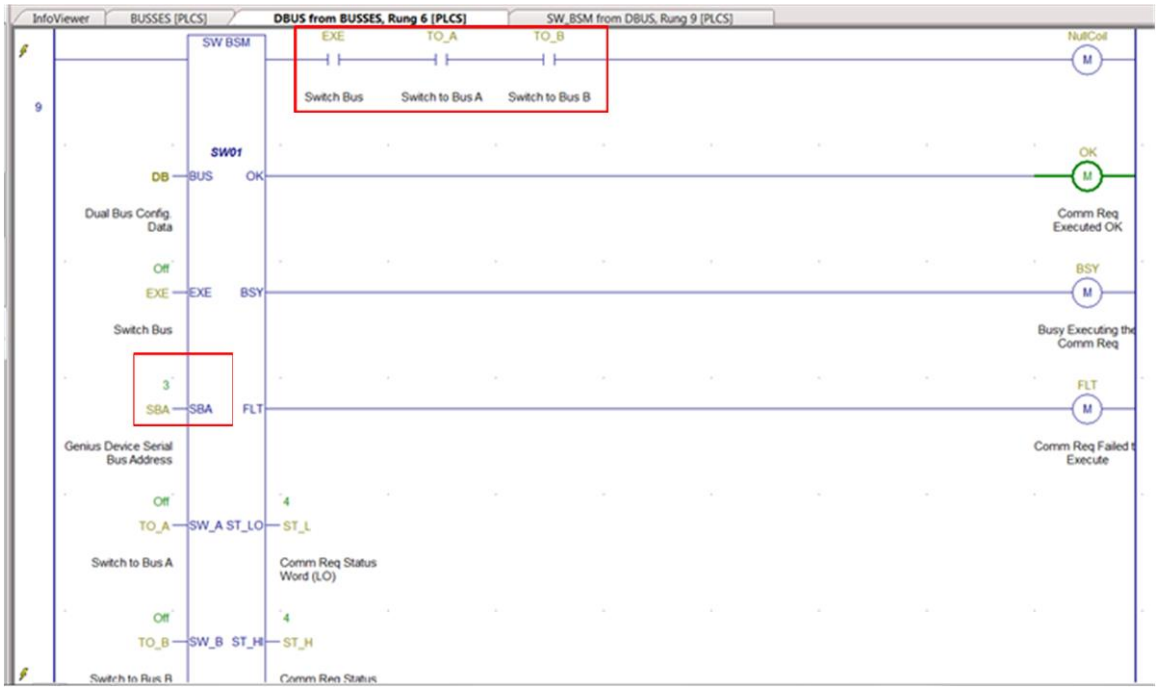

Figure 31: Switch BSM Logic

NOTE: The highlighted elements may be used to control and execute the Switch BSM function.

User Accessible Inputs

EXE Initiates the execution of a bus switch operation. This may be done by selecting the contact at the top right of the function block and then turning the reference ON using a right-click. Note: do not force this reference. It will automatically reset.

SBA This variable contains the value (i.e., the Serial Bus Address) for the Genius device that is to be switched. You may change this value by selecting the variable and then depress the Control key and Enter key simultaneously.

TO_A Issues a datagram to switch the specified device to ***Bus A*** (if it is on ***Bus B*** currently). A fault will be reported if the device is already connected onto ***Bus A***. This reference may be turned on by selecting the contact and then right click. The reference maintains its state.

NOTE: The function will turn ON its fault output if ***TO_A*** and ***TO_B*** are both ON or both OFF.

TO_B This is similar to ***TO_A***, except that it applies to switching a device to ***Bus B***.

Outputs

OK The function executed successfully.

BSY The function is busy executing a communication request that has been issued to the associated PROFINET Controller module. Typically, this will be related to the current Bus Switch event.

FLT The bus switching request was not completed due to an error in the COMMREQ structure, a fault related to the GCG/PNC/Genius device, or a timeout because a component is not available.

ST_LO The value of the low-order word of the COMMREQ. Refer to the GCG User Manual to interpret the result.

ST_HI The value of the high-order word of the COMMREQ. Refer to the GCG User Manual to interpret the result.

Automatic Role Switch

Zoom into the ***DBUS*** block to display the Automatic Role Switch (***AUT_SW***) function block. This function block allows the user to transfer control from the current Active PLC to the current Backup PLC in the event that a GCG associated with the Active PLC fails.

While the function block is enabled, it will evaluate the Genius combined status bits that are received from the Active PLC and compare them with the Genius combined status bits in the Backup PLC. The comparison is performed within the Serial Bus Address range of 01..29. If any bit in the Backup PLC is ON while it's comparable bit in the Active PLC is OFF, a corresponding timer will be enabled. If the timer expires, a service request will be issued to perform a role switch.

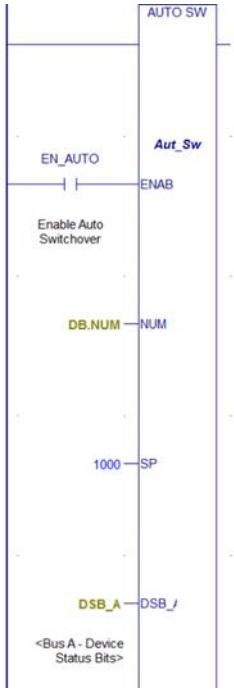

Figure 32: Automatic Role Switch (AUT_SW) Function Block

ENAB	This Boolean reference determines if automatic switching is active in the Backup PLC.
NUM	This should not be changed. (It is the reference to the Bus Number [0..15]).
SP	The timer preset that is applied to the bit comparisons. (The value in milliseconds should always be less than the value of the Hold-Last-State timer. A typical setpoint is 1000 msec.)
DSB_A	This should not be changed. (It is the reference to the Bus A Status Bits).
DSB_B	This should not be changed. (It is the reference to the Bus B Status Bits).

Chapter 6 Updating from a Previous Release

6.1 Overview

The upgrade process relies upon Machine Edition Toolchest operations to:

- save information that is in the current application's target,
- retrieve the revised components as part of the upgrade,
- rebuild the project using the new and saved Toolchest items.

There are several tasks that must be done in a specific order. First, the existing application (project) should be duplicated. The duplicate copy should be renamed, possibly to include descriptive revision information. Next, the duplicate project is opened so that some of the dual-bus components may be saved as Proficy Toolchest items.

6.2 Duplicate the Current Project

1. Open Proficy Machine Edition and navigate to the Project Manager.
2. Select then create a duplicate of your existing project. You may rename the duplicate to include descriptive revision information if desired. The duplicate will become your working project.
3. Open the working project.

6.3 Save Dual-Bus Components

Several of the Dual-bus program components contain logic that is specific to the current project. The logic block *BUSSES* contains the objects that are associated with each dual bus pair. Some objects contain the real-time data for the bus pairs and others contain the configuration for each bus pair.

The top-level block (*BUSSES*) and the blocks that contain bus configuration data (*INIT_GB00*, *INIT_GB01*, etc.) should be saved in the Machine Edition Toolchest.

Later in the process, these blocks will be retrieved and placed back into the application. In the *Navigator* window, expand the target that contains the logic for the user-application and dual-bus components.

1. Make certain that the Toolchest is visible. (In the *Machine Edition* menu, select the *View* tab, then check the box for *Toolchest*.)
2. Create a new Toolchest Drawer that will be used to receive items from your application.
3. In the *Toolchest*, click on *Local* from the dropdown list. Then right-click anywhere in the items that are displayed. This will produce a pop-up menu like the graphic shown in Figure 33:

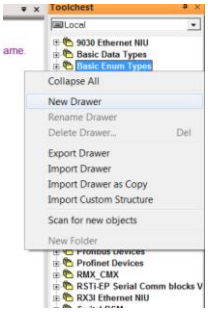

Figure 33: Pop-up Menu for Local

4. Enter the name of the new drawer, for instance, "*SavedDBus*".
5. In the Project Navigator window, expand *Program Blocks* to reveal the various program blocks used in the application. Locate the program block named ***BUSSES***, plus any blocks that start with the letters ***INIT_GB*** (such as, ***INIT_GB00, INIT_GB01***, etc.)

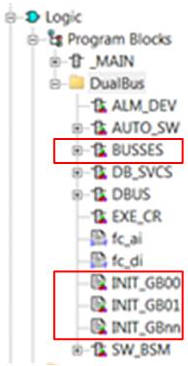

Figure 34: Identify Program Blocks

6. Drag and drop these blocks into the new Toolchest drawer.

6.4 Delete Out-of-Date Logic Components

1. In the *Project Navigator* window, double-click on the program block *_Main* so that the ladder block is displayed in the Infoviewer pane.
2. Locate and then delete the rung that contains the call to the program block ***BUSSES***.

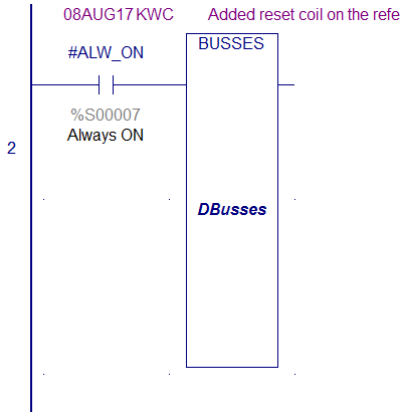

Figure 35: Delete Rung Invoking Program Block *BUSSES*

3. Click on the *Variables* tab and scroll to the top of the list.

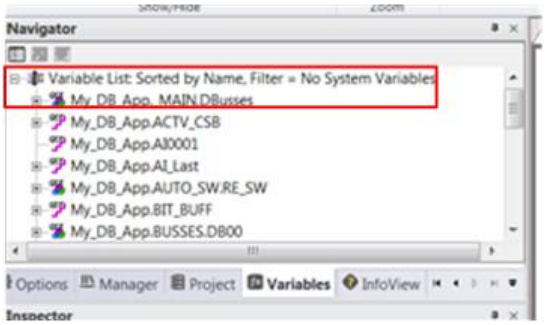

Figure 36: Delete Variables Associated with *BUSSES*

4. Right-click on *Variable List* and then click on *Delete Unused Variables…* This will delete the variables that are associated with the program block named ***BUSSES***. (It allows us to delete the block and blocks that are called within the block.)
5. In the *Project Navigator* window, locate the program block named ***BUSSES***.

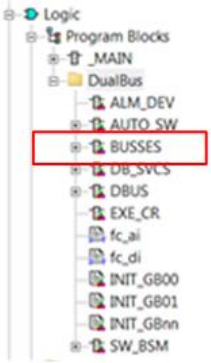

Figure 37: Identify Program Block *BUSSES* to be Deleted

6. Delete the ladder logic block named ***BUSSES***.

6.5 Delete Remaining Dual-Bus Program Blocks

1 In the *Project Navigator* window, there will be a collection of outdated ladder logic blocks, structured text blocks and possibly C-blocks.

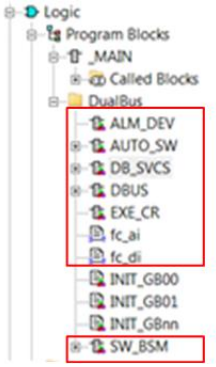

Figure 38: Identify Remaining Blocks to be Deleted

2 Using the following order, delete these blocks:

a. *DBUS*
b. *DB_SVCS*
c. *AUTO_SW*
d. *SW_BSM*
e. *ALM_DEV*
f. *EXE_CR*
g. *fc_ai*
h. *fc_di*

6.6 Add Revised Dual-Bus Program Blocks

In the *Toolchest* window, click on *DualBus* and expand the drawer so that the individual folder items are visible. While depressing the *Ctrl* key, drag the following items from the *Toolchest's DualBus* folders into *Logic||Program Blocks* for the PLC target. Please make certain that the items are added in the proper order:

Group03 – LDs

Block	Variable Name Entry
ALM_DEV	*DEV*
EXE_CR	*CR01*

Note: The blocks fc_ai and fc_di have been eliminated and are no longer used.

Group04 – LDs

Block	Variable Name Entry
DB_SVCS	*DBS*
SW_BSM	*SW01*
AUTO_SW	*Aut_Sw*

Group05 – LDs

Block	Variable Name Entry
DBUS	*DB00*

6.7 Add Saved Dual-Bus Program Blocks

In the *Toolchest* window, click on *SavedDBus* and expand the drawer so that the individual folder items are visible. While depressing the *Ctrl* key, drag the following items from the *Toolchest's SavedDBus* folders into *Logic||Program Blocks* for the PLC target. Please make certain that the items are added in the proper order:

Bus Configuration Blocks:

Block	Variable Name Entry
INIT_GB00	*IGB00*
INIT_GB01..nn[3]	*IGB01..nn*

Top Level Block:

Block	Variable Name Entry
BUSSES	*IGB00*

6.8 Add Logic to _Main

In the ladder block named ***_Main***, insert a new row at the beginning of the program.

From the *Navigator* window, select the program block named ***BUSSES*** and drag it into the first rung. This will create a new instance of the block. It will require a name: enter ***GBusses*** for the name.

Zoom into the ladder block named ***BUSSES*** to verify that the logic is correct.

- Zoom into ***INIT_GB00*** and verify that the configuration entries are identical to the entries in the original application. Repeat for any additional bus pairs that were part of the original application.
- Verify that there is an instance of ***DBUS*** for each pair of the dual-bus pairs that were in the original application.

[3] Note: Only required if there are multiple pairs of dual-busses.

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