GE Fanuc Automation

Programmable Control Products

Max-ON Software

User's Manual

GFK-2053A

May 2009

Warnings, Cautions, and Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

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

Note

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

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CIMSTAR	Modelmaster	Series 90	VersaPro
Field Control	Motion Mate	Series Five	VuMaster
GEnet	ProLoop	Series One	Workmaster

Content of This Manual

This manual describes how to use Max-ON Tools software and the associated PLC drivers.

Related Publications

CIMPLICITY® HMI Software	GFK-1189	*Important Product Information*
	GFK-1180	*HMI User's Manual*
	GFK-1181	*Device Communications Manual*
	GFK-1353	*Server Redundancy Operations Manual*
Field Control™ I/O	GFK-0826	*Field Control I/O Modules User's Manual*
	GFK-0825	*Field Control Genius Bus Interface Unit User's Manual*
Genius® I/O	GEK-90486	*Genius I/O System and Communications User's Manual*
	GFK-1034	*Series 90-30 Bus Controller User's Manual*
	GFK-0695	*Series 90-30 Enhanced Genius Communications Module User's Manual*
	GFK-0412	*Series 90-30 Genius Communications Module User's Manual*
	GFK-0450	*Genius PowerTRAC Block User's Manual*
	GFK-0415	*Genius High-Speed Counter User's Manual*
Series 90™-30 Programmable Control Products	GFK-0356	*Series 90-30 Programmable Controller Installation Manual*
	GFK-0467	*Series 90-30/20/Micro Programmable Controllers Reference Manual*
	GFK-0898	*Series 90-30 I/O Module Specifications Manual*
	GFK-0255	*Series 90-30 Programmable Coprocessor and Support Software User's Manual*
	GFK-0487	*Series 90 PCM Development Software (PCOP) User's Manual*
	GFK-0293	*Series 90-30 High Speed Counter User's Manual*
	GFK-0412	*Series 90-30 Genius Communications Module User's Manual*
	GFK-1034	*Series 90-30 Genius Bus Controller User's Manual*
	GFK-0582	*Series 90 PLC Serial Communications User's Manual*
VersaMax™ I/O	GFK-1504	*VersaMax Modules, Power Supplies, and Carriers User's Manual*
	GFK-1535	*VersaMax Genius NIU User's Manual*
VersaPro™ Software	GFK-1670	*VersaPro Programming Software User's Guide*

Contents

Chapter 1 Introduction

Welcome

Thank you for choosing Max-ON software and GE Fanuc controllers to implement your critical control project.

Max-ON software consists of several software components, some of which execute in a pair of Hot-Standby PLCs, and some of which execute upon your programming workstation.

The controller-based software consists of a set of application blocks that perform the Redundancy portion of the Hot Standby application. These application blocks are provided as part of a Proficy™ Machine Edition Project that is the starting point of your redundant automation application. Using GE Fanuc's Proficy Logic Developer PLC programming software, you add your application logic to this project, and then store the overall project to each of the Hot Standby controllers.

The Max-ON Configuration Utility, which is launched from the Logic Developer PLC Project, provides a utility to allow the control system designer to customize the functionality of the redundant system.

A Proficy View Project is also provided to monitor the status of the Redundant System and to display diagnostic information.

With the Max-ON LD Project, you can:

- Create a Hot Standby system that operates using a combination of GE Fanuc Genius™ I/O, Field Control™, Series 90™-30 remote Genius drops, and Genius VersaMax™ I/O, as well as Series 90-30 and PACSystems Ethernet NIUs.
- Synchronize application data using an Ethernet LAN.

With the Max-ON Configuration Utility software, you can:

- View and modify the parameters of the Hot Standby Redundancy system:
  - Redundant System Parameters
  - Synchronization Data Groups
  - Synchronization Network Interface Parameters
  - Genius I/O Bus definitions

With the Max-ON View Project, you can:

- Establish a communication link to the Hot Standby CPUs to:
  - Monitor system-level alarms in real-time
  - Monitor performance characteristics in real-time
  - Display information about the Redundant system: Max-ON driver version, CPU modules

Installing Max-ON Software

System Requirements

Max-ON Software may be installed on a PC that has the minimum requirements shown below:

- 1 GHz Pentium class processor
- 256 MB RAM or more
- Windows NT 4.0 (Service pack 6a or later), Windows 2000 Professional (Service Pack 4 recommended), or Windows XP Professional (Service Pack 2 recommended)
- 50 MB of free disk space

***NOTE**: Max-ON Software requires Logic Developer PLC Professional Edition Release 5.80 or later.*

To Install Max-ON Software

1. Make sure that you have installed Proficy Machine Edition release 5.80 or later. This is required to configure and program the Max-ON CPU.
2. It is recommended that you close all applications including virus checking, Internet Explorer, and HMI software that might be running in the background. You may need to check the task manager to determine if other applications are running. As a further precaution, it is also recommended that you re-boot the PC to make sure components that Max-ON Configuration Utility needs to update are not running during the installation process.
3. Put the Max-ON Software CD in CD-ROM Drive.
4. Select the CD drive from Windows Explorer.
5. Double click Setup.exe.
6. Follow the user prompts to complete the installation.

Uninstalling Max-ON Software

Max-ON Software can be uninstalled only from the computer upon which it is installed. It cannot be uninstalled over a network. You can uninstall Max-ON Software from the Add/Remove Programs option on the Windows Control Panel or from the Windows Start Menu.

If the computer has other GE Fanuc software products installed, Max-ON Software can be uninstalled without removing any files needed by those applications. To uninstall Max-ON Software, do the following:

1. Choose Uninstall from the Start Menu or the Control Panel.
2. A dialog box appears asking if you are sure you want to uninstall.
3. Confirm the Uninstall.

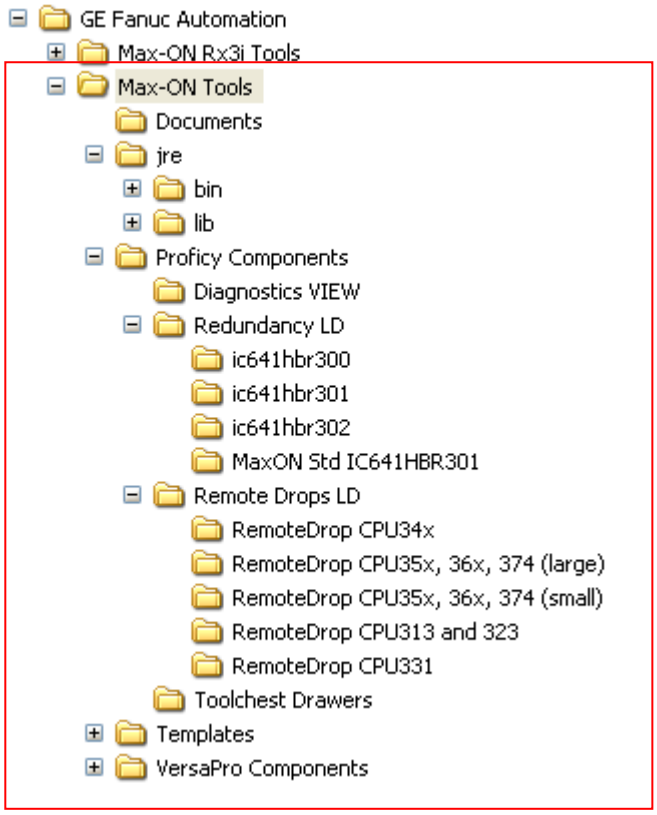
- All files relating to Max-ON Software will be removed from the hard drive. Any files used by both Max-ON Configuration Utility and another application will be left on the system.
- All registry entries relating to Max-ON Software will be removed from the systems registry.
- Icons for Max-ON Software will be removed from the Start Menu.
- Any data you created (for example, Project that you have created) will be left on the system.

Note: You may also uninstall Max-ON Software by choosing Add/Remove Programs from the Control Panel, then selecting Max-ON Tools.

Max-ON Component Installation

The default installation places the Max-ON Software and the associated project components in the GE Fanuc Automation directory.

The Max-ON Tools components are installed in the tree structure as shown below:



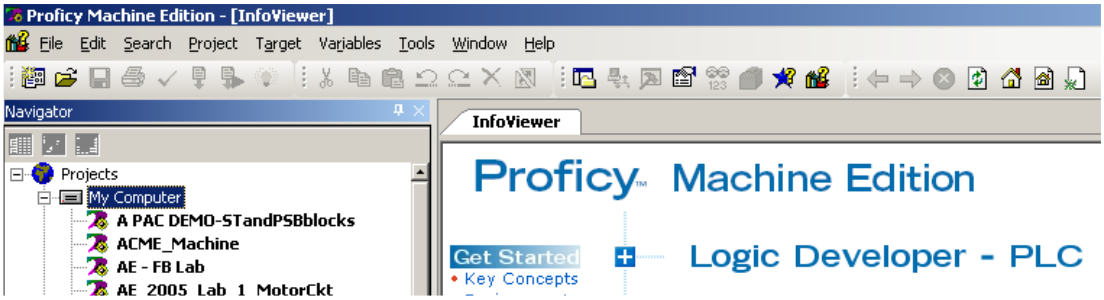
The Max-ON Configuration Utility is located in the *Max-ON Tools* directory. It is launched by double-clicking on the Max-ON configuration file (*config.mxn*) located in the Proficy Logic Developer PLC project.

The default Max-ON Hot Standby Redundancy application project, named *Max-ON LD Project vx_yy.zip*, is located in the *Redundancy LD* directory. This project must be brought into your Proficy Machine Edition development environment using Proficy Machine Edition's *File > Restore Project…* menu.

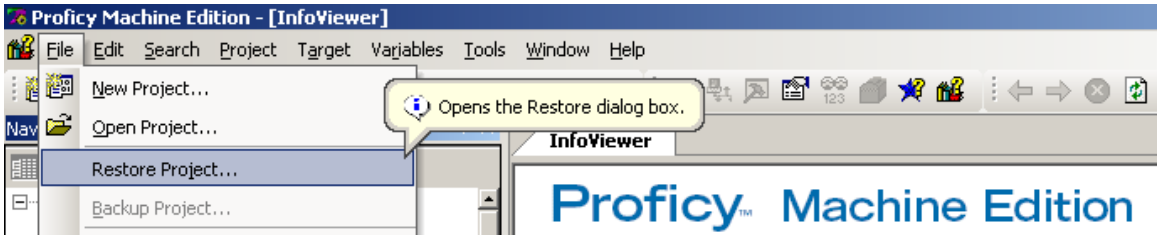
A Proficy View Diagnostic project is located in the *Diagnostics VIEW* directory. When it is active, this diagnostic utility displays key information regarding the operation and state of the redundant CPU pair. This project must also be brought into your Proficy Machine Edition development environment using Proficy Machine Edition's *File > Restore Project…* menu.

Adding the Max-ON Hot Standby Redundancy Application Project to Proficy Machine Edition

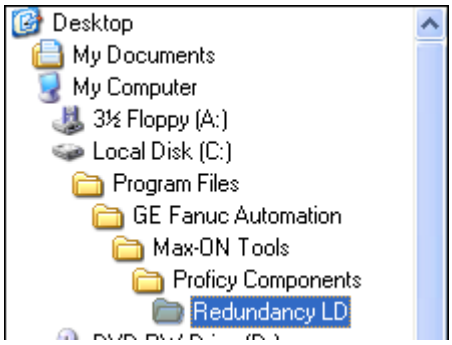
The default Max-ON LD project is added to the Machine Edition project Navigator by using the *File > Restore Project*…menu item. Select the Project Navigator window making certain that there is no project open at this time.



Using the *File* menu, click on *Restore Project...*



Navigate to the *Proficy Components* directory, then to the *Redundant LD* directory. Make certain that the selection for **Files of Type** has been set to *Proficy Machine Edition (*.zip)*.



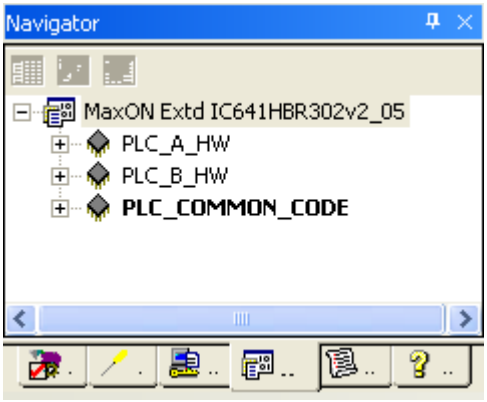
Select the *Max-ON LD Project HBR30xv#_##.zip* file.

When you click on *Open*, a new project will be added to the Proficy Navigator window.

Now you may give this new Project a descriptive project name. You may also use this project to create a Machine Edition project template that can me used as a starting point for future Max-ON projects.

Launching the Max-ON Configuration Utility

The Max-ON Configuration Utility is launched from the Machine Edition project. Open the project that you restored in the previous section. There are three targets in the project:

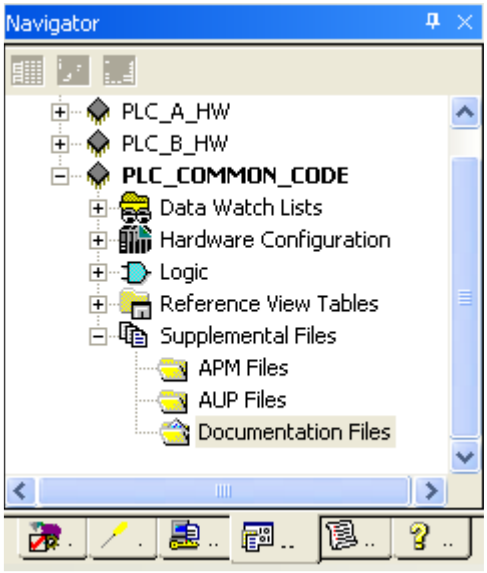


- *PLC_A_HW* – This target contains the hardware configuration for PLC A. It must be edited to reflect the hardware settings and components in your system. Then it must be downloaded to PLC A (only).

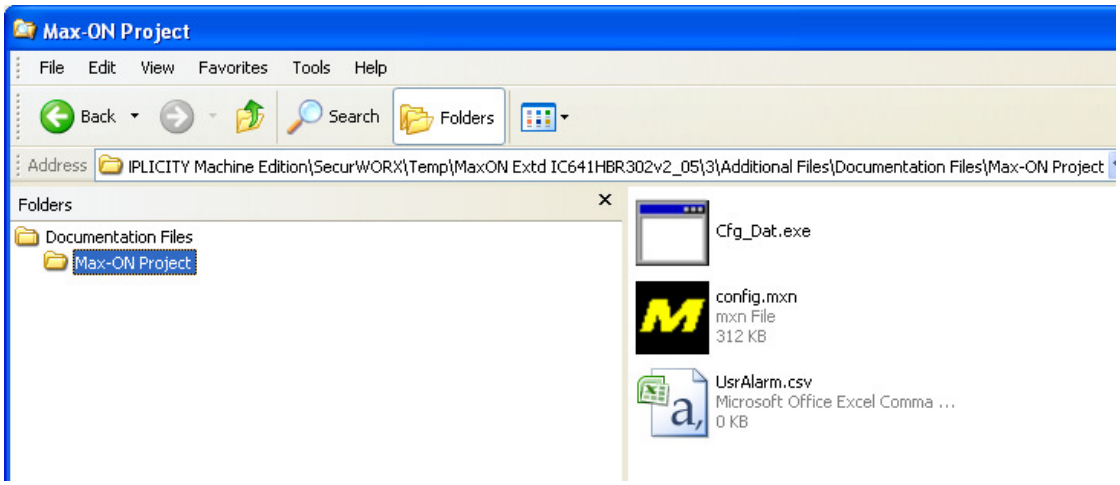
- *PLC_B_HW* – This target contains the hardware configuration for PLC B. It must be edited to reflect the hardware settings and components in your system. It will be very similar to PLC A hardware configuration, except for certain items such IP addresses, Genius bus controller settings, etc. In a similar fashion, this configuration must be downloaded to PLC B (only).
- *PLC_COMMON_CODE* – This target contains the core logic for the Max-ON redundancy application. You must add your application logic starting in the rung that follows the call to the core Max-ON logic (hbr_000). The logic from this target will be downloaded to both PLC A and PLC B. Note that the download consists of the PLC Logic Only, the Hardware Configuration option must be unchecked.

You navigate to the Max-ON Configuration Utility by following these steps:

1. Select the target *PLC_COMMON_CODE*.
2. Expand the tree structure so that the *Supplemental Files* folder named *Documentation Files* is visible.



3. Double-click on *Documentation Files*. This will launch *Windows Explorer* for this directory.
4. Click on the *Max-ON Project* directory to display its contents. The Explorer window will be similar to what is shown below.



5. Double-click on the Max-ON Configuration file named *config.mxn*. This launches the Max-ON Configuration Utility.
6. You may now examine and edit the parameters of the Max-ON redundant system.

Technical Support

Technical Support is available at no charge for 90 days after purchase. A support agreement can be purchased from your local GE Fanuc distributor if extended support is required.

If problems arise that can't be solved using the information in your product manual, online Help system, Proficy GlobalCare knowledge base, or the GE Fanuc Technical Advisor knowledge base, contact us by telephone, fax, or mail. When contacting us, call from a telephone near your computer and have your Machine Edition software running. Have the following information handy to help us assist you as quickly as possible:

- Proficy Machine Edition software installation serial number, the Proficy Machine Edition software Product name, and version number from the **Help >About** dialog box.
- The brand and model of any hardware in your system.
- Operating system and version number.
- The steps you performed prior to the problem occurring.

GE Fanuc Global Care Web Site

The GE Fanuc Global Care Web Site offers product, service, and support information for GE Fanuc hardware and software products. The Global Care web site is located at:
http://globalcare.gefanuc.com/
Visit this site for the latest up-to-date technical information.

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Chapter 2 System Overview

Architecture

A Max-ON Series 90-30 Hot Standby Redundancy system consists of two Series 90-30 Controllers, at least one Genius bus used to transfer key system data, and an I/O system. The I/O devices may share the Genius bus that is used to transfer the system data.

Max-ON for the 90-30 PLCs is available in three different models. The models are distinguished from each other by the number of I/Os than may be serviced, the number of Genius I/O LANs supported, the quantity of synchronized data that may be transferred, and the use of one or more optional Ethernet LAN(s) for application data transfers.

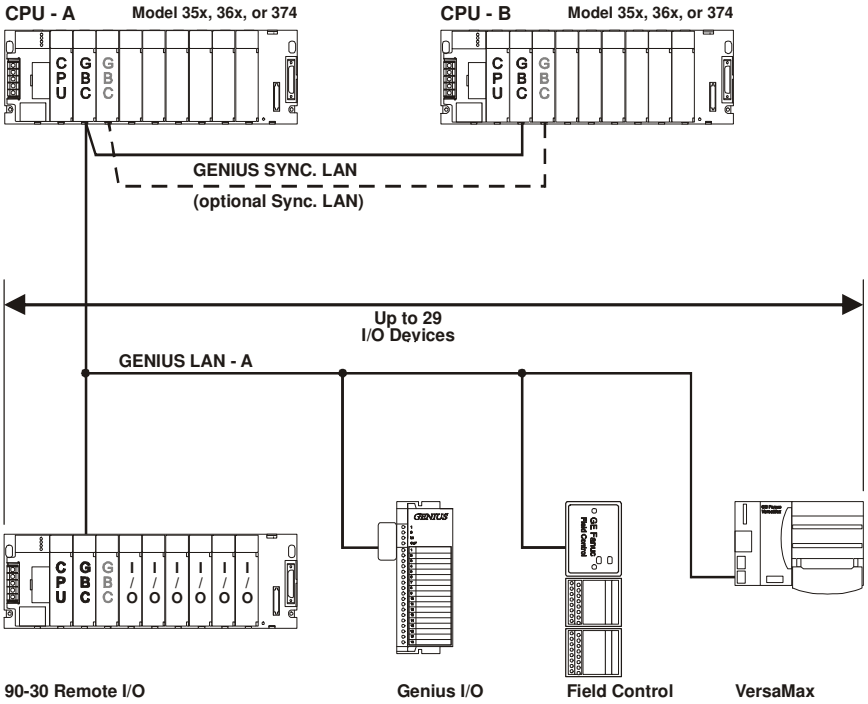
The I/O system may be implemented using a combination of Genius I/O, Field Control I/O, VersaMax I/O, or Remote I/O drops based upon Series 90-30 I/O.

Product Selections

Max-ON is available in three different models. By offering scaleable solutions, you may chose the product that matches your I/O requirements as well as data synchronization performance. (For high performance systems, you should investigate the GE Fanuc PACSystems family of Hot-Standby processors.)

Max-ON Lite

Max-ON Lite is the entry level product offering in the Series 90-30 Critical Control Family.

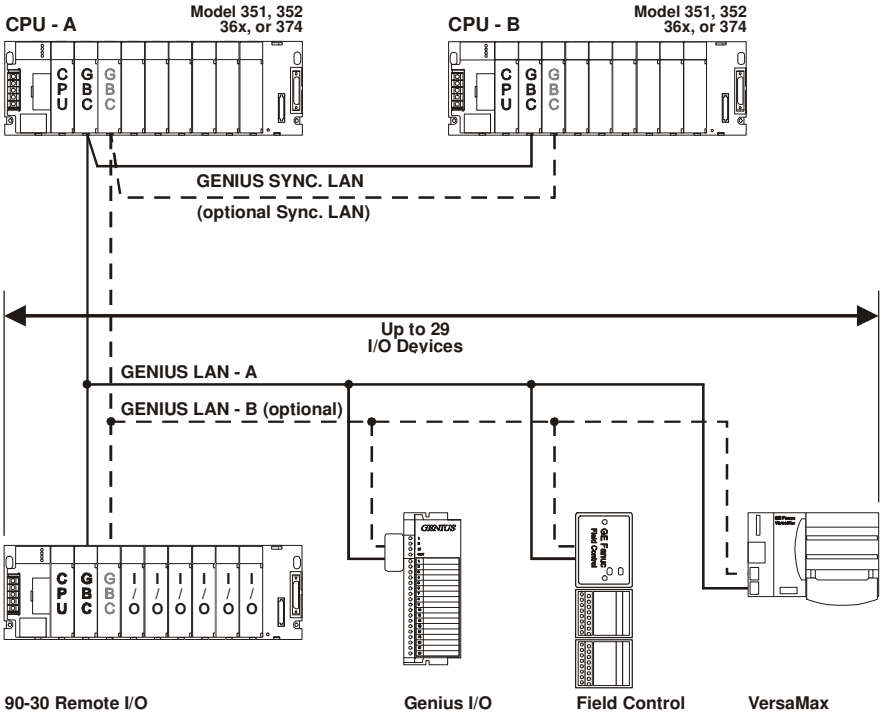


This product provides the following functionality:

Discrete Inputs (%I)	128
Discrete Outputs (%Q)	64
Analog Inputs (%AI)	32
Analog Outputs (%AQ)	12
Synchronized Internal Coils (%M)	128
Synchronized Registers (%R)	300
I/O Busses	one (also serves as a Synchronizing LAN)
Synchronizing LANs	one or two Genius LANs
CPU Models	350, 351, 352, 360, 363,364, or 374
I/O Families	Genius, Field Control, VersaMax, 90-30 Drop

Max-ON Standard

Max-ON Standard is the mid-level product offering in the Series 90-30 Critical Control Family. It has been designed to satisfy the majority of the application requirements. This product has been enhanced over the Lite product by adding support for a dual I/O bus, increased I/O capacity, larger synchronized data transfers, extra I/O diagnostics, and analog input scaling.



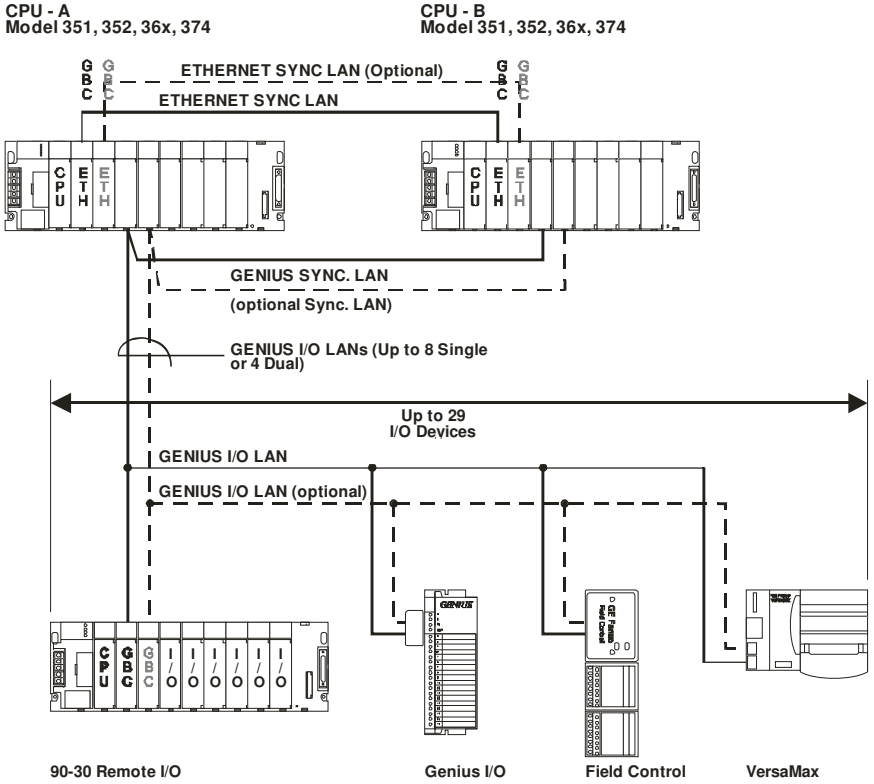
This product provides the following functionality:

Discrete Inputs (%I)	512
Discrete Outputs (%Q)	512
Analog Inputs (%AI)	512
Analog Outputs (%AQ)	64
Synchronized Internal Coils (%M)	2048
Synchronized Registers (%R)	8000
I/O Busses	up to two simplex busses, or one dual bus up to 29 devices per simplex or dual bus (also serve as Synchronizing LANs)
Synchronizing LANs	one or two Genius LANs (also serve as I/O busses)
CPU Models	351, 352, 360, 363, 364, or 374
I/O Families	Genius, Field Control, VersaMax, 90-30 Drop

Max-ON Extended

Max-ON Extended is the high-level product offering in the Series 90-30 Critical Control Family. It has been designed to satisfy applications that have higher performance requirements.

This product has been enhanced over the Standard product by adding support for up to 8 simplex or 4 dual I/O busses and additional I/O. Data synchronization is implemented using one or two Ethernet LANs. Genius LAN(s) is still available if you decide that Ethernet is not necessary. (Genius LANs also provide additional backup in the event the Ethernet LANs fail.)



This product provides the following functionality:

Discrete Inputs (%I)	2048
Discrete Outputs (%Q)	2048
Analog Inputs (%AI)	1024
Analog Outputs (%AQ)	256
Synchronized Internal Coils (%M)	4096
Synchronized Registers (%R)	8000
I/O Busses	up to eight simplex busses, or four dual busses (also serve as Synchronizing LANs) up to 29 devices per simplex or dual bus
Synchronizing LANs	one or two Ethernet LANs one or two Genius LANs (also serve as I/O busses)
CPU Models	351, 352, 360, 363, 364, or 374
I/O Families	Genius, Field Control, VersaMax, 90-30 Drop

Software Components

Max-ON software consists of several components, some of which execute in the Hot Standby Controllers, and some of which execute in your programming workstation. A Logic Developer PLC Project provides the basic template for the Logic of the Redundant System. This project is modified by the system designer to add the other necessary Logic to perform the user application, and then the final application is stored in the Controllers using Proficy Logic Developer PLC.

You may think of the software provided in the Project template for the Controllers as “drivers” that handle the complex tasks associated with Hot Standby redundancy. These drivers allow the two Controllers to behave as a single Controller from the perspective of your application.

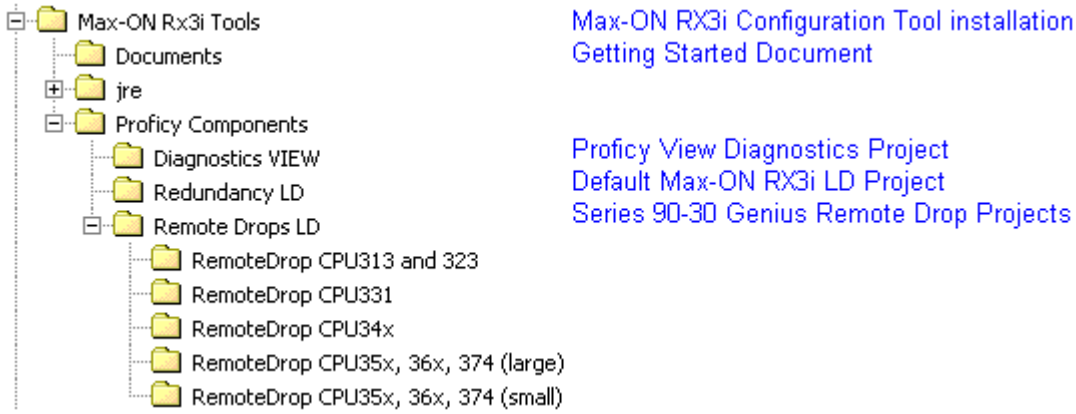
The Max-ON Configuration Utility allows the system designer to customize the parameters of the Max-ON drivers and to specify the hardware that is contained within the system. The Max-ON Configuration Utility software operates in Windows XP Professional, Windows NT4.0, and Windows 2000 Professional.

The Max-ON Configuration Utility software allows you to define the way your system is constructed and how you want the system to operate. It provides additional information that is not included in the Hardware Configuration files produced by Logic Developer PLC.

The Max-ON software includes a Proficy View Diagnostic Project that allows you to observe the way your system is operating and helps you to diagnose problems. This Project displays the operational status of the redundant system in real time.

The Max-ON software also includes a set of projects to configure Series 90-30 Remote Genius Drops.

The Max-ON software components are organized as follows:



Hot Standby Redundancy Operation

During each controller scan, the Max-ON redundancy drivers are solved first, and then your application logic is solved. The Max-ON redundancy drivers handle the following functions:

- **Determine Mastership** – One CPU operates as the Master. The other operates as the Backup. Output devices use the output states from the Master only. In a Max-ON system, the user may specify either PLC to be the preferred Master. If no preference is specified, then Mastership "floats" between the PLCs. The current Master retains its status until it fails or until the user switches Mastership, at which time the Master and Backup exchange their roles.
- **Transfer Synchronization Data** – If the Master fails, the Backup must be prepared to control the process using the latest internal states from the ex-Master. These states may represent such things as latched coils, timer/counter values, PID values, system set points, and perhaps user-calculated values.
- **Enforce an Orderly PLC Startup** – When a failed PLC is returned to service, it must not attempt to assume control of the system prior to being synchronized to the current Master. If both PLCs startup simultaneously, then whichever one was the last valid Master assumes the Mastership.
- **Process Genius Dual Bus I/O Devices** – When the system uses dual Genius I/O busses, input devices are mapped automatically from the active I/O LAN into the PLC's input reference tables.
- **Execute Diagnostic Tests** – Automatically post time-stamped fault messages into the Max-ON Alarm Table. Identify system problems such as bus faults, loss of devices, change of Mastership, program restart, and power-up event.

Failover Time

There are two factors that contribute to failover time.

Token Rotation Time: This time interval varies somewhat from one Genius bus to another. It is defined as the update period for the I/O LAN. This period is a function of the number of devices on the LAN, the quantity of input/output data associated with each device, the LAN's baudrate, and the quantity of global data being transferred. Generally this time period ranges from a few milliseconds to perhaps 100 milliseconds.

Mastership Time: This is the time interval for the Backup PLC to recognize that the Master PLC has failed. It takes one or two PLC scans to determine that the Master has failed. Then it takes an additional scan to activate the output data stream in the Backup PLC.

The actual failover time is the longer of either...

3 Token Rotation Times, or

1 Mastership Time.

Lacking output data from the current Master's GBC, each output circuit on each device on the I/O LANs will hold its last state for up to 2.5 seconds before it assumes the Default State unless there is output data from the Backup GBC. (This assumes that each device has been configured for either BSM present or for long timeout.) Then the output device will begin using output data from the other GBC.

Synchronized Data Transfers

Data Reference Types

Data from within the following reference ranges may be selected for transfer from the Master to the Backup PLC.

%M00001.....%M02048
%M02049.....%M04096 (Max-ON Extended Only)
%Q00001.....%Q02048
%AQ0001.....%AQ0256
%R00001 .....%R08000

Groups

Synchronized data may be transferred in up to 6 groups for each of the data types listed previously. This allows the system to transfer non-contiguous data blocks. The general format uses a Starting Reference, paired with a Length.

Quantities

For each Synchronized Data type, the system will sum the lengths in each configured group to arrive at a total amount. The total for each data type must not exceed any of the maximums listed in the table below:

Catalog Number	Description	Registers	Discrete Outputs	Internal Coils	Analog Outputs
IC641HBR300	Max-ON Lite	300	64	128	12
IC641HBR301	Max-ON Standard	8000	512	2048	64
IC641HBR302	Max-ON Extended	8000	2048	4096	256

Note: If one attempts to configure a transfer having a larger value than is allowed, then the CPU with the invalid configuration will post a fault message and then shutdown immediately. It cannot be restarted until a valid configuration having a proper quantity has been stored.

I/O Bus Topologies

Depending upon the Max-ON product, a system supports the use of single (non-redundant) and/or dual (redundant) busses interfacing to the I/O devices.

Max-ON Lite allows the use of only a single LAN to the I/O devices.

Max-ON Standard supports one redundant LAN or two non-redundant LANs.

Max-ON Extended supports up to four redundant LANs or up to eight non-redundant LANs, or a mixture of the two. However, the system may not have more than eight bus controllers in a PLC.

Redundant busses are superior to non-redundant busses when there is a requirement to protect against cable failures or Genius bus controller failures.

When the primary consideration is to protect against cable failures, then the system designer should consider separating the cables so that a single mechanical failure does not damage both cables.

Selecting the I/O

Max-ON systems may be implemented using any combination of the following I/O:

Genius Block	Genius blocks are intelligent, self-contained, configurable I/O modules. The blocks are available as discrete, analog, and special purpose types, such as the high-speed counter. Many of the blocks offer advanced diagnostic capabilities such as open circuit, short circuit, and overload detection. Each block is configured using a hand-held monitor.
Genius Field Control	Genius Field Control is a family of versatile, modular I/O devices. The I/O modules are small and rugged and are available in both discrete and analog versions. I/O Terminal Blocks provide universal field wiring terminals for the I/O modules, allowing I/O module types to be mixed on the same I/O Terminal Block. The I/O Terminal block is mounted on a DIN rail. As many as eight Field Control I/O modules (four I/O terminal blocks) can be connected to one Bus Interface Unit. Together, they make up a Field Control "station". The bus interface unit provides either a single or a dual, redundant LAN connection to the Hot Standby PLCs. Each station is configured using a hand-held monitor.
Genius Remote 90-30 Drop	Genius Remote 90-30 drops consist of a Series 90-30 CPU, power supply, base plate, and one Genius bus controller for a single LAN connection or two bus controllers for a dual, redundant LAN connection. Normally, input and output modules are installed in the base. A Scanner routine executes in the drop's CPU. This routine scans all input devices and transmits the input states to the Hot Standby PLCs. The routine also monitors outputs (%Q and %AQ) in the Synchronized Data stream from the Hot Standby PLCs. Any output data that is configured to be active in the remote drop is captured from the data stream and then is mapped into the Drop's output reference tables. Configuration of the remote drop is accomplished using the Logic Developer PLC software package. Also, a few rungs of ladder logic must be edited in order to characterize the outputs in the drop.
Genius VersaMax	Genius VersaMax I/O products feature DIN-rail mounted modules with up to eight I/O and option modules per "rack" and up to 8 racks per VersaMax I/O Station system. Expansion racks can be located up to 750 meters from the main VersaMax I/O Station rack. Expansion racks can include any VersaMax I/O, option, or communications module.
Genius Third Party	In some cases, third party devices may be used on the LAN as well. These devices must comply with the Genius I/O specification relating to Controller Redundancy.

With a Max-ON system, you may select I/O devices based upon functionality, cost, physical design, items carried in spare parts inventory, or personnel expertise.

Product Authorization

A Max-ON system will operate in demonstration mode for 22 days. In this mode, all of the system's capabilities are fully operational. At the end of the period, PLC A will either stop immediately (if it is the backup) or begin an orderly transfer of Mastership to PLC B. If the transfer is successful, then PLC A will shutdown automatically. ***At this point, the system will be operating in a non-redundant manner.***

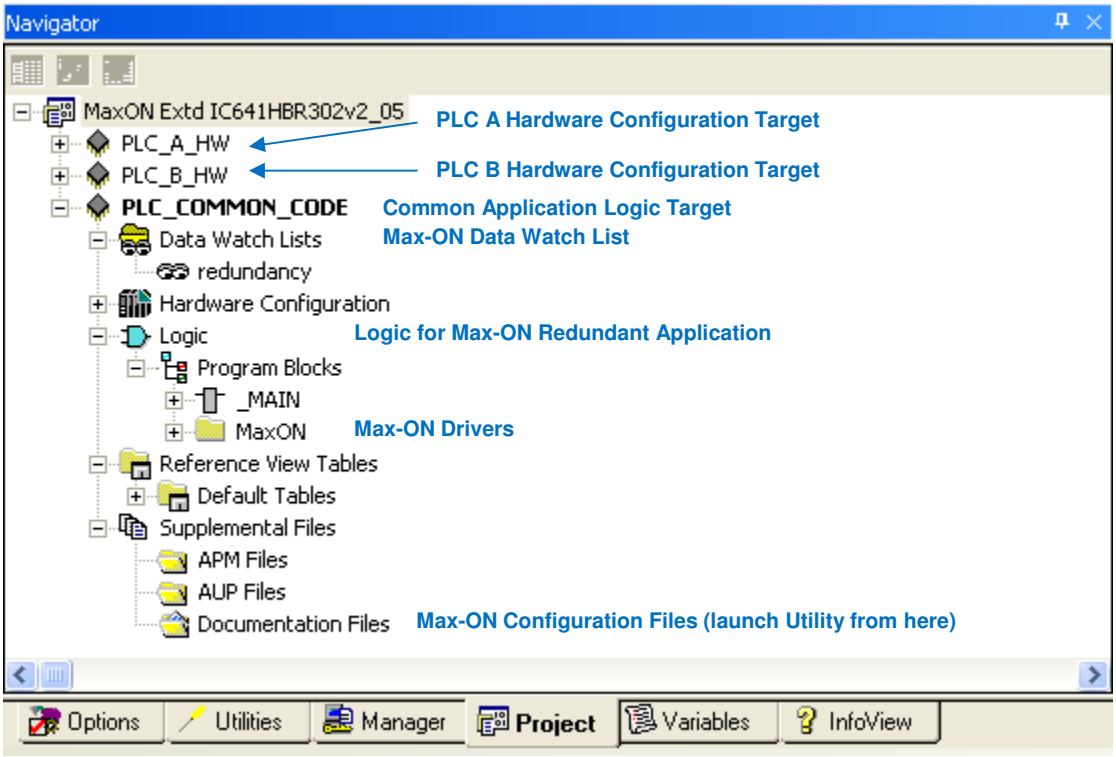
A Max-ON system that is installed in a production environment MUST be authorized in order to allow PLC A to run indefinitely.

For additional details on product authorization, refer to Chapter 8.

Chapter 3 Building a Max-ON Hot Standby Application

Max-ON Project

Max-ON encapsulates your entire application within a single Machine Edition Project. Using a generic Max-ON Project, you can create a new Max-ON Redundancy project. The generic project contains all of the base Max-ON redundancy application components needed to perform the redundant application. You add the hardware configuration information for each PLC in your application, add your application logic, and define the parameters of the Redundant System using the Max-ON Configuration Utility that was launched from the Logic Developer PLC Project.



Project Workflow

Step 1 - Gather Information

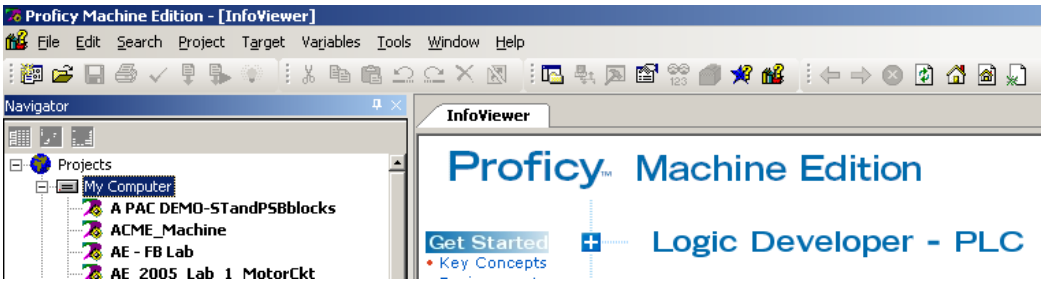
Gather the information about your system:

I/O Bus topologies and addresses
Synchronization LAN locations
Module types and locations
I/O Devices including bus assignment, bus addresses, circuit references, number of circuits and I/O family type.

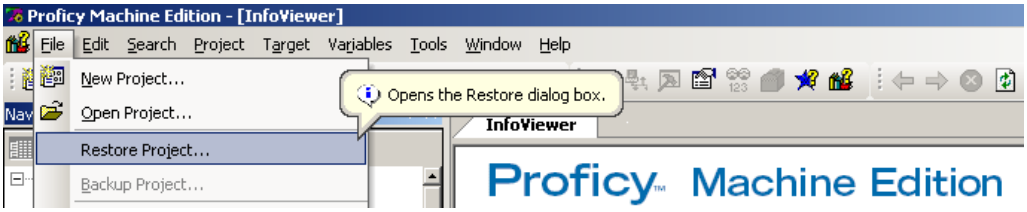
Step 2 - Create a New Max-ON Project

In Proficy Logic Developer PLC:

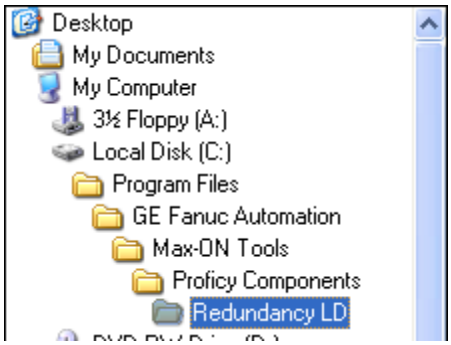
Create a new project based on the Generic Max-ON Project. The redundant ladder project is added to the Machine Edition project Navigator by using the *File > Restore Project…* menu item. Select the Project Navigator window making certain that there is no project open at this time.



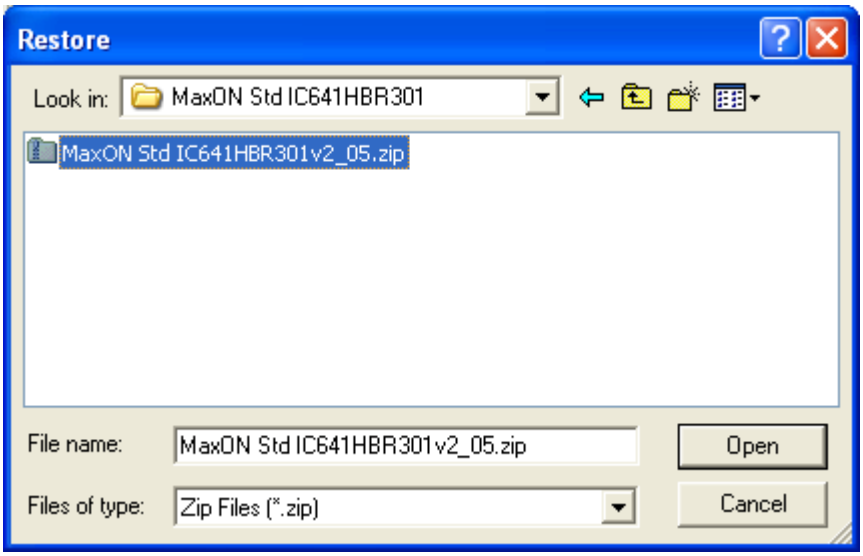
Using the *File* menu, click on *Restore Project...*



Navigate to the *Proficy Components* directory, then to the *Redundancy LD* directory. Make certain that the selection for **Files of Type** has been set to *Proficy Machine Edition (*.zip)*.



When you click on *Open*, a new project will be added to the Proficy Navigator window.



Give your project a descriptive name in the Machine Edition Navigator.

Configure the Project Information in the Max-ON Configuration Utility, using the information you gathered in step 1. (Refer to Chapter 4 for more information.)

Enter *Project Setting* information by launching the Project Settings dialog in the Max-ON Configuration Utility. (Refer to Chapter 4 for more information.)

Enter *Developer* and *End User Information* by launching the Biographical Information dialog in the Max-ON Configuration Utility. . (Refer to Chapter 4 for more information.)

Step 3 - Configure the Controller Hardware

In Logic Developer PLC:

For CPU A:

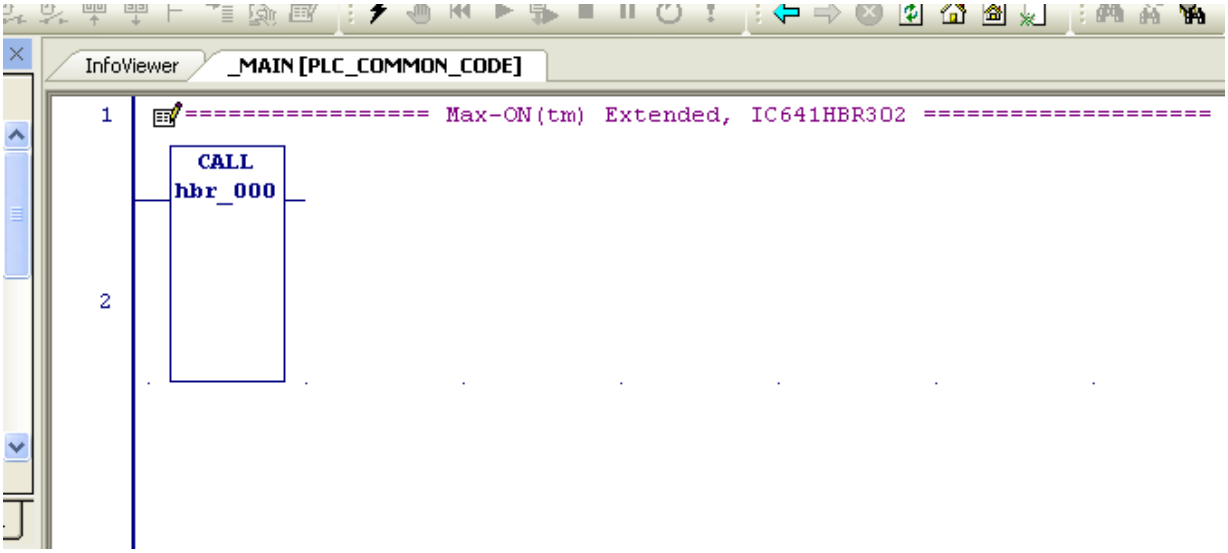
1. Open the Hardware Configuration for *PLC_A_HW* target in the Max-ON Project.
2. Configure the PLC hardware for PLC A:
   - CPU Memory
   - CPU SNP ID
   - Genius Bus Controllers
   - I/O Devices on the Genius Bus (or Busses)
   - Ethernet Modules
   - Ethernet IP Address and Subnet Mask
   - Device Status Address
3. Store the new hardware configuration into CPU A
4. Set the time and date for CPU A.

For CPU B:

1. Open the Hardware Configuration for PLC_B_HW target in the Max-ON Project.
2. Configure the PLC hardware for PLC B.
   - CPU Memory
   - CPU SNP ID
   - Genius Bus Controllers
   - I/O Devices on the Genius Bus (or Busses)
   - Ethernet Modules
   - Ethernet IP Address and Subnet Mask
   - Device Status Address
3. Store the new hardware configuration into CPU B.
4. Set the time and date for CPU B.

Step 4 - Add Your Application Logic

Using Logic Developer PLC, open the PLC_COMMON_CODE Target folder and add your application logic **after** the call to the subroutine named *HBR_000*.



If you are using an Existing Project

If you have developed the application previously, then you may use the Machine Edition Toolchest to place the Max-ON Blocks into the Project.

If this is a New Application

Add your application logic into the project folder directly after the CALL to the hbr_000 Block. That is, start the application specific logic beginning at _MAIN, Rung 3.

Step 5 - Configure the I/O Devices

Genius or Field Control

If you are using Genius or Field Control, then set the appropriate parameters for Serial Bus Address, I/O Settings, I/O Quantities, Redundant Controllers, BSM present (always set to yes), BSM Controller (set to yes when a dual I/O bus is used), etc.

Genius VersaMax I/O

In Logic Developer PLC, add a Target for each VersaMax I/O Drop. Add the appropriate modules to the drop and then configure the parameters for each module. Connect to each drop with a serial cable and then store the configuration data.

Remote Genius 90-30 Drops

If you are using Remote Genius 90-30 Drops, then configure the Genius bus controller(s), and edit the configuration rungs in the remote's I/O driver. Make certain that Synchronized Data has been configured for the range of outputs used by the Remote Drop.

Step 6 - Start the System

Divide the system into manageable subsystems that may be verified as independent entities.

I/O Bus

Make certain that the Genius LAN(s) have been installed correctly... LAN polarity and shield IN/OUT are connected consistently and correctly. Also make certain that terminating resistors are installed at each end of the LAN(s).

Genius and Field Control – Using a Handheld Monitor, verify that output devices may be turned ON or OFF from the LAN.

Use the Handheld Monitor check the LAN for any Bus Error activity.

I/O Devices

When Interfacing to CPU A:

With the I/O operating, place CPU A in RUN mode and CPU B in STOP mode.

Verify that the system input devices return real-time values properly.

Verify that system output devices may be controlled from the Output Reference Tables.

> **Note:** This might require that you place a temporary JUMP in your application. The JUMP should be placed immediately after the CALL to *HBR_000*. The companion label should be placed at the end of _MAIN.

When Interfacing to CPU B:

With the I/O operating, place CPU A in STOP mode and CPU B in RUN mode.

Verify that the system input devices return real-time values properly.

Verify that system output devices may be controlled from the Output Reference Tables.

Hot Standby Operation

Place both CPUs into RUN mode.

Make certain that there is only one Master and only one Backup.

Make certain that there is no preferred Master.

Place CPU B into STOP mode; then place it into RUN mode.

Make certain that Synchronized Data is transferred properly to CPU B.

Transfer Mastership from A to B by placing the CPU A into STOP mode.

Make certain that the I/O did not dropout during the transfer.

Place CPU A into RUN mode.

Make certain that it becomes a Backup properly.

Transfer Mastership from B to A by placing the CPU B into STOP mode.

Make certain that the I/O did not dropout during the transfer.

Place CPU B into RUN mode.

Make certain that it becomes a Backup properly.

Make certain that Synchronized Data is transferred properly to CPU B.

Step 7 - Debug the System

Use the Max-ON View Diagnostic Project

Restore the Proficy View Project from the installation directory into Proficy Machine Edition.

Enter the Ethernet Addresses of PLC A and PLC B into the Proficy View Project.

Download and Run the View Project on your workstation.

Examine the Alarm and the Real-time Status displays.

Simplify the System

Here are a few suggestions from other system developers that have worked well.

Turn OFF one PLC and troubleshoot the system using the remaining one.

Disable Max-ON drivers by placing an #ALW_OFF contact prior to the call to HBR_000. Now determine if input/output devices operate properly. This will require that you modify the hardware configuration for the Genius bus controllers. Place them in “Enable at Start”. Don’t forget to change the configuration to “Disable at Start” when it is time to place the system into its final, redundant operation.

Disable your application code and troubleshoot the Max-ON functionality. Check to make certain that synchronized data items transfer properly. Check to make certain that the Hot Standby CPUs will exchange mastership properly.

Chapter 4 The Max-ON Configuration Utility

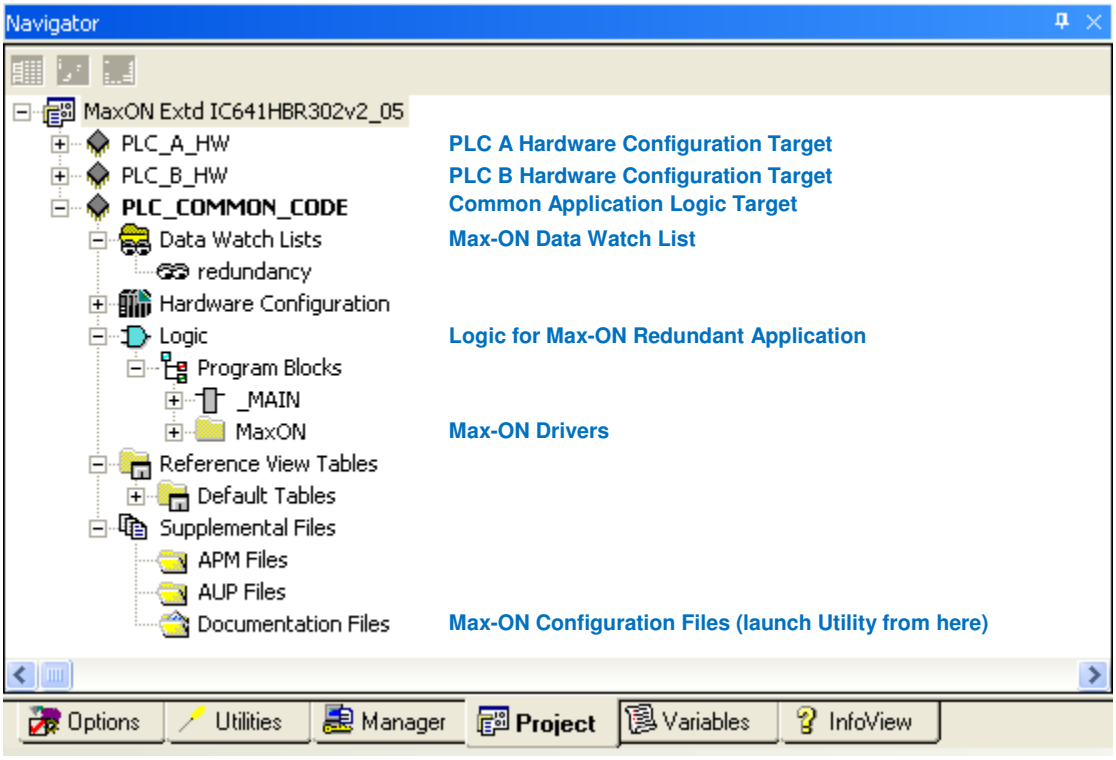
The Max-ON Configuration Utility is used to create or edit the operating parameters used by the Max-ON redundancy drivers. These parameters specify such things as, bus topologies, I/O addresses, and definitions for the ranges of synchronized data transfers.

Max-ON Projects

A Max-ON Project is a collection of items needed to define the elements of a redundant system. If you inspected a Max-ON Project using Logic Developer PLC, you would see that it consists of a Machine Edition Project with 3 Targets:

- *PLC_A_HW* – This target contains the hardware configuration for PLC A. It must be edited to reflect the hardware settings and components of PLC A in your system. Then it must be downloaded to PLC A (only).
- *PLC_B_HW* – This target contains the hardware configuration for PLC B. It must be edited to reflect the hardware settings and components of PLC B in your system. It will be very similar to PLC A hardware configuration, except for certain items such IP addresses, and Genius bus controller settings. In a similar fashion, this configuration must be downloaded to PLC B (only).
- *PLC_COMMON_CODE* – This contains the core redundancy logic for the Max-ON redundancy application. You must add your application logic starting in the rung that follows the call to the core Max-ON logic (hbr_000). The logic from this target will be downloaded to both PLC A and PLC B. Note that the download consists of the PLC Logic Only, the Hardware Configuration option must be unchecked.

The diagram below illustrates how the Max-ON Project is organized:

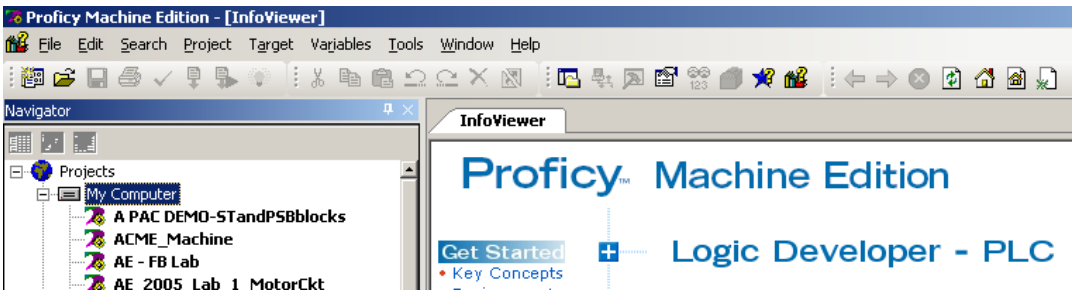


When creating a Max-ON Project, the best approach is to start with the generic project that is supplied with the Max-ON software. This assures that all of the basic components of the Max-ON redundant application are included in the project.

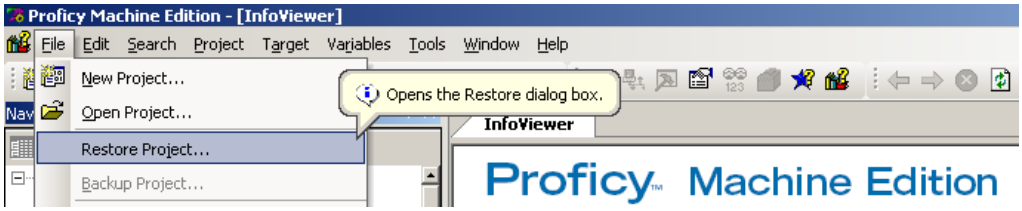
Creating a New Max-ON Project

To create a new Max-ON Project in Proficy Logic Developer PLC:

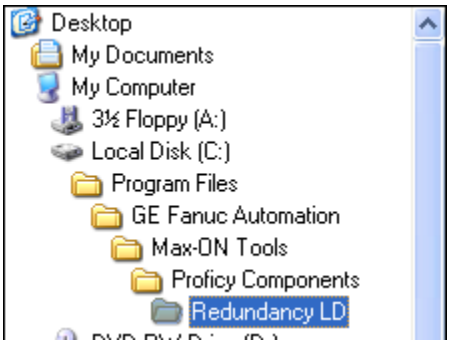
1. Create a new project based on the generic Max-ON Project. A new Max-ON Project is added to the Machine Edition project Navigator by using the *File > Restore Project…* menu item. Select the Project Navigator window, making certain that there is no project open at this time.



2. Using the *File* menu, click on the *Restore Project...* menu.



3. Navigate to the *Proficy Components* directory where the Max-ON Tools software has been installed, then to the *Redundant LD* directory. Make certain that the selection for **Files of Type** in the Restore dialog has been set to *Proficy Machine Edition (*.zip)*.



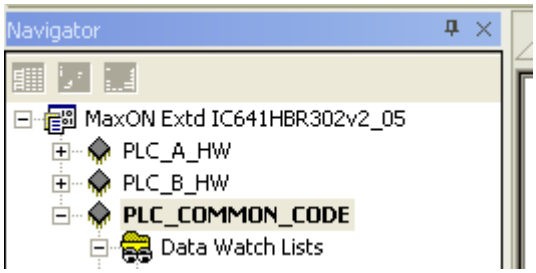
4. When you click on *Open*, a new project will be added to the Proficy Navigator window.

5. Give your project a descriptive name in the Machine Edition Navigator.

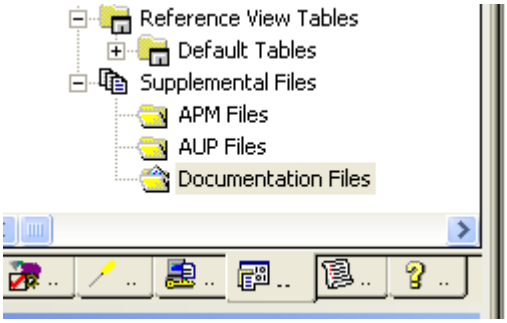
Launching the Max-ON Configuration Utility

The Max-ON Configuration Utility is launched from the Max-ON Machine Edition Project. For example, open the project that you created in the previous section. Navigate to the Max-ON Configuration Utility by following these steps:

1. Select the target *PLC_COMMON_CODE* node in the Navigator.

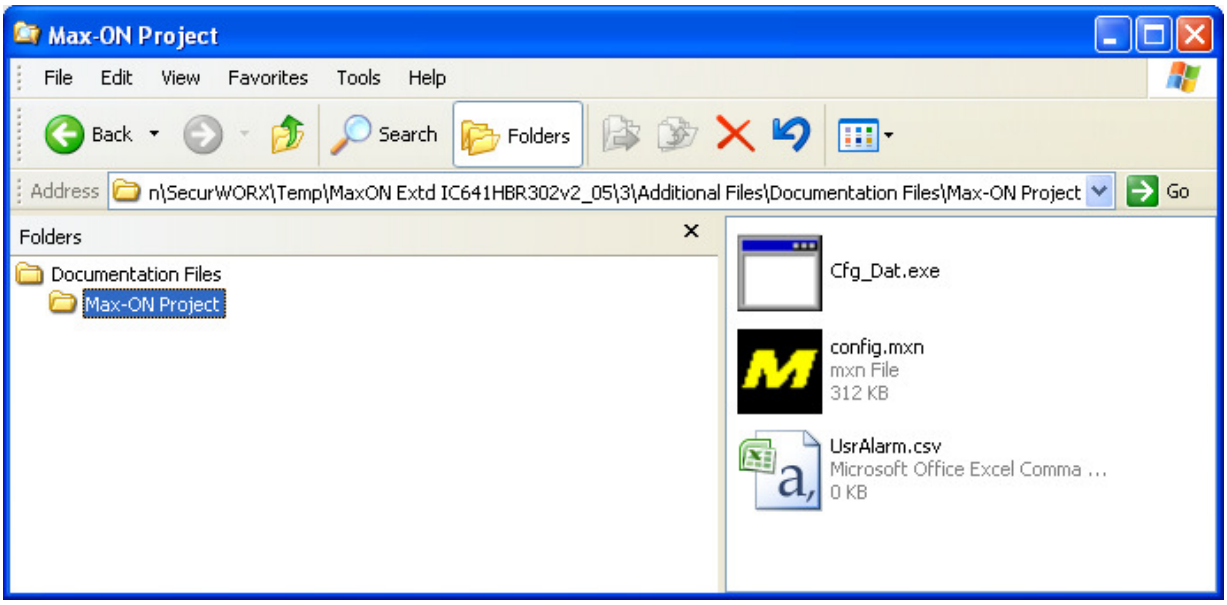


2. Expand the tree structure so that the *Supplemental Files* folder named *Documentation Files* is visible.



3. Double-click on *Documentation Files*. This will launch *Windows Explorer* for this directory.

4. Click on the *Max-ON Project* directory to display contents. The Explorer window will be similar to what is shown below.

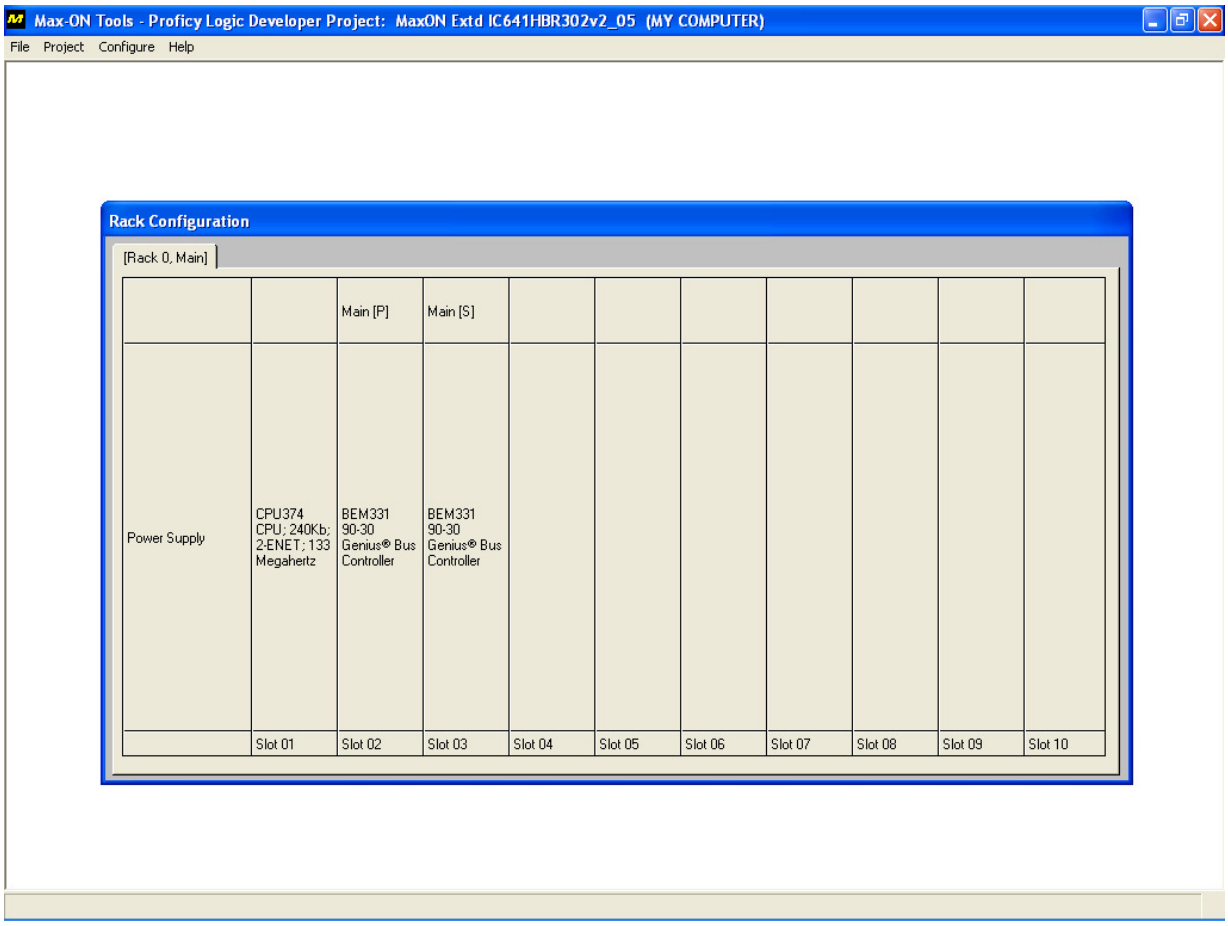


5. Double-click on the Max-ON Configuration file named *config.mxn*. This launches the Max-ON Configuration Utility. You may now examine and edit the parameters of the Max-ON redundant system.

The *Cfg_Dat.exe* file in the Max-ON Project directory is the C Block that is modified by the Max-ON Configuration Utility. After the utility has updated this file, you must update the *Cfg_Dat* C Block that is located in the PLC_COMMON_CODE target in the Max-ON Project.

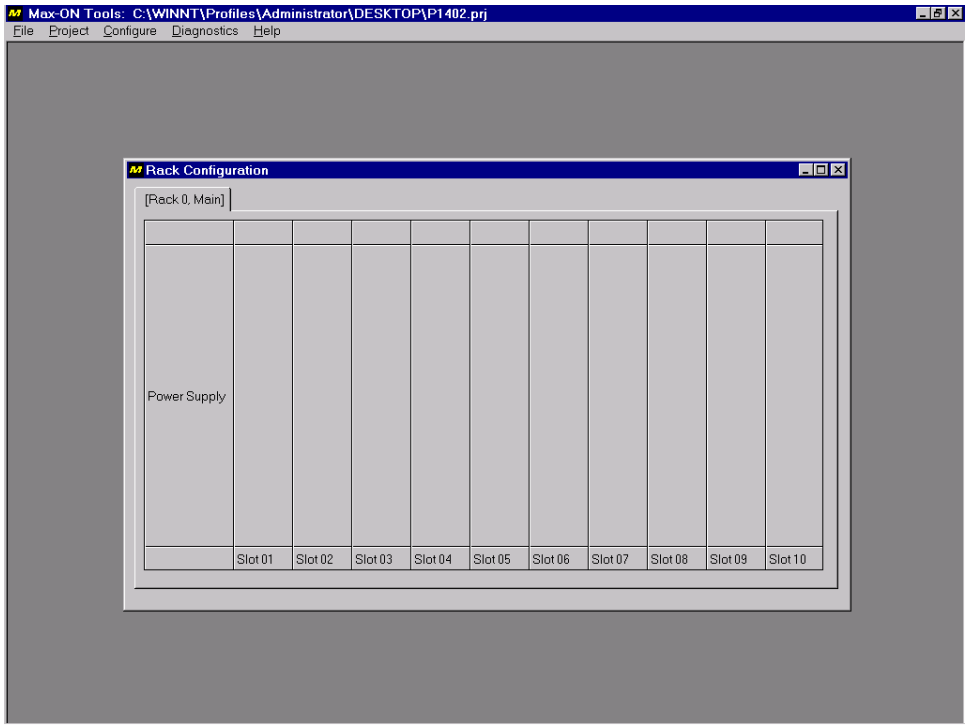
Working with the Max-ON Configuration Utility

Now that you have created a Max-ON Project and launched the Max-ON Configuration Utility, you can set the parameters of the redundant system. When the Max-ON Configuration Utility is launched it will display the following:

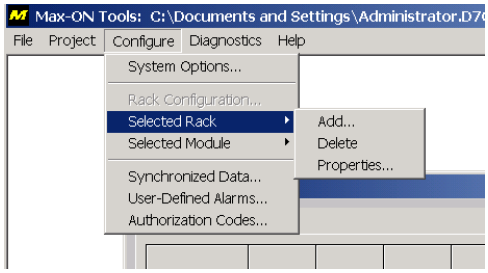


Working with Racks

While a project is open, one or more racks will be visible. The racks contain a generic view of the hot-standby PLCs. Rack-0 must always have a CPU configured in slot 1. The rack may contain one or more bus controllers, and possibly other modules as well. Additional racks may contain one or more bus controllers, and possibly other modules. Details for any rack may be accessed by clicking on its tab.



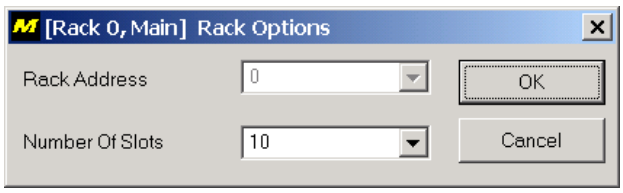
Once a rack has been selected, you may access more options by selecting *Configure*, then *Selected Rack* on the main menu bar. The following drop down list of menu items will appear:



Add Add an expansion rack to the system.

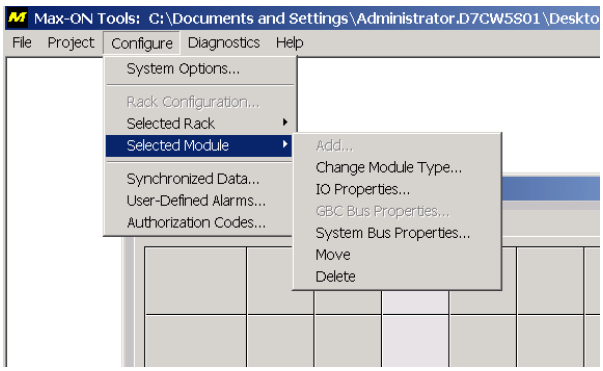
Delete Delete an existing rack from the system. If there are I/O modules on the rack, then the utility will ask you to confirm the deletion of the rack and all of its I/O modules. If you answer YES, then the rack and all of its modules will be deleted. If you answer NO, then the rack will not be deleted.

Properties Display a dialog box that allows you to set the size of the expansion rack. Valid selections are 5 slots or 10 slots.



Working with Modules

Each rack contains either 5 slots or 10 slots in which modules may be installed. By selecting a slot and then selecting *Configure* from the main menu bar, you may perform additional operations.



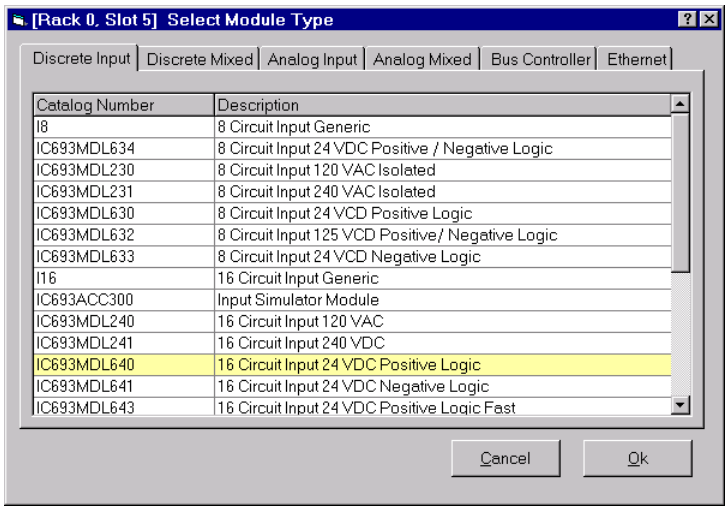
Add	Add a new module to a rack.
Change Module Type	Change the selected module from its current type to a different module type.
I/O Properties	Display a dialog box that allows you set or change the starting reference address (and optionally the length) for the selected module.
GBC Bus Properties	Display a dialog box that allows you to set or change the properties of the selected Genius bus controller. The properties include bus name, primary/secondary bus controller, and bus I/O devices.
System Bus Properties	Display a dialog box that allows you to set or change the properties of the selected Ethernet module, CPU364 or CPU374 port. The properties include the dotted IP addresses of the CPU A and B ports; and setting the primary/secondary LAN characteristic.
Move	Move the selected module from its current rack/slot location to a new rack/slot location.
Delete	Delete the selected module from the system.

Simplex Genius Bus

This is a non-redundant I/O bus that connects to one or more I/O devices.

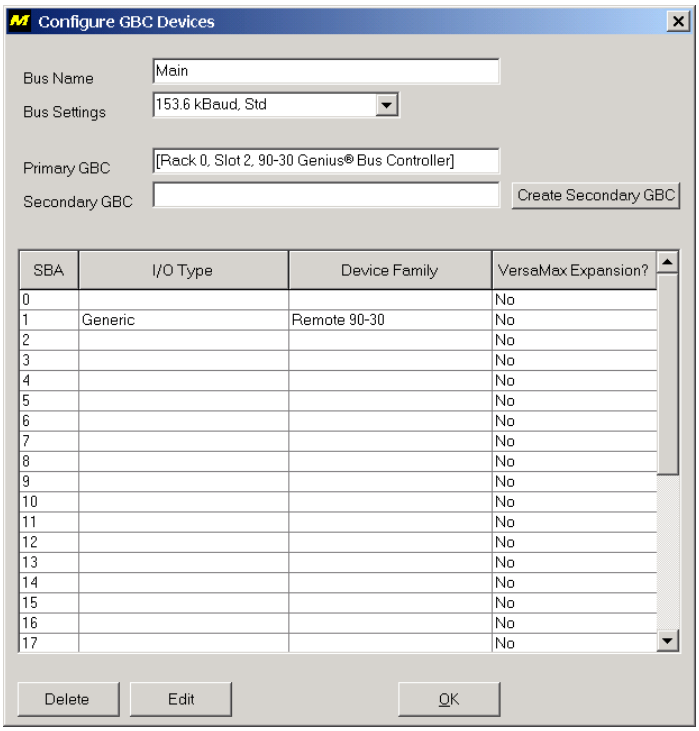
To Add a Bus –

1. Either select an empty slot location or double-click on an empty slot location. The *Select Module Type* dialog box will appear.



2. Select the tab *Bus Controllers*.
3. Select IC693BEM331 for the module type.
4. Click *Ok*.
5. Either select the slot of the existing bus controller and right-click, or double-click on the existing bus controller, or select the bus controller and use the menu Configure, then GBC Bus Properties.

The Bus Properties dialog box will appear.

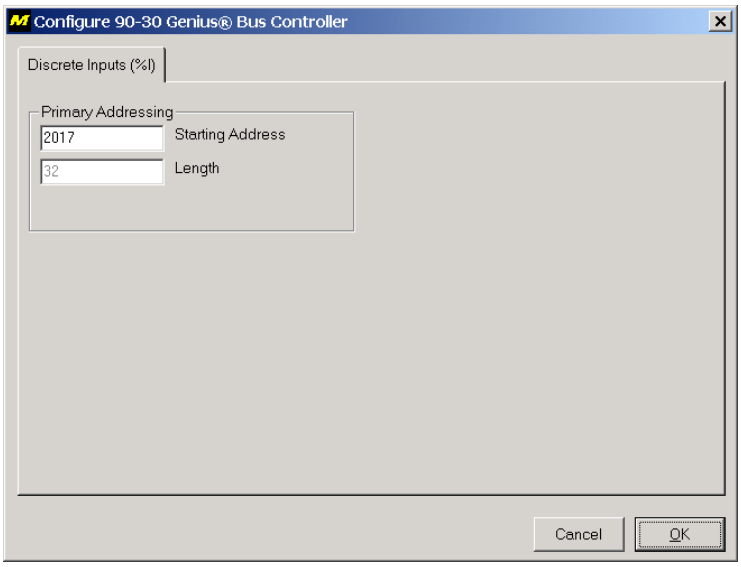


7. Enter the name of the bus in the text box.
8. Either click on *Ok*, or continue by adding devices to the bus.

Edit the I/O Properties –

After you have entered the bus controller, you must enter the starting address for the device status words.

1. Select the slot of the bus controller.
2 Either right click the slot to display the popup menu, or use the menu *Configure*, then *IO Properties*. The *I/O Properties* dialog box will appear.

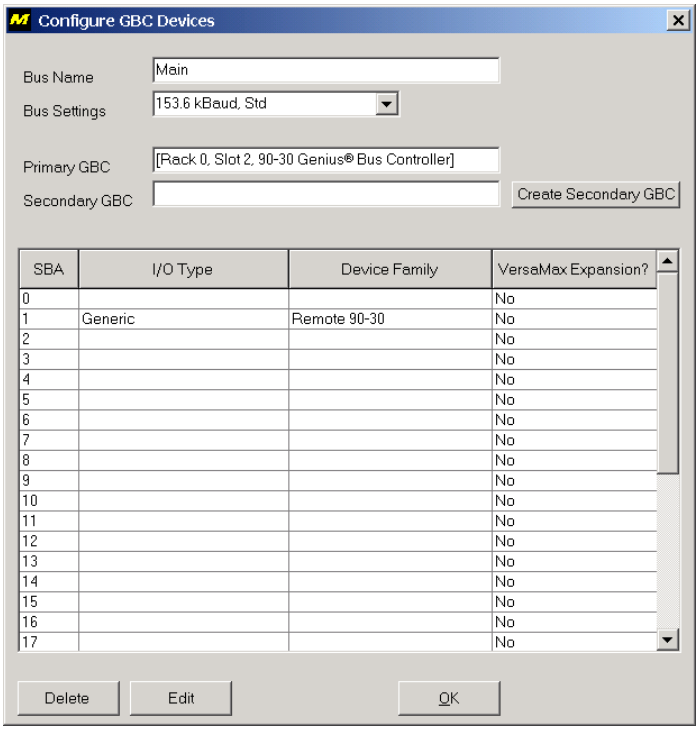


3. Enter a status address. (A suggested practice is to address devices such as Genius bus controllers, Ethernet modules, etc., at high addresses. This leaves the low addresses available for Input devices connected to your field sensors.)
4. Click *Ok* to complete the session.

Adding a Secondary Bus

To add a secondary bus to an existing bus –

1 Either select the slot of the existing bus controller and right-click, or double-click on the existing bus controller, or select the bus controller and use the menu *Configure*, then *GBC Bus Properties.* The Bus Properties dialog box will appear.



Click on the button Create Secondary GBC.

Now select the slot location in which you wish to place the secondary Genius bus controller. A message box will appear asking if you wish to create a bus controller.

Click Yes to continue.

The secondary bus will be created. Any devices that were present on the primary bus will be present on the secondary bus as well.

Click OK to close the dialog box.

Edit the I/O Properties –

After you have entered the bus controller, you must enter the starting address for the device status words.

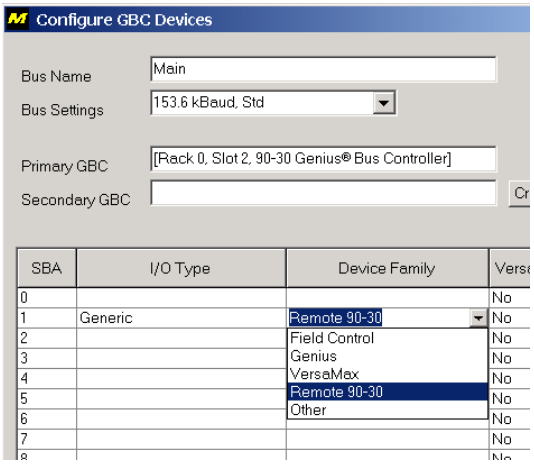
1. Select the slot of the secondary bus controller.

2. Either right click the slot to display the popup menu, or use the menu *Configure*, then *IO Properties*. The I/O Properties dialog box will appear.
3. Enter a status address. (A suggested practice is to address devices such as Genius bus controllers, Ethernet modules, etc., at high addresses. This leaves the low addresses to Input devices connected to your field sensors.)
4. Click *Ok* to complete the session.

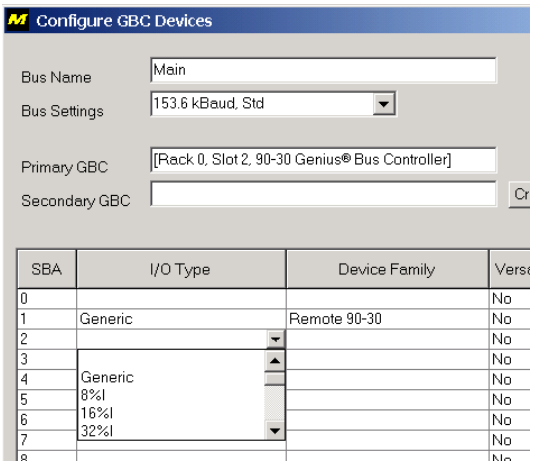
Adding an I/O Device

Select the slot for the bus controller that is associated with the device –

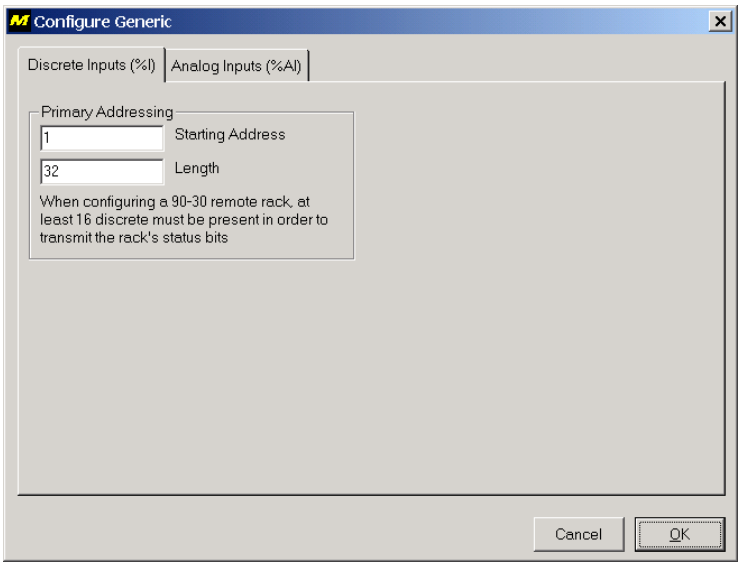
1. Display the bus properties using one of these methods:
   - either double click on the slot, or
   - right-click on the slot to display the popup menu,
   - or use the menu item *Configure* then *Selected Modules* then *GBC Bus Properties*
2. Click on the row that is to contain the device.
3. Click in the column labeled *Device Family*. A dropdown list will appear



4. Select the family for the I/O device.
5. Click on the column labeled *I/O Type*. A dropdown list will appear.



6. Select the *I/O Type* for the device, using the drop down list selections. If your I/O device does not match with any of the selections, then select *Generic*. Also, you should select Generic if the device is a *Remote 90-30* drop.
7. *Without* changing the row, click on the *Edit* button
8. The *Configure* dialog box will appear.



9. Edit the device properties
10. Click *OK* to complete the session or *Cancel* to leave the session without making any changes.

Editing an I/O Device

1 Using the mouse, select the slot that corresponds to the bus containing the device.
2 Display the bus properties using one of these methods:
- either double click on the slot, or
- right-click on the slot to display the popup menu, or
- use the menu item *Configure* then *Selected Modules* then *GBC Bus Properties*

3 Click on the row that contains the device.
4 Click on the *Edit* button.
5 The *Configure* dialog box will appear.
6 Edit the device properties
7 Click *OK* to complete session or *Cancel* to leave the session without making any changes.

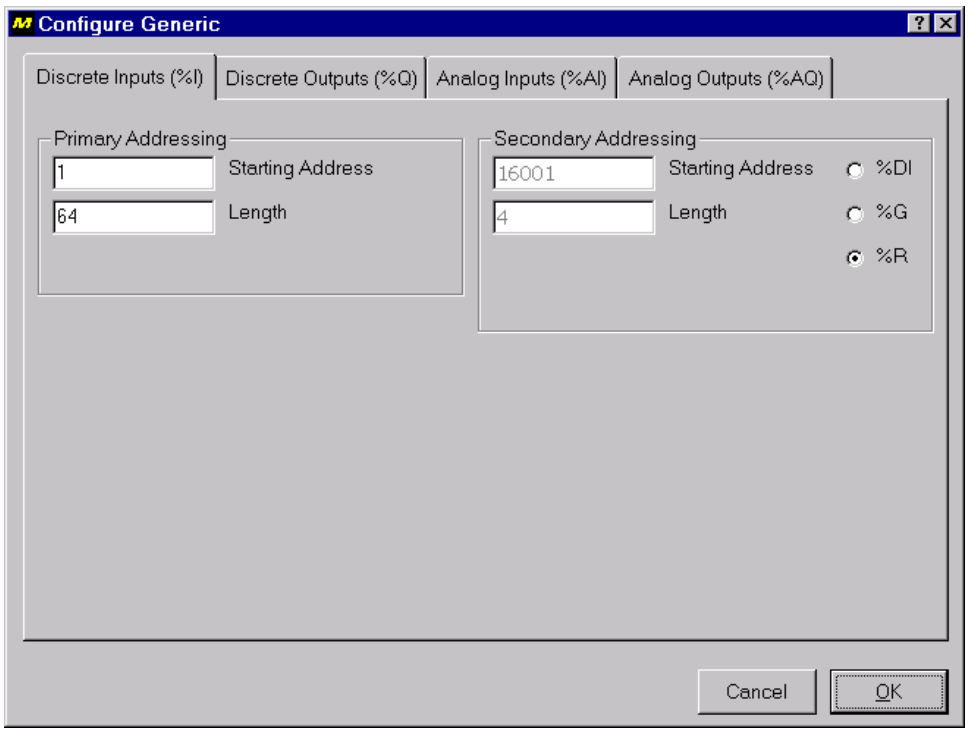
Deleting an I/O Device

1. Using the mouse, select the slot that corresponds to the bus containing the device.
2 Display the bus properties using one of these methods:
- either double click on the slot, or
- right-click on the slot to display the popup menu, or
- use the menu item *Configure* then *Selected Modules* then *GBC Bus Properties*

3 Click on the row that contains the device.
4 Click on the *Delete* button.
5 The device has been deleted.

Configuring Discrete Inputs

This form allows you to configure discrete inputs. If the bus to which this device is attached has been configured to have a secondary bus controller, then both the Primary Addressing and Secondary Addressing boxes will be displayed, If this is a single (non-redundant) bus, then only the Primary Addressing box will be displayed.



Primary Addressing Box –

As the name implies, Primary Addressing is the base address assigned to the discrete inputs. This address establishes the references that the input devices will use while they are connected to the primary bus. These are the same references that will be used throughout the user application logic.

Starting Address	The first reference address used within the discrete input group.
Length	The number of discrete references that are to be included on this device.

Secondary Addressing Box –

When a dual bus is employed, there must be an alternate location for the discrete inputs to report their status. The alternate location is the reference area in which the inputs will appear while they are connected to the secondary I/O bus.

Max-ON redundancy drivers detect when inputs are reporting into the secondary reference area and then map the inputs automatically from the secondary area into the primary address

locations. This permits the user-application to be written with references to the primary addresses only.

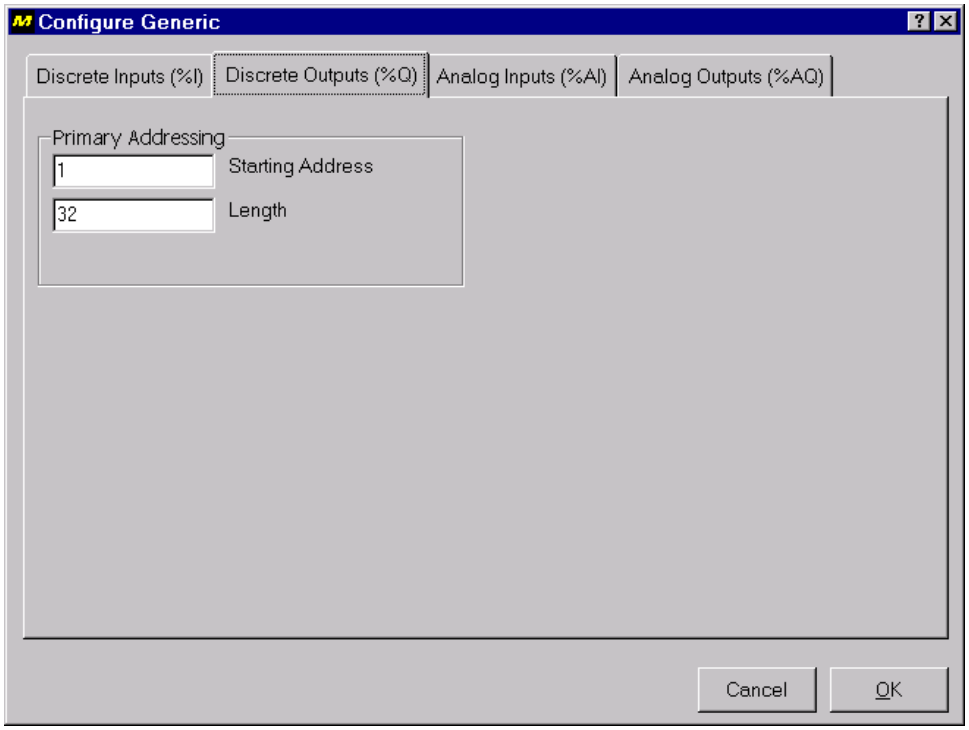
Starting Address — The first reference address used in the secondary (alternate) reference table. You cannot enter a value here. However, you may select the desired reference table for the alternate location.

- If the Primary Address Length is a multiple of 16, then the inputs will be mapped into the 90-30 register table.
- If the Length is an odd multiple of 8, then the inputs may be mapped into either %I or %G references.

Length — The number of discrete references that are to be included on this device. This is a read-only value that is generated from the number that was entered into the Primary Address box.

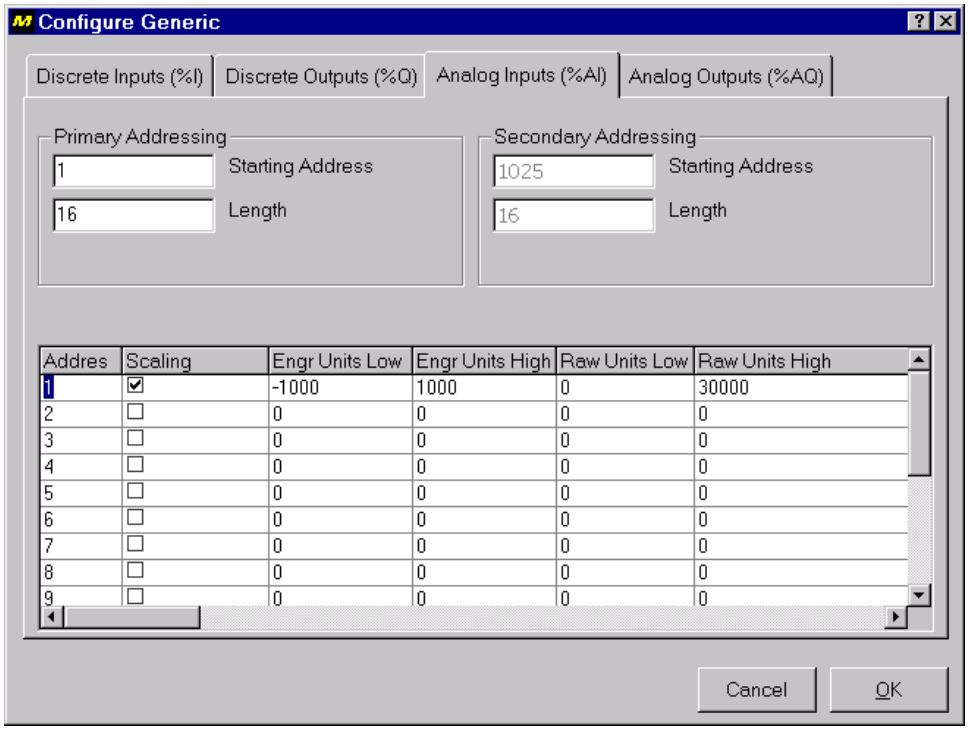
Configuring Discrete Outputs

This form allows you to configure discrete outputs. The main purpose of this form is to identify the device and the circuit reference so that its online status may be monitored. Any offline/online activity will be reported in the Max-ON Fault Table.



Configuring Analog Inputs

This form allows you to configure how the Max-ON driver will process analog inputs. The inputs may be configured on a per circuit basis.



Primary Addressing Box –

As the name implies, Primary Addressing is the base address assigned to the analog inputs. This address establishes the references that the analog input devices will use while they are connected to the primary bus. These are the same references that will be used throughout the user application logic.

Starting Address	The first reference address used within the discrete input group.
Length	The number of discrete references that are to be included on this device

Secondary Addressing Box –

When a dual bus is employed, there must be an alternate location for the analog inputs to report their values. The alternate location is the reference area in which the inputs will appear while they are connected to the secondary I/O bus.

Max-ON redundancy drivers detect when the inputs are reporting into the secondary reference area and then map the inputs automatically from the secondary area into the primary address locations. This permits the user-application to be written with references to the primary addresses only.

Starting Address	The first reference address used in the secondary (alternate) reference table. You cannot enter a value here. The reference will always be equal to the primary reference plus an offset of 1024.
Length	The number of discrete references that are to be included on this device. This is a read-only value that is generated from the number that was entered into the Primary Address box.

Circuit Configurations –

Analog input scaling is used to convert raw values received from the input device into scaled values. Because many bus devices are able to perform their own scaling. This option may be enabled for devices that do not provide scaling inherently. Please be aware that enabling this option adds to overall scan time and consumes additional configuration memory.

The entries are as follows:

Address	The analog circuit reference. This item is read-only.
Scaling	A check box that enables scaling from raw units to engineering units for the corresponding analog input circuit.
Raw Units Low	The lowest raw count value that the analog circuit will produce.
Raw Units High	The highest raw count value that the analog circuit will produce.
Engineering Units Low	The desired lowest value expressed in the sensor's measurement units.
Engineering Units High	The desired highest value expressed in the sensor's measurement units.

The acceptable range of values for any of the units is –32768 to +32767.

If the raw value produced by the analog circuit is less than the Raw Units Low value OR if the value is greater than the Raw Units High value, then an alarm will be generated for the analog circuit.

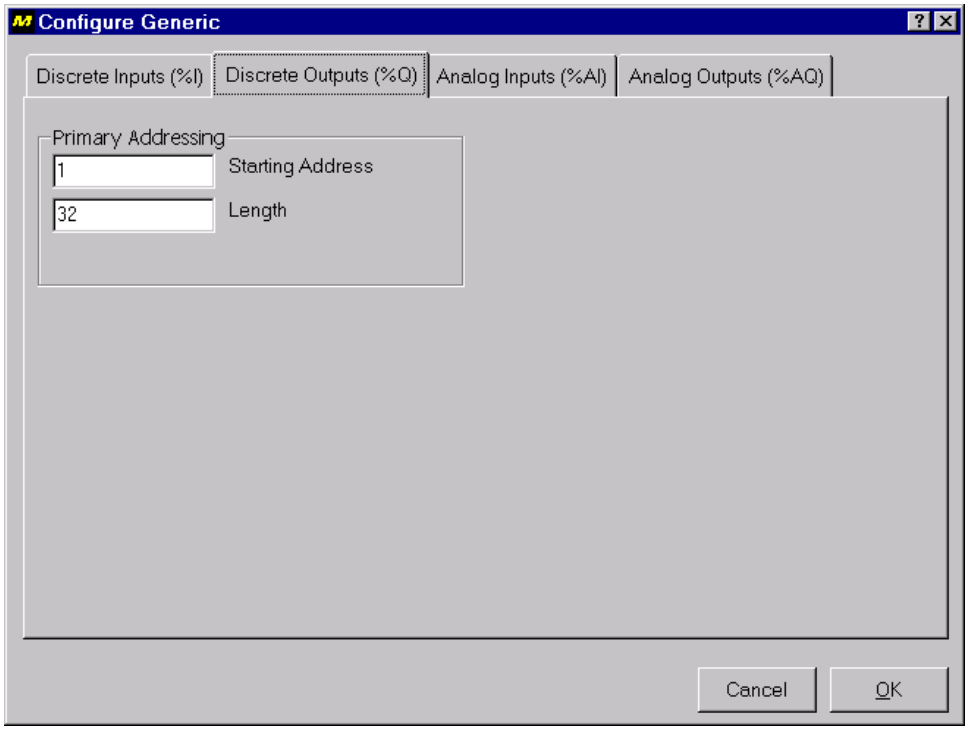
Notes:

- Many of the GE Fanuc analog input devices are capable of performing scaling independently. It is better to use the built-in capabilities of the devices. This will reduce the PLC scan time by eliminating the extra processing associated with the scaling function. Also, it reduces the amount of configuration memory consumed.

- If the device is configured to be on a dual bus, then the backup analog input addresses will be at the primary address plus an offset of 1024. For example, %AI00001 will have an associated backup address at %AI01025.

Configuring Analog Outputs

This form allows you to configure analog outputs. The main purpose of this form is to identify the device and the circuit reference so that its online status may be monitored. Any offline/online activity will be reported in the Max-ON Fault Table.



Configuring the Secondary Address

On dual bus systems, discrete and analog inputs are mapped from the primary bus controller's buffers into the normal input reference tables.

Inputs from the secondary bus controller are placed into an alternate area and then the Max-ON PLC driver remaps the alternate states into the table area used by the primary. Remapping occurs whenever the device is detected as being present on the secondary bus, but not present on the primary. (In most instances the data will be available on one of the busses, but not both. The exception is for Remote 90-30 drops, in which case, there are bus controllers on each bus.)

Analog Inputs –

For analog inputs, the alternate addressing is fixed at the primary's address reference plus 1024. Thus an analog input circuit addressed at %AI00001 will have an alternate, or secondary address, at %AI01025.

Discrete Inputs –

For discrete inputs, the addressing is more flexible.

- If the primary address is on a word multiple (i.e, 1, 17, 33, etc.) AND the length is a word multiple (i.e., 16, 32, 48, etc.), then the secondary addresss will be mapped into %R space.
- If the primary address does not meet the criteria above, then the user may select an alternate address at either a %G reference or a %I reference.

Project Configuration Report –

The configuration utility will calculate secondary bus references automatically. Please use the configuration report to obtain the information that is needed to configure the secondary bus controllers for discrete and analog inputs.

Defining Ethernet LANs

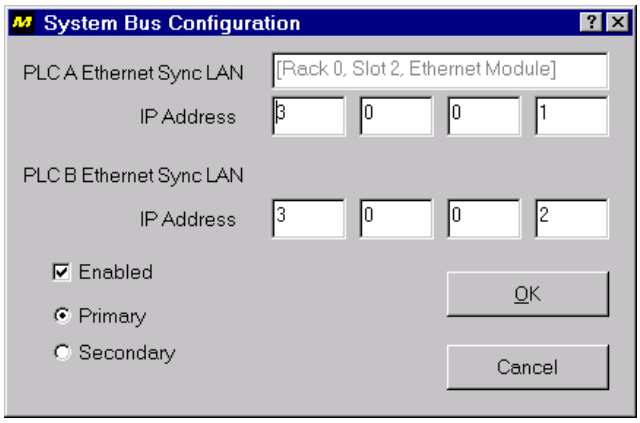
Configuring the Ethernet Interface

If you are using Max-ON Extended, and you wish to employ Ethernet to transfer the Synchronized Data, then you will need to configure the Ethernet Interface devices in Max-ON Tools. (Note: You will need to configure the hardware separately in VersaPro.)

The network interface may be implemented using the built-in port on a CPU364 or CPU374. Or the interface may be implemented using a CMM321. If you are using a dual LAN topology, then you may use two CMM321 modules in each PLC for the Sync LANs. Or, you may use one CMM321 and a built-in CPU port.

When the Ethernet module (or CPU) has been entered, you must enter the corresponding device status address. Generally, it is a good practice to place these bits in the upper area of the %I references (configurable range 1..2048).

When dual Ethernet LANs are employed, you must specify which device is to be the primary device and which is to be the secondary device. Each module must be configured separately.



If no Ethernet LAN is enabled, then all Sync Data transfers will occur by way of the Genius Bus (Busses) that have been configured to act as the System Bus (Busses.)

Synchronized Data

Configuring Data Transfers

Reference Types

Data from within the following reference ranges may be transferred from the Master to the Backup PLC.

%M00001....%M02048

%Q00001....%Q02048

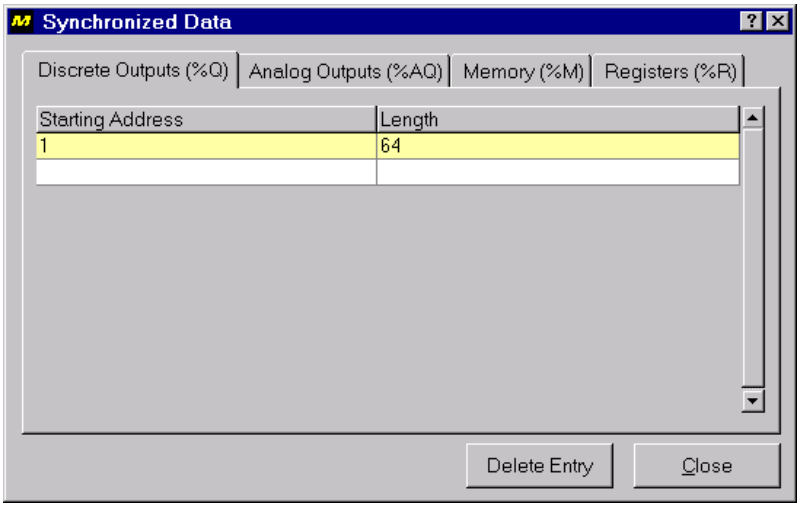
%AQ0001....%AQ0256

%R00001 ....%R08000

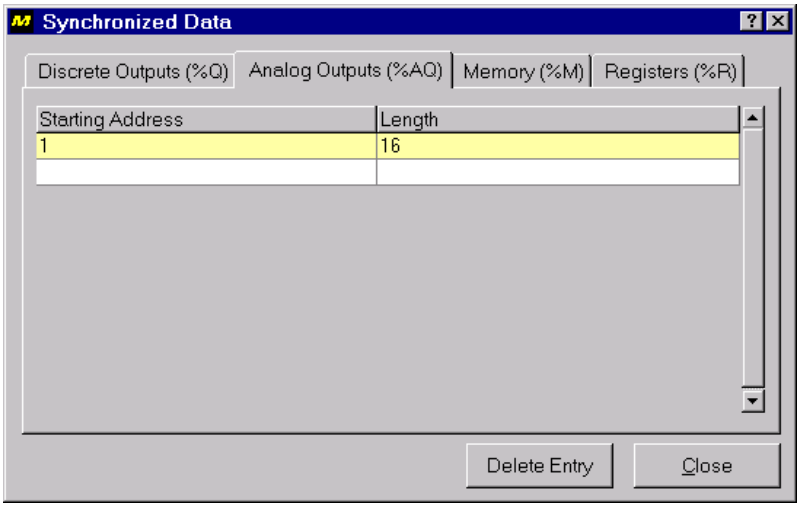
Groups

Synchronized data may be transferred in up to 6 groups for each of the data types listed above. This allows transfer of non-contiguous data areas. The general format uses a Starting Reference, paired with a Length.

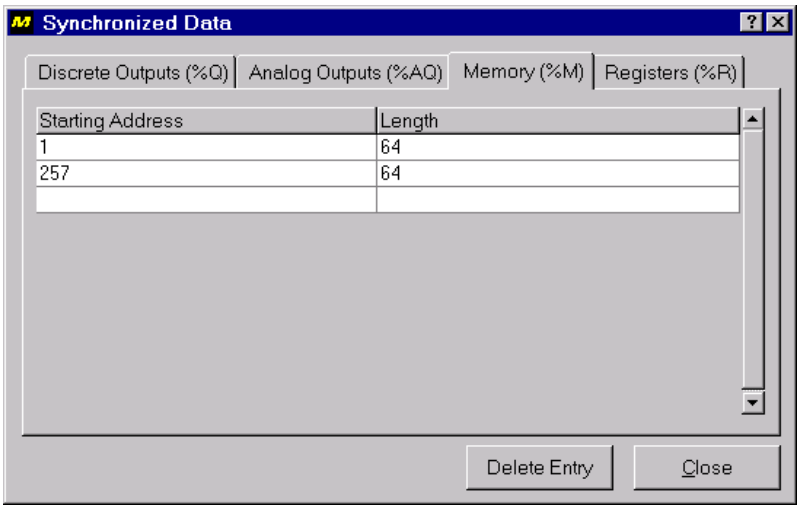
Discrete Outputs



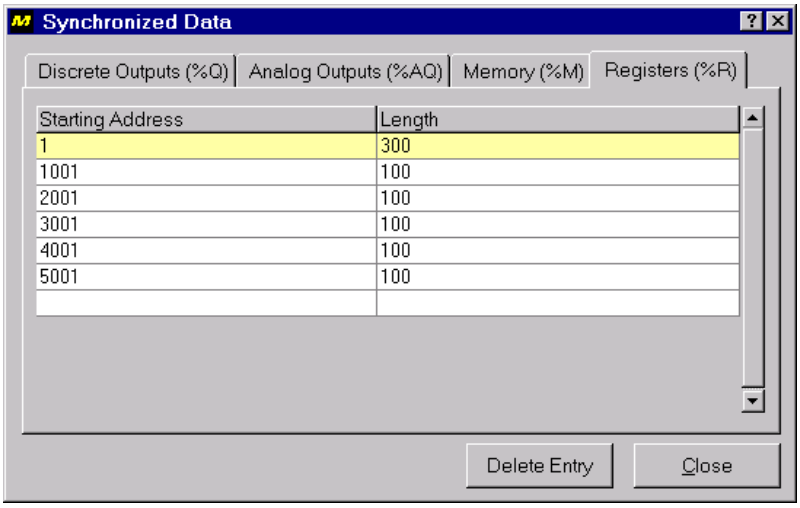
Analog Outputs



Internal Coils



Registers



Maximum Quantities

For each Synchronized Data type, the system will sum the lengths in each configured group to arrive at a total amount for that data type. The total must not exceed the size listed in the table below:

Product	Registers	Discrete Outputs	Internal Coils	Analog Outputs
Lite	300	64	128	12
Standard	8000	512	*2048	64
Extended	8000	2048	*4096	256

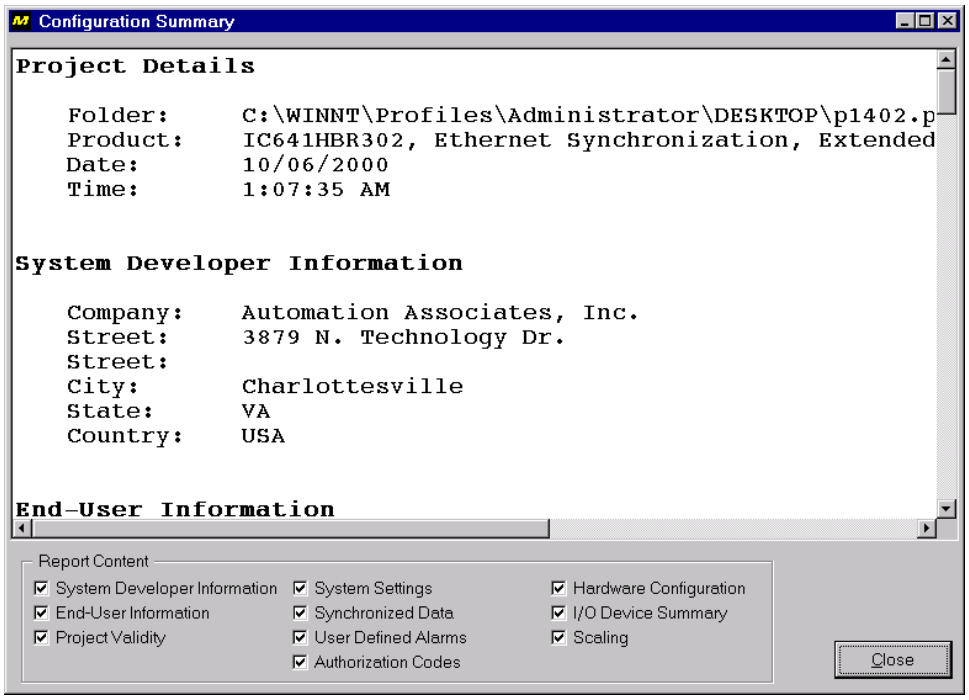
*The system flags, although included in this number, are not transferred.

Note: If one attempts to configure a transfer having a larger value than is allowed, then the CPU with the invalid configuration will post a fault message and then shutdown immediately. It will not restart until a valid configuration has been stored.

Project Information

Configuration Report

The configuration summary provides information about your project. You determine the content of the report by the options which are checked. Each time an option box is changed, the report will update automatically.



Here are the options and their descriptions.

System Developer Info	The information that was entered onto the workstation. This is stored in the System Registry, but not in the project database.
End User Info	The information that was entered in the End User dialog. It is stored in the project database. The information includes company name, contact name, address, etc.
Project Validity	This is a list of any errors that have been detected during a *Project-Save*.
System Settings	These settings relate to the parameter that were entered in the System Options.
Synch. Data	This is a listing of all of the Synchronized Variables and all groups in each type.
User Defined Alarms	This is a listing of any User-Defined Alarms that have been entered.
Authorization Codes	This is a listing of the current value for the PLC Key Code along with the current entries for the Authorization codes.
Hardware Config.	This lists configuration parameters associated with the CPU and all Genius bus controllers, Ethernet modules, and rack-based I/O modules.
I/O Device Summary	This lists the configuration parameters for all Genius bus I/O devices.
Scaling	This lists the scaling parameters for any analog input groups that have been Enabled.

Sample Configuration Report

Project Details

```
    Folder:           C:\WINNT\Profiles\Administrator\DESKTOP\P1402.prj
    Product:          IC641HBR302, Ethernet Synchronization, Extended Version
    Date:             09/16/2000
    Time:             7:07:34 PM
```

System Developer Information

```
    Company:          Automation Associates, Inc.
    Street:           3879 N. Technology Park Dr.
    Street:
    City:             Charlottesville
    State:            VA
    Country:          USA
```

End-User Information

```
    First Name:*                John
    Last Name:*                 Smith
    Title:                      Project Manager
    Company:*                   Acme Manufacturing
    Address:*                   1122 Oak Blvd.
    City:*                      Charlottesville
    State/Province:*            VA
    Country:*                   USA
    Zip/Postal Code:*           22901
    Phone Number:*              804-555-1234
    Fax Number:*                804-555-4321
    E-mail Address:             john@acme-mfr.com
    Product Serial Number:*     1234-555-6789
    Site Contact:               John Smith
    CPU-A Key Code:             4299
```

Miscellaneous System Settings

```
    Dual Synchronizing LAN:     enabled
    Program Change Audit Trail: enabled
    Fast Offline Detection:     enabled
    Default Multiplexer Period: 100 msec.
```

Hardware Configuration

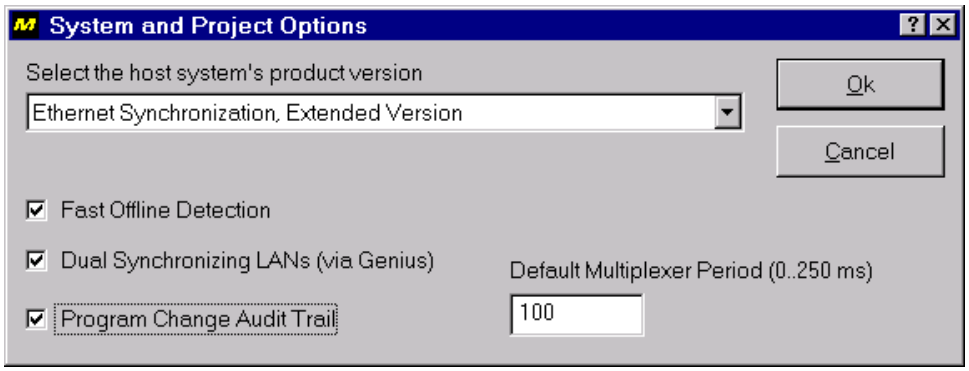
```
    [Rack 0, Main]
         [Slot 1]  Catalog:             IC693CPU364
                   Description:         CPU; 240Kb; 1-RS485; 1-ENET
                   Status Reference:    %I01825
                   PLC A IP Address:    0.0.0.0
                   PLC B IP Address:    0.0.0.0
         [Slot 2]  Catalog:             IC693CMM321
                   Description:         Ethernet Module
                   Status Reference:    %I01905
                   PLC A IP Address:    0.0.0.0
                   PLC B IP Address:    0.0.0.0
         [Slot 3]  Catalog:             IC693BEM331
                   Description:         90-30 Genius® Bus Controller
                   Status Reference:    %I02017
         [Slot 4]  Catalog:             IC693BEM331
                   Description:         90-30 Genius® Bus Controller
                   Status Reference:    %I01985
```

Device Summary (I/O LAN Devices Only)

```
    %I References Used:      64 out of 2048
    Groups Used:             1
    %Q References Used:      32 out of 2048
    Groups Used:             1
    %AI References Used:     16 out of 1024
    Groups Used:             1
    %AQ References Used:     16 out of 256
    Groups Used:             1
    Number of IO Groups:     4
```

```
    Group Registers:         964 registers available out of 994 total

    Bus Name:  Main
         Input Default:      off
         Output at Start:    disabled
         Redundant LAN:      yes

         Primary Controller
              Status Reference:         %I02017
              Model:                    IC693BEM331, 90-30 Genius® Bus Controller
              Series Six Reference:     0
              Rack:                     0
              Slot:                     3

              SBA  Input1  Length  Input2  Length  Output1 Length  Output2 Length
              1    %I0001  64      %AI0001 16      %Q0001  32      %AQ0001 16

         Secondary Controller
              Status Reference:         %I01985
              Model:                    IC693BEM331, 90-30 Genius® Bus Controller
              Series Six Reference:     0
              Rack:                     0
              Slot:                     4
              SBA  Input1  Length  Input2  Length  Output1 Length  Output2 Length
              1    %R16001 4       %AI1025 16      %Q0001  32      %AQ0001 16

Analog Input Scaling
    SBA                  RawLow      RawHigh     EngrLow     EngrHigh

Synchronized Data
    Discrete Outputs
         %Q00001, length 64
    Analog Outputs
         %AQ00001, length 16
    Memory
         %M00001, length 64
         %M00257, length 64
    Registers
         %R00001, length 300
         %R01001, length 100
         %R02001, length 100
         %R03001, length 100
         %R04001, length 100
         %R05001, length 100

User Defined Alarms
    3840      P1402: Startup Sequence Failure
    3841      P1402: Discharge High Pressure Alarm
    3842      P1402: Discharge High-High Pressure Shutdown

Project Validity
    The authorization codes are not valid for the current project type (IC641HBR302)

Authorization Codes
    %R9011    4299    (CPU-A Key from most recent connection)
    %R9012    0000
    %R9013    0000
    %R9014    0000
    %R9015    0000
    %R9016    0000
    %R9017    0000
    %R9018    0000
    %R9019    0000
    %R9020    0000
    %R9021    0000
```

System Options



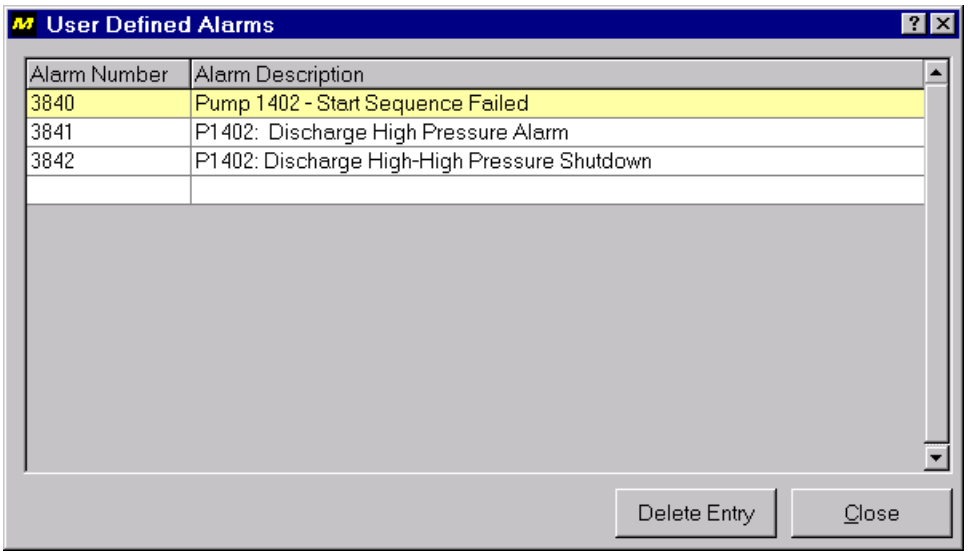
Product Version	A dropdown list provides a selection of Max-ON products that may be used as the base for this project. **Once the project has been selected, it may not be changed.**
Fast Offline Detection	Enabling this option directs the PLCs to detect an offline condition within one PLC scan. If the option is not enabled, then it will require two consecutive scans to produce an offline condition.
Dual Sync LANs	Enabling this option instructs the system to expect two channels for Synchronized Variable and System data exchange. The channels are always implemented via Genius LANs.
Program Change Audit Trail	Checking this box instructs the system to monitor the program for changes to logic. If there is a change, the value in the change counter (%R9003/9004; type double) will be incremented by one, and a date/time (%R9005.9007, packed BCD) will be posted for the moment at which the change occurred.
Default Multiplexer Period	This value is the default time period used to advance the Synchronized Data multiplexer. It is useful when there are Remote 90-30 Drops present in the system.

User Defined Alarms

The user may post self-defined faults from within the application. However, before Max-ON Tools Diagnostics can display the user alarms, they must be configured.

Adding an alarm -

1. Make certain that your current project file has been opened.
2. From the main menu, select *Configuration*, then *User-Defined Alarms*.
3. The User-Defined Alarms dialog box will be displayed.



4. Place the cursor in the first available alarm field. Enter the Alarm Number. (The valid alarm numbers must be within the range 3840 to 4095, decimal.) If you attempt to enter a number outside this range you will receive an error message.
5. Move the cursor to the descriptor area and enter an alarm legend.
6. Repeat steps 3 and 4 for any additional user-defined alarms
7. Close the Alarm Configuration Window.
8. Save your project.

Deleting an alarm -

1. Make certain that your current project file has been opened.
2. From the main menu, select *Configuration*, then *User-Defined Alarms*.
3. Place the cursor in the row that is to be deleted.
4. Click on the *Delete* pushbutton.
5. Repeat steps 3 and 4 for any additional user-defined alarms
6. Close the Alarm Configuration Window.
7. Save your project.

Note: In order for User-Defined Alarms to be active, ladder logic must be added to the application. The logic passes the user specified alarm number to the Alarm handler. (See Max-ON Advanced Programming topic: User-Defined Alarms.)

Chapter 5 Programming Considerations

This chapter provides additional information on programming considerations and system resources for the Max-ON product. In many cases, Max-ON System Variables have been predefined to use in application logic in order to interact with the Max-ON redundancy driver.

Reserved References

Max-ON redundancy drivers make use of a small number of variable references. Some of these references are used for the internal operation of the drivers to hold system state information. Many are available to your application logic to provide both information on the system and to control the operation of the redundancy drivers.

I/O References	
%I00001 to 2048	Available to all applications
%Q00001 to 2048	Available to all applications
%AI00001 to configured limit	Available to all applications
%AQ00001 to configured limit	Available to all applications
Boolean References	
%G00001 to 1024	Available to all applications
%G01025 to 1280	Reserved by Max-ON
%M00001 to 0928	Available to all applications
%M00929 to 1024	Reserved by Max-ON
%M01025 to 4096	Available to all applications
%S (all)	Available to all applications
%T00001 to 256	Available to all applications
Word References	
%R00001 to 8000	Available to all applications
%R08001 to 16384	Reserved by Max-ON
%R16385 to configured limit	Available to all applications

System Status Flags

The System Status Flags indicate key operating characteristics of a Max-ON system. These flags may be monitored by an HMI to display such things as current Master. Optionally, the system designer may use the status flags to control the operation of the application.

Variable Name	*Reference*	*Description*
ID_A	%M01017	ID Flag for CPU A
ID_B	%M01018	ID Flag for CPU B
CPU_RUN	%M01019	CPU is in RUN Mode
MASTER	%M01020	Master Flag
SYNC_OK	%M01021	All Data has been Synchronized
	%M01022 – %M01024	Reserved

%M01017 ***ID Flag for CPU A*** (ID_A) – This flag is ON in the CPU identified as PLC A. (Setting the CPU Identity)

%M01018 ***ID Flag for CPU B*** (ID_ B) – This flag is ON in the CPU identified as PLC B. (Setting the CPU Identity)

%M01019 ***CPU is in RUN Mode*** (CPU_RUN) – This flag is ON if the CPU is in RUN Mode. It is OFF if the CPU is in STOP/Disabled or STOP/Enabled.

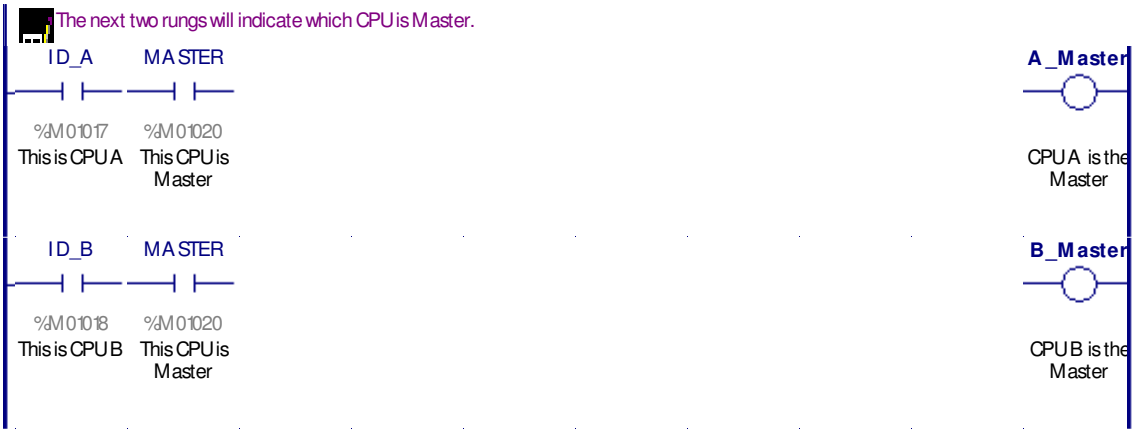
%M01020 ***Master Flag*** (MASTER) – This flag is ON in whichever CPU is the current Master.

%M01021 ***All Data has been Synchronized*** (SYNC_OK) – This flag is always ON in the CPU identified as the current Master. It is ON in the Backup CPU at the moment when all Synchronized Data items have been updated.

Indicating Mastership

Using the System Status Flag %M01020 (Master) and the System Status Flags %M01017 and %M01018 (the CPU Identity flags), you may determine which PLC is the current Master. By combining these flags it is possible to link discrete outputs to indicator lamps, link to internal coils to provide status points to an HMI, or even link discrete outputs to data switches to route communications lines from a peripheral to the CPU serial ports.

In the example below, the Flags are used to control discrete outputs that are attached to indicator lamps.



Local Status Flags – Instantaneous

The following status flags represent the instantaneous (not latched) state corresponding to the associated descriptors.

Variable Name	*Reference*	*Description*
AUTH_ALM	%M00961	Authorization Alarm
REM_OFF	%M00962	Remote CPU Offline
PROG_CHG	%M00963	Program Changed
HWC_CHG	%M00964	HW Configuration Changed
	%M00965 - %M00968	Reserved

%M00961 ***Authorization Alarm*** (AUTH_ALM) – This alarm bit indicates that the corresponding PLC is operating in DEMO mode. In a system that has been properly authorized, this flag will be OFF.

%M00962 ***Remote CPU Offline*** (REM_OFF)– The companion PLC is offline. This may be due to the CPU being in STOP, Fault, or Power-OFF. Also, it may be due to a cable problem or Ethernet Interface failure.

%M00963 ***Program Changed*** (PROG_CHG) – The program in the Local CPU has changed.

%M00964 ***HW Configuration Changed*** (HWC_CHG) – The hardware configuration in the Local CPU has changed.

Local Status Flags – Instantaneous (cont.)

Variable Name	*Reference*	*Description*
PWR_UP	%M00969	Power Up
PRG_RST	%M00970	Program Restart
E1_OFFL	%M00971	System Ethernet Bus Primary Offline
E2_OFFL	%M00972	System Ethernet Bus Secondary Offline
	%M00973 - %M00992	Reserved

%M00969 ***Power Up*** (PWR_UP) – The Local CPU has undergone a power-up event.

%M00970 ***Program Restart*** (PRG_RST) – The Local CPU has been switched from STOP mode to RUN mode.

%M00971 ***System Ethernet Bus Primary Offline*** (E1_OFFL) – The primary Ethernet LAN is offline. This may be due to a cable problem, a transceiver problem, a hub/switch problem, an ETM001 module failure or a LAN configuration error.

%M00972 ***System Ethernet Bus Secondary Offline*** (E2_OFFL) – The secondary Ethernet LAN is offline. This may be due to a cable problem, a transceiver problem, a hub/switch problem, an ETM001 module failure or a LAN configuration error.

%M00973 - %M00992 Reserved

Local Status Flags – Latched

The following status flags represent the latched state corresponding to the associated descriptors. The states are set by the first instance of the associated event. The flags are reset by either a Local Alarm Clear (RST_LOC or %M01015) or a Master Alarm Clear (RST_ALL or %M01016). If the underlying alarm condition is persistent, then the flag will be set again.

Reference	*Description*
%M00993	Authorization Alarm (A-Only)
%M00994	Authorization Fault (A-Only)
%M00995	Remote CPU Offline
%M00996	Program Changed
%M00997	HW Config Changed
%M00998	Programs Miscompare
%M00999	Reserved
%M01000	Reserved

%M00993 ***Authorization Alarm*** – This alarm bit indicates that the corresponding PLC is operating in DEMO mode.

%M00994 ***Authorization Fault*** – This fault bit indicates that the system was operating in DEMO mode for over 22 days and has subsequently shutdown. The PLC Fault Table will indicate shutdown due a Service Request.

%M00995 ***Remote CPU Offline*** – The companion CPU is offline. This may be due to the CPU being in STOP, Fault, or Power-OFF. Also, it may be due to a cable problem or Ethernet Interface failure.

%M00996 ***Program Changed*** – The program in the Local CPU has changed.

%M00997 ***HW Config Changed*** – The hardware configuration in the Local CPU has changed.

%M00998 ***Programs Miscompare*** – The program in CPU A is not the same as the program in CPU B.

Local Status Flags – Latched (cont.)

Reference	*Description*
%M01001	Power Up
%M01002	Program Restart
%M01003	Max-ON Alarm (Fault) Present
%M01004	Max-ON Alarm (Fault) Table Full
%M01005	Config Fault
%M01006 – %M01008	Reserved

%M01001 ***Power Up*** – The Local CPU has undergone a power-up event.

%M01002 ***Program Restart*** – The Local CPU has been switched from STOP mode to RUN mode.

%M01003 ***Max-ON Fault Present*** – There is at least one fault entry in the Local CPU's Max-ON Alarm Table.

%M01004 ***Max-ON Fault Table Full*** – The Local CPU's Max-ON Alarm Table is full.

%M01005 ***Config Fault*** – The Max-ON configuration has exceeded one or more limits for the allowable size of Synchronized Data transfers.

%M01006 - %M01008 Reserved

Remote Status Flags - Latched

The following flags indicate the status as received from the companion (remote) CPU. For instance, if you are attached to CPU A in Logic Developer PLC, then these bits in CPU A will depict system status received from CPU B.

The flags below are latched. They may be cleared by resetting the alarms (see Command Flags). If the alarm condition persists, then the flag(s) will be set again.

Reference	*Description*
%M00929	Remote is Offline
%M00930	Remote Forces (Overrides) Present
%M00931	Remote PLC Low Battery
%M00932	Remote Config Mismatch
%M00933	Remote Loss of I/O Module
%M00934	Remote Loss of Option Module
%M00935	Remote Option Module Hard Fault
%M00936	Remote Option Module Soft Fault

%M00929 ***Remote is Offline*** – CPU is offline, or there has been a bus failure on a system that uses a single Ethernet Sync bus, or on a system using dual Sync busses, both have failed.

%M00930 ***Remote Forces (Overrides) Present*** – There is at least one force (override) present in the remote, same as #OVR_PRE (%S0011) in the remote.

%M00931 ***Remote PLC Low Battery*** – Same as #PLC_BAT (%S0014) in the remote.

%M00932 ***Remote Config Mismatch*** – Same as #CFG_MM (%SA0009) in the remote.

%M00933 ***Remote Loss of I/O Module*** – Same as #LOS_IOM (%SA0014) in the remote.

%M00934 ***Remote Loss of Option Module*** – Same as #LOS_SIO (%SA0015) in the remote.

%M00935 ***Remote Option Module Hard Fault*** – Same as #HRD_SIO (%SA0027) in the remote.

%M00936 ***Remote Option Module Soft Fault*** – Same as #SFT_SIO (%SA0031) in the remote.

Remote Status Flags – Latched (cont.)

Reference	*Description*
%M00937	Remote System Fault Present
%M00938	Remote I/O Fault Present
%M00939	Remote Max-ON Fault Present
%M00940	Remote Max-ON Fault Table Full
%M00941	Remote Program Changed
%M00942	Remote HW Config Changed
%M00943	Remote Power Up
%M00944	Remote Program Restart
%M00945	Remote Authorization Alarm
%M00946 – %M00960	Reserved

%M00937 ***Remote System Fault Present*** – Same as #SY_PRES (%SC0012) in the remote.

%M00938 ***Remote I/O Fault Present*** – Same as #IO_PRES (%S0013) in the remote.

%M00939 ***Remote HBR Fault Present*** – there is at least one fault in the Max-ON fault table.

%M00940 ***Remote HBR Fault Table Full*** – The Max-ON fault table is full.

%M00941 ***Remote Program Changed*** – The user application in the remote has changed.

%M00942 ***Remote HW Config Changed*** – The hardware configuration in the remote has changed.

%M00943 ***Remote Power Up*** – The remote has undergone a power-up event.

%M00944 ***Remote Program Restart*** – The remote has undergone a Program Stop-to-Run event.

%M00945 ***Remote Authorization Alarm*** –The Remote CPU is operating in DEMO mode.

%M00946 - %M00960 Reserved

System Command Flags

Operation of the system may be influenced by interfacing to the Max-ON command flags. They may be accessed within application logic, and in some instances by an HMI.

Variable Name	*Reference*	*Description*
SEL_A	%M01009	Select A as Preferred
SEL_B	%M01010	Select B as Preferred
SW_MSTR	%M01011	Switch Master (self-resetting)
AUT_SWP	%M01012	Auto Sweep Mode
	%M01013	Not used
	%M01014	Clear Remote Alarms (self-resetting)
RST_LOC	%M01015	Clear Local Alarms (self-resetting)
RST_ALL	%M01016	Clear All Alarms (self-resetting)

The definitions of the flags are as follows:

%M01009 ***Select A as Preferred*** (SEL_A) - Used in conjunction with SEL_B (%M01010) to determine the manner in which Mastership operates. (See *Selecting the Master*)

%M01010 ***Select B as Preferred*** (SEL_B) - Used in conjunction with SEL_A (%M01009) to determine the manner in which Mastership operates. (See *Selecting the Master*)

%M01011 ***Switch Master (self-resetting)*** (SW_MSTR) - Used to exchange Mastership (See *Selecting the Master*). If it is set ON, the Max-ON driver will reset it to OFF automatically. (See *Switching the Master*)

%M01012 ***Auto Sweep Mode*** –When this is set to ON, the Backup CPU will be set to Constant Sweep mode automatically, and the Master will be set to Normal Sweep mode automatically. (See *PLC Sweep Mode*.)

%M01013 Not used.

%M01014 ***Clear Remote Alarms (self-resetting)*** - When issued to the Master, CLEARS the alarms in the Backup CPU only. If it is set ON, the Max-ON driver will reset it to OFF automatically.

%M01015 ***Clear Local Alarms (self-resetting)*** - Clears the alarms in the CPU to which it is directed. Is reset automatically.

%M01016 ***Clear All Alarms (self-resetting)*** - When issued to the Master, CLEARS the alarms in the Master and Backup CPUs. Is reset automatically.

Mastership Modes

You may specify the Mastership mode of operation for the Hot Standby CPUs. This may be accomplished by setting the states of the System Command Flags, SEL_A (%M01009) and SEL_B (%M01010). Both CPUs must have the states set identically in order to function properly. The truth table shown below illustrates the operation of the Mastership Command Flags.

SEL_A %M01009	*SEL_B %M01010*	*Description*
0	0	Float
1	0	A Preferred
0	1	B Preferred
1	1	Float

- **A Preferred** - In this mode, SEL_A (%M01009) is ON and SEL_B (%M01010) is OFF. Assume that CPU A is currently the Master. If CPU A fails or is placed in STOP, then CPU B will become the new Master. CPU B will remain the Master until CPU A is repaired or is restored to RUN mode. As soon as the all of the Synchronized Data has been updated in CPU A, the Mastership will return to CPU A.

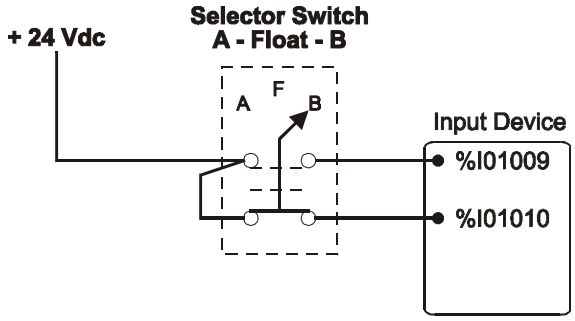
- **B Preferred** - In this mode, SEL_A (%M01009) is OFF and SEL_B (%M01010) is ON. The description is similar to A Preferred, except that the roles are transposed.

- **Float** - Either CPU may be the Master. Mastership will not change unless the current Master fails or is placed into STOP or RUN-Outputs Disabled mode. When the failed/stopped CPU is restored to service, the current Mastership does not change. While the system is in Float Mode, Mastership may be changed by setting the System Command Flag, SW_MSTR (%M01011). Float Mode is required if you intend to switch Mastership using an HMI.

Setting the Master Using a Selector Switch

A three position, center-OFF, selector switch may be connected to a pair of discrete inputs shared by the two CPUs. This allows a system operator to chose either of the CPUs to be the Preferred Master, or the Mastership may float between the two controllers.

In the example that follows, the switch contacts are wired to discrete inputs SEL_A (%I01009) and SEL_B (%I01010). When the switch is in the ***A*** position, only SEL_A (%I01009) is ON. When the switch is in the ***B*** position, only SEL_B (%I01010) is ON. When the switch is in the center (***Float)*** position, SEL_A (%I01009) and SEL_B (%I01010) are both OFF.



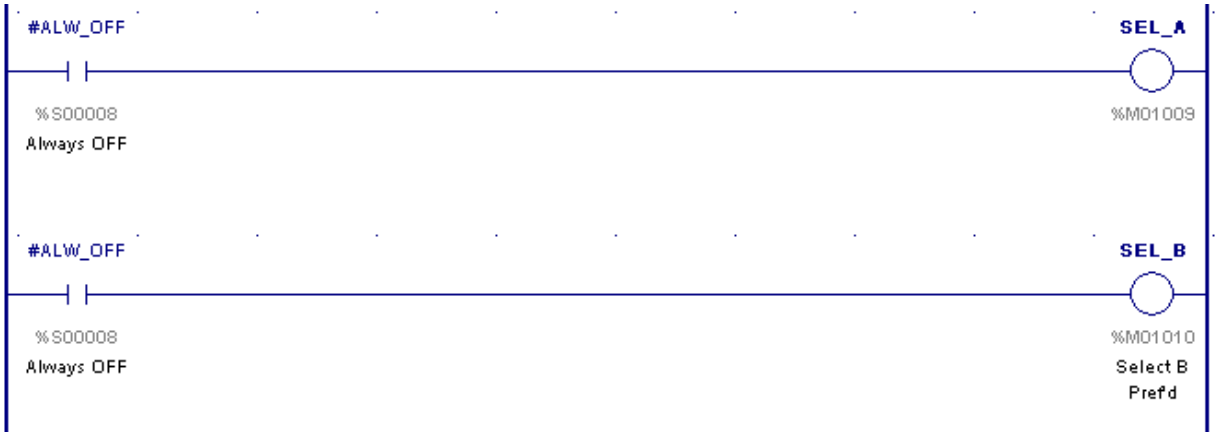
Setting a Preferred Master

You may set a permanent, Preferred Master. In this mode, if the corresponding CPU fails (or is placed in STOP), then the companion CPU will assume Mastership. As soon as the Preferred Master resumes operating normally, and its Synchronized Data has been updated, then the Mastership will transfer.

The example shown below sets PLC A as the preferred master.

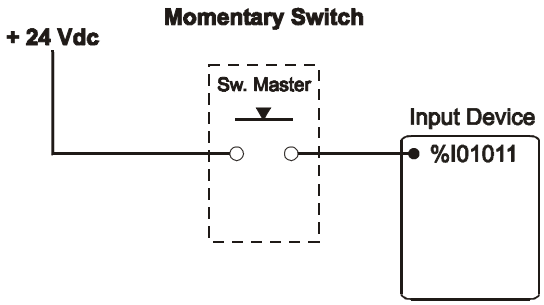
Setting the System for Floating Master

Set the system to Floating Master by including the logic shown below in your application. Include this logic in any system that must change mastership based upon a command initiated by either momentary pushbutton or HMI.



Switching Mastership Using a Momentary Pushbutton

You may switch Mastership using a momentary pushbutton switch that is wired to a discrete input shared by the Hot Standby CPUs. In the example that follows, the switch is wired to discrete input Sw_Mstr_Pb (%I01011). When this input transitions from Off to On, the System Command Flag SW_MSTR (%M01011) will be set. The system will reset SW_MSTR (%M01011) after it has completed processing the switchover.



First, you must set the system for Floating Mastership. (Refer to *Setting the System for Floating Master*.)

Then include the following logic to implement the Toggle Master function.

If a command to set SW_MSTR (%M01011) has been issued, then the system will operate in the following manner.

- If both CPUs receive the command, and there is no Preferred Master, then the Mastership will change as soon as data synchronization is complete.
- If only the Master receives the command, and the Backup is available, and there is no Preferred Master, and data synchronization is complete, then the transfer will occur.
- If one or both of the CPUs receive the command, and the Master is the Preferred Master, then the request is discarded.
- If only the backup receives the command, then no transfer will occur.
- After the relevant conditions above have been evaluated, SW_MSTR (%M01011) will be reset automatically.

Switching Mastership Using an HMI

In your HMI application, configure an operation that sets the command flag SW_MSTR (%M01011) in the current Master CPU. The HMI should set SW_MSTR (%M01011) in each PLC. This command will be executed in the current Master CPU, but will be ignored in the current Backup CPU. Each CPU will reset the command automatically.

Assuming that there is no preferred Master set in either CPU, then the transfer will occur as soon as data synchronization is complete. In most cases, this will happen immediately.

You must set the system for Floating Mastership. (Refer to *Setting the System for Floating Master*.) No other logic is required.

System Data Registers

Variable Name	Reference	Function	Description
CAT_NUM	%R9001	Catalog Number	300 = IC641HBR300 (Max-ON Lite) 301 = IC641HBR301 (Max-ON Standard) 302 = IC641HBR302 (Max-ON Extended)
REV_NUM	%R9002	Current Release Number	integer with implied decimal point (e.g., +00101 = v1.01)
USR_N1	%R9003 %R9004	User Version Number	(double precision) If audit trail has been enabled, Max-ON will increment this register pair each time a program change is stored or updated. If audit trail is not enabled, then the user may enter any value here.
PDAT_01	%R9005 - mm:ss %R9006 - dd:hh %R9007 - yy:mm	User Version Date	Related to above...this is a packed BCD date. yy/mm/dd | hh:mm:ss
	%R9008 %R9009	Program Size	(double precision) An approximate program size. Some users include this value with the checksum value for additional security in revision control.
	%R9010	Program Additive Checksum	
	%R9011	PLC Keycode	Automatically generated by the system. Range is 1..9999.
	%R9011	Auth. Code 01	Authorization codes used by PLC A.
	%R9012	Auth. Code 02	
	%R9013	Auth. Code 03	
	%R9014	Auth. Code 04	
	%R9015	Auth. Code 05	
	%R9016	Auth. Code 06	
	%R9017	Auth. Code 07	
	%R9018	Auth. Code 08	
	%R9019	Auth. Code 09	
	%R9020	Auth. Code 10	
	%R9021 thru %R9024	Not used	
REM_SCN	%R9025	Remote CPU's Current Scan time	Instantaneous PLC Scan time in msec.
LOC_SCN	%R9026	Local CPU's Current Scan time	Instantaneous PLC Scan time in msec.
LOC_MUX	%R9027	Average Mux. Packet Interval	Average time interval for advancing to the next multiplexer packet. (msec.)
IOM_UPD	%R9028	%S, %M, %Q, %AQ Update Interval	Time to update all %S, %M, %Q, %AQ and time of day in the backup PLC (sec. X 0.01)
REG_UPD	%R9029	%R Update Interval	Time to update registers in the backup PLC (sec. X 0.01)
NUM_FLT	%R9030	Number of Faults in Fault Table	0 = empty; 33 = full
NUM_FLT[001]	%R9031.. %R9036	Fault Record #01	Max-ON generated fault table.
NUM_FLT[007]	%R9037.. %R9041	Fault Record #02	
	…	…	
	…	…	
NUM_FLT[156]	%R9186.. %R9190	Fault Record #32	

Advanced Topics

PID Function Blocks

The PID function block uses a data structure consisting of 40 registers. These registers contain not only configuration parameters, but also intermediate and final terms used in the internal calculations. Some of the internal calculations are based upon values from the PLC's system clock. Because the internal clocks in the two CPUs are not synchronized precisely to each other, it is necessary to include a small amount of logic to compensate for the difference.

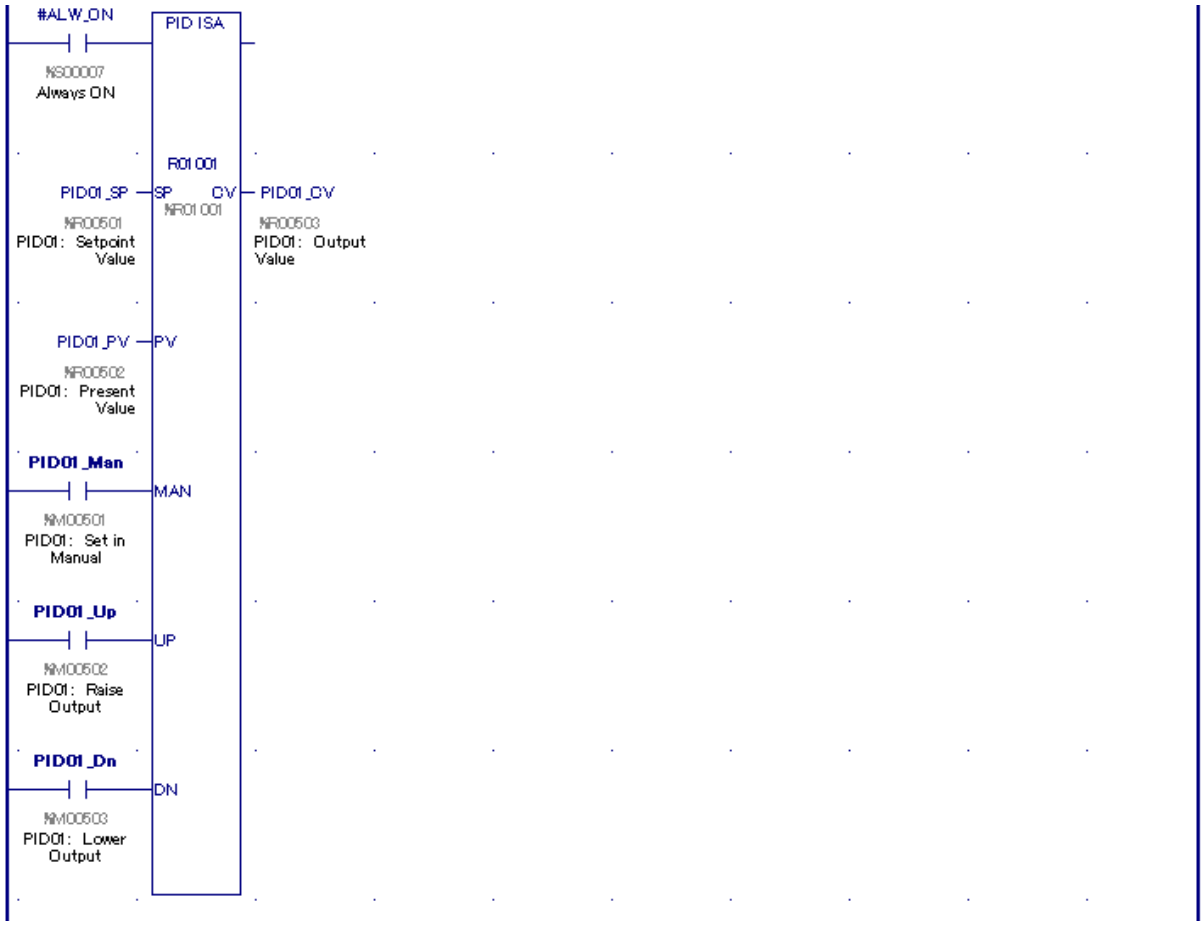
Also, it will be necessary to include the PID registers in one or more of the %R Synchronized Data Groups. This ensures that the PID in the Backup CPU tracks the Master.

The ladder logic is straightforward. Two rungs are used for each PID loop. For this example the following PLC references are used:

%M00501	PID01_Man	PID01: Set in Manual
%M00502	PID01_UP	PID01: Set in Manual
%M00503	PID01_DN	PID01: Set in Manual
%R00501	PID01_SP	PID01: Set in Manual
%R00502	PID01_PV	PID01: Set in Manual
%R00503	PID01_CV	PID01: Set in Manual
%R01001..1040	PID01	PID01: Parm Block

The first Rung allows the PID to be placed in Manual by an HMI or a local control station. This is accomplished by setting P01_MAN. (Note that %M00501 is active only in the Master CPU. If P01_MAN is SET in the Backup, then it will be reset before the rung containing the PID is solved.)

The second rung controls the operation of the PID function.



The following table describes how the PID behaves as a function of Mastership and Manual states.

	Master = TRUE	**Master = FALSE**
Manual = TRUE	PID is in Manual. Master CV is controlled by UP and DN.	PID is in Manual. Backup CV “Tracks” Master CV
Manual = FALSE	PID is in Automatic.	PID is in Manual. Backup CV “Tracks” Master CV

In this example, the PID parameters begin at PID_P01 (%R01001). For PID loop 01, there must be a synchronized data group configured that assures that registers %R01001 through %R01040 are transferred. You must include the registers associated with other PID functions as well. Also, it is customary to include the Setpoint word in the Synchronized Data set.

User-Defined Alarms

The user may post self-defined faults from within the application by performing the following steps.

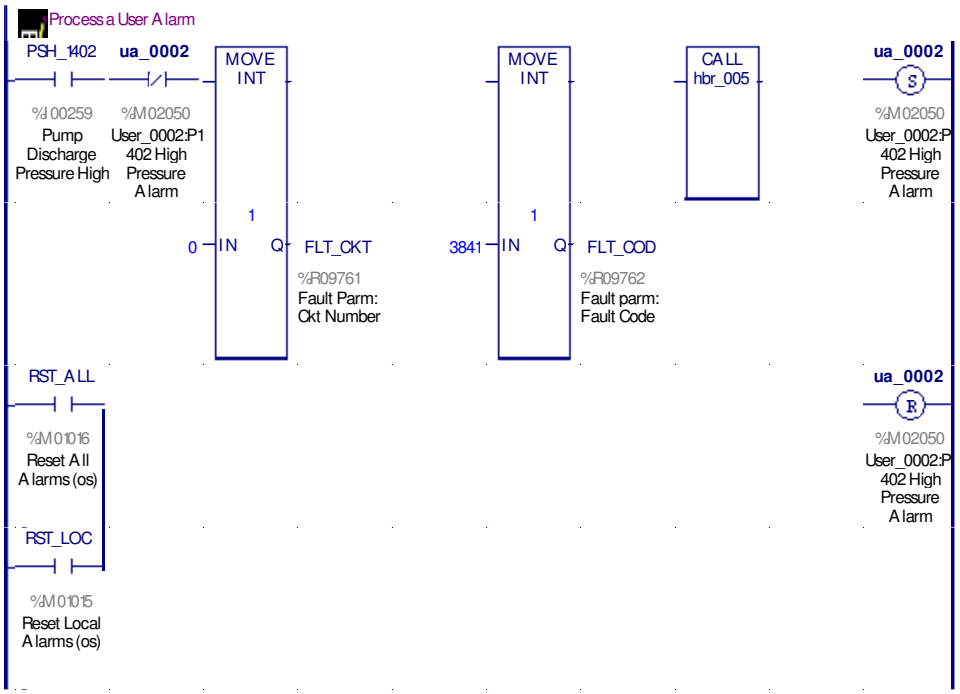
Note: User defined Alarms are not available in this version the Max-ON VIEW Diagnostic Tool.

In Your Application Folder

1. Move a user specified fault value into FLT_COD (%R9762). The fault value must be in the range 3840..4095 (decimal) inclusive.

2. In most cases, move a value 0 into FLT_CKT (%R9761). However, you may define your own identifier that may be MOVed into this register.

3. Call the subroutine named ***HBR_005***. This must be done for only once, otherwise each subsequent call will post an additional alarm into the alarm table. In the sample logic shown below, ua_0002 (%M02050) has been used as an alarm latch. The user-defined alarm will be posted only if the coil is not already set. Note that a setcoil is used so that the alarm state will be retained through a loss of power. Also, a rung has been provided that resets the coil if the alarm clear flags are invoked.



Max-ON variables used by subroutine ***HBR_005*** to log a user defined alarm.

Variable Name	*Reference*	*Description*
FLT_CKT	%R09761	Fault Parameter: Circuit Number
FLT_COD	%R09762	Fault Parameter: Fault Code

Alarm Table Organization

The Alarm Table begins at %R9030 and ends at %R9190. The Alarm Table organization is shown below.

Variable Name	Register	Description
NUM_FLT	%R9030	Number of Faults in Table (0 = empty; 33 = full)
NUM_FLT[001]	%R9031	Record 1 – Fault Type
NUM_FLT[002]	%R9032	Record 1 – Fault Location
NUM_FLT[003]	%R9033	Record 1 – Time Stamp
NUM_FLT[004]	%R9034	Record 1 – Time Stamp
NUM_FLT[005]	%R9035	Record 1 – Time Stamp
NUM_FLT[006]	%R9036	Record 2 - Fault Type
NUM_FLT[007]	%R9037	Record 2 - Fault Location
	...	...
NUM_FLT[156]	%R9186	Record 32 - Fault Type

The value in NUM_FLT (%R09030) indicates the number of active faults (alarms) in the table. A value of zero indicates that the fault table is empty. A value of 33 indicates that the table is full. When the table is full, no further faults may be added to the table.

The first fault table entry is located in NUM_FLT[001..005] (%R9031..9035). The second fault entry is in NUM_FLT[006..010] (%R9036..9040). This pattern is repeated for a total of 32 fault records.

Alarm Record Structure

Each record in the Alarm Table consists of 5 registers. Each register may be interpreted as a pair of bytes whose definitions are shown in the table below. If the registers are displayed as hexadecimal values in Logic Developer PLC, then the interpretation may be simplified.

Byte Offset	Description
0	Timestamp: Seconds (BCD)
1	Timestamp: Minutes (BCD)
2	Timestamp: Hours (BCD)
3	Timestamp: Day of Month (BCD)
4	Timestamp: Month (BCD)
5	Timestamp: Year (BCD)
6	Circuit Reference - lsb
7	Circuit Reference - msb
8	Alarm Subclass
9	Alarm Class

Bytes 0..5 These contain date and time information stored as BCD values. The simplest way to view these in Logic Developer PLC is to display the fault table registers as hexadecimal numbers.

Bytes 6..7 Bytes 6 and 7 contain the decimal value of an I/O circuit reference. The value in this pair of bytes must be interpreted in the context of the Alarm Class that has generated the message. The Alarm Class is contained in Byte 9. The value will be zero for CPU or system-level hot standby faults.

Byte 8 This byte contains the Alarm Subclass code. The subclass contains the rack number in the upper nibble and the slot number in the lower nibble. This number implies different fault descriptions depending upon the value of the Alarm Class contained in byte 9.

Byte 9 This byte contains the Alarm Class code. The valid range is 0000..4095.

Alarm Class (Offset 9)	***Alarm Subclass (Offset 8)***	***Circuit Reference Range (Integer) (Offset 6/7)***	***Alarm Class Description***
00	00..FF	Always 0	System level faults
01	00..FF	0001..2048	Discrete input circuit
02	00..FF	0001..2048	Discrete output circuit
03	00..FF	0001..1024	Analog input circuit
04	00..FF	0001..0256	Analog output circuit
05	00..FF	00..31	I/O LAN device
06..0E	00..FF	- - -	Not defined
0F	00..FF	-32768..32767	User-defined

The tables in the following pages describe the predefined alarms.

Alarm Class 00h - System Level Alarms

Decimal Code	Hex Code	Description	
001	0001	CPU Stopped	The CPU identified in the Source Column has transitioned from Run to Stop.
002	0002	Program Restart	The CPU identified in the Source Column has transitioned from Stop to Run.
003	0003	Power Up	Power has been restored to the CPU identified in the Source Column
004	0004	Invalid CPU ID	The CPU identified in the Source Column does not have a valid ID. Open the hardware configuration. Zoom into the CPU module and set the Checksum Length to 11 for CPU A or 12 for CPU B.
005	0005	Duplicate IDs	The CPUs have identical IDs. Verify that the hardware configuration has been stored to the proper CPUs. Verify the identities in the project have been set so that the Checksum Length for CPU A is 11 and 12 for CPU B.
006	0006	New Authorization	Not used.
007	0007	Authorization Alarm	This occurs after operating for a total of approximately 22 days in Demo mode.
008	0008	Authorization Fault	This occurs after operating for a total of approximately 22 days in Demo mode.
009	0009	Authorization Corruption	Not used.
010	000A	Program Changed	The application program in the identified CPU has changed either due to a program store or due to online editing.
011	000B	HW Config Changed	The hardware configuration in the identified CPU has changed.
012	000C	Program Checksum Mismatch	There is a discrepancy between the checksum in CPU A and CPU B. This implies that the programs in the two CPUs are not equivalent.
013	000D	Remote is Offline	The companion CPU has transitioned to an Offline mode.
014	000E	Remote is Online	The companion CPU has transitioned to an Online mode.
015	000F	Local Switches to Master	The CPU identified in the Source Column has become a Master.
016	0010	Local Switches to Backup	The CPU identified in the Source Column has become a Backup.
017	0011	Genius Sync P Failure	Not used.
018	0012	Genius Sync S Failure	Not used.
019	0013	Genius Sync P LRC Error	Not used.
020	0014	Genius Sync S LRC Error	Not used.
021	0015	%Q Configuration Fault	A defective configuration has been entered. There are either too many %Q groups, or the reference range exceeds the capacity of the system.
022	0016	%AQ Configuration Fault	A defective configuration has been entered. There are either too many %AQ groups, or the reference range exceeds the capacity of the system.
023	0017	%M Configuration Fault	A defective configuration has been entered. There are either too many %M groups, or the reference range exceeds the capacity of the system.
024	0018	%R Configuration Fault	A defective configuration has been entered. There are either too many %R groups, or the reference range exceeds the capacity of the system.

Decimal Code	Hex Code	Description	
025	0019	Corrupted Config	A defective configuration has been entered.
026	001A	Ethernet Synchronization Primary Failure	The System's primary Ethernet LAN has failed. CPU A and CPU B are unable to transfer Synchronized Data via the primary Ethernet LAN.
027	001B	Ethernet Synchronization Secondary Failure	The System's secondary Ethernet LAN has failed. CPU A and CPU B are unable to transfer Synchronized Data via the secondary Ethernet LAN.
028	001C	Illegal Mastership State	There are either two Masters or two Backups in operation.
029	001D	Not used	
...	...	...	
032	0020	Not used	

Fault Class 01h - Discrete Inputs

Decimal Code	*Hex Code*	*Description*	
257	0101	Circuit Offline	The discrete input reference displayed in the Source Column has transitioned to an offline state.
258	0102	Not used	
259	0103	Remote Rack Offline	The remote drop corresponding to the discrete input reference displayed in the Source Column has transitioned to an offline state.
260	0104	Remote Rack Overrides Present	The corresponding remote drop has I/O overrides present.
261	0105	Remote Rack PLC Low Battery	The corresponding remote drop has an indication of low CPU Battery voltage. Replace or connect the battery in the remote drop.
262	0106	Remote Rack Config Mismatch	There is a configuration discrepancy between the modules installed in the remote rack and the hardware configuration that has been stored into the remote rack.
263	0107	Remote Rack Loss of I/O Module	An I/O module in the remote rack has failed.
264	0108	Remote Rack Loss of Opt Mod	
265	0109	Remote Rack Opt Mod Hard Fault	
266	010A	Remote Rack Opt Mod Soft Fault	
267	010B	Remote Rack Sys Fault Present	
268	010C	Remote Rack I/O Fault Present	
269	010D	Remote Rack Program Changed	
270	010E	Remote Rack HW Configuration Changed	
271	010F	Remote Rack Power Up	Power has been lost and then subsequently restored at the remote rack.
272	0110	Remote Rack Program Restart	The remote rack has transitioned from STOP to RUN.
273	0111	Remote Rack Gen Bus P LRC	
274	0112	Remote Rack Gen Bus S LRC	
275	011D	Not used	
...	...	...	
288	0120	Not used	

Fault Class 02h - Discrete Outputs

Decimal Code	Hex Code	Description	
513	0201	Circuit Offline	The device corresponding to the circuit reference number shown in the Source Column has transitioned to offline.
514	0202	Not used	
...	...	...	
544	0220	Not used	

Fault Class 03h - Analog Inputs

Decimal Code	Hex Code	Description	
769	0301	Circuit Offline	The device corresponding to the circuit reference number shown in the Source Column has transitioned to offline.
770	0302	Not used	
771	0303	Under-range	After scaling, the resulting value is less than the lower engineering unit limit.
772	0304	Over-range	After scaling, the resulting value is greater than the upper engineering unit limit.
773	0305	Not used	
...	...	...	
800	0320	Not used	

Fault Class 04h - Analog Outputs

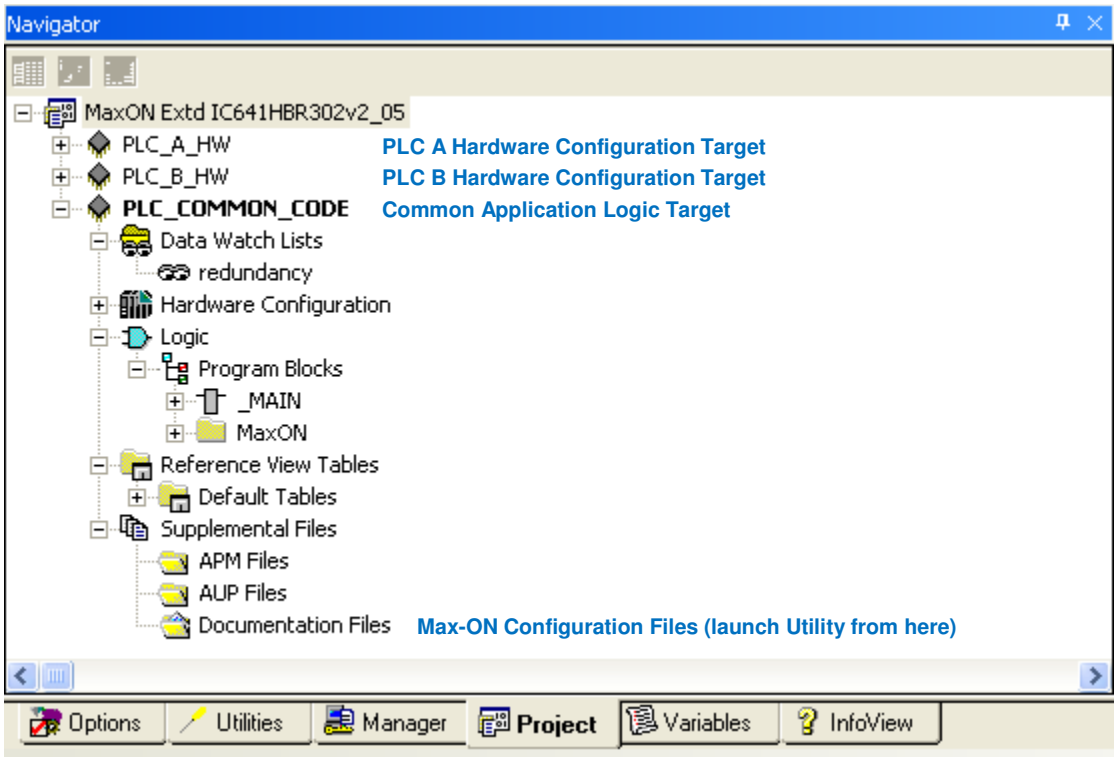
Decimal Code	Hex Code	Description	
1025	0401	Circuit Offline	The device corresponding to the circuit reference number shown in the Source Column has transitioned to offline.
1026	0402	Not used	
...	...	...	
1055	0420	Not used	

Fault Class 05h – I/O LAN Alarms

Decimal Code	Hex Code	Description	
1089	0501	Addition of Device	The device corresponding to the circuit reference number shown in the Source Column has transitioned to online.
1090	0502	Loss of Device	The device corresponding to the circuit reference number shown in the Source Column has transitioned to offline.
1091	0503	Not used	
...	...	...	
1120	0520	Not used	

Chapter 6 Configuring the Hot Backup CPUs

A Max-ON Project contains three Targets that are used to distinguish between hardware configurations for PLC A and PLC B, and the user application that is common to both of the CPUs. The figure shown below illustrates the various components contained in the Generic Project named *MaxON Extd IC641HBR302v2_05*



When a Max-ON project is created, a hardware configuration Target is provided for PLC A and one is provided for PLC B. In most aspects, these targets are very similar to each other. The significant differences between the two hardware configurations are:

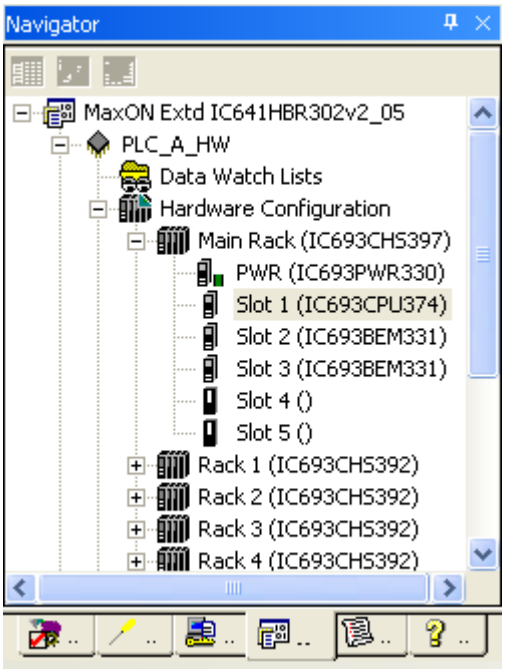
- Identity settings for the CPUs (via logic checksum words)
- Serial communication port settings and SNP ID
- Ethernet interface IP addresses
- Genius bus controllers configuration

Many of the configuration items are completed during the process of developing the Project. The following sections provide details on the configuration of these elements.

Configuring PLC A

Open the Hardware Configuration for PLC_A_HW

In the Max-ON Project, select and expand the Hardware Configuration node of the *PLC_A_HW* target.

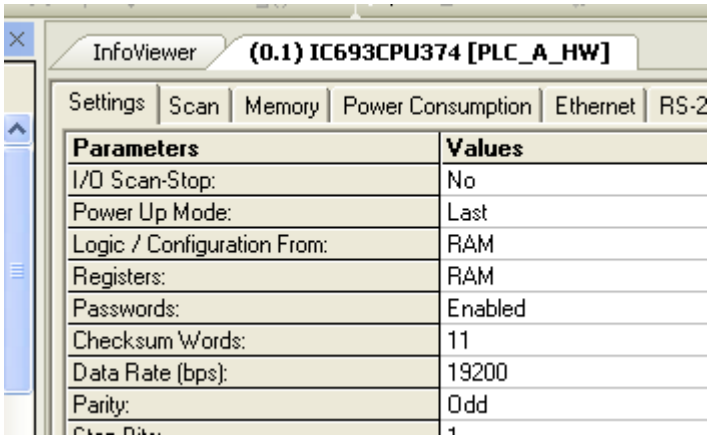


Set the Max-ON Identity for PLC A

The identity for CPU A is determined by the value set in the *Checksum Words* parameter. The parameter is located in the CPU's Hardware Configuration for CPU A.

Open the CPU module's Hardware Configuration by double-clicking on the IC693CPU374 module. (Your project might use a different CPU model number.)

Click on the *Settings* tab to display the *Checksum Words* parameter.



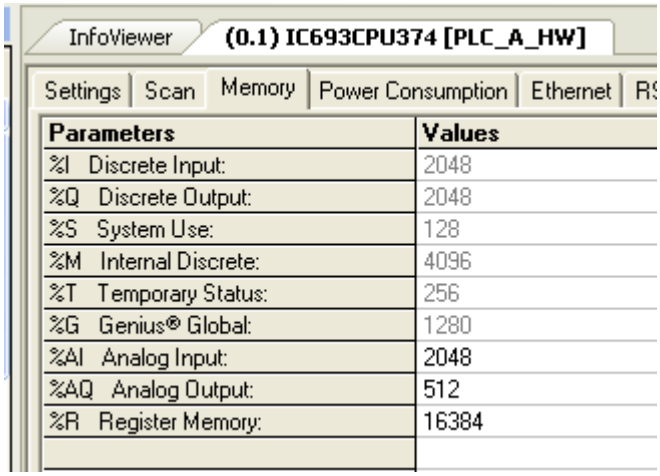
Verify that the *Checksum Words* parameter value is set to 11. If it is not 11, change the parameter to this value.

Set Memory Limits for PLC A

The Max-ON drivers have memory requirements as defined below:

%R ***Registers***	***%AI*** ***Analog In***	***%AQ*** ***Analog Out***
16384 (minimum)	2048 (minimum)	512 (minimum)

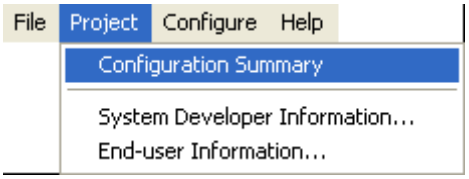
Select the *Memory* tab of the CPU configuration and verify that these values have been configured. Please note the memory limits may be larger than these values for use in your application.



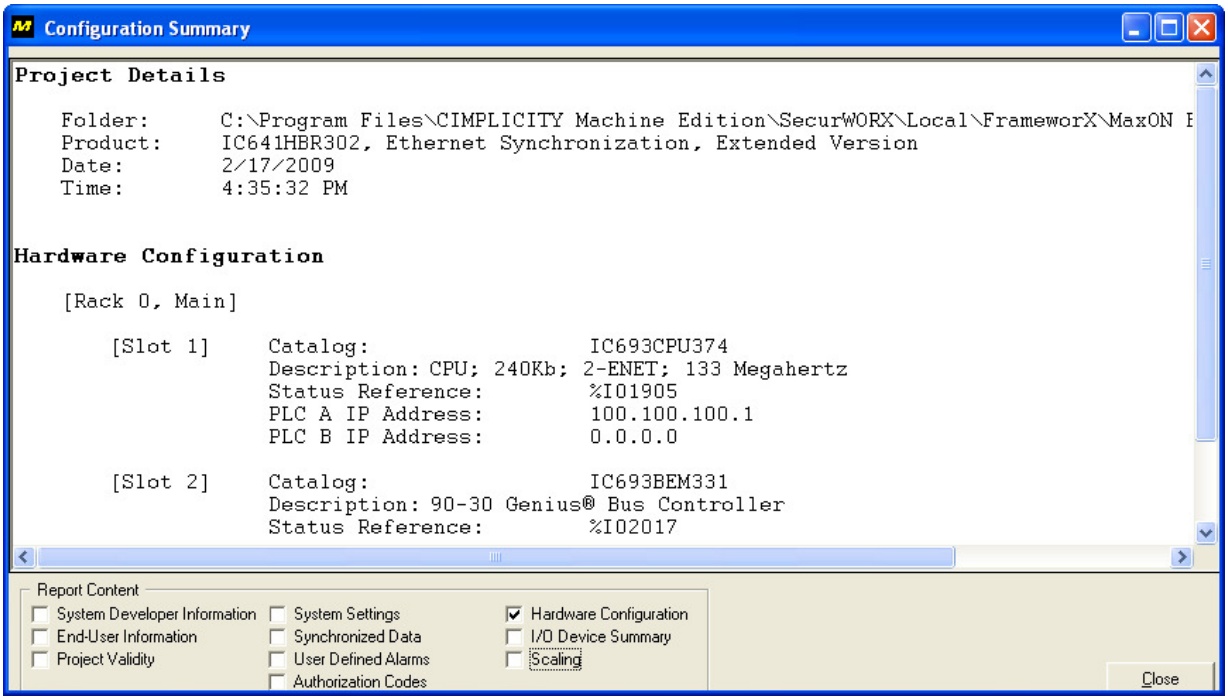
Configure Ethernet Sync Network for PLC A

Use the Sync LAN Interface Module configuration summary from the Max-ON Configuration Utility as a guide for configuring the Ethernet synchronization interfaces in the system.

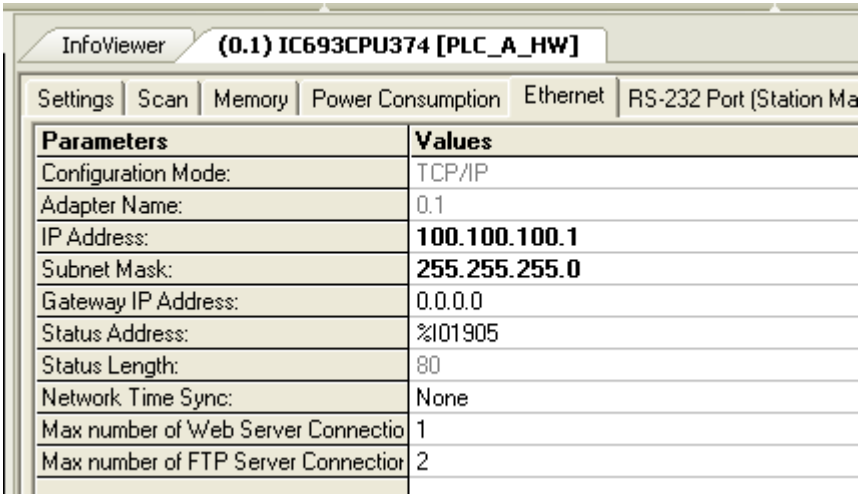
You may display the summary by using the *Project* menu and then click on *Configuration Summary*.



Limit the information displayed on the summary page by clearing all of the check boxes except for *Hardware Configuration*.



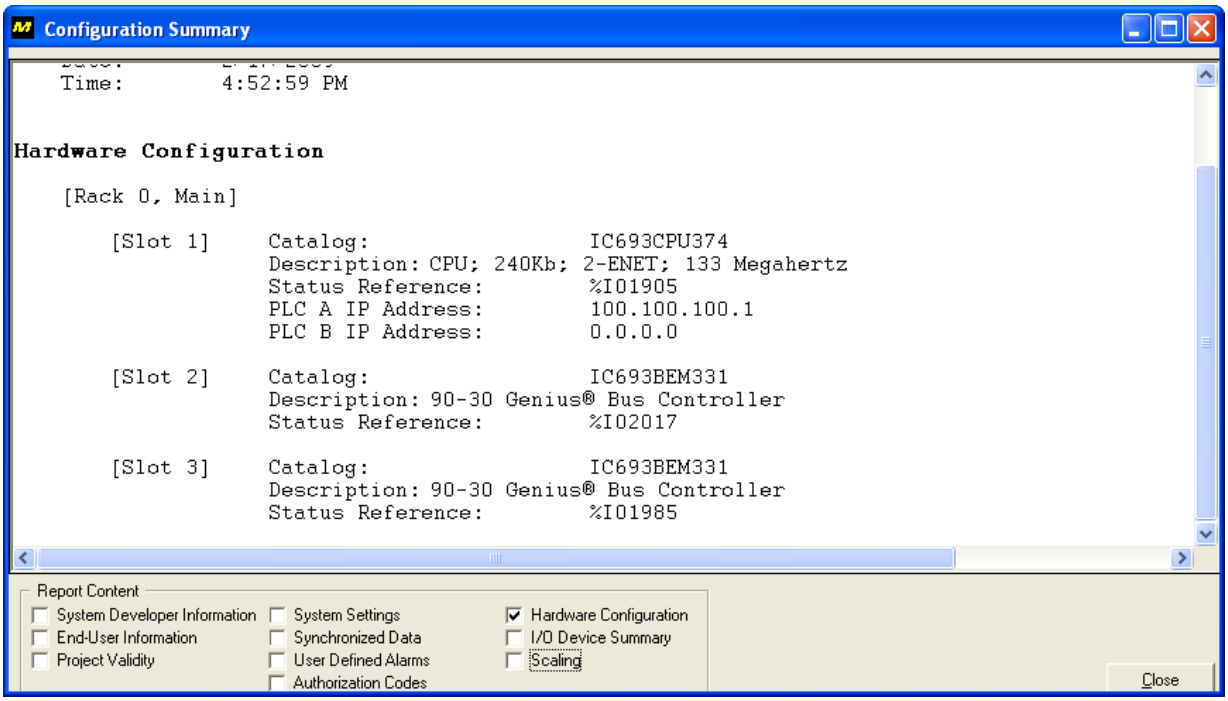
Add the Ethernet Interface module(s) to the appropriate slot(s) in the Hardware Configuration for PLC A and configure its parameters to match the Max-ON Configuration Summary.



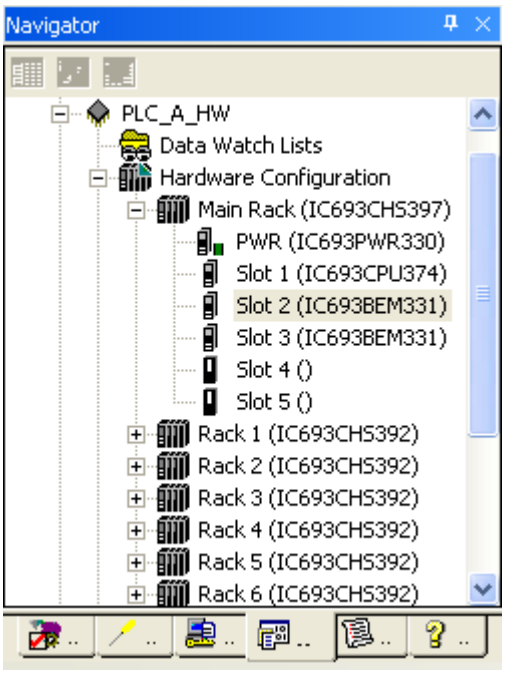
Parameters	Values
Configuration Mode:	TCP/IP
Adapter Name:	0.1
IP Address:	**100.100.100.1**
Subnet Mask:	**255.255.255.0**
Gateway IP Address:	0.0.0.0
Status Address:	%I01905
Status Length:	80
Network Time Sync:	None
Max number of Web Server Connectio	1
Max number of FTP Server Connectior	2

Configure Genius Bus Controllers for PLC A (if used)

Use the Configuration Summary from the Max-ON Configuration Utility as a guide for configuring the Genius busses in the system.



Add the Genius bus controllers to the appropriate slot(s) in the Hardware Configuration for PLC A and configure its parameters to match the Max-ON Configuration Summary.



Serial Bus Address (SBA)

All Genius bus controllers in PLC A must be configured to have the *Serial Bus Address* set at 31.

Inputs Default

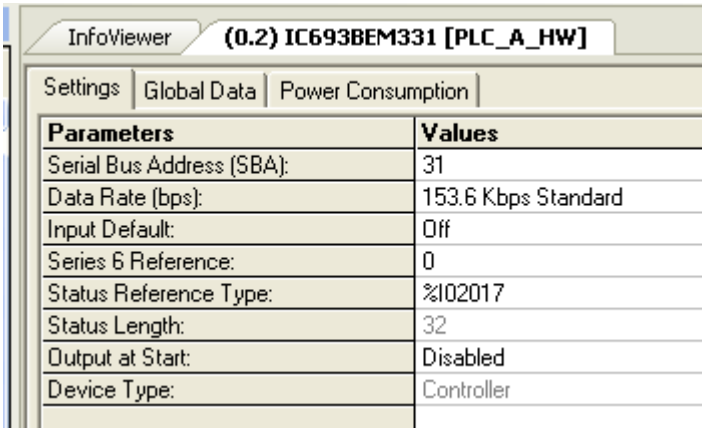
Input Default should be set to *Off*.

Status Reference Type

The recommended practice is set the *Status Address Type* at the high end of the discrete input references. For instance, the first GBC might start at %I02017, length 32.

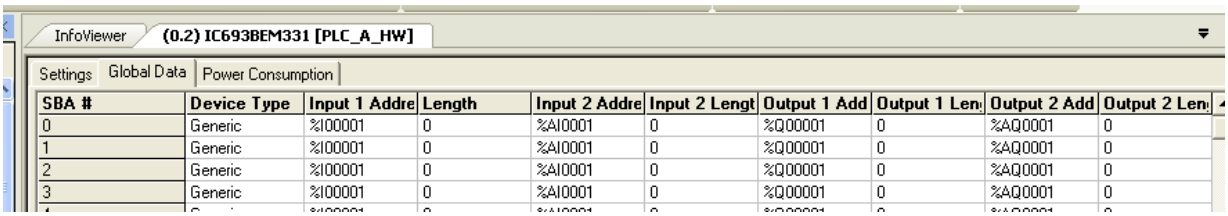
Output at Start

Outputs at Start must be set to *Disabled*.



Global Data (Primary LAN)

Configure the global data that is transferred between PLC A and PLC B by clicking on the Primary LAN Genius bus controller and then selecting the Global Data tab.



Scroll down to the rows for Serial Bus Addresses 30 and 31 and set the reference types, starting addresses and lengths according to the table shown below.

SBA #	Device Type	Input 1 Address	Length	Input 2 Address	Length	Output 1 Address	Length	Output 2 Address	Length
30	Generic	%R09872	62	%AI0001	0	%Q00001	0	%AQ0001	0
31	Controller					%R09936	62	%AQ0001	0

Global Data (Secondary LAN)

Configure the global data that is transferred between PLC A and PLC B by clicking on the Secondary LAN Genius bus controller and then selecting the Global Data tab.

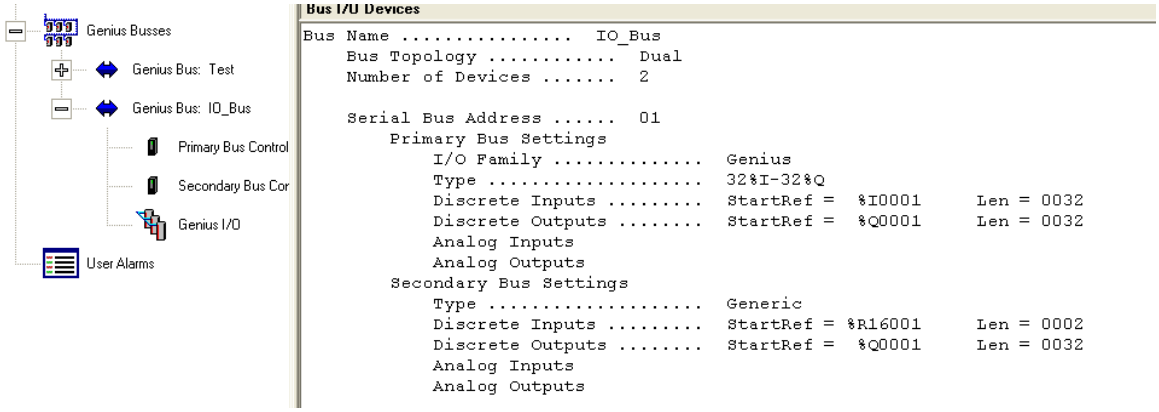
Scroll down to the rows for Serial Bus Addresses 30 and 31 and set the reference types, starting addresses and lengths according to the table shown below.

SBA #	Device Type	Input 1 Address	Length	Input 2 Address	Length	Output 1 Address	Length	Output 2 Address	Length
30	Generic	%R09808	62	%AI0001	0	%Q00001	0	%AQ0001	0
31	Controller					%R09936	62	%AQ0001	0

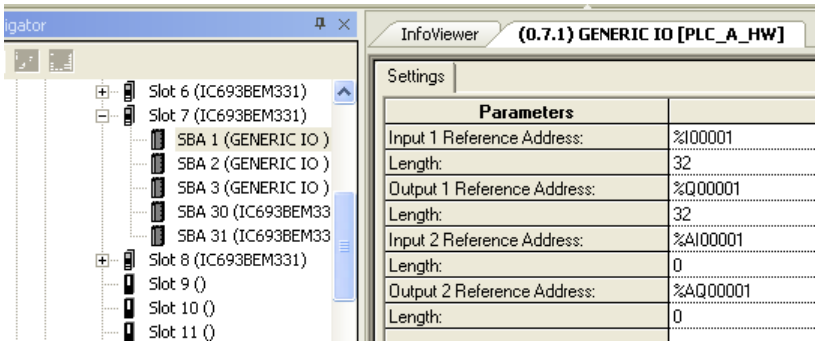
Configure I/O Devices on the Primary Bus for PLC A

Use the Bus I/O configuration summary from the Max-ON Configuration Utility as a guide for configuring the Genius devices that reside on the Genius bus.

Add Genius devices to the GBC's configuration and configure the Genius device parameters to match. A sample is shown below.



Repeat this process for each Genius device in the Max-ON configuration.



Repeat the above process until there are no more bus controllers to be configured.

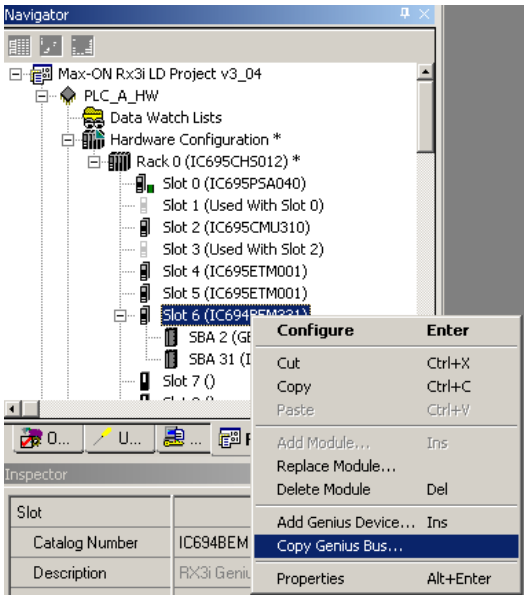
Note: VersaMax I/O is no longer configured automatically by the PLC Max-ON drivers. Please make certain that you use the Remote I/O Manager in Machine Edition to set and download the configurations.

If there are no Secondary busses in the system then store the configuration into CPU A. Otherwise, configure the secondary bus as explained next.

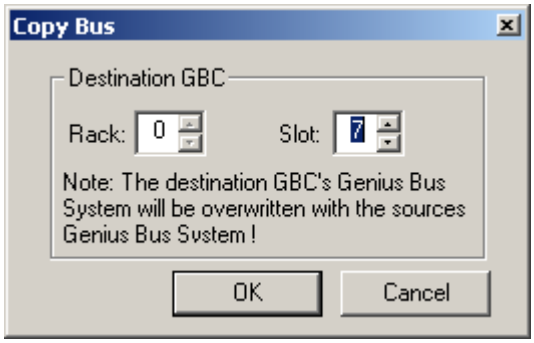
Configure I/O Devices on the Secondary Bus for PLC A

Use the Bus I/O configuration summary from the Max-ON Configuration Utility as a guide for configuring the Genius devices that reside on the Secondary Genius bus.

You can use the *Copy Genius Bus* function in the hardware configuration to facilitate the speedy duplication of Genius bus configurations.



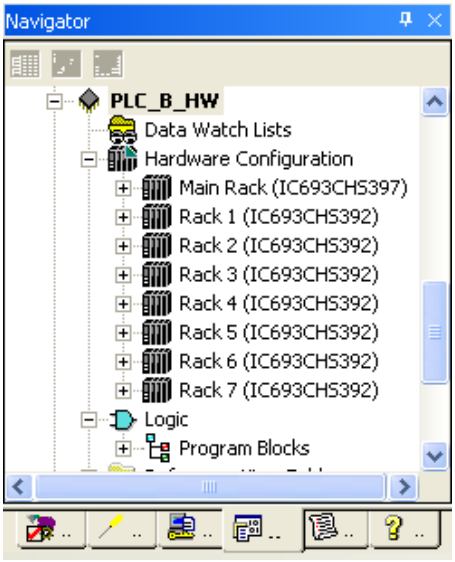
Select the location for the duplicate Genius Bus and an exact copy will be made to the destination slot location.



Configuring PLC B

Open the Hardware Configuration for PLC_B_HW

In the Max-ON Project, select and expand the Hardware Configuration node of the PLC_B_HW target.

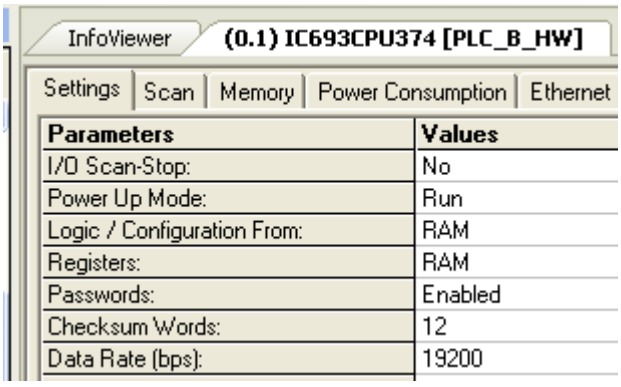


Set the Max-ON Identity for PLC B

The identity for CPU B is determined by the value set in the *Logic Checksum Words* CPU Parameter located in the CPU's Hardware Configuration for CPU B.

Open the CPU module's Hardware Configuration by double-clicking on the IC693CPU374 module. (Your project might use a different CPU model number.)

Click on the *Settings* tab to display the *Checksum Words* parameter.



Verify that the *Checksum Words* parameter value is set to 12. If it is not 12, change the parameter to this value.

Set Memory for PLC B

Normally, the memory in CPU B is configured the same as for CPU A. Please refer to the information used for CPU A, and make adjustments to the CPU B memory configuration, if necessary.

Configure Ethernet Sync Network for PLC B

Repeat the configuration process for the Ethernet synchronization interfaces in PLC B.

Configure Ethernet Interface for Ethernet I/O LANS for PLC B (if used)

Configure the Ethernet Interfaces used in conjunction with any Ethernet NIUs that are part of your system.

Configure Genius Bus Controllers for PLC B (if used)

Serial Bus Address

All Genius bus controllers in PLC B should be configured to have their serial bus addresses set at 30.

Input Default

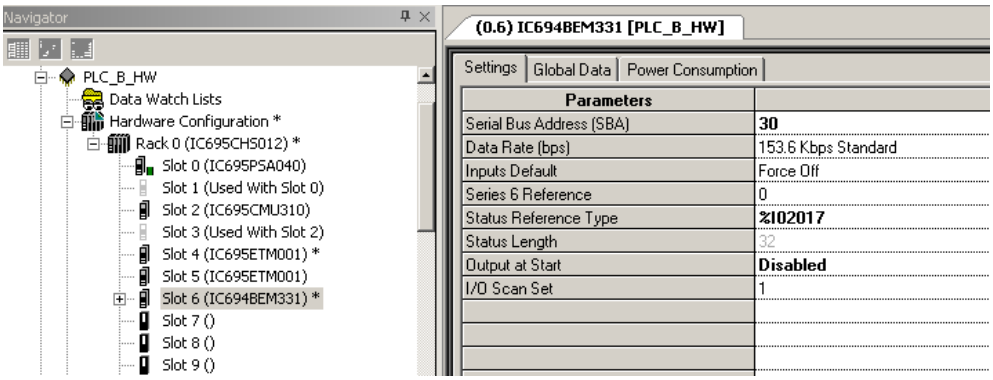
Inputs should be set to Force OFF.

Status Reference Type

The recommended practice is set the device status address at the high end of the discrete input status references. For instance, the first GBC might start at %I02017, length 32.

Output at Start

Outputs must be set to Disabled at Start.



Configure I/O Devices on the Primary and Secondary Busses for PLC B

The I/O devices in CPU B are configured exactly the same as for CPU A. Please refer to the instructions earlier in this chapter to complete their configuration.

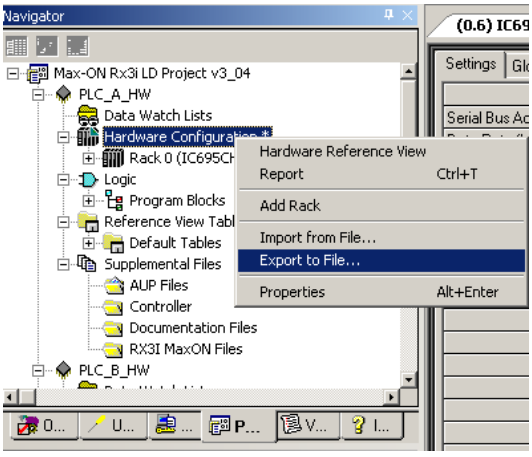
Copying PLC A Configuration to PLC B Configuration

A productivity tool that can also be used to speed the duplication of the Hardware Configuration between PLC A and PLC B is to Export the Hardware Configuration from PLC A and Import it into PLC B. This will accelerate the configuration of the hardware configuration and you only need to modify the slight differences in PLC B.

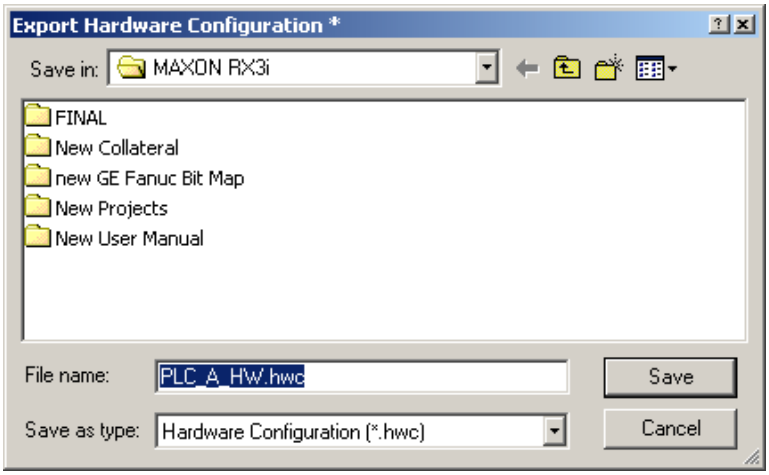
To export the Hardware Configuration from the PLC_A_HW target and import it into the PLC_B_HW target:

Select the Hardware Configuration node for PLC_A_HW target.

Select the *Export to File…* right mouse menu item.

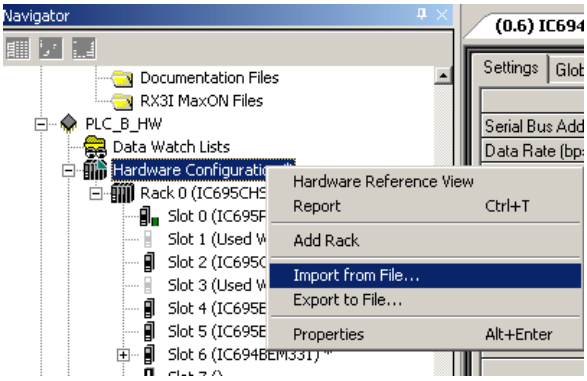


Specify a file name for the configuration, or use the default name PLC_A_HW.hwc.

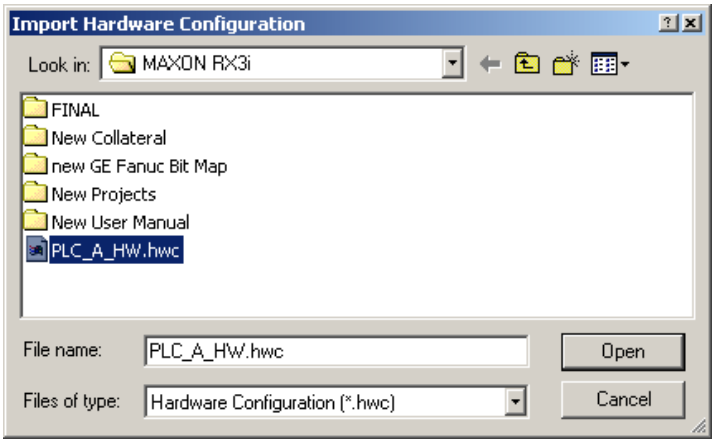


Select the Hardware Configuration node for PLC_B_HW target.

Select the *Import from File…* right mouse menu item.



Specify the file name used in Step 3 (default name PLC_A_HW.hwc).



Now modify the Hardware Configuration for PLC_B_HW Target to match the parameters of PLC B in your system.

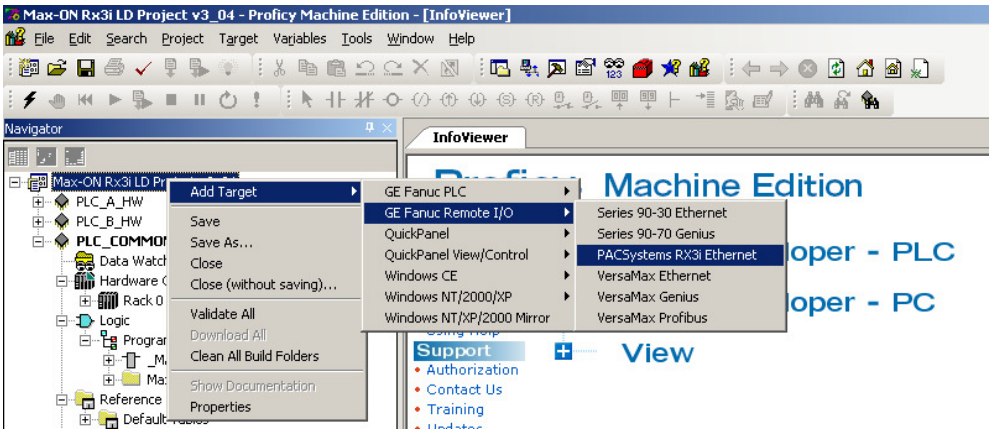
Chapter 7 Configuring the I/O Devices

Configuring the Ethernet I/O Devices

Before you may use your system, you must configure the Ethernet I/O devices that are to be installed on the Ethernet I/O bus. For Max-ON RX3i the Ethernet devices may consist of PACSystems RX3i ENIUs and/or Series 90-30 ENIUs.

For a complete description of how to configure and use the PACSystems RX3i ENIUs, please see GFK-2434, titled *PACSystems RX3i Ethernet Network Interface Unit*. A summary of the process to configure this ENIU is as follows:

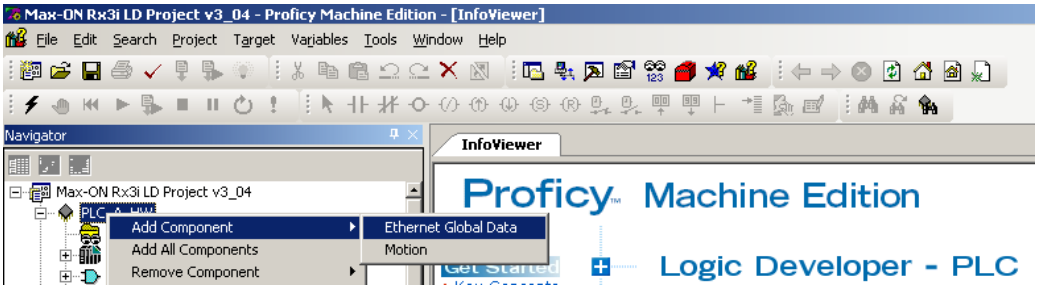
1. Determine the IP Addresses for the Primary (PLC A) and Secondary (PLC B) Controllers and the Ethernet NIU.
2. Add the PACSystems ENIU target(s) to your Machine Edition Project by selecting the *Add Target > GE Fanuc Remote I/O > PACSystems RX3i Ethernet* menu.



3. Set the IP Address and Subnet Mask on the Ethernet Transmitter module(s) ETM001 in the Ethernet NIU target, Set Gateway IP Address if required.
4. Set the Ethernet Global Data Local Producer ID in the Ethernet NIU.
5. Add the input and output modules to the Ethernet NIU configuration. If you add or change modules later in the project, EGD Exchanges in the ENIU and controller may need to be updated.
6. Complete the Ethernet Global Data Exchanges for the ENIU.
7. If the ENIU has any Local Logic, develop this logic for the ENIU target. The RX3i Ethernet NIU allows the addition of up to 20K bytes of logic to be executed locally in

the I/O Station. A LD logic block named “Local User Logic” is provided for this purpose.

8. Repeat steps 2 through 7 for each ENIU.
9. Store this information to each ENIU.
10. Add the Ethernet Global Data component to the Primary (PLC_A_HW target) and Secondary (PLC_B_HW target) Controllers.



11. Set the EGD Local Producer ID in the controllers.
12. Create EGD Exchanges in the Primary controller (PLC A) to match the EGD exchanges in each ENIU.
13. Create EGD Exchanges in the Secondary controller (PLC B) to match the EGD exchanges in each ENIU.
14. If Remote COMMREQ Calls will be used with the ENIUs, add the RCC Parameterized C Block to the PLC_COMMON_CODE target’s application, and add any logic needed to execute these commands.
15. Store the Hardware Configurations (PLC_A_HW and PLC_B_HW targets) to PLC A and PLC B.
16. Store the Application Logic (PLC_COMMON_CODE target) to PLC A and PLC B.
17. Verify that the EGD Exchanges are working.
18. Verify that any RCC commands are working.
19. Verify that any Local Logic is working.

Configuring the Genius I/O Devices

Before you may use your system, you must configure the Genius I/O devices that are to be installed on the Genius I/O bus.

You must configure each device for:

- Serial Bus Address (SBA)
- Type of I/O (Input, Output, Combination)
- Scaling
- Defaults

Additionally, you must set the I/O to operate properly for redundancy:

- Dual I/O busses
- Hot Standby controller

Genius and Field Control I/O

While you are configuring the Genius I/O, you must configure extra parameters that govern system operation with respect to redundant PLCs and redundant (dual) Genius I/O busses. Please note that for Genius and Field Control I/O, you must have a Handheld Monitor available to set these parameters.

Redundant Controllers

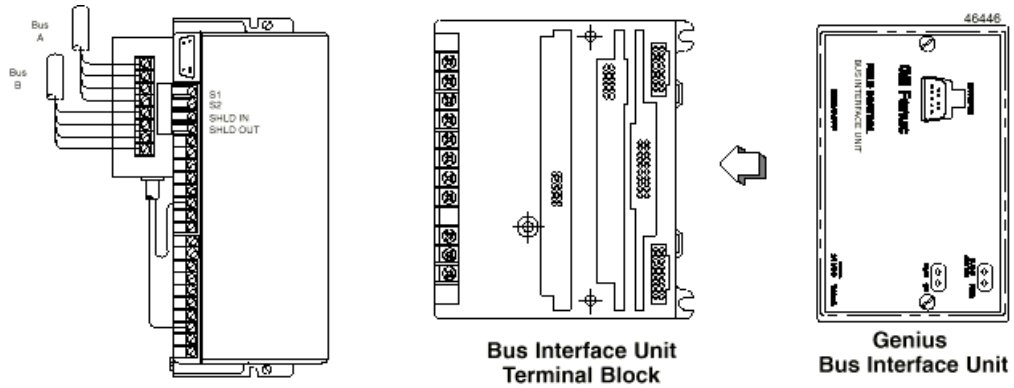
Using the Genius Handheld Monitor (HHM), set each Genus device for *Redundant Controllers = YES*.

BSM Present

Using the Genius Handheld Monitor (HHM), set the *BSM Present* configuration parameter to YES. **This is required whether or not a dual Genius I/O bus is being used.**

When this parameter is configured as YES, then the output default period is extended from 3 token rotation time periods to 2.5 seconds. The extra time allows the RX3i PLCs to exchange mastership correctly.

BSM Controller



If the Genius I/O device is attached directly to a dual bus, either by a Bus Switching Module (BSM) or a Bus Interface Unit (BIU), then you must configure this device to be a BSM Controller.

Genius Block with BSM

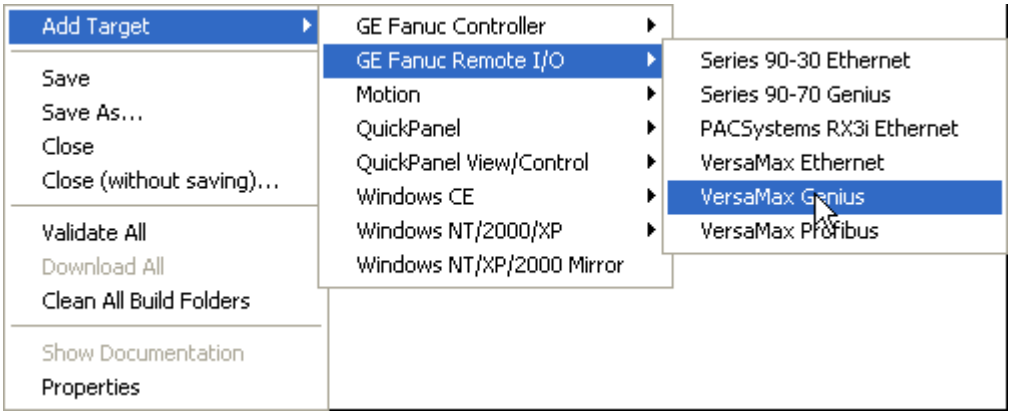
In the case of a Genius Block connecting to the BSM, setting the block to be a BSM Controller allocates its first output to the control of the BSM. It is assumed that the BSM is connected to the first output circuit.

In the case of Field Control connecting to the BIU, setting the parameter to be a BSM Controller directs the BIU to activate its internal bus switching circuitry.

If the device is connected to a "stub" downstream of another device that controls the switching, then set BSM Controller to NO.

Genius VersaMax I/O

1. Add the PACSystems VersaMax target(s) to your Machine Edition Project by selecting the *Add Target > GE Fanuc Remote I/O > VersaMax Genius* menu.



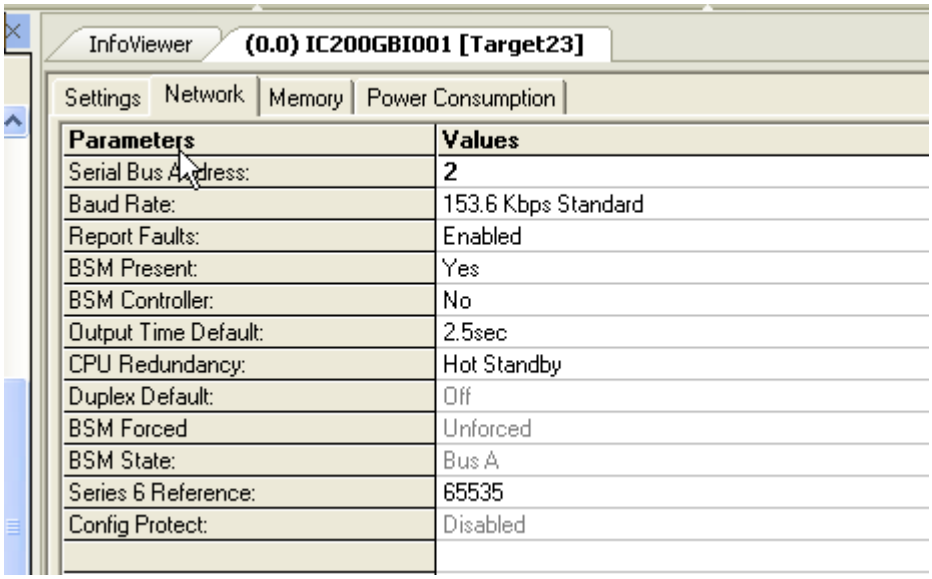
2. Click on the Target and rename it to match your application conventions.
3. Expand the *Hardware Configuration* and then click on the Genius NIU component (IC200GBI001)
4. Set the following parameters:

Serial Bus Address:	Set this in accordance with the addressing scheme for your project.
Baud Rate:	Normally this is set to 153.6 kbps Standard, however it may require adjustment depending upon cable selections, distances and the presence of electrical noise.
BSM Present:	Set this to Yes

BSM Controller: Set this to Yes if there are two Genius busses that connect directly to the NIU. Set this to No, if there is a single bus connection.

Output Time Default: Normally this is set to 2.5 Seconds

CPU Redundancy: Set this to Hot Standby.



5. Select this as the active target.
6. Set the Comm port characteristics.
7. Connect a serial programming cable to your workstation and to the VersaMax I/O drop.
8. Store the configuration into the drop.
9. Repeat this for any other VersaMax I/O drops in the system.

Remote 90-30 Genius Drops

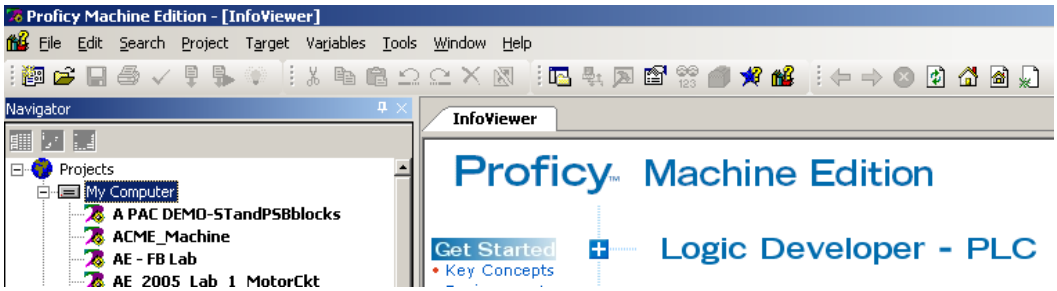
A Remote 90-30 Genius Drop consists of a Series 90-30 CPU, power supply, base, and one or more Genius bus controllers. Input and output modules are installed in the CPU base. Modules also may be installed in an I/O Expansion base.

A Scanner routine executes in the drop's CPU. This routine scans all input devices and transmits the input states to the Hot Standby PLCs by way of the I/O bus.

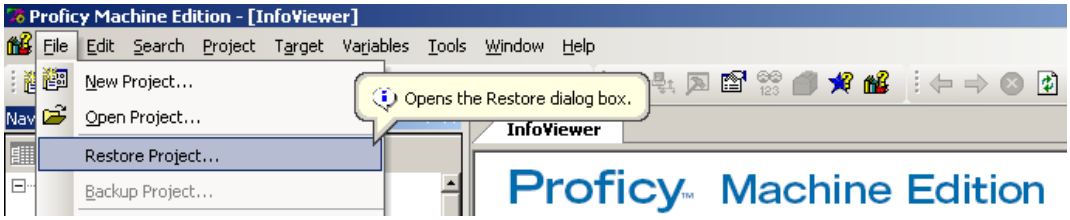
Creating the Remote 90-30 Genius Drop Project

Follow these steps to create a Remote 90-30 Genius Drop Project in Proficy Logic Developer PLC:

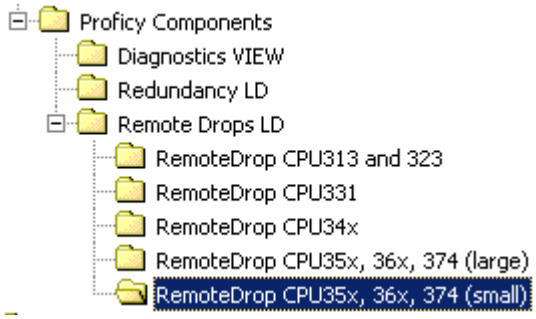
1. Create a new project based on the appropriate Remote 90-30 Genius Drop template. The Remote 90-30 Genius Drop project is added to the Machine Edition project Navigator by using the *File > Restore Project…* menu item. Select the Project Navigator window making certain that there is no project open at this time.

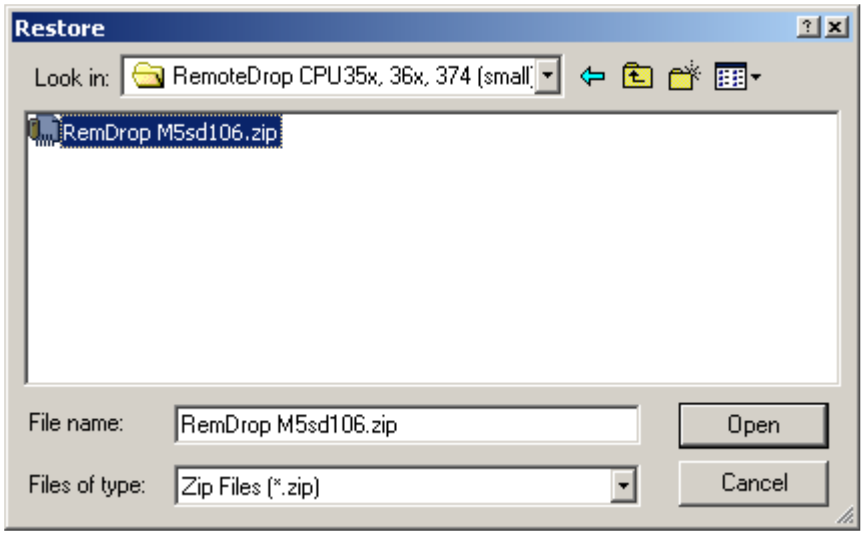


2. Using the *File* menu, click on *Restore Project...*



3. Navigate to the *Proficy Components* directory, then to the *Remote Drops LD* directory. Open the desired Remote Drop directory, *RemoteDrop CPU35x, 36x, 374 (small)*, for example. Make certain that the selection for **Files of Type** has been set to *Proficy Machine Edition (*.zip)*. Select the Remote Drop project backup file.





When you click on *Open*, a new project will be added to the Proficy Navigator window.

4. Give your project a descriptive name in the Machine Edition Navigator.

Remote Drop Status Word

A remote drop always places important status information into its local references at %I00001 through %I00016 inclusive. The definition of these inputs is shown in the table below.

Bit Offset	*Description*
1	Offline
2	Overrides Present
3	PLC Low Battery
4	Config Mismatch
5	Loss of I/O Module
6	Loss of Option Module
7	Option Module Hard Fault
8	Option Module Soft Fault
9	System Fault Present
10	I/O Fault Present
11	Program Changed
12	HW Config Changed
13	Power Up
14	Program Restart
15	Bus 1 LRC Error
16	Bus 2 LRC Error

To ensure proper operation of the remote drop, you must not configure any local module such that it overlaps these discrete input addresses. Make certain that addressing for your modules begins at %I00017 or above.

Configuring the Drop's GBC

The Genius bus controller in the remote drop must be configured to transmit the input data to the Hot Standby PLCs and also to receive global data from the Hot Standby PLCs. In the Remote Drop, global data contains the discrete and analog output data.

Primary Bus

The Genius bus controller should be configured as follows:

In the Settings Tab

Serial Bus Address (SBA):	Any address from 0 to 29 is acceptable. (Note: Normally a Genius Handheld Monitor normally is set for SBA=0. It is standard practice to avoid 0 when using Field Control or Genius I/O.)
Status Reference Type:	%I00481 for M23, M31, and M40 drop folders %I02017 for M5S and M5L drop folders

In the Global Data Tab

At the GBC's Address:

Input 1 Address	%I00001
Input 1 Length	always 0
Input 2 Address	%AI00001
Input 2 Length	always 0
Output 1 Address	%I00001
Output 1 Length	16 plus the number of Discrete Inputs installed
Output 2 Address	%AI00001
Output 2 Length	The number of Analog Inputs installed

At SBA 30:

Input 1 Address	See Buffer Registers
Input 1 Length	62
Input 2 Address	%AI00001
Input 2 Length	always 0
Output 1 Address	%Q00001
Output 1 Length	always 0
Output 2 Address	%AQ00001
Output 2 Length	always 0

At SBA 31:

Input 1 Address	See Buffer Registers
Input 1 Length	62
Input 2 Address	%AI00001
Input 2 Length	always 0
Output 1 Address	%Q00001
Output 1 Length	always 0
Output 2 Address	%AQ00001
Output 2 Length	always 0

Secondary Bus (optional)

The Genius bus controller should be configured as follows:

In the Settings Tab

Serial Bus Address (SBA):	Any address from 0 to 29 is acceptable. (Note: Normally a Genius Handheld Monitor normally is set for SBA=0. It is standard practice to avoid 0 when using Field Control or Genius I/O.)
Status Reference Type:	%I00449 for M23, M31, and M40 drop folders %I01985 for M5S and M5L drop folders

In the Global Data Tab

At the GBC's Address:

Input 1 Address	%I00001
Input 1 Length	always 0
Input 2 Address	%AI00001
Input 2 Length	always 0
Output 1 Address	%I00001
Output 1 Length	16 plus the number of Discrete Inputs installed
Output 2 Address	%AI00001
Output 2 Length	The number of Analog Inputs installed

At SBA 30:

Input 1 Address	See Buffer Registers
Input 1 Length	62
Input 2 Address	%AI00001
Input 2 Length	always 0
Output 1 Address	%Q00001
Output 1 Length	always 0
Output 2 Address	%AQ00001
Output 2 Length	always 0

At SBA 31:

Input 1	See Buffer Registers
Input 1 Length	62
Input 2	%AI00001
Input 2 Length	always 0
Output 1	%Q00001
Output 1 Length	always 0
Output 2	%AQ00001
Output 2 Length	always 0

The table shown below should be used to configure the Genius bus controller(s) in a remote drop. The table lists the register references that must be entered into the Logic Developer PLC hardware configuration based upon the template folder that was used to create the remote drop.

	Remote 90-30 Genius Drop Project Name				
Description	**RemDrop M23dxyy.zip**	**RemDrop M31dxyy.zip**	**RemDrop M4xdxyy.zip**	**RemDrop M5sdxyy.zip**	**RemDrop M5ldxyy.zip**
Receive Buffer Primary Bus, CPU A SBA-31	%R00705	%R01729	%R09680	%R09680	%R16065
Receive Buffer Secondary Bus, CPU A SBA-31	%R00833	%R01857	%R09808	%R09808	%R16193
Receive Buffer Primary Bus, CPU B SBA-30	%R00769	%R01793	%R09744	%R09744	%R16129
Receive Buffer Secondary Bus, CPU B SBA-30	%R00897	%R01921	%R09872	%R09872	%R16257

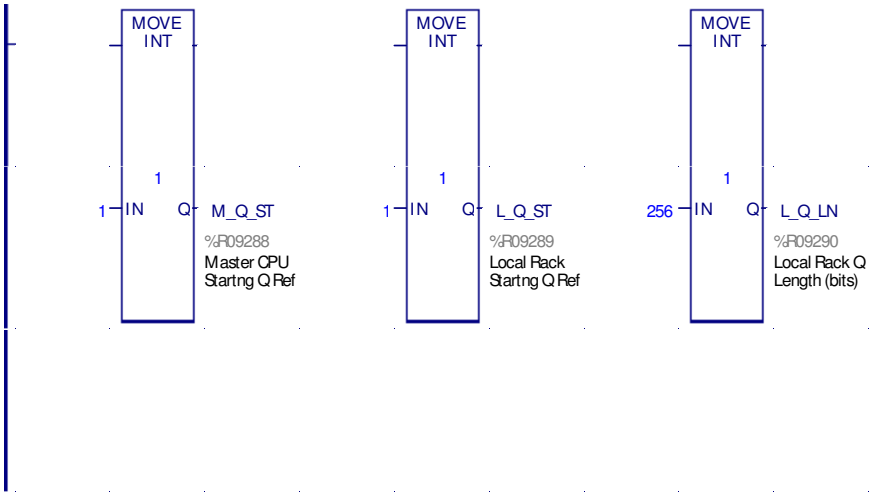
Configuring the Discrete Output Range

Discrete output states are broadcast as global data from the Hot Standby PLCs. The global data is intercepted by the Remote Drop and then mapped to local output states. The mapping process allows output references from the Hot Standby PLCs to be translated to a different set of output references in the remote drop.

For example, assume that your Remote Drop is implemented using a model IC693CPU323. This CPU supports a maximum of 512 discrete output addresses. Your Hot Standby CPUs are each a model IC695CMU310. This CPU supports 32640 output addresses. The mapping process allows a portion of the output addresses in the range %Q00001..02048 to be mapped into the range %Q00001..00512 at the remote drop.

Configuring the Range

1. In Logic Developer PLC, open the Remote Drop project.
2. Using the navigator, open the Block named *mxn_cfg*.
3. Edit the first rung of data moves.
4. In the first MOVE function, a constant is moved into the reference named M_Q_ST (Master CPU Starting Q Ref) Enter the starting reference for the outputs that are to be received from the Hot Standby PLCs.
5. In the second MOVE function, a constant is moved into the reference named L_Q_ST (Local Rack Starting Q Ref) Enter the starting reference for the outputs in the Remote Drop in that you wish to place the Hot Standby values.
6. In the third MOVE function, a constant is moved into the reference named L_Q_LN (Local Rack Q Length (bits)) Enter the number of outputs that are to be mapped into the Remote Drop.
7. Save the Project.
8. Store the Project to the Remote Drop.



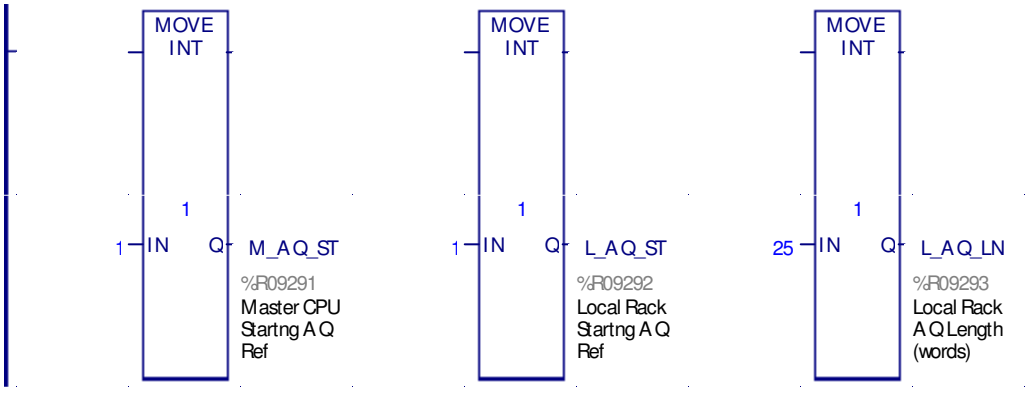
Configuring the Analog Output Range

Analog output values from the Hot Standby PLCs are intercepted by the Remote Drop and then mapped (i.e. the output reference may be modified) to local output references.

For example, assume that your Remote Drop is implemented using a model IC693CPU323. This CPU supports a maximum of 512 analog output addresses. Your Hot Standby CPUs are each a model IC695CMU310. This CPU supports up to 32640 analog output addresses. The mapping process allows a portion of the output addresses in the range %AQ00001..32640 to be mapped into the range %AQ00001..00032 at the remote drop.

Configuring the Range

1. In Logic Developer PLC, open the Remote Drop project.
2. Using the navigator, open the Block named *mxn_cfg*.
3. Edit the second rung of data moves.
4. In the first MOVE function, a constant is moved into the reference named M_AQ_ST (Master CPU Starting AQ Ref) Enter the starting reference for the outputs that are to be received from the Hot Standby PLCs.
5. In the second MOVE function, a constant is moved into the reference named L_AQ_ST (Local Rack Starting Q Ref) Enter the starting reference for the outputs in the Remote Drop in that you wish to place the Hot Standby values.
6. In the third MOVE function, a constant is moved into the reference named L_AQ_LN (Local Rack Q Length (words)) Enter the number of outputs that are to be mapped into the Remote Drop.
7. Save the Project.
8. Store the Project to the Remote Drop.



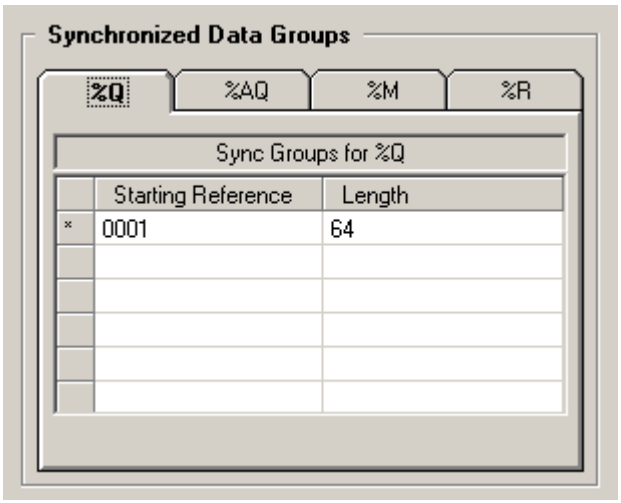
Configuring the Hot Standby GBCs

The bus controllers should be configured in the same fashion as other I/O devices.

Configuring the Synchronized Output Variables

Discrete and analog outputs in a Remote Drop receive values from the Hot Standby CPUs by way of the Synchronized Variables data exchange. In order for outputs to update properly, there must be a corresponding range of Synchronized Variables that has been configured in Max-ON RX3i Configuration Utility.

For example, in the configuration shown below, remote drops would be able to access discrete outputs only within the range %Q00001..00064. No other discrete output data is being broadcast in the global data exchange, and thus no other discrete output data is available for the remote drops.



Chapter 8 Product Authorization

Without a valid product authorization, a Max-ON system will operate in demonstration mode for 22 days. While operating in this mode, all of the system's capabilities are fully functional. At the end of the demo period, PLC A will initiate an orderly transfer of Mastership to PLC B. Then PLC A will shutdown automatically.

A Max-ON system that is installed in a production environment **MUST** be authorized in order to allow PLC A to run indefinitely.

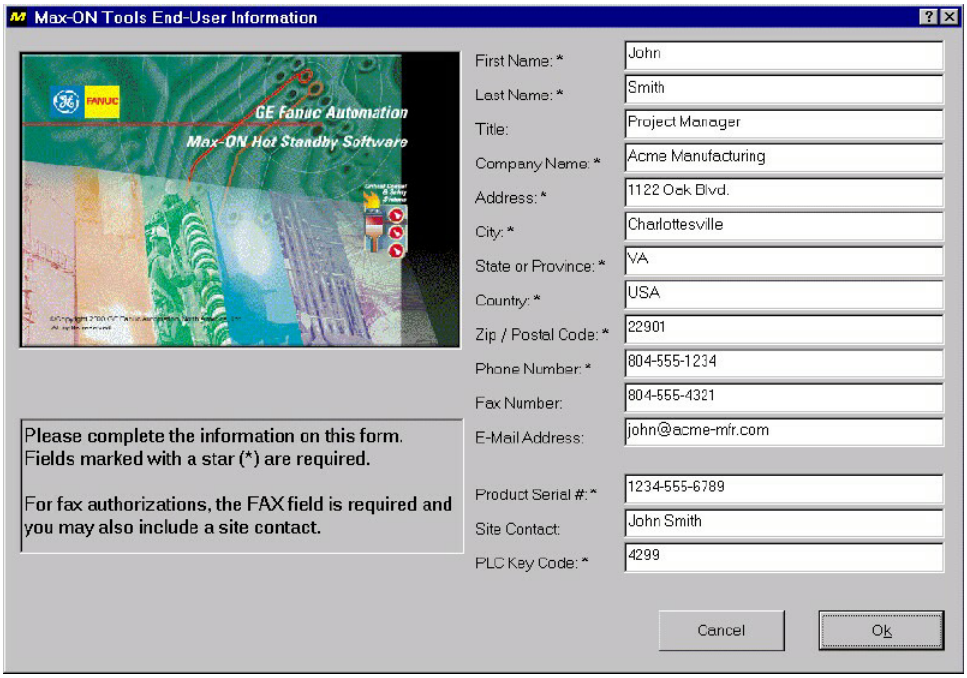
Generating the Key Code

In order for the authorization codes to be generated properly, the hardware configurations must have been stored into CPUs A and B. Then the application target must have been stored as well. When CPU A runs for the first time, it will generate a unique Key Code that it used to start the authorization process.

Create the Authorization Request Form

1. Using Max-ON Tools Configuration package, make certain that the appropriate project file has been opened.

2. Select the menu item *Project*, then *End-User Information*. The form shown below will be displayed.



3. Enter the information into the text boxes on the form, making certain that you fill in all of the items that are marked with an asterisk (*). Although not required, please fill the other entries as well.

4. Verify that the PLC Key Code is visible, and that it agrees with the most current value in CPU A, register %R09011. (If the Key Code is not visible, then you may retrieve the value using the Proficy View project *Max-ON Diagnostics*.)

5. Select the menu item *Project*, then *Configuration Summary*.

6. Disable all checkboxes except for the one labeled *End-User Information*.

7. Using Max-ON Tools, select the menu item *File*, then either *Print Configuration Summary* (to print a hard-copy of the *End-User Information*) or *Save Config Summary to RTF File* (to produce an electronic copy of the information.)

Obtain the Authorization Codes

Obtain your Authorization Codes from GE Fanuc. The GE Fanuc Authorization Desk is located in Edmonton, Alberta (Canada). You may contact them by telephone, fax or e-mail:

Authorization Telephone Number
(800) 647-4196 (US and Canada)
available M-F
8:00am-4:00pm, MST

Authorization Fax Number
(780) 420-2049

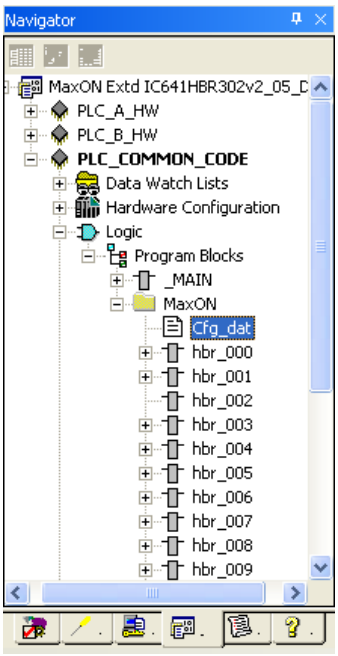
Authorization Email
authorization@gefedmonton.ge.com

Enter the Authorization Codes

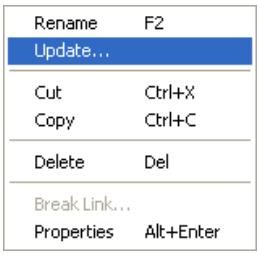
1. Using Max-ON Tools, select the menu item *Configure*, then *Authorization Codes*.
2. Enter the values that you received from GE Fanuc into the corresponding text boxes.
3. When you finished entering all of the values, click Ok to continue.
4. Using Max-ON Tools, select the menu item *File*, then *Save Project Folder*. Max-ON Tools will verify the authorization codes. If the authorization codes are valid, then you
5. A new configuration report will appear.
6. If the report contains the response, "*The authorization codes are invalid"*, then there has been an error entering one or more of the codes. Correct your entry (entries) and then repeat steps 3..5.
7. If the report contains the response, "*The project is valid"*, then the utility has revised your project folder to include the new authorization codes.
8. Save the project configuration. This will update the project file and also update the c-block that is used by the PLC.

Update the C-Block

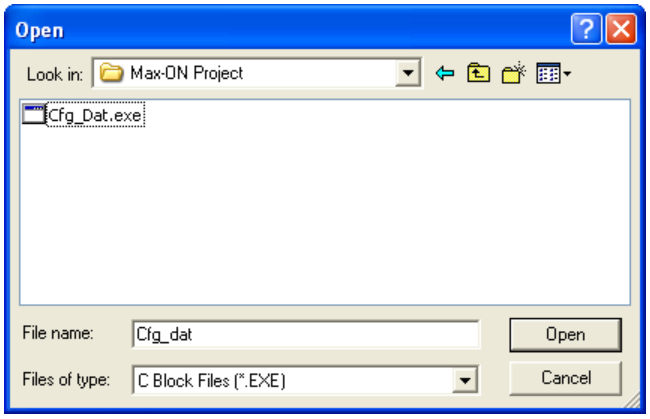
1. Click on the c-block named Cfg_dat. The block is located in the MaxON project located in the target named PLC_COMMON_CODE.



2. Right click on Cfg_dat. A popup menu will be displayed.



3. Click on *Update*. A dialog box similar to the one shown below will be displayed. (Note that you may have to navigate to the folder containing the c-block. In a default Machine Edition installation, the basepath will be "c:\Program Files\Cimplicity MACHINE EDITION\SecurWORX\Temp\..."



4. Double-click on *Cfg_Dat.exe* to update the project.

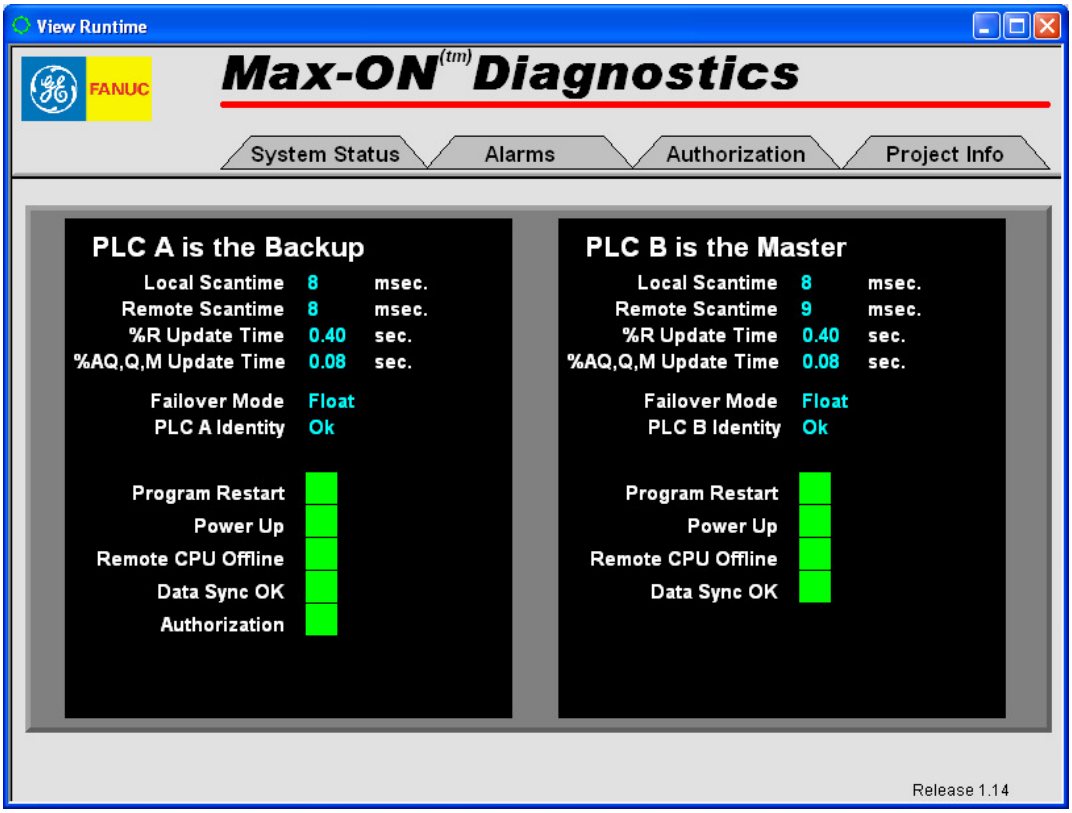
Store the Target

1. Using Cimplicity Machine Edition, set PLC_COMMON_CODE as the active target.
2. Connect to CPU A and then store the target.
3. Connect to CPU B and then store the target.

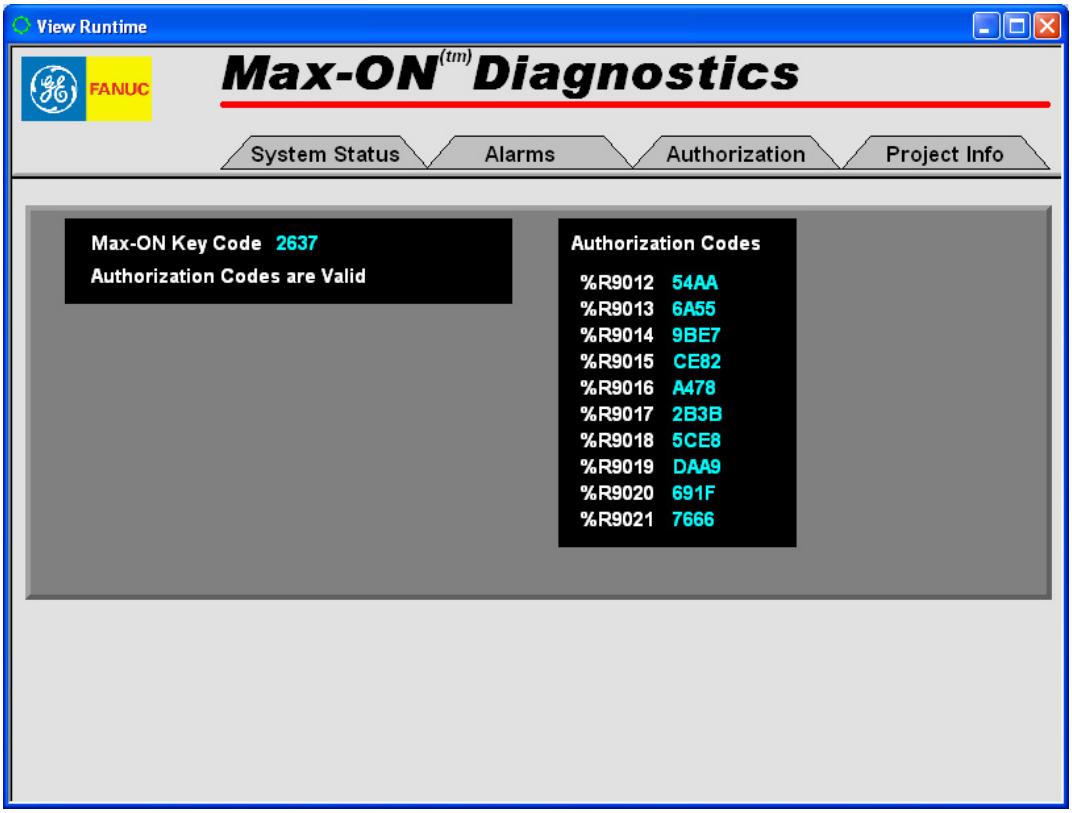
Verifying the Authorization Codes

1. Using Proficy View, open the *Max-ON Diagnostics* project.
2. Make certain that you have available functional communications with both PLCs. (This can be Ethernet or Serial.) Also, make certain that the communication drivers are updated to reflect Ethernet settings or Serial Port settings.

3. Start the View project by pressing F9. The following window will appear:



4. Using the mouse, click on the *Authorization* tab. The following window will be displayed:



5. Verify that the authorization codes are valid. You may have to wait up to a minute for the form to update. (This is because the authorization codes are validated once per minute.)

7. If the codes are not valid...

   - Make certain that you have selected and stored the correct folder to CPU A.
   - Make certain that you that the PLC Key Code agrees with the value that you submitted to GE Fanuc.
   - Make certain that in the section above, the Configuration Summary indicated *The project is valid*.

Restarting CPU A

If CPU A has halted due to an Authorization fault, it may be restarted by performing the following procedure.

1. While CPU A is in STOP mode, set the internal coil reference %M1016 (Reset All Alarms)
2. Restart CPU A. This will reset the timer that is associated with the Authorization Alarm and Authorization Fault. Also, this will reset the internal coil references %M0993 (Authorization Alarm) and %M0994 (Authorization Fault).

3. Wait approximately one or two minutes and then check to make certain that the Authorization Fault (%M0993) remains cleared.

Chapter 9 Updating an Existing Application

This chapter explains how to upgrade the Max-ON program blocks in your application to a newer version of Max-ON using the Proficy Toolchest.

Overview

The general sequence for updating an application is as follows:

1. **Revise the Hardware Configurations**
   - Update the existing hardware configuration for the target named PLC_A_HW.
   - Update the existing hardware configuration for the target named PLC_B_HW.
2. **Revise the Application with new Max-ON Drivers**
   - Backup your current project.
   - Delete the Max-ON driver blocks (except for Cfg_Dat) from the target named PLC_COMMON_CODE.
   - Ctrl-Drag new Max-ON drivers from the Toolchest into the target named PLC_COMMON_CODE.
3. **Download both Hardware Configurations**
   - Select the hardware target that is associated with the Backup PLC. Set it as the *Active Target*.
   - Go online and place the Backup PLC into STOP mode.
   - Download (Hardware only) the appropriate hardware target to the Backup PLC.
   - Place the Backup PLC in RUN Mode.
   - Go offline.
   - Switch Mastership so that the current Backup becomes the Master.
   - Select the hardware target that is associated with the new Backup PLC. Set it as the *Active Target*.
   - Go online and place the Backup PLC into STOP mode.

- Download (H9ardware only) the appropriate hardware target to the Backup PLC while it is in STOP mode.
- Place the Backup PLC in RUN Mode.
- Go offline.

4. Download the Application Logic

- Set *PLC_COMMON_CODE* as the Active Target.
- Adjust the target's Ethernet I.P. address to match the address of the Backup PLC. (Or if using a serial connection, connect to the programming port on the Backup PLC.)
- Download (Logic only) the target named *PLC_COMMON_CODE* into the Backup PLC.
- Place the Backup PLC in RUN Mode.
- Go offline.
- Switch Mastership so that the current Backup becomes the Master.
- Adjust the target's Ethernet I.P. address to match the address of the Backup PLC. (Or if using a serial connection, connect to the programming port on the Backup PLC.)
- Download (Logic only) the target named *PLC_COMMON_CODE* into the Backup PLC.
- Place the Backup PLC in RUN Mode.

Additional information on how to revise the three Max-ON targets follows.

Updating an Existing Max-ON Application

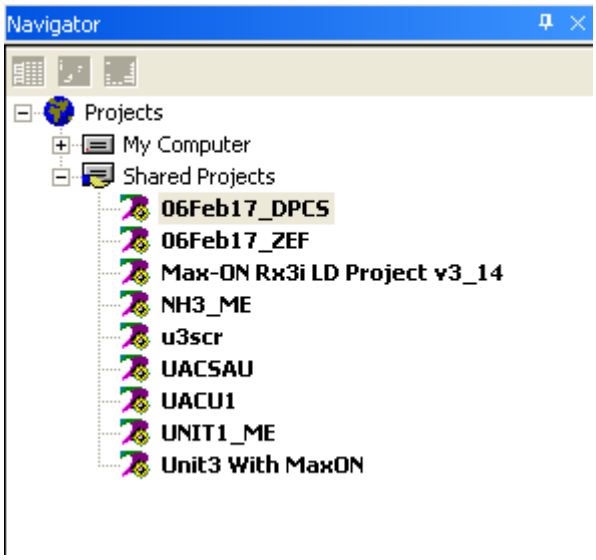
If you have a Max-ON application that was created using an earlier version of Max-ON software, such as version 2.04, you **must** update the Max-ON Drivers in your application to take advantage of issue resolutions in later versions. A Machine Edition Toolchest drawer is provided on the Max-ON Software Release CD to aid in the upgrade process.

To upgrade an existing Max-ON application, perform the following steps:

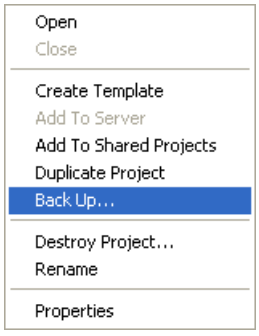
Backup the Application

Back-up your Max-ON application using the Backup feature in Machine Edition.

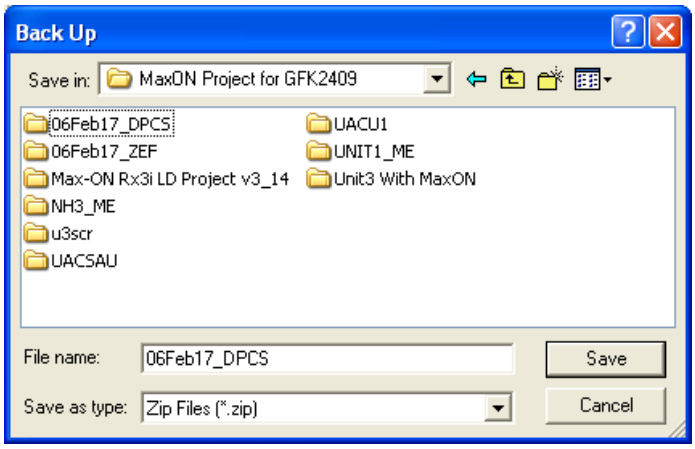
1. Make certain that all projects are closed so that only the current projects are displayed in the Navigator window.
2. Select the project that is to be backed-up. (In this example it is *06Feb17_DPCS*.)



3. Right-click on the project and the following menu list will be displayed.



4. Select *Back UP* and the following dialog box will be displayed.



5. Navigate to the directory in which you wish to save the backup copy of the project.
6. Make certain that the file is saved as a Zip File (*.zip), and then click on *Save*.

Update the Max-ON Drivers

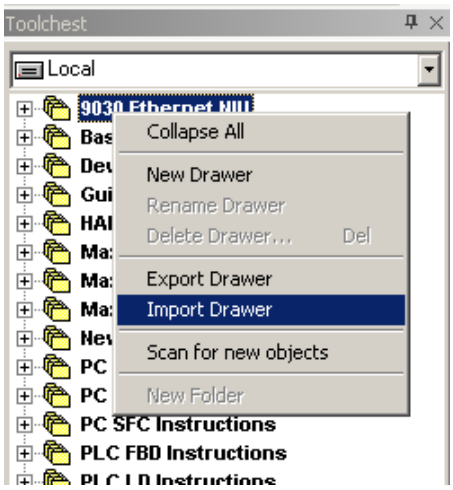
1. Import the latest Max-ON Driver Toolchest drawer into Machine Edition.

    a. Open your Max-ON Project in Machine Edition.

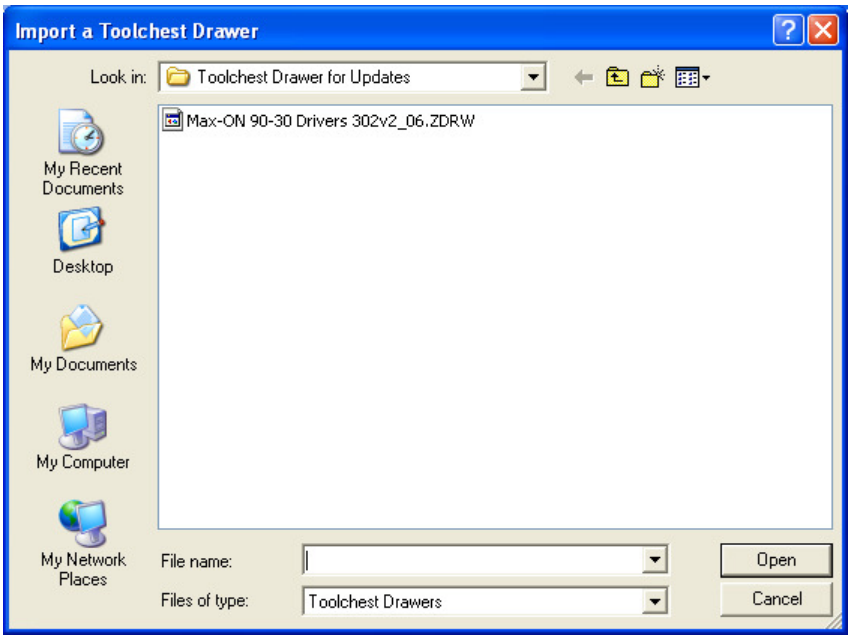
    b. Open the Toolchest by pressing the Toolchest button on the Toolbar, or by pressing Shift+F9.

    c. Select a node in the Toolchest.

    d. Using the right-mouse button, select *Import Drawer*.



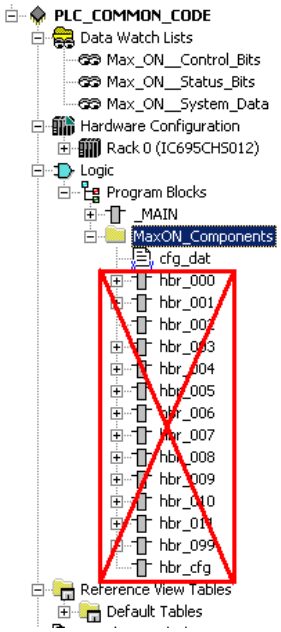
    e. Navigate to the Max-ON Driver Toolchest drawer located on the Max-ON Software Release CD. The file is named: *Max-ON Drivers v2_nn.ZDRW*, where *nn* indicates the release number.



f. Press the **Open** button. This will add the drawer to your Toolchest.

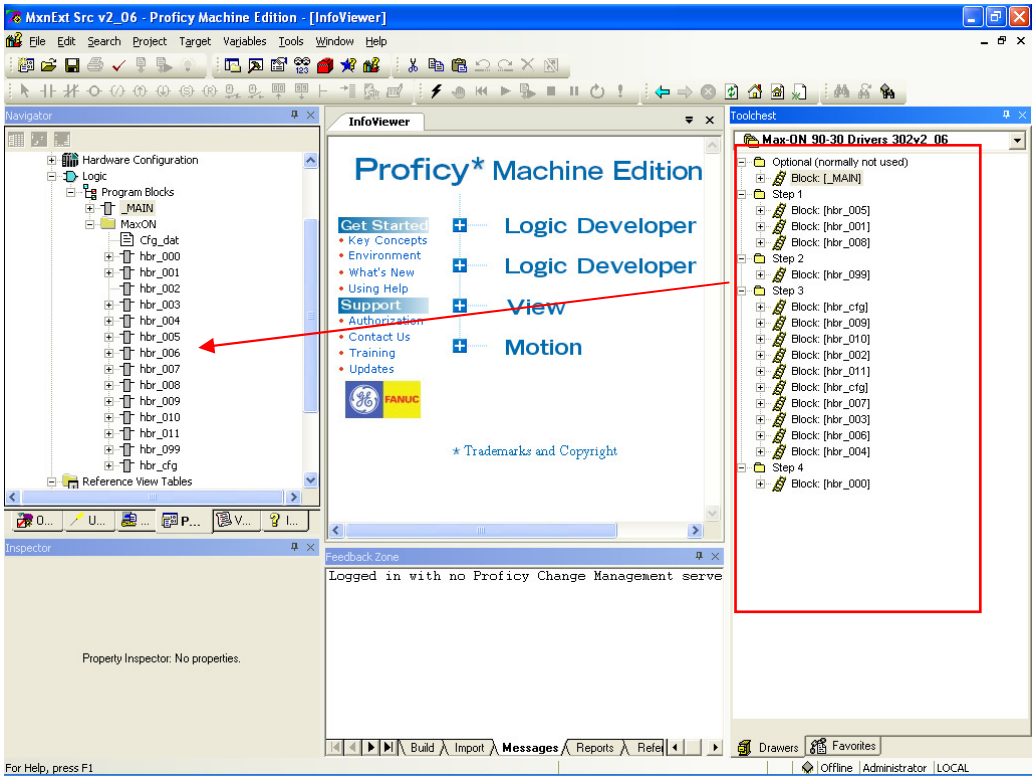
2. Expand the MaxON_Components folder in the PLC_COMMON_CODE Target in your project to display the current set of Max-ON Drivers. If you examine the Block Properties of each Block, you can see your current Block revision, such as v2.06.

3. Delete the Max-ON Driver blocks that start with “hbr_” from the MaxON_Components folder.



DO NOT delete the *cfg_dat* C Block.

4. Add the version Max-ON Drivers to the MaxON_Components folder directory using the Ctrl-Drag-and-Drop operation from the Toolchest.



The Blocks must be added to the Machine Edition Project in the following order:

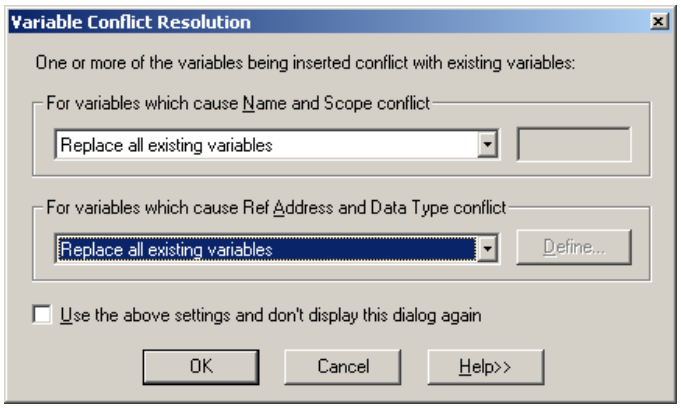
a. hbr_001, hbr_005, hbr_008

b. hbr_099

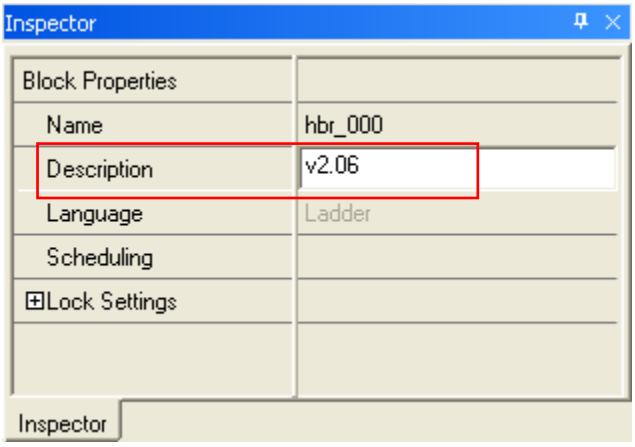
c. hbr_002, hbr_003, hbr_004, hbr_006, hbr_007, hbr_009, hbr_010, hbr_011, hbr_cfg

d. hbr_000

5. When performing the Ctrl+Drag-and-Drop Toolchest operation, when the Variable Conflict Resolution dialog is displayed, you must select the "**Replace all existing variables**" option to ensure that any new MaxON variables are properly defined.



6. An _MAIN Block is also available in the Toolchest Drawer. This Block has a comment in the first rung that details the revision history. However, this block is not normally imported.
7. Validate your Max-ON application to verify that all Max-ON Driver blocks are properly located in the Project.
8. You can also verify the version of each hbr_ Block by checking the description in the Block Properties:



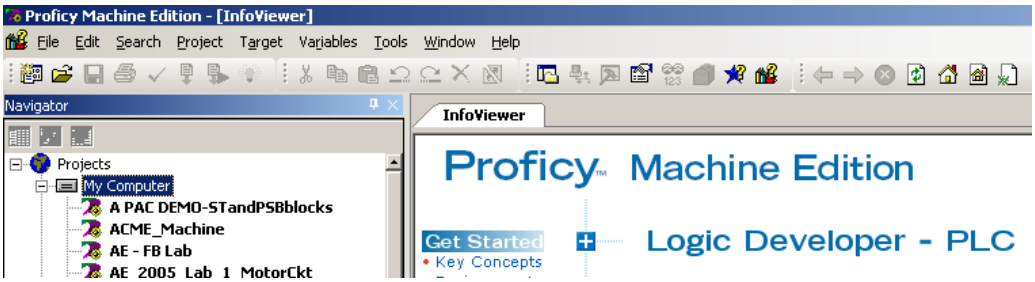
Chapter 10 Diagnostic Tools

A Proficy View project is included on the Max-ON installation CD that provides diagnostic functions for your redundant system. Max-ON Diagnostics may be used to obtain real-time status, alarms and historical operating information relating to the Max-ON redundancy PLCs.

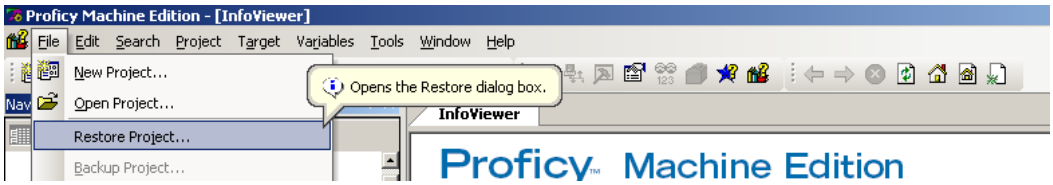
Step 1 - Create a Max-ON Diagnostic Tool View Project

In Proficy View:

1. Create a new project based on the generic Max-ON Diagnostic Tool project. This project is added to the Machine Edition project Navigator by using the *File > Restore Project…* menu item. Select the Project Navigator window, making certain that there is no project open at this time.

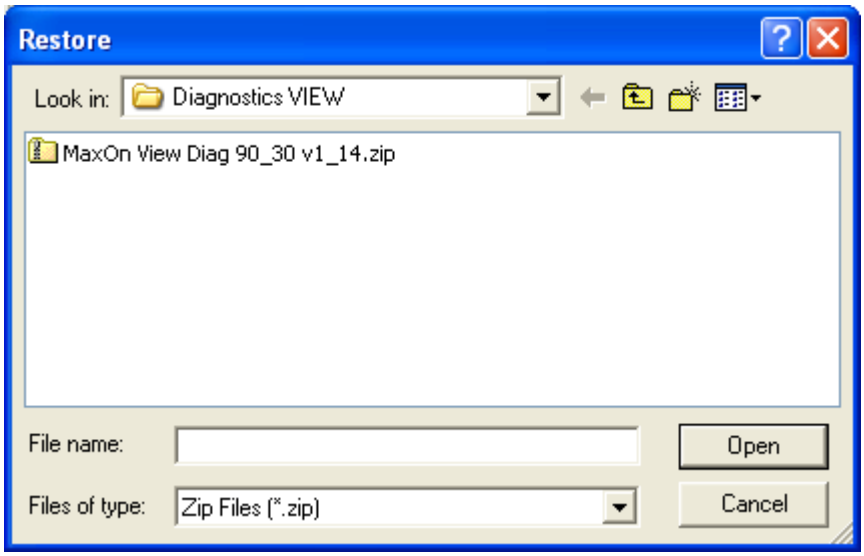


2. Using the *File* menu, click on *Restore Project*...



3. Navigate to the *Proficy Components* directory, then to the *Diagnostics VIEW*. Make certain that the selection for **Files of Type** has been set to *Proficy Machine Edition (*.zip)*.

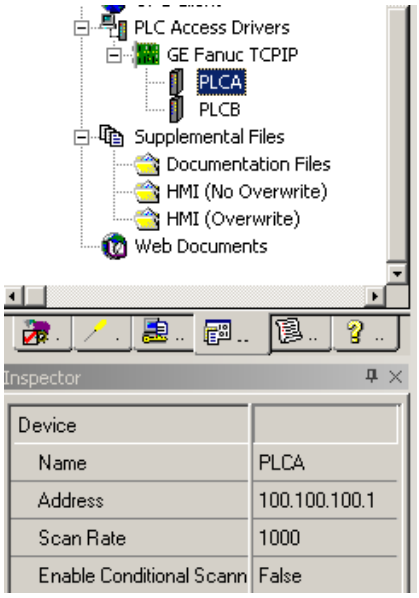
When you click on *Open*, a new project will be added to the Proficy Navigator window.



Step 2 – Configure Ethernet Connections to the PLCs

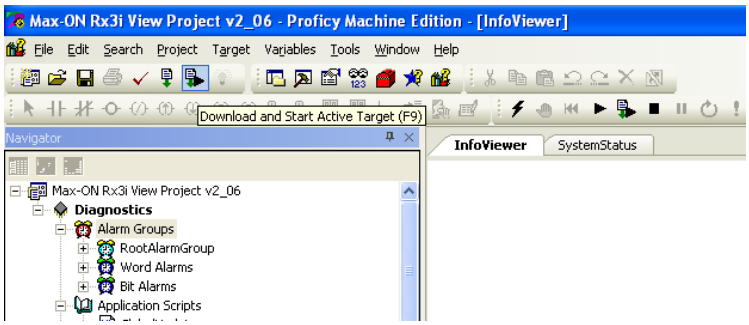
In order to conduct data transfers between Max-ON Diagnostics and the Hot Standby PLCs, you need to establish an Ethernet communication connection to the PLCs. To configure the Ethernet addresses of the PLCs in the View Project:

1. Open the View project that was restored in Step 1.
2. Expand the PLC Access Drivers node in the Navigator for the View target and select the PLCA device.



3. Modify the Address of PLCA in the Inspector to match the IP address of PLC A in your Max-ON system.
4. Repeat step 3 for PLCB.

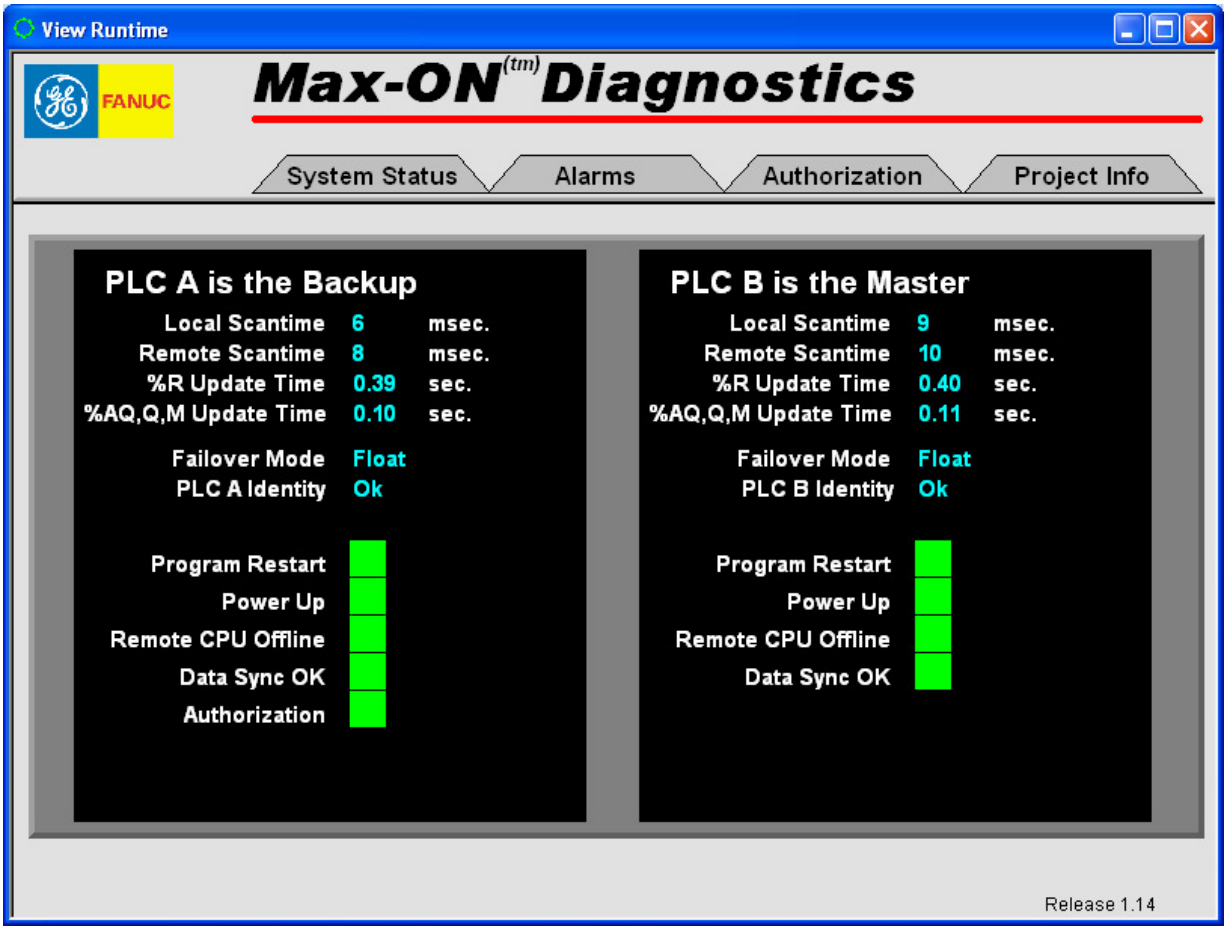
5. Select the Download and Start Active Target toolbar button to start the Max-ON Diagnostic program, or press the F9 key.



This will launch the View project to run on your PC.

Step 3 – Use the Max-ON Diagnostic Tool

Once the Diagnostic Tool starts on your PC, the main Diagnostics page will be displayed:



System Status	Clicking on this tab displays the Real-time Status page. The page contains information on scan times, update rates, and PLC status.
Alarms	Clicking on this tab will bring up the Alarm Table display page. This page lists any alarms that have been archived within the PLCs that have active connections. Alarms may be cleared from this display page.
Project Info	Clicking on this tab will display the Project Information page. Catalog number, version number, program checksum, and other items are displayed.
Authorization	Clicking on this tab will display the Authorization page that indicates if the system is operating in Demo mode or not.

Please note that if the Diagnostic Tool is not communicating with the PLCs, a ? will be displayed for the items.

The  symbol indicates a Latched Alarm condition, where a  symbol indicates a current Alarm condition.

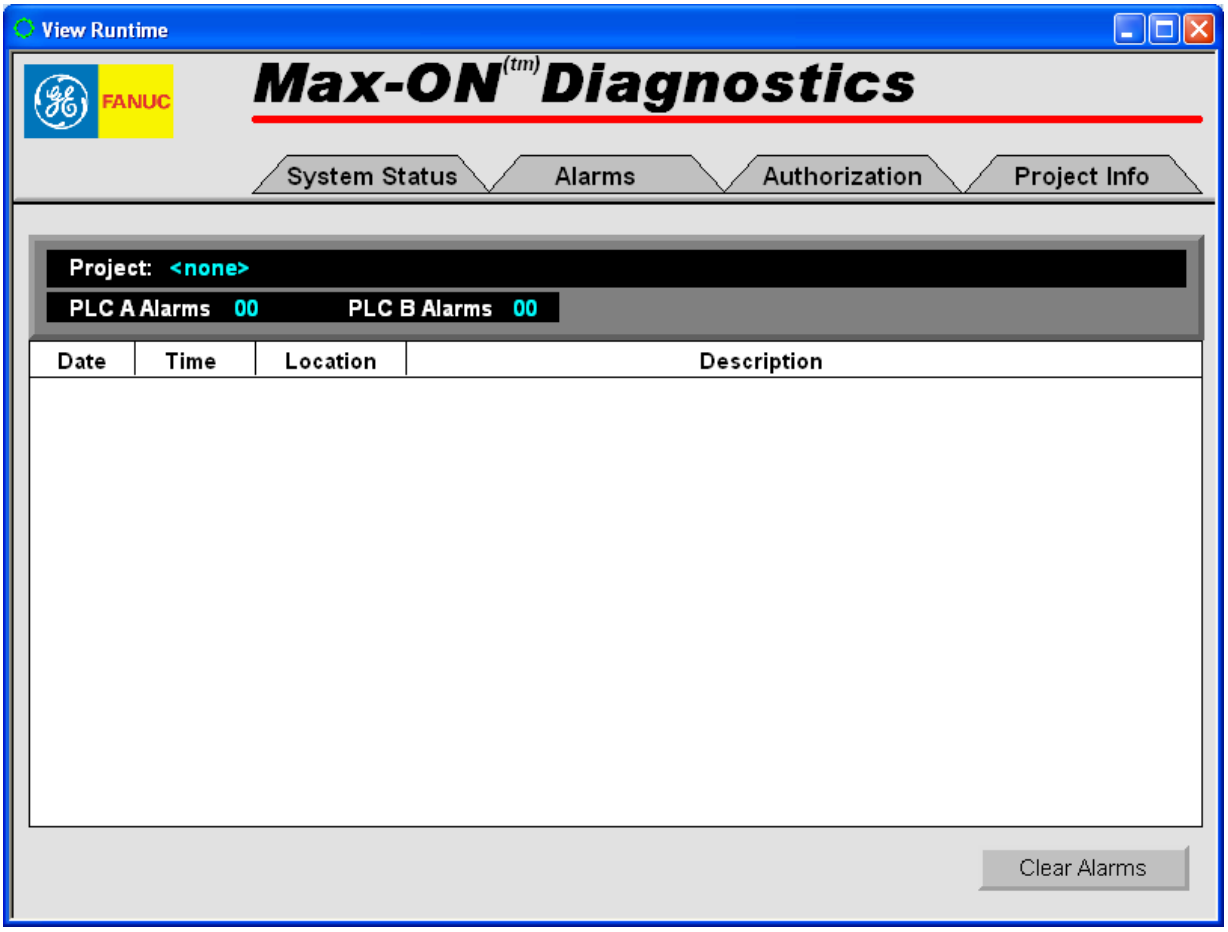
System Status

You may view items that relate to the current operating characteristics of your system on the System Status page. An example is shown in the picture above.

PLC A and PLC B Status	Indicates the operating status of the corresponding PLC, either Running or Stopped.
Local Scan Time	The scan time, in milliseconds, for the Local PLC.
Remote Scan Time	The scan time, in milliseconds, for the Remote PLC.
%R Update Time	This is the time required to update synchronized data of type %R. The time is reported in seconds.
%AQ, Q, M Update Time	This is the time required to update all configured synchronized data of the types %AQ, %M, and %Q. The time is reported in seconds.
Failover Mode	This field indicates the mastership status of the corresponding PLC, either Master or Backup. There never should be two Masters or two Backups in a system that is operating properly.
PLC A and PLC B Identity	A-Preferred, B-Preferred, or Float
Program Restart	The local CPU has been switched from STOP mode to RUN mode.
Power Up	The local CPU has undergone a power-up event**.**
Remote CPU Offline	The companion PLC is offline. This may be due to the CPU being in STOP, Fault, or Powered Off. Also it may be due to a cable problem or Ethernet Interface failure.
Data Sync OK	This field indicates the completion status for the transfer of synchronized data. The Backup CPU will indicate either Synced (all Synchronized Variables have been received) or Not Synced. The Master CPU always indicates Synced (ON). It is ON in the Backup CPU at the moment when all Synchronized Data items have been updated.
Authorization	This indicates that PLC A is operating in DEMO mode. PLC A will operate for up to 22 days in this mode. At the end of the 22 day period, Mastership will transfer to PLC B (if it is available). At this point, PLC A will transition to STOP mode.

Alarms

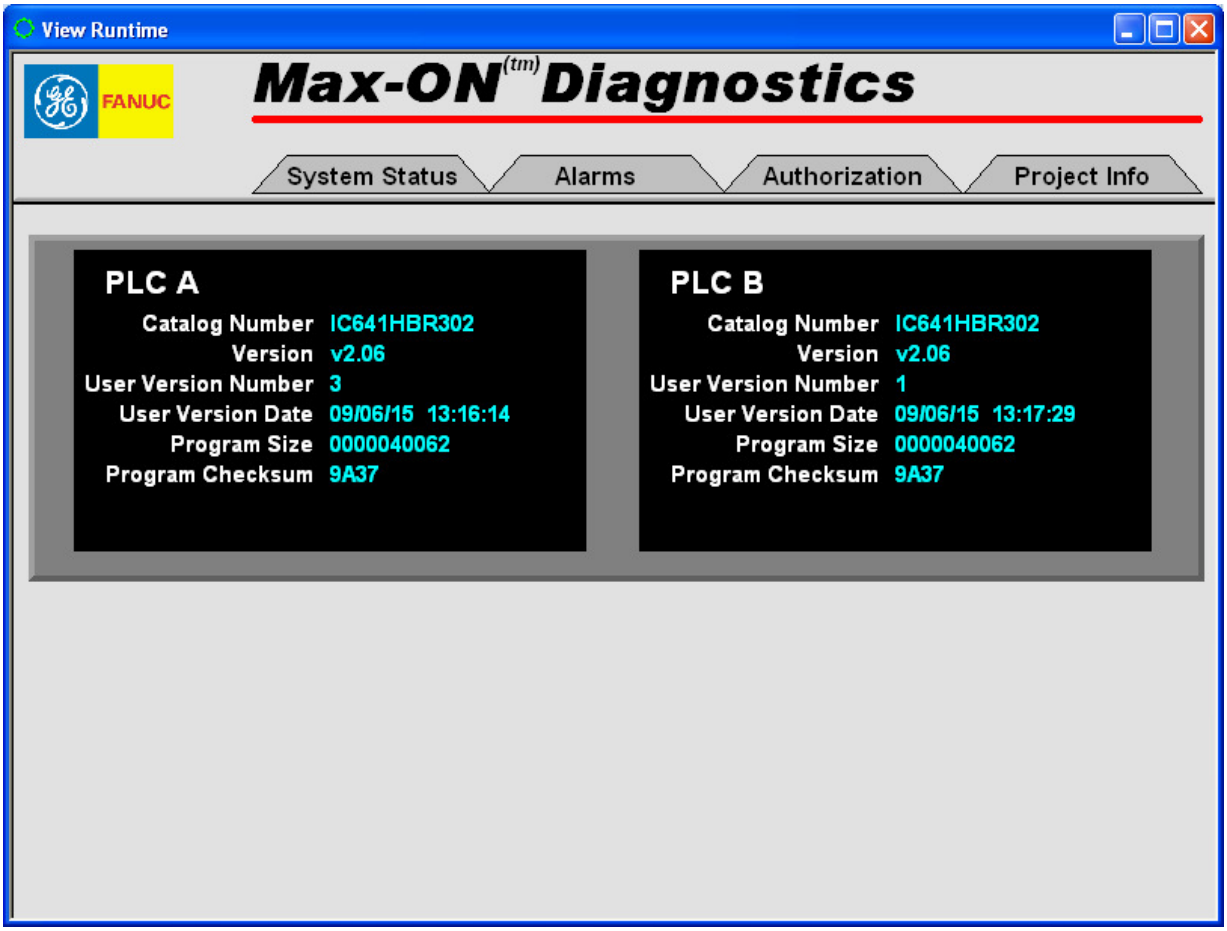
Historical information is stored in the alarm table. This table contains archived information for up to 32 alarm records for each PLC. The records store information for both system alarms and optional user-defined alarms. Each alarm record consists of an identifier for the event that initiated the entry, along with a date/time stamp to indicate when the event occurred. Typical events include change of Hot Standby mastership, loss of PLC power, program restart, and loss of I/O devices.



Note: User defined alarms are not available in the current version of Max-ON Diagnostic Tools.

Project Information

You may view certain items that relate to the general nature of your system. Select the *Project Info* tab.

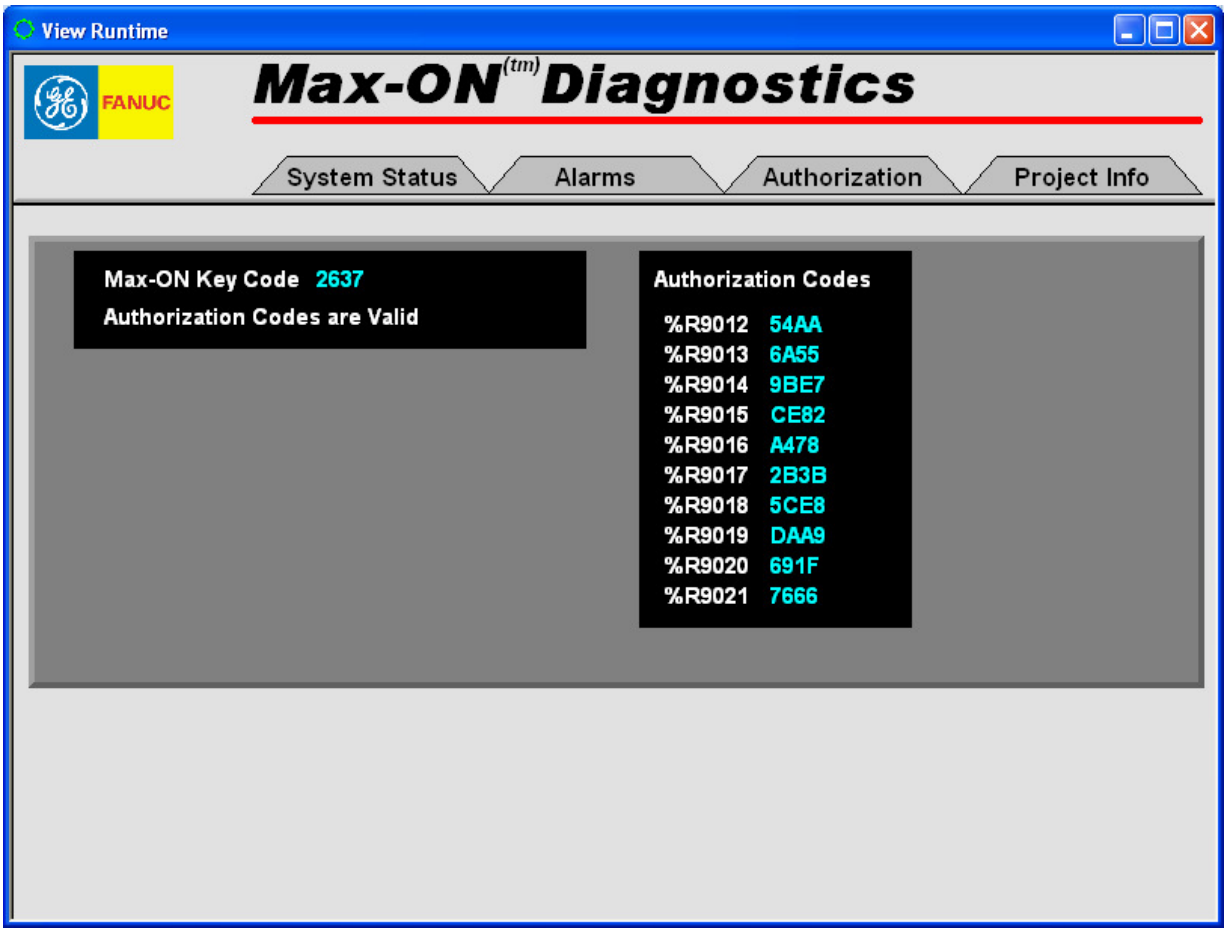


PLC Catalog Number	The catalog number for the Max-ON drivers that are running in the corresponding PLCs.
SW Version	The current version number of the Max-ON PLC drivers
User Version Number	If Audit trail has been enabled, then this represents the number of times the application logic has been changed. If Audit trail has not been enabled, then the Max-ON drivers will not update any value here.
User Version Date	If Audit trail has been enabled, then the current date and time will be posted here each time the application logic is changed. If Audit trail has not been enabled, then the Max-ON drivers will not update any value here.
Program Size	An approximate program size. There will be a slight difference between the value displayed in Logic Developer PLC and the value displayed here. The Max-ON value shows the total for program logic,

	but does not include the memory overhead associated with subroutines.
Program Checksum	The additive checksum for the Program. (This is a 16-bit entity, displayed as four hex digits.)

Authorization

You may view the information related to the authorization of your system by selecting the *Authorization* tab.



Max-ON Key Code — This field displays the current decimal value of the keycode contained in PLC A, register %R09010.

Authorization Codes — The left pane indicates if the current Authorizations codes are valid for the Max-ON system.

The right pane displays the ten Authorization codes that are set in the Max-ON drivers.

Appendix A Ethernet Information

Ethernet Hardware

The Series 90-30 PLC offers two classes of modules that support Ethernet connectivity.

I/O Module

The IC693CMM321 module installs in the 90-30 rack to provide one network link. The module provides an AAUI connector that supports one link to a 10 megabit network by way of an external Ethernet transceiver.

CPU Modules

The IC693CPU364, IC693CPU370, IC693CPU372 and IC693CPU374 contain a built-in 10BaseT port. The CPU link has considerably higher throughput than the IC693CMM321 link.

PLC Sweep Mode

For the Ethernet interfaces to work efficiently, it is necessary to extend the scantime in one or both of the PLCs. The extra time is used to transfer Synchronized Variables through the CPU Communications Window. There are two approaches. Each has its own advantage.

Automatic Mode Selection –

In this approach, the system detects which CPU is the Backup and then sets the Backup to *Constant Sweep*. If there is a transfer in Mastership, then the Max-ON driver will set the Master CPU into *Normal Sweep* and the Backup to *Constant Sweep*.

Why you should consider this approach –

The Master always operates with the fastest scantime possible.

The Backup will adjust its timing regularly to meet current system requirements.

The period for *Constant Sweep* is determined automatically once per second. The value is calculated by adding 75 milliseconds to the Master's scan time and then rounding downward to the nearest multiple of 5 milliseconds.

To enable this mode of operation:

1. Open your application folder.

2. Prior to the call to HBR_000, enter a rung that sets %M1012 to ON.
3. Store the application folder into CPU A.
4. Store the application folder into CPU B.

Manual Mode –

The second method is to configure the CPUs to execute in *Constant Sweep* mode. The configuration is entered via the Hardware Configuration utility. Both of the hardware configuration targets (*PLC_A_HW* and *PLC_B_HW*) must be set and then stored into the corresponding CPUs.

Why you should consider this approach –

By having the Master in *Constant Sweep* mode, Ethernet communications with HMIs may be improved dramatically.

Prerequisite: The system has been completed and is operating in its normal fashion (i.e., all application logic has been finished, HMIs are attached and communicating, and all peripherals are connected and operating normally.)

The procedure is as follows:

1. Record the peak PLC scantime in the Master CPU. You should observe the system for several minutes to obtain this value.
2. Add 75 to the value you obtained in step 1. Round this value up to the next multiple of 5.
3. Open the hardware configuration folder for CPU A.
4. Zoom into the CPU module. Click on the *Scan* tab.
5. Set the *Sweep Mode* to *Constant Sweep.*
6. Set the *Sweep Timer* to the value calculated in step 2.
7. Store the configuration into CPU A.
8. Open the hardware configuration folder for CPU B.
9. Repeat steps 4 through 6.
10. Store the configuration into CPU B.
11. Open your application folder.
12. Prior to the call to HBR_000, enter a rung that resets %M1012 to OFF.
13. Store the application folder into CPU A.
14. Store the application folder into CPU B.

Appendix B Frequently Asked Questions

Does Max-ON Tools generate my hardware configuration?

No. You must use the Max-ON project report to produce the information that is used to guide you through the configuration.

Is the hardware configuration in the application folder used in any fashion?

Yes. The memory limits on the CPU must be set to be compatible with your application requirements. Note that you may have to adjust these in the two hardware configuration folders as well.

Can Max-ON Tools add on to one of my existing application folders.

No. You must start with the correct Max-ON project and then add your application to it.

Can I change the catalog number on my existing Max-ON project folder?

No. You will have to create a new project using the desired catalog number.

My two CPUs stop immediately after I store my Max-ON project. What did I do wrong?

One or more of the Synchronized Data types that you have configured is greater than the maximum quantity allowed for the product on which the project is based.

My two CPUs will not start. What is wrong?

There are several possibilities. You should use Max-ON Tools to display the Fault Tables in the PLCs.

Error Message	Possible Cause
Invalid CPU ID, Duplicate IDs	The checksum word lengths are incorrect. CPU A should be configured to have a checksum word length of 11. CPU B should be configured to have a checksum word length of 12.
%Q Configuration Fault, %AQ Configuration Fault, %M Configuration Fault, %R Configuration Fault	One or more of the Synchronized Data types that you have configured is greater than the maximum quantity allowed for the product on which the project is based.

My system indicates that both PLCs are Masters. What is wrong?

The two PLCs are not exchanging global data properly.

- If the system is being started up for the first time, then there may be a problem with the global data configuration in the Genius bus controllers. Or, there may be a problem with the LAN or hardware.
- There might be one or more bus failures, or a failed Genius bus controller. Investigate the hardware and check the bus connections. Make certain that terminating resistors have been installed correctly and that they are of the proper resistance for the cable you are using.

I stopped one of my CPUs and then disabled the Max-ON PLC drivers in the remaining CPU. Now my output devices aren't working. What has happened?

You will need to change the configuration in the Genius bus controllers. Set *Output at Start* to *Enabled*. Don't forget to change the configuration to *Disabled* when you are ready to run the Max-ON drivers again.

CPU A has stopped. I know that the authorization period has expired, but I can't get the CPU running again. What can I do?

Make certain that you turn ON %M1016 while CPU A is in STOP. Then restart the CPU. This will authorize CPU A for an additional 22 days.

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